CITY OF HOUSTON

HOUSTON AIRPORT SYSTEM (HAS)

INVITATION TO BID (ITB)
PN 913 / SOLICITATION NO.: HJA-IDOBLDG-2022-006
IDO BUILDING STANDARDS SPACE FIT-OUT

Date Issued:	March 25, 2022
Pre-Bid Conference / Site Visit:	April 7, 2022, 01:30 P.M., CST 111 Standifer Road, Humble TX 77338 HAS IDO Wright Brothers Conference Room 100.4
Questions Deadline:	April 14, 2022 @ 3:00 P.M., CST
Solicitation Due Date:	May 19, 2022 @ 10:30 A.M., CST City Secretary Office, City of Houston City Hall Annex, Public Level, Room P101 900 Bagby Street, Houston TX 77002
Solicitation Contact Person:	Jorge Ardines Sr. Procurement Specialist, Houston Airport System jorge.ardines@houstontx.gov

Project Summary: HAS is seeking a construction contractor that will construct an estimated 4,200-SF shell space in the HAS IDO Building into office space.

NIGP Code: 91200
MWBE Goal (Construction Services): N/A

DS CH

DocuSigned by:
Jerry Adams
0DD350139A6E4C8...

Jerry Adams
Chief Procurement Officer

3/21/2022 | 3:02 CDT

Date

City of Houston - Department of Aviation – Infrastructure Division

PROJECT MANUAL

IDO BUILDING STANDARDS SPACE FIT-OUT
111 STANDIFER RD., HUMBLE, TX 77338

PROJECT No.: ***913***
CIP No.: N/A

VOLUME 1 OF 1

Divisions 00 through 28

Issue for Permit
January 2021

JACOBS
5985 ROGERDALE RD
HOUSTON, TX 77072
281.721.8400

Document 00010

TABLE OF CONTENTS

Doc.
No. **Document Title**

INTRODUCTORY INFORMATION

00010 Table of Contents
00015 List of Drawings

BIDDING REQUIREMENTS

INSTRUCTIONS TO BIDDERS
00200 Instructions to Bidders
00210 Supplementary Instructions to Bidders
00220 Request for Bid Information

BID FORMS AND SUPPLEMENTS (NOTE: TO BE PROVIDED WITH BID)
00410 Bid Form, Parts A & B
00430 Bidder's Bond
00454 Affidavit of Non-interest
00455 Ownership Information Form
00457 Conflict of Interest Questionnaire
00460 POP Program Acknowledgement Form
00461 Hire Houston First Affidavit
00480 Form SCM-1 Reference Verification

POST-BID PROCEDURES
00495 Post-bid Procedures

Doc.
No. **Document Title**

CONTRACTING REQUIREMENTS

AGREEMENT: (NOTE: TO BE PROVIDED AFTER RECEIPT OF NOTICE OF INTENT TO AWARD)
00501 Resolution of Corporation
00520 Agreement

BONDS AND CERTIFICATES: NOTE: TO BE PROVIDED AFTER RECEIPT OF NOTICE OF INTENT TO AWARD)
00600 List of Proposed Subcontractors and Suppliers, Parts A & B
00601 Drug Policy Compliance Agreement
00604 History of OSHA Actions and List of On-the-job Injuries
00605 List of Safety Impact Positions
00610 Performance Bond
00611 Statutory Payment Bond
00612 One-year Maintenance Bond
00620 Affidavit of Insurance
00621 ACORD Certificate of Insurance Form
00630 Agreement to Comply with POP Program
00631 Pay or Play (POP) Program – List of Subcontractors
00632 EEO Certification by Material Suppliers, Professional Service Providers
00636 Certificate of Interested Parties FORM 1295

GENERAL CONDITIONS
00700 General Conditions

SUPPLEMENTARY CONDITIONS
00800 Supplementary Conditions
00805 EEO Program Requirements
00821 Wage Scale for Building Construction
00840 Pay or Play (POP) Program

Doc.
No. **Document Title**

SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS
01110 Summary of Work
01145 Use of Premises
01210 Cash Allowances
01255 Modification Procedures
01270 Measurement and Payment
01290 Payment Procedures
01312 Coordination and Meetings
01321 Construction Photographs
01325 Construction Schedules
01326 Construction Sequencing
01330 Submittal Procedures
01340 Shop Drawings. Product Data and Samples
01423 Reference
01450 Contractor's Quality Control
01455 City’s Acceptance Testing
01505 Temporary Facilities
01506 Temporary Controls
01507 Temporary Signs
01550 Public Safety and Contractor’s Safety Staffing
01555 Traffic Control and Regulation
01576 Waste Material Disposal
01610 Basic Product Requirements
01630 Product Options and Substitutions
01731 Cutting and Patching
01740 Site Restoration
01761 Protection of Existing Services
01770 Contract Closeout
01785 Project Record Documents

Doc. No. **Document Title**

DIVISION 2 - SITE WORK
024119 Selective Demolition

DIVISION 6 - WOOD AND PLASTICS
064116 Plastic-Laminate-Clad Architectural Cabinets

DIVISION 7 - THERMAL AND MOISTURE PROTECTION
079200 Joint Sealants

DIVISION 8 - DOORS AND WINDOWS
081216 Aluminum Frames
081216 Interior Aluminum Doors, Door Frames, and Storefront Framing
081416 Flush Wood Doors
087100 Door Hardware
088700 Decorative Film Overlay

DIVISION 9 - FINISHES
092216 Non-Structural Metal Framing
092900 Gypsum Board
095000 Wood Panel Ceilings
095113 Acoustical Panel Ceilings
096513 Resilient Base and Accessories
096519 Resilient Tile Flooring
096813 Tile Carpeting
097200 Wall Coverings
099123 Interior Painting

DIVISION 10 - SPECIALITIES
101100 Visual Display Units
101423 Panel Signage
102600 Wall and Door Protection
104416 Fire Extinguishers

DIVISION 12 - FURNISHINGS
123623.13 Plastic-Laminate-Clad Countertops

DIVISION 21 – FIRE SUPPRESSION
211313 Wet-Pipe Sprinkler Systems
211316 Preaction Sprinkler Systems

DIVISION 22 – PLUMBING
220500 Common Work Results for Plumbing

Doc. No.	Document Title
220719	Plumbing Piping Insulation
221116	Domestic Water Piping
221316	Sanitary Waste and Vent Piping
224000	Commercial Plumbing Fixtures

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

230500	Common Work Results for HVAC
230529	Hangers and Supports for HVAC Piping and Equipment
230553	Identification for HVAC Piping and Equipment
230593	Testing Adjusting and Balancing for HVAC
230713	Duct Insulation
230716	HVAC Equipment Insulation
233100	HVAC Ducts and Casings
233300	Air Duct Accessories
233600	Air Terminal Units
233713	Diffusers Registers and Grilles
238126	Split-System Air-Conditioners

DIVISION 26 – ELECTRICAL

260500	Common work results for electrical
260519	Low-Voltage Electrical Power Conductors and Cables
260526	Grounding and Bonding for Electrical Systems
260529	Hangers and Supports for Electrical Systems
260533	Raceways and Boxes for Electrical Systems
260544	Sleeves and Sleeve Seals for Electrical Raceways and Cabling
260553	Identification for Electrical Systems
260573.13	Short-Circuit Studies
260573.16	Coordination Studies
260573.19	Arc-Flash Hazard Analysis
262213	Low-voltage distribution transformers
262416	Panelboards
262726	Wiring Devices
262813	Fuses
262816	Enclosed Switches and Circuit Breakers
265119	LED Interior Lighting
265213	Emergency and Exit Lighting

DIVISION 27 – COMMUNICATIONS

270526	Telecommunications Grounding and Bonding
270528	Interior Communication Pathways
270553	Identification and Labeling of Communication Infrastructure
271100	Communications Cabinets and Equipment Rooms
271300	Backbone and Riser Media Infrastructure

TABLE OF CONTENTS

Doc. No.	Document Title
271500	Horizontal Media Infrastructure
274000	Audiovisual Systems

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

281300	Access Control
284621	Addressable Fire-Alarm Systems

END OF DOCUMENT

Document 00015

GENERAL

G-00	COVER
G-01	DRAWING INDEX
G-02	GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS
G-100	ACCESSIBILITY REQUIREMENTS AND DETAILS
G-101	LIFE SAFETY PLAN

ARCHITECTURAL

A-001	GENERAL NOTES
A-101	FLOOR PLAN
A-111	REFLECTED CEILING PLAN
A-121	FINISH PLAN
A-411	INTERIOR ELEVATIONS
A-571	INTERIOR DETAILS
A-601	ROOM FINISH SCHEDULE
A-602	MATERIAL LEGEND
A-603	DOOR SCHEDULE, DOOR DETAILS, AND WINDOW TYPES
A-701	PARTITION TYPES
A-801	FURNITURE AND SIGNAGE PLAN
A-802	FURNITURE AND SIGNAGE SCHEDULES

FIRE PROTECTION

F-100	FIRE PROTECTION GENERAL NOTE AND DETAILS
F-101	FIRE PROTECTION OVERALL PLAN

PLUMBING

P-001	PLUMBING LEGEND AND GENERAL NOTES
P-101	PLUMBING RENOVATION PLAN
P-501	PLUMBING DETAILS
P-601	PLUMBING SCHEDULES

MECHANICAL

M-001	MECHANCIAL LEGEND AND GENERAL NOTES
M-101	MECHANICAL DEMOLITION PLAN
M-102	MECHANICAL RENOVATION PLAN
M-201	ROOF PLAN
M-501	MECHANICAL DETAILS
M-502	MECHANICAL DETAILS
M-601	MECHANICAL SCHEDULES

ELECTRICAL

E-001	ELECTRICAL GENERAL NOTES & SYMBOLS
E-101	ELECTRICAL OVERALL PLAN
E-201	ELECTRICAL POWER / FIRE ALARM
E-301	ELECTRICAL LIGHTING
E-601	ELECTRICAL ONE-LINE

TELECOMMUNICATIONS

T-001	TELECOM INDEX
T-101	TELECOM PLAN
T-102	TELECOM OVERALL PLAN – CABLE TRAY
T-201	TELECOM REFLECTED CEILING PLAN
T-400	TELECOM ENLARGED PLANS
T-500	TELECOM DETAILS
TA-001	AUDIOVISUAL INDEX
TA-101	AUDIOVISUAL PLAN
TA-201	AUDIOVISUAL REFLECTED CEILING PLAN
TA-501	AUDIOVISUAL DETAILS
TA-502	AUDIOVISUAL DETAILS
TA-601	AUDIOVISUAL ELEVATIONS
TA-701	AUDIOVISUAL SCHEMATICS
TY-001	SECURITY INDEX
TY-101	SECURITY PLAN
TY-500	SECURITY CAMERA DETAILS
TY-501	SECURITY DETAILS

Document 00200

TABLE OF CONTENTS

INSTRUCTIONS TO BIDDERS

PARAGRAPH	TITLE	PAGE
1.0	*RELATED DOCUMENTS*	3
2.0	*DEFINITIONS*	3
3.0	*NOTICE TO BIDDERS*	3
4.0	*BID DOCUMENTS*	5
5.0	*EXAMINATION OF DOCUMENTS, SITE, AND LOCAL CONDITIONS*	5
6.0	*INTERPRETATIONS DURING BIDDING*	5
7.0	*ADDENDA*	6
8.0	*SUBSTITUTION OF PRODUCTS*	6
9.0	*PREPARATION OF BIDS*	6
10.0	*BID SUBMISSION*	6
11.0	*BID SECURITY*	6
12.0	*SUBCONTRACTORS AND SUPPLIERS*	7
13.0	*MODIFICATION OR WITHDRAWAL OF BID*	7
14.0	*BID DISQUALIFICATION*	7
15.0	*PREBID MEETING*	7
16.0	*OPENING OF BIDS*	7
17.0	*EVALUATION AND CONSIDERATION OF BIDS*	7
18.0	*ACCEPTANCE OF THE BID*	7

Document 00200

INSTRUCTIONS TO BIDDERS

1.0 RELATED DOCUMENTS

A. Document 00210, Supplementary Instructions to Bidders.

B. Document 00320, Geotechnical Information.

C. Document 00330, Existing Conditions.

D. Document 00410 – Bid Form, Parts A & B.

E. Document 00495, Post-Bid Procedures.

F. Document 00520, Agreement.

G. Document 00700, General Conditions.

H. Document 00800, Supplementary Conditions.

2.0 DEFINITIONS

A. Definitions set forth in Document 00700, General Conditions, and in other documents of Project Manual, are applicable to Bid Documents.

B. *Addendum:* Written or graphic instrument issued prior to Bid opening, which clarifies, modifies, corrects, or changes Bid Documents.

C. *Alternate:* The total amount bid for additions to work, as described in Section 01110, Summary of Work. Each Alternate includes cost of effects on adjacent or related components, and Bidder's overhead and profit.

D. *Bid:* A complete and properly signed offer to perform the Work in accordance with this Document and Document 00210, Supplementary Instructions to Bidders.

E. *Bid Date:* Date and time set for receipt of Bids as stated in Document 00210, Supplementary Instructions to Bidders, or as modified by Addenda.

F. *Bid Documents:* Project Manual, Drawings, and Addenda.

G. *Bid Supplement: A* Bid submittal that is required in Document 00410, Bid Form.

H. *Bidder:* Person or firm, identified in Document 00410B, Bid Form, Part B, including its successors, and its authorized representative.

I. *Code:* Code of Ordinances, Houston, Texas.

J. *Low Bidder:* Apparent successful Bidder that qualifies as a responsible Bidder and that submits Bid with lowest Total Bid Price.

K. *Project Manager:* Person designated in Document 00100, Advertisement for Bids, and Document 00220, Request for Bid Information, to represent the City during bidding and post-bid periods.

L. *Project Manual:* Volume assembled for the Work that includes the bidding requirements, sample forms, Conditions of the Contract, and Specifications.

M. *Security Deposit:* A certified check, cashier's check, or bid bond in the amount of 10 percent of the Total Bid Price.

N. *Total Bid Price:* Total amount bid for performing the Work as identified by Bidder in Document 00410B, Bid Form, Part B, which amount includes:

1. Stipulated Price;

2. Total Base Unit Prices;

3. Total Extra Unit Prices;

4. Total Cash Allowances; and

5. Total Alternates.

3.0 NOTICE TO BIDDERS

A. Chapter 18, Ethics and Financial Disclosure, of the City of Houston Code of Ordinances makes it unlawful for a Contractor to offer any contribution to a candidate for City elective office (including elected officers and officers-elect) during a certain period of time prior to and following the award of the Contract by the City Council. The term "Contractor" includes proprietors of proprietorships, all partners of partnerships, and all officers, directors, and holders of 10 percent or more of the outstanding shares of corporations. A statement disclosing the names and business addresses of each of those persons will be required to be submitted with each bid or proposal; for a City Contract. Bidder shall complete and submit Document 00455, Ownership Information Form, with its Bid to comply with this requirement. See Chapter 18 of

the Code for further information.

B. Chapter 15, Article VIII, of the City's Code provides that no contract shall be let, nor any other business transaction entered into, by the City with any person indebted to the City or a qualifying entity, if the contractor or transaction comes within the provisions of Section 15-1 (c) of the Code. Exceptions are provided in Section 15-126 of the Code. Bidder shall complete and submit Document 00455, Ownership Information Form, with its Bid to comply with this requirement.

C. Neither bidder(s) nor any person acting on bidder(s)'s behalf shall attempt to influence the outcome of the award by the offer, presentation or promise of gratuities, favors, or anything of value to any appointed or elected official or employee of the City of Houston, their families or staff members. All inquiries regarding the solicitation are to be directed to the designated City Representative identified on the first page of the solicitation. Upon issuance of the solicitation through the pre-award phase and up to the date the City Secretary publicly posts notice of any City Council agenda containing the applicable award, aside from bidder's formal response to the solicitation, through the pre-award phase, written requests for clarification during the period officially designated for such purpose by the City Representative, neither bidder(s) nor persons acting on their behalf shall communicate with any appointed or elected official or employee of the City of Houston, their families or staff through written or oral means in an attempt to persuade or influence the outcome of the award or to obtain or deliver information intended to or which could reasonably result in an advantage to any bidder. However, nothing in this paragraph shall prevent a bidder from making public statements to the City Council convened for a regularly scheduled session after the official selection has been made and placed on the City Council agenda for action, or to a City Council committee convened to discuss a recommendation regarding the solicitation.

D. Compliance with Certain State Law Requirements.

1. *Anti-Boycott of Israel*. Contractor certifies that Contractor is not currently engaged in, and agrees for the duration of this Agreement not to engage in, the boycott of Israel as defined by Section 808.001 of the Texas Government Code.

2. *Anti-Boycott of Energy Companies*. Contractor certifies that Contractor is not currently engaged in, and agrees for the duration of this Agreement not to engage in, the boycott of energy companies as defined by Section 809.001 of the Texas Government Code.

3. *Anti-Boycott of Firearm Entities or Firearm Trade Associations*. Contractor certifies that Contractor does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association, or will not discriminate against a firearm entity or firearm trade association for the duration of this Agreement, as defined by Section 2274.001 of the Texas Government Code.

4. *Certification of No Business with Foreign Terrorist Organizations*. For purposes of Section 2252.152 of the Code, Contractor certifies that, at the time of this Agreement neither Contractor nor any wholly owned subsidiary, majority-owned subsidiary, parent company or affiliate of Contractor, is a company listed by the Texas Comptroller of Public Accounts under Sections 2252.153 or 2270.0201 of the Texas Government Code as a company known to have contracts with or provide supplies to a foreign terrorist organization.

E. **Zero Tolerance Policy for Human Trafficking and Related Activities**. The requirements and terms of the City of Houston's Zero Tolerance Policy for Human Trafficking and Related Activities, as set forth in Executive Order 1-56, as revised from time to time, are incorporated into this Contract for all purposes. Bidder has reviewed Executive Order 1-56, as revised, and shall comply with its terms and conditions as they are set out at the time of this Contract's effective date. Bidder shall notify the City's Chief Procurement Officer, City Attorney, and the Director of any information regarding possible violation by the Bidder or its subcontractors providing services or goods under this Contract within 7 days of Bidder becoming aware of or having a

reasonable belief that such violations may have occurred, have occurred, or are reasonably likely to occur.

F. The requirements of Subchapter J, Chapter 552, Government Code, may apply to this bid and the contractor or vendor agrees that the contract can be terminated if the contractor or vendor knowingly or intentionally fails to comply with a requirement of that subchapter.

G. **Prospective Vendor Responsibility**. The City will award contracts only to the responsible vendor possessing the ability to perform successfully under the terms and conditions of a proposed procurement. The City's policy is to award contracts only to a prospective vendor whom the City's contracting department has determined to be responsible, considering the following non-exhaustive factors:

- Record of integrity and business ethics, including timely payments to subcontractors/subconsultants, business judgment, reputation, and reliability.
- History of compliance with public policy and applicable laws, or the lack thereof.
- Record of past performance, including but not limited to, poor performance, failure to achieve reasonable progress, or defaulting on existing or previous City of Houston contracts, if any.
- Capacity to perform the required work or provide the required goods or services, which may include having (or having the ability to obtain) adequate financial and technical resources to perform the contract and any necessary equipment, facilities, organization, experience, efficiency, operational control, or technical skills, as applicable.
- Financial responsibility, including the ability to provide adequate bonds and insurance, as applicable.
- History of compliance with prevailing wage and other labor standards requirements.
- Record of failure to make good faith efforts to meet MWBE goals.
- Qualification and eligibility to receive an award under applicable laws and regulations, including any federal rules or regulations (e.g., 2 CFR Part 200).
- Ineligibility due to being suspended or debarred by federal, state, city, or county governmental agencies.

4.0 BID DOCUMENTS

A. The Bid Documents may be obtained at location specified in Document 00210, Supplementary Instructions to Bidders.

B. The Bid Documents are made available only for the purpose of bidding on the Work. Receipt of Bid Documents does not grant a license for other purposes.

C. On receipt of Bid Documents, Bidder shall verify that documents are legible and complete, compare contents of Project Manual with Document 00010, Table of Contents, and compare Index of Drawings with Document 00015, List of Drawings. Bidder shall notify Project Manager if Bid Documents are incomplete.

D. If City of Houston Standard Specifications or Standard Details are required by the Project Manual, Bidder shall refer to Document 00210, Supplementary Instructions to Bidders for purchase information.

5.0 EXAMINATION OF DOCUMENTS, SITE, AND LOCAL CONDITIONS

A. Bidder shall examine Project site, become familiar with local conditions under which the Work shall be performed, conduct appropriate investigations, and correlate personal observations with requirements of the Bid Documents before submitting a Bid.

B. Bidder shall make site investigations to the extent Bidder deems necessary to ascertain extent of subsurface conditions.

C. Failure of Bidder to perform the investigations prior to submitting a Bid does not relieve Bidder of responsibility for investigations, interpretations and proper use of available information in the preparation of its Bid.

D. Bidder shall observe limitations of access to occupied or restricted site as stated in Document 00210, Supplementary Instructions to Bidders.

6.0 INTERPRETATIONS DURING BIDDING

A. Bidder shall immediately submit Document 00220, Request for Bid Information, to Project Manager upon finding errors, discrepancies, or omissions in Bid Documents. Confirmation of receipt of questions by the City is the responsibility of Bidder. Verbal discussions and answers are not binding.

B. Document 00220, Request for Bid Information, must be received at least 10 days before the Bid Date to allow issuance of Addenda in accordance with Paragraph 7.O.D. Replies, if issued, are by Addenda.

7.0 ADDENDA

A. Addenda that affect bidding requirements are applicable only through issuance of the Notice to Proceed. Addenda that affect the Contract are a part of the Contract.

B. BIDDERS WHO SUBMIT A BID ON THIS PROJECT SHALL BE PRESUMED TO HAVE RECEIVED ALL ADDENDA AND TO HAVE INCLUDED ANY COST THEREOF IN THEIR BIDS, REGARDLESS OF WHETHER THEY ACKNOWLEDGE THE ADDENDA OR NOT.

C. The City will make Addenda available at same location where the Bid Documents may be obtained. The City will notify plan holders of record when Addenda are available. Bidders are responsible for obtaining Addenda after notification.

D. No Addendum will be issued later than noon on Monday before Bid Date, except Addenda with minor clarifications, withdrawing request for Bids, or postponing Bid Date.

8.0 SUBSTITUTION OF PRODUCTS

A. No substitutions of Products will be considered during the bidding period.

9.0 PREPARATION OF BIDS

A. Bidder shall fill in applicable blanks in Document 00410A&B, Bid Form, Parts A & B, and Bid Supplements. In addition, Bidder shall bid all Alternates. Bidder shall properly sign Document 00410B, Bid Form.

B. Bidder shall initial all pages, except signature page, of Document 00410B, Bid Form, Part B.

C. Bidder is responsible for all costs incurred by the Bidder, associated with preparation of its Bid and compliance with Post-bid Procedures.

D. Bidder may not adjust preprinted price on line items stating "Fixed Unit Price" in the description on the Bid Form.

E. Bidder may increase, but not decrease, preprinted price on line items stating "Minimum Bid Price" in the description on the Bid Form by crossing out the minimum and inserting revised price on the line above. Bidder **may not** decrease the preprinted price on line items stating “Minimum Bid Price”.

F. Bidder may decrease, but not increase, preprinted price on line items stating "Maximum Bid Price" in the description on the Bid Form by crossing out the maximum and inserting revised price on the line above. Bidder **may not** increase the preprinted price on line items stating “Maximum Bid Price”.

G. Bidder shall insert a price no greater than the maximum preprinted range and no less than the preprinted range for line items stating "Fixed Range Unit Price" in the description on the Bid Form by crossing out prices noted and inserting revised price on the line above.

H. Bidder may not adjust Cash Allowance amounts.

10.0 BID SUBMISSION

A. City Secretary will receive Bids on Bid Date at location specified in Document 00210, Supplementary Instructions to Bidders.

B. Bids submitted after Bid Date will be returned to Bidder unopened.

C. Verbal, facsimile, or electronic Bids are invalid and will not be considered.

D. Bidder shall submit in person or by mail one copy of the signed Document 00410, Bid Form, Parts A and B, along with required Security Deposit, and required Bid Supplements, in a sealed, opaque envelope. In addition, Bidder shall clearly identify Project, Bid Date and Bidder's name on outside of envelope. If forwarded by mail, the sealed envelope containing the Bid must be enclosed in another envelope addressed for postal delivery.

11.0 BID SECURITY

A. Bidder shall submit a Security Deposit with its Bid.

B. Certified Check or Cashier's Check

1. Bidder shall make check payable to the City of Houston.

2. A check is submitted on the condition that if Bidder is named Low Bidder and fails either to timely and properly submit documents required in Document 00495, Post-Bid Procedures, the City will cash the check in accordance with Paragraph 11.0.E.

C. Bid Bond

1. The bid bond must be a valid and

enforceable bond, signed by a surety that complies with other requirements set out by law.

2. The bid bond must name the City of Houston as obligee, and be signed by the Bidder as principal and signed and sealed by the surety.

3. The bid bond must be conditioned such that if Bidder is named Low Bidder and then fails to timely and properly submit documents required in Document 00495, Post-Bid Procedures, surety will be obligated to pay to the City an amount in accordance with Paragraph 11.0.E.

D. Security Deposits will be retained until after the Contract is awarded or all Bids are rejected.

E. Low Bidder forfeits Security Deposit if it fails to timely and properly submit documents required in Document 00495, Post-Bid Procedures. The City may claim an amount equal to the difference between the Total Bid Price of the defaulting Bidder and the Total Bid Price of the Bidder awarded the Contract. If Security Deposit is a check, the City will reimburse any remaining balance to the defaulting Bidder.

12.0 SUBCONTRACTORS AND SUPPLIERS

A. The City may reject proposed Subcontractors or Suppliers.

B. Refer to Document 00800,– Supplementary Conditions, for MWBE, PDBE, DBE and SBE goals.

13.0 MODIFICATION OR WITHDRAWAL OF BID

A. A Bidder may modify or withdraw a Bid submitted before the Bid Date by written notice to the City Secretary. The notice may not reveal the amount of the original Bid and must be signed by the Bidder.

B. Bidder may not modify or withdraw its Bid by verbal, facsimile, or electronic means.

C. A withdrawn Bid may be resubmitted up to the time designated for receipt of Bids.

14.0 BID DISQUALIFICATION

A. The City may disqualify a Bid if the Bidder:

1. fails to provide required Security Deposit in the proper amount;

2. improperly or illegibly completes information required by the Bid Documents;

3. fails to sign Bid or improperly signs Bid;

4. qualifies its Bid; or

5. improperly submits its Bid.

B. When requested, Low Bidder shall present satisfactory evidence that Bidder has regularly engaged in performing construction work as proposed, and has the capital, labor, equipment, and material to perform the Work.

15.0 PREBID MEETING

A. A prebid meeting is scheduled to be held at the place, time, and date listed in Document 00210, Supplementary Instructions to Bidders.

B. All Bidders, subcontractors, and suppliers are invited to attend.

C. Representatives of City Engineer will attend.

16.0 OPENING OF BIDS

A. Bids are opened by the City Secretary and publicly read in City Council Chambers on the Public Level in City Hall Annex at 11:00 a.m. on Bid Date.

B. Place and date of Bid opening may be changed in accordance with Sections 15-45(c) of the City Code.

17.0 EVALUATION AND CONSIDERATION OF BIDS

A. Project Manager will tabulate, record and evaluate Bids.

B. The City may reject all Bids or may reject any defective Bid.

18.0 ACCEPTANCE OF THE BID

A. The City will send to Low Bidder Document 00498, Notice of Intent to Award. Acceptance by the City is conditioned upon Bidder's timely and proper submittal of documents required in Document 00495, Post-Bid Procedures.

B. The Bid remains open to acceptance and is irrevocable for the period of time stated in Document 00410A, Bid Form, Part A.

END OF DOCUMENT

Document 00210

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

The following Paragraphs modify Document 00200 - Instructions to Bidders. Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions, the unaltered portions of the Instructions to Bidders remains in effect.

PARAGRAPH 2.0 – DEFINITIONS:

Add the following sub-Paragraphs to this Paragraph:

O. *Office of Business Opportunity (OBO):* All references to Affirmative Action Contract Compliance Division (AACC) set forth in Document 00700 – General Conditions and in other documents of the Project Manual, shall refer to, and include, the Office of Business Opportunity.

If there is no bid of a Local Business that meets these criteria, the City will award the contract to the lowest responsible bidder.

PARAGRAPH 4.0 – BID DOCUMENTS

Add the following sub-Paragraphs to this Paragraph:

A. Add the following Paragraph A.1:

1. Bid documents may only be obtained electronically at the Houston Airport System's website: https://www.fly2houston.com/biz/opportunities/solicitations/

D. Add the following Paragraph D.1:

1. Copies of the City Standard Specifications and Details may be acquired at no cost on the Houston Airport System's website https://www.fly2houston.com/biz/resources/building-standards-and-permits/) "*HOUSTON AIRPORTS DESIGN STANDARDS*"

E. The following plan rooms, whose names, addresses, phone and fax numbers were last updated on April 9, 2007, have been authorized by the City to display Bid Documents for examination:

(Note: The Bid Documents furnished to the plan rooms for examination can be in electronic format, in hard copies, or in any other formats pertaining to each City Contracting Division's discretion.)

1. Associated General Contractors (AGC-HHUI), Highway, Heavy Utilities and Industrial Branch, 2400 Augusta St., Suite 305 , Houston, TX 77057, 713-334-7100, Fax 713-334-7130. Email: msimons@agctx.org
(Attention: Mellora Connelly)

2. Houston Minority Business Development Center, 2900 Woodridge, Suite 124, Houston, TX 77087, 713-644-0821, Fax 713-644-3523. Email: gtamez@gacompanies.com

3. The Builders' Exchange of Texas, Inc., 4047 Naco Perrin Blvd., Ste. 100 San Antonio, TX 78217, 210-564-6900, Email: editor@virtialbx.com

F. Add the following sub-Paragraph F.1:

1. **Designation as a Hire Houston First City Business (CB) or Local Business (LB)**

To be designated as a City Business ("CB") or as a Local Business ("LB") for the purposes of the Hire Houston First Program, as set out in Article XI of Chapter 15 of the Houston City Code, a bidder or proposer must submit the **Hire Houston First Application and Declaration** to the Director of the Office of Business Opportunity and receive notice that the application has been processed and the appropriate designation (if any) is awarded, prior to the submission of a bid or proposal. Bidders must show evidence of HHF designation (as applicable) prior to, or accompanying, the submission of a bid or proposal.

The absence of a Hire Houston First designation does not preclude a business from bidding on City of Houston contracts.

2. The City will award this contract to a "Local Business", as that term is defined in Section 15-176 of the City of Houston Code of Ordinances ("the Code"):

- If the bid of the Local Business is less than $100,000 and is the lowest responsible bid or is within 5% of the lowest bid received, or
- If the bid of the Local Business is more than $100,000 and is the lowest responsible bid or is within 3% of the lowest bid received, and
- Unless the Director determines that such an award would unduly interfere with contract needs, as provided in Section 15-181 of the Code.

Download the HHF Application and Declaration from the Office of Business Opportunity Webpage at the City of Houston e-Government Website, located at:

http://www.houstontx.gov/obo/hirehoustonfirst.html

or, delivered to:

Office of Business Opportunity
611 Walker, 7th Floor
Houston, Texas 77002.
Phone: (832) 393-0951
Fax: (832) 393-0646
hirehoustonfirst@houstontx.gov

PARAGRAPH 5.0 – EXAMINATION OF DOCUMENTS, SITE, AND LOCAL CONDITIONS

D. Add the following sub-Paragraph D.1:

1. Area within contract limits is currently restricted. Access for examination is restricted to times, durations, routes and presence of City authorities, occurring at the conclusion of the Prebid Meeting or as otherwise directed by City Engineer. See Paragraph 15.0 below.

PARAGRAPH 8.0 – SUBSTITUTION OF PRODUCTS

Delete the existing sub-Paragraph A in its entirety, and replace it with the following sub-Paragraphs A, B, C, and D:

A. Where Bid Documents specify a specific Product with provision for consideration of substitutions (or equal), requests for pre-bid approval of substitutions will be considered from Bidders only if received by Project Manager 10 days or more prior to Bid Date.

B. Requests for substitutions must provide complete information to determine acceptability of the Products, in accordance with provisions of Document 00700 - General Conditions.

******OR *****

Requests for substitutions must provide complete information to determine acceptability of the Products, in accordance with provisions of Document 00700 - General Conditions and Document 01630 – Product Options and Substitutions. <u>(Use on Signage/Wayfinding's projects or where is applicable).</u>

C. The City will consider requests for substitutions and, if approved, will issue an Addendum. Bidder shall base its Bid only on substitutions approved in Addenda. Substitutions, not listed in an Addendum, are not allowed.

D. Bidder shall include in its Bid, costs of substitutions approved by Addenda.

PARAGRAPH 9.0 – PREPARATION OF BIDS

Add the following sub-Paragraph I to this Paragraph:

I. For math errors the City encounters in analyzing Bids, the following guidance will be used:

In the event of a conflict between:	The Bid Price is:
1. Individual Unit Price and Extension of that Unit Price	Individual Unit Price times Estimated Quantity
2. A Unit Price extension and total of Unit Price Extensions	Sum of all Individual Unit Price Extensions
3. Individual Alternate and total of Alternates	Sum of all Individual Alternates
4. Individual subtotals for Stipulated Price, Base Unit Prices, Extra Unit Prices, Contractor Bonus, Cash Allowances, and Alternates; and the Total Bid Price	Sum of Individual subtotals for Stipulated Price, Base Unit Prices, Extra Unit Prices, Contractor Bonus, Cash Allowances and Alternates

PARAGRAPH 10.0 – BID SUBMISSION

Add the following sub-Paragraph A.1 to this Paragraph:

A. Add the following sub-Paragraph A.1:

1. Sealed bids, in triplicate, one (1) original marked “Original” and two (2) copies of the bids (also includes two (2) USB drives of all required submittals identified in Document 00410 Section 1.0 Offer) will be received by the City Secretary of the City of Houston, in the City Hall Annex, Public Level, 900 Bagby, Room P101, Houston, Texas 77002, until 10:30 a.m., (CST) on May 19, 2022.

E. Add the following Paragraph “E.” to Section 10:

E. Bidders shall submit Document 00470 Bidder’s MWSBE Participation Plan (or 00470D Bidder’s DBE Participation Plan if FAA funded project) with the bid. If the MWSBE goal is not met, the Document 00471 Pre-bid Good Faith Efforts, and Document 00472 Bidder’s MWSBE Goal Deviation Request form shall also be included in the submission with the bid (If the DBE goal is not met, following Section 2.A.12. of Document 00806).

11.0 – BID SECURITY: Add the following Paragraph 1. to Section 11.0.A.:

1. Bidder shall submit a Security Deposit in the form of:
a.) Certified Check;
b.) Cashier’s Check; or

c.) Bid Bond
Bidder should submit just one form of Security Deposit among the three listed above, and such form shall be issued according to Section 11.0.B and 11.0.C.

PARAGRAPH 15.0 – PREBID MEETING

Add the following sub-Paragraph A.1 to this Paragraph:

A. Add the following Paragraph A.1:

1. A Prebid Meeting will be held at Houston Airport System, IDO Building located at 111 Standifer Road, Humble TX 77338, in the HAS IDO Wright Brothers Conference Room #100.4 at 1:30 p.m. (CST) Thursday, April 7, 2022.
2. Pre-bid Meeting Questions will be due from bidders at 3:00 p.m. (CST), April 14, 2022.
3. A Site Visit will begin immediately after the Pre-bid Meeting. The meeting and site visit are the only opportunity for bidders to see the site prior to Bid Due Date.

16.0 – OPENING OF BIDS: Replace Section B with the following:

B. Place and date of Bid opening may be changed in accordance with Section 15-45(c) of the City Code.

The following Section is added as part of this solicitation:

3.0 – NOTICE TO BIDDERS

F. RESOLVING PROTESTS

1. Protests will be handled in accordance with City of Houston Administrative Policy AP 5-12. http://www.houstontx.gov/adminpolicies/5-12.pdf.

END OF DOCUMENT

Document 00220

REQUEST FOR BID INFORMATION

PROJECT: IDO Building Standards Space Fit-Out

PROJECT No.: 913

TO: Jorge Ardines, Senior Procurement Specialist
18600 Lee Road
Humble, TX 77338

Phone No. 281-233-1620

Email Addr. jorge.ardines@houstontx.gov

(Type or Print question legibly; use back if more space is needed)

This request relates to _____ and/or _____
Drawing / Detail No. Specification Section No.

Attachments to this request: _____

_____ _____
Signature Date

_____
(Type or Print Name)

_____
(Type or Print Company Name)

END OF DOCUMENT

Document 00410A

BID FORM – PART A

To: **The Honorable Mayor and City Council of the City of Houston**
City Hall Annex
900 Bagby Street
Houston, Texas 77002

Project: IDO Building Standards Space Fit-Out
Project No.: 913
Bidder: _____
(Print or type full name of business entity, such as corporation, LLC, etc)

1.0 OFFER

A. Total Bid Price: Having examined the Project location and all matters referred to in Bid Documents for the Project, we, the undersigned, offer to enter into a Contract to perform the Work for the Total Bid Price shown on the signature page of this Document

B. Security Deposit: Included with the Bid is a Security Deposit in the amount of 10 percent of the Total Bid Price subject to terms described in Document 00200 – Instructions to Bidders.

C. Period for Bid Acceptance: This offer is open to acceptance and is irrevocable for 180 days from Bid Date. That period may be extended by mutual written agreement of the City and Bidder.

D. Addenda: All Addenda have been received. Modifications to Bid Documents have been considered and all related costs are included in the Total Bid Price.

E. Bid Supplements: The following documents are attached:

[X] Security Deposit *(as defined in Document 00200 – Instructions to Bidders)*
[ ] Document 00450 - Bidder's Statement of MWSBE Status
[X] Document 00454 - Affidavit of Non-interest
[X] Document 00455 - Ownership Information Form
[X] Document 00457 – Conflicts of Interest Questionnaire (CIQ)
[X] Document 00460 – Pay or Play Acknowledgement Form (POP 1-A)
[X] Document 00461 – Hire Houston First Affidavit
[ ] Document 00470 – Bidder's MWSBE Participation Plan *(required unless no MWSBE participation goal is provided in Document 00800* (the "Goal")*)*.
[ ] Document 00470D - Bidder's DBE Participation Plan *(required for AIP funded project)*
[ ] Document 00471 – Bidder's Record of Good Faith Efforts *(required if the goal in Bidder's Participation Plan–Document 00470 is lower than the Goal).*
[ ] Document 00472 – Bidder's Goal Deviation Request *(required if the goal in Bidder's Participation Plan–Document 00470 is lower than the Goal).*
[X] Document 00480 – Form SCM-1 Reference Verification
[ ] Document 00481 – Non-Collusion Statement

[ ] Document 00842 – Letter of Intent
[ ] Others as listed: _____

2.0 CONTRACT TIME

A. If offer is accepted, Contractor shall achieve Date of Substantial Completion within 210 Calendar days after Date of Commencement of the Work, subject to adjustments of Contract Time as provided in the Contract.

Document 00410B

BID FORM – PART B

1.0 TOTAL BID PRICE HAS BEEN CALCULATED BY BIDDER, USING THE FOLLOWING COMPONENT PRICES AND PROCESS (PRINT OR TYPE NUMERICAL AMOUNTS):

A. STIPULATED PRICE: $[N/A, if Unit Price Job]

(Total Bid Price; minus Base Unit Prices, Extra Unit Prices, Cash Allowances and All Alternates, if any)

B. BASE UNIT PRICE TABLE:

Item No.	Spec Ref.	Base Unit Short Title	Unit of Measure	Estimated Quantity	Unit Price (this column controls)	Total in figures
TOTAL BASE UNIT PRICES						$_____

C. EXTRA UNIT PRICE TABLE:

Item No.	Spec Ref.	Extra Unit Short Title	Unit of Measure	Estimated Quantity	Unit Price (this column controls)	Total in figures
TOTAL EXTRA UNIT PRICES						$_____

REST OF PAGE INTENTIONALLY LEFT BLANK

CASH ALLOWANCE TABLE:

Item No.	Spec Ref.	Cash Allowance Short Title	Cash Allowance in figures (1)
[1]		Building Permit	5,000
TOTAL CASH ALLOWANCES			5,000

REST OF PAGE INTENTIONALLY LEFT BLANK

E. ALTERNATES TABLE:

Item No.	Spec Ref.	Alternate Short Title	Unit of Measure	Estimated Quantity	Unit Price (this column controls)	Total Price for Alternate in figures
TOTAL ALTERNATES						$_____

REST OF PAGE INTENTIONALLY LEFT BLANK

F. TOTAL BID PRICE: **$**_____
(Add Totals for Stipulated Price, Base Unit Price, Extra Unit Price, Cash Allowance, and All Alternates, if any)

2.0 SIGNATURES: By signing this Document, I agree that I have received and reviewed all Addenda and considered all costs associated with the Addenda in calculating the Total Bid Price.

Bidder: _____
(Print or type full name of your proprietorship, partnership, corporation, or joint venture.*)

**By: _____
Signature Date

Name: _____
(Print or type name) Title

Address: _____
(Mailing)

_____
(Street, if different)

Telephone and Fax Number: _____
(Print or type numbers)

* If Bid is a joint venture, add additional Bid Form signature sheets for each member of the joint venture.

** Bidder certifies that the only person or parties interested in this offer as principals are those named above. Bidder has not directly or indirectly entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding.

Note: This document constitutes a government record, as defined by § 37.01 of the Texas Penal Code. Submission of a false government record is punishable as provided in § 37.10 of the Texas Penal Code.

Footnotes for Tables B through E:
(1) Fixed Unit Price determined prior to Bid. Cannot be adjusted by the Bidder.
(2) Minimum Bid Price determined prior to Bid. Can be increased by the Bidder, but not decreased, by crossing out the Minimum and inserting revised price on the line above. **Cannot** be decreased by the Bidder.
(3) Maximum Bid Price determined prior to Bid. Can be decreased by the BIdder, but not increased, by crossing out the Maximum and inserting revised price on the line above. A Bid that increases the Maximum Bid Price may be found non-conforming and non-responsive. **Cannot** be increased by the Bidder.
(4) Fixed Range Bid Price determined prior to Bid. Unit Price can be adjusted by Bidder to any amount within the range defined by crossing out prices noted and noting revised price on the line above.

Document 00430
BIDDER'S BOND

THAT WE,_____, as Principal,
(Bidder)
("Bidder"), and the other subscriber hereto,_____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston, a municipal corporation, in the sum of _____ Dollars ($_____) (an amount equal to 10 percent of the Total Bid Price, including Cash Allowances and Alternates, if any), for the payment of which sum, well and truly to be made to the City of Houston and its successors, the Bidder and Surety do bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Bidder has submitted on or about this day a proposal offering to perform the following:

_____

_____
(Project Name, Location and Number)
in accordance with the Drawings, Specifications, and terms and conditions related thereto to which reference is hereby made.

NOW, THEREFORE, if the Bidder's offer as stated in the Document 00410 – Bid Form is accepted by the City, and the Bidder executes and returns to the City Document 00520 – Agreement, required by the City, on the forms prepared by the City, for the Work and also executes and returns the same number of the Performance, Payment and Maintenance Bonds (such bonds to be executed by a Corporate Surety authorized by the State Board of Insurance to conduct insurance business in the State of Texas, and having an underwriting limitation in at least the amount of the bond) and other submittals as required by Document 00495 - Post-Bid Procedures, in connection with the Work, within the Contract Time, then this obligation shall become null and void; otherwise it is to remain in full force and effect.

If Bidder is unable to or fails to perform the obligations undertaken herein, the undersigned Bidder and Surety shall be liable to the City for the full amount of this obligation which is hereby acknowledged as the amount of damages which will be suffered by the City on account of the failure of such Bidder to perform such obligations, the actual amount of such damages being difficult to ascertain.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other Party at the address prescribed in the Contract documents, or at such other address as the receiving Party may hereafter prescribe by written notice to the sending Party.

IN WITNESS THEREOF, the Bidder and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

_____
(Name of Bidder)

By:_____
Name:
Title:

By:_____
Name:
Title:
Date:

ATTEST/SURETY WITNESS: (SEAL)

_____
(Full Name of Surety)

_____
(Address of Surety for Notice)

_____

_____
(Telephone Number of Surety)

By:_____
Name:
Title:
Date:

By:_____
Name:
Title:
Date:

Document 00454

AFFIDAVIT OF NON-INTEREST

BEFORE ME, the undersigned authority, a Notary Public in and for the State of Texas, on this day personally appeared _____, who
Affiant
being by me duly sworn on his oath stated that he is _____ of
Title

_____
Name of Firm

the firm named and referred to and in the foregoing; and that he knows of no officer, agent, or employee of the City of Houston being in any manner interested either directly or indirectly in such Contract.

_____
Affiant's Signature

SWORN AND SUBSCRIBED before me on_.
Date

_____
Notary Public in and for the State of TEXAS

_____
Print or type name

My Commission Expires: _____
Expiration Date

END OF DOCUMENT

Document 00455

OWNERSHIP INFORMATION FORM

The City of Houston Ownership Information Form is used to gather information to comply with:

a. The City of Houston Contractor Ownership Disclosure Ordinance (Chapter 15 of the Code of Ordinances, Article VIII. City Contracts; Indebtedness to City);
b. The City of Houston Fair Campaign Ordinance (Chapter 18 of the Code of Ordinances); and,
c. The State of Texas Statement of Residency Requirements (Tex. Govt. Code Chapter 2252).

Please complete the form, in its entirety, and submit it with the Official Bid or Proposal Form. Except as noted below regarding the Statement of Residency, failure to provide this information may be just cause for rejection of your bid or proposal.

NOTICE OF AFFIRMATIVE ACCEPTANCE OF THE CITY OF HOUSTON FAIR CAMPAIGN ORDINANCE

By submitting a bid or proposal to the City of Houston for a Contract in excess of $50,000 or for which a request is presented to City Council for approval, all respondents agree to comply with the Chapter 18 of the Code of Ordinances.

Further, pursuant to Section 18-36 of the Code of Ordinances, it shall be unlawful either for any person who submits a bid or proposal to contribute or offer any contribution to a candidate or for any candidate to solicit or accept any contribution from such person for a period commencing at the time of posting of the City Council Meeting Agenda including an item for the award of the Contract and ending upon the 30th day after the award of the Contract by City Council.

INSTRUCTIONS

1. Please **type** or **legibly print in dark ink** responses. Individuals and entities should disclose their full, legal names (not initials) and all required corporate letters (“Inc”, “LLP”, etc.).
    a. If a firm is operating under an assumed name, the following format is recommended: *Corporate/Legal Name* DBA *Assumed Name*.
2. Full addresses are required, including street types (“St”, “Rd”, etc.) and unit number.
3. Individuals or entities with 10% or more ownership of the corporation, partnership, or joint venture (including persons who own 100%) are required to be disclosed with their full name and full address. All officers and directors are also required to be disclosed with their full name and full address.

PROJECT AND BID/PROPOSAL PREPARER INFORMATION

Project or Matter Being Bid: _____

Bidder's complete firm/company business information
Name: _____
Business Address [*No./Street]* _____
City / State / Zip Code _____
Telephone Number _____

Bidder's email address
Email Address: _____

STATEMENT OF RESIDENCY
*(THE STATEMENT OF RESIDENCY PORTION OF THIS DOCUMENT IS **NOT APPLICABLE IF** THE SOLICITATION INDICATES FEDERAL FUNDS WILL BE USED)*

TEX. GOV'T CODE §2252.001(4) defines a **"Resident bidder"** as a bidder whose principal place of business* is in this state, and includes a contractor whose ultimate parent company or majority owner has its principal place of business in this state.

TEX. GOV'T CODE §2252.001(3) defines a **"Nonresident bidder"** as a bidder who is not a resident in this state.

* Principal Place of Business in Texas means that the business entity:

- has at least one permanent office located within the **State of Texas,** from which business activities other than submitting bids to governmental agencies are conducted and from which the bid is submitted; and
- has at least one employee who works in the Texas office.

Based on the definitions above, your business is a:

☐ TEXAS RESIDENT BIDDER

☐ NONRESIDENT BIDDER

If you are a Nonresident Bidder, does your home state have a statute giving preference to resident bidders? If so, you must attach a copy of the statute to this Document.

A copy of the State of _____ statute is attached.

NOTE: The State of residency of a bidder is not used in the decision-making criteria for the award of contracts for projects receiving federal funding, whether in whole or in part.

IDO Building Standards Space Fit-Out
Project No. 913 **OWNERSHIP INFORMATION FORM**

CONTRACTING ENTITY ORGANIZATIONAL ENTITY TYPE

FOR PROFIT ENTITY:

- ☐ SOLE PROPRIETORSHIP
- ☐ CORPORATION
- ☐ PARTNERSHIP
- ☐ LIMITED PARTNERSHIP
- ☐ JOINT VENTURE
- ☐ LIMITED LIABILITY COMPANY
- ☐ OTHER *(specify in space below)*

NON-PROFIT ENTITY:

- ☐ NON-PROFIT CORPORATION
- ☐ UNINCORPORATED ASSOCIATION

_____

_____

LISTING OF ADDRESSES

List all current and prior addresses where the bidder does/has done business or owns property (real estate and/or business personal property) in the city of Houston ("Houston") in the past 3 years from the date of submittal of this form. If within the past 3 years from the date of submitting this form, the bidder does not and has not done business and has not or does not own property (real estate and/or business personal property) in Houston, please state "None" on the first line below.

_____
Address

_____
Address

_____
Address

ATTACH ADDITIONAL SHEETS AS NEEDED.

LISTING OF OFFICERS

LIST ALL OFFICERS OF THE ENTITY, REGARDLESS OF THE AMOUNT OF OWNERSHIP (IF NONE STATE “NONE”)

Name_____ _____
Officer Address

Name_____ _____
Officer Address

Name_____ _____
Officer Address

Name_____ _____
Officer Address

Name_____ _____
Officer Address

Name_____ _____
Officer Address

LISTING OF DIRECTORS OR MEMBERS

LIST ALL DIRECTORS OF THE ENTITY, REGARDLESS OF THE AMOUNT OF OWNERSHIP (IF NONE STATE “NONE”)

Name_____ _____
Director or Member Address

Name_____ _____
Director or Member Address

Name_____ _____
Director or Member Address

Name_____ _____
Director or Member Address

Name_____ _____
Director or Member Address

DISCLOSURE OF OWNERSHIP (OR NON-PROFIT OFFICERS)

Bidders are required to disclose all owners of 10% or more of the Contracting Entity. For non-profit entities, please provide the complete information for the President, Vice-President, Secretary, and Treasurer.

IN ALL CASES, USE FULL NAMES, LOCAL BUSINESS AND RESIDENCE ADDRESSES AND TELEPHONE NUMBERS. DO NOT USE POST OFFICE BOXES FOR ANY ADDRESS. INCLUSION OF E-MAIL ADDRESSES IS OPTIONAL, BUT RECOMMENDED.

ATTACH ADDITIONAL SHEETS AS NEEDED.

Contracting Entity:

Name:_____
Business Address [*No./Street]* _____
City / State / Zip Code _____
Telephone Number _____
Email Address: _____

DISCLOSURE OF OWNERSHIP (OR NON-PROFIT OFFICERS) *continued*.

Owner(s) of 10% or More (IF NONE, STATE "NONE."):

Name:_____
Business Address [*No./Street]* _____
City / State / Zip Code _____
Telephone Number _____
Email Address: _____
Residence Address *[No./Street]* _____
City / State / Zip Code _____

Owner(s) of 10% or More (IF NONE, STATE "NONE."):

Name:_____
Business Address [*No./Street]* _____
City / State / Zip Code _____
Telephone Number _____
Email Address: _____
Residence Address *[No./Street]* _____
City / State / Zip Code _____

ATTACH ADDITIONAL SHEETS AS NEEDED.

OPTIONAL: TAX APPEAL INFORMATION

If the firm/company or an owner/officer is actively protesting, challenging, or appealing the accuracy and/or amount of taxes levied with a tax appraisal district, please provide the following information:

Debtor (Firm or Owner Name):	
Tax Account Nos.:	
Case or File Nos.:	
Attorney/Agent Name:	
Attorney/Agent Phone No.:	
Tax Years:	

Status of Appeal ***[DESCRIBE]*:**

If an appeal of taxes has been filed on behalf of your company, please include a copy of the official form receipted by the appropriate agency.

REQUIRED: UNSWORN DECLARATION

I certify that I am duly authorized to submit this form on behalf of the firm, that I am associated with the firm in the capacity noted below, and that I have personal knowledge of the accuracy of the information provided herein. I affirm that all the information contained herein is true and correct to the best of my knowledge. I understand that failure to submit accurate information with my submission may result in my submission being considered non-responsive and non-responsible.

Preparer's Signature **Date**

Printed name

Title

NOTE: This form constitutes a **governmental record,** as defined by Section 37.01 of the Texas Penal Code. Submission of a false government record and falsification of a governmental record are crimes, punishable as provided in Section 37.10 of the Texas Penal Code.

Document 00457

Conflict of Interest Questionnaire

Local Government Code Chapter 176 requires Bidders with the City of Houston ("City") to file a Conflict of Interest Questionnaire with the City Secretary of the City of Houston.

The Conflict of Interest Questionnaire is available for downloading on the Texas Ethics Commission's website at: http://www.ethics.state.tx.us

The completed Conflict of Interest Questionnaire will be posted on the City Secretary's website. Also you will find a list of the City Local Government Officers on the City Secretary's website.

For your convenience the CIQ form is attached as part of this document. Although the City has provided this document for the Bidders convenience, it is the Bidders responsibility to submit the latest version of the CIQ form as promulgated by the Texas Ethics Commission.

The Failure of any Bidder to comply with this law is a Class C misdemeanor.

END OF DOCUMENT

CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code, by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. *See* Section 176.006(a-1), Local Government Code.

A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.

OFFICE USE ONLY

Date Received

1 **Name of vendor who has a business relationship with local governmental entity.**

2 ☐ **Check this box if you are filing an update to a previously filed questionnaire.** (The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)

3 **Name of local government officer about whom the information is being disclosed.**

_____

Name of Officer

4 **Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary.**

A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor?

☐ Yes ☐ No

B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity?

☐ Yes ☐ No

5 **Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more.**

6 ☐ Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1).

7

_____ _____

Signature of vendor doing business with the governmental entity Date

CONFLICT OF INTEREST QUESTIONNAIRE
For vendor doing business with local governmental entity

A complete copy of Chapter 176 of the Local Government Code may be found at http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm. For easy reference, below are some of the sections cited on this form.

Local Government Code § 176.001(1-a): "Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on:

(A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity;

(B) a transaction conducted at a price and subject to terms available to the public; or

(C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency.

Local Government Code § 176.003(a)(2)(A) and (B):

(a) A local government officer shall file a conflicts disclosure statement with respect to a vendor if:

***

(2) the vendor:

(A) has an employment or other business relationship with the local government officer or a family member of the officer that results in the officer or family member receiving taxable income, other than investment income, that exceeds $2,500 during the 12-month period preceding the date that the officer becomes aware that

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor;

(B) has given to the local government officer or a family member of the officer one or more gifts that have an aggregate value of more than $100 in the 12-month period preceding the date the officer becomes aware that:

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor.

Local Government Code § 176.006(a) and (a-1)

(a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:

(1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);

(2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or

(3) has a family relationship with a local government officer of that local governmental entity.

(a-1) The completed conflict of interest questionnaire must be filed with the appropriate records administrator not later than the seventh business day after the later of:

(1) the date that the vendor:

(A) begins discussions or negotiations to enter into a contract with the local governmental entity; or

(B) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity; or

(2) the date the vendor becomes aware:

(A) of an employment or other business relationship with a local government officer, or a family member of the officer, described by Subsection (a);

(B) that the vendor has given one or more gifts described by Subsection (a); or

(C) of a family relationship with a local government officer.

City of Houston
Pay or Play Program
Acknowledgement Form

It has been determined that the project currently open for bidding meets the criteria of the City of Houston Pay or Play program. This form acknowledges your awareness of the Pay or Play program which is authorized by Ordinance 2007-534. Your signature below affirms that you will comply with the requirements of the program upon contract award and ensure the same on behalf of your subcontractors that may be subject to the Pay or Play Program.

I declare under penalty of perjury under the laws of the State of Texas that if awarded this contract which meets the criteria for the City of Houston's Pay or Play Program, I will comply with all requirements of the Pay or Play Program in accordance with Executive Order 1-7.

Fill out all information below and submit this form with your bid/proposal packet.

_____
Solicitation Number

_____ _____
Signature Date

_____ _____
Print Name City Vendor ID

_____ _____
Company Name Phone Number

_____
Email Address

For more information about the Pay or Play program please visit http://www.houstontx.gov/obo/popforms.html.

Questions about the Pay or Play Program should be referred to the Department POP Liaison; an updated contact list is available on the Office of Business Opportunity website or call the POP Contract Administrator at 832-393-0633.

Hire Houston First
Application and Affidavit

Thank you for your interest in the Hire Houston First initiative. It is the policy of the City of Houston as defined in Chapter 15, Article XI, to use the City's spending powers in a manner that promotes fiscal responsibility and maximizes the effectiveness of local tax dollars by ensuring a portion of citizens' tax dollars remain in the local economy for economic benefit of the citizens by utilizing all available legal opportunities to contract with city and/or local businesses.

Businesses interested in becoming eligible to participate in the Hire Houston First initiative must complete this application and sign the attached affidavit. Only businesses that meet the requirements will be eligible to participate in the Hire Houston First initiative. A completed HHF application is NOT evidence of designation under the Hire Houston First initiative. An applicant's eligibility must be confirmed in writing by the Office of Business Opportunity.

Definitions:

A. **City Business** means a business with a principal place of business within city limits.

B. **Local Area** means eight counties in and surrounding Houston city limits. The counties are Harris, Fort Bend, Montgomery, Brazoria, Galveston, Chambers, Waller, and Liberty.

C. **Local Business** means a business with a principal place of business in the local area.

D. **Principal place of business** means the business must be headquartered or have an established place or places of business in the incorporated limits of the city or the local area as applicable, from which 20% or more of the entity's workforce are regularly based, and from which a substantial role in the entity's performance of a commercially useful function or a substantial part of its operations is conducted. A location utilized solely as a post office box, mail drop or telephone message center or any combination thereof, with no other substantial work function, shall not be construed as a principal place of business.

E. **Headquartered** means the location where an entity's leadership directs, controls, and coordinates the entity's activities.

Application

Please complete the following form/affidavit and submit it to the Office of Business Opportunity, Houston Business Solutions Center located at 611 Walker, Lobby Level, Houston, TX 77002 (832) 393-0954. Applications may be submitted via e-mail to houstonBSC@houstontx.gov or faxed to 832.393.0650. Incomplete applications and affidavits will not be processed. Please answer all questions.

1. **Application Date:**_____

2. **Company is applying as (please check at least one box):**

   - ☐ City Business (CB) with a principal place of business within the city limits from which a substantial role in the entity's performance of a commercially useful function or a substantial part of its operations is conducted as defined in Chapter 15, Article XI.
   - ☐ Local Business (LB) with a principal place of business in the local area from which a substantial role in the entity's performance of a commercially useful function or a substantial part of its operations is conducted as defined in Chapter 15, Article XI.

3. **Name of Owner or CEO:**_____ **Name of Company**:_____

FOR OFFICE USE ONLY: ☐

4. **Business Address**(*for use in determining HHF eligibility)*:_____
Street City State Zip Code

5. **Mailing Address**(*If different from Business Address)*:_____
Street City State Zip Code

6. **Business Phone Number:**_____ **Business Fax Number:**_____

7. **Business E-Mail:**_____ **Business Website:**_____

8. **Federal Tax ID Number:**_____ **COH Vendor Registration ID Number:**_____

9. **Describe the primary activities of your firm:**_____

_____

10. **In accordance with the aforementioned definition for "headquartered", is your company's headquarters or corporate office located in one of the following eight counties?**

YES ☐ **NO** ☐

If yes, check all that apply.

- ☐ Harris
- ☐ Brazoria
- ☐ Chambers
- ☐ Fort Bend
- ☐ Galveston
- ☐ Liberty
- ☐ Montgomery
- ☐ Waller

How many employees are based within the county or counties you selected?_____
If you answered "no" to question 10, please answer questions 11, 12 and 13.

11. **What is the number of employees that are based within the following eight counties?**_____

- Harris
- Brazoria
- Chambers
- Fort Bend
- Galveston
- Liberty
- Montgomery
- Waller

12. **List all company locations inside city limits and in the 8 county local area as well as addresses, primary activities and number of employees at each location.**

Business Address	Primary Activities	Number of Employees
Business Name: **Street Address:** **City, State:** **Zip Code:** **Main Phone Number:**		
Business Name: **Street Address:** **City, State:** **Zip Code:** **Main Phone Number:**		
Business Name: **Street Address:** **City, State:** **Zip Code:** **Main Phone Number:**		

Business Address	Primary Activities	Number of Employees
Business Name: **Street Address:** **City, State:** **Zip Code:** **Main Phone Number:**		

13. List all company locations OUTSIDE the eight (8) county local area, including headquarters locations, as well as addresses, primary activities and number of employees at each location.

Business Address	Corporate Headquarters?	Primary Activities	Number of Employees
Business Name: **Street Address:** **City, State:** **Zip Code:** **Main Phone Number:**	**YES/NO**		
Business Name: **Street Address:** **City, State:** **Zip Code:** **Main Phone Number:**	**YES/NO**		
Business Name: **Street Address:** **City, State:** **Zip Code:** **Main Phone Number:**	**YES/NO**		
Business Name: **Street Address:** **City, State:** **Zip Code:** **Main Phone Number:**	**YES/NO**		
Business Name: **Street Address:** **City, State:** **Zip Code:** **Main Phone Number:**	**YES/NO**		

14. What is the total number of employees in the entire company?____

15. Is the company represented on this application an independent or dependent subsidiary of a company with headquarters located outside the eight county local area? (Check One)

☐ **NOT** a subsidiary of any company

☐ **YES** – An independent subsidiary. Please submit Federal corporate tax returns and any other documentation necessary to show independence from the parent company.

☐ **YES** – A dependent subsidiary. Please answer the following questions:

(a). What is the total number of employees within the (8) county local area inclusive of the company represented on this application and the parent company?____

(b). What is the total number of all employees inclusive of the company represented on this application and the parent company?____

Hire Houston First Affidavit

I_____ certify and affirm that my business _____ is not
Name of Company Owner Name of Company
a location utilized solely as a post office box, mail drop or telephone message center or any combination thereof, with no other substantial work function.

The undersigned swear/affirm that the foregoing information and statements are true and correct with regard to the employee breakdown of the company's work force, location, and principal place of business. In addition, the undersigned gives permission to the City of Houston to conduct random audits to ensure compliance with the Hire Houston First Initiative under Chapter 15, Article XI.

_____ _____
Name of Company Owner Name of Company

On this day before me appeared (name)_____ with proper identification, who being duly sworn, did execute the foregoing affidavit and did aver that he or she was properly authorized to execute this affidavit and did so as his or her free act/deed.

_____ _____
Signature (Owner /Applicant) Title

_____ _____
Name (Print) Date

(Seal)

Notary Attest:

_____ _____
Notary Public Commission Expiration

DOCUMENT 00480 REFERENCE VERIFICATION

1.0 REFERENCES

1.1 Contractor must be able to demonstrate that they have sufficient expertise, qualified personnel experienced and that their company has done or currently providing the services of similar size as specified in the statement of work. Contractor must have been actively engaged as an actual business entity in the activities described in the bid document for at least the five (5) years immediately prior to the submission of their bid.

1.2 The reference(s) must be included in the space provided below. Additional pages may be added if necessary. References must be included at the time of bid submittal.

LIST OF CURRENT/PREVIOUS CUSTOMERS

1. Company Name: _____

   Contact Person/Title: _____ Phone No.: _____

   E-mail Address: _____

   Address: _____

   Contract Award Date: _____ Contract Completion Date: _____

   Contract Name/Title: _____

   Project Description: _____

   _____

2. Company Name: _____

   Contact Person/Title: _____ Phone No.: _____

   E-mail Address: _____

   Address: _____

   Contract Award Date: _____ Contract Completion Date: _____

   Contract Name/Title: _____

   Project Description: _____

   _____

3. Company Name: _____

   Contact Person/Title: _____ Phone No.: _____

   E-mail Address: _____

   Address: _____

   Contract Award Date: _____ Contract Completion Date: _____

   Contract Name/Title: _____

   Project Description: _____

   _____

DOCUMENT 00480 REFERENCE VERIFICATION

SAMPLE REFERENCE VERIFICATION
Houston Airport System
Planning, Design & Construction
Reference Verification for_____(Respondent's Company Name)
Name of Company:
Name of Contact:
Phone Number of Contact:
E-Mail Address of Contact:
QUESTIONS TO BE ASKED BY HOUSTON AIRPORT SYSTEM
1. When did this company perform work for you?
2. What type of service did this company perform for you?
3. Did they perform the work as agreed?
4. Was the company timely with responding to your needs?
5. How many instances of services has this company provided for you?
6. Did company representatives conduct themselves in a professional manner?
7. Would you do business with this company again?
Additional Comments:
Name/Phone Number of Person conducting Reference Verification:
SIGNATURE:_____DATE: _____

Document 00495

POST-BID PROCEDURES

1.0 DOCUMENT ADDRESSES

A. Notice of Intent to Award.

B. Monitoring Authority

C. Requirements of Bidder.

D. Failure of Bidder to comply with requirements.

E. Notice to Proceed.

2.0 NOTICE OF INTENT TO AWARD

A. The City will provide written Notice of Intent to Award to Low Bidder.

3.0 DEFINITIONS

A. The "Monitoring Authority" for this Project is:

Houston Airport System
Office of Business Opportunity
Contract Compliance Section
18600 Lee Road, Suite 131
Humble, Texas 77338

4.0 REQUIREMENTS OF BIDDER

A. Within10 work days of receipt of Notice of Intent to Award, Low Bidder shall execute and deliver to Jorge Ardines, Senior Procurement Specialist (Supply Chain Management) and Monitoring Authority, for the City's approval, documents indicated by an "X" below:

[X] Document 00501 - Resolution of Contractor
[X] Document 00520 – Agreement
[ ] Document 00570 – Revised MWSBE Participation Plan *(Only submit if you have changed your MWBE participation plan from the original 00470)*
[ ] Document 00571 – Post-Bid Good Faith Efforts *(Only submit if you could not meet MWBE participation goals from the 00570)*

[ ] Document 00572 – Contractor's Goal Deviation Request *(Only submit if you could not meet MWBE participation goals from the 00570)*
[X] Document 00600 - List of Proposed Subcontractors and Suppliers
[X] Document 00601 - Drug Policy Compliance Agreement
[ ] Document 00602 - Contractor's Drug-free Workplace Policy *(Contractor creates this document.)*
[X] Document 00604 - History of OSHA Actions and List of On-the-job Injuries
[X] Document 00605 - List of Safety Impact Positions *(Contractor completes this list. Do not submit if submitting Document 00606.)*
[ ] Document 00606 - Contractor's Certification of No Safety Impact Positions *(Do not submit if submitting Document 00605.)*
[ ] Document 00607 - Certification Regarding Debarment, Suspension, and Other Responsibility Matters (For AIP Grant only)
[ ] Document 00608 - Contractor's Certification Regarding Non-segregated Facilities for Project Funded by AIP Grant (For AIP Grant only)
[ ] Document 00609 – List of Nonroad Diesel Equipment (Do not need to submit if not participating in Clean Air Incentive under Document 00800 Section 9.13.2)
[X] Document 00610 - Performance Bond (100% of total amount of bid)
[X] Document 00611 - Statutory Payment Bond (100% of total amount of bid)
[X] Document 00612 - One-year Maintenance Bond (100% of total amount of bid)
[ ] Document 00613 - One-year Surface Correction Bond (4% of total amount of bid)
[X] Document 00620 - Affidavit of Insurance
[X] Document 00621 – City of Houston *Certificate of Insurance (for guidance, see Document 00800, Article 11)*
[ ] Document 00622 - Name and Qualifications of Proposed Superintendent *(Contractor creates this document.)*
[ ] Document 00628 - Affidavit of Compliance with DBE Program (For AIP Grant only)
[ ] Document 00629 - Affidavit for FAA Form 7460-1
[X] Document 00630 – Agreement to comply with POP Program
[X] Document 00631 - City of Houston Pay or Play Program – List of Participating Subcontractors
[X] Document 00632 – EEO Certification by Material Suppliers, Professional Service Providers
[X] Document 00636 – Certificate of Interested Parties FORM 1295
[ ] Document 00810 – Wage Scale for Engineering Construction; Exhibit B, Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees; Exhibit C, Certificate from Subcontractor Appointing Officer or Employee to Supervise Payment of Employees (For AIP Grant only)

[ ] Document 00811 – Wage Scale for Building Construction; Exhibit B, Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees; Exhibit C, Certificate from Subcontractor Appointing Officer or Employee to Supervise Payment of Employees (For AIP Grant only)

[ ] Document 00812 – Wage Scale for Engineering Heavy Construction [For Water and Sewer]; Exhibit B, Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees; Exhibit C, Certificate from Subcontractor Appointing Officer or Employee to Supervise Payment of Employees

[ ] Document 00814 – Wage Scale for Engineering Heavy Construction [For Flood Control]; Exhibit B, Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees; Exhibit C, Certificate from Subcontractor Appointing Officer or Employee to Supervise Payment of Employees

[ ] Document 00820 – Wage Scale for Civil Engineering Construction [For CIP Funded Project]; Exhibit B, Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees; Exhibit C, Certificate from Subcontractor Appointing Officer or Employee to Supervise Payment of Employees

[X] Document 00821 – Wage Scale for Building Construction [For CIP Funded Project]; Exhibit B, Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees; Exhibit C, Certificate from Subcontractor Appointing Officer or Employee to Supervise Payment of Employees

B. Original forms contained in Document 00805 - Equal Employment Opportunity Program Requirements:

1. Original forms contained in Document 00805 - Equal Employment Opportunity Program Requirements:
   - [X] EEO-3, Certification by Bidder Regarding Equal Employment Opportunity
   - [X] EEO-6, Total Work Force Composition of the Company *or in lieu thereof, a copy of the latest Equal Employment Opportunity Commission's EEO-1 form (This information is required only if the Contractor has a work force of 50 or more people and the Contract is $50,000 or more.)*
   - [X] EEO-7, Company's Equal Employment Opportunity Compliance Program
   - [X] EEO-26, Certification by Proposed Subcontractor Regarding Equal Employment Opportunity

C. Designations of Subcontractors and Suppliers, who have been selected by Bidder in Part B - Schedule of Non-MWBE/PDBE/DBE/SBE Subcontractors and Suppliers of Document 00600 - List of Proposed Subcontractors and Suppliers, and accepted by the City, may be changed only with prior notice and acceptance by Project Manager as provided in Conditions of the Contract.

D. On Bidder's written request, Jorge Ardines, Procurement Specialist may grant an extension of time, not to exceed 5 days, to furnish documents specified in Paragraphs 4.0.A and 4.0.B. If Bidder is required to resubmit documents specified in Paragraph 4.0.A or 4.0.B, Bidder shall do so within time limits provided in the request for resubmission.

E. Designations of Subcontractors and Suppliers, who have been selected by Bidder in its Participation Plan, and accepted by the City, may be changed only with prior notice and acceptance by the Monitoring Authority as provided in Document 00808 - Minority and Women-owned Business Enterprise (MWBE),Persons with Disabilities Business Enterprise (PDBE) and Small Business Enterprise (SBE)Program.

5.0 FAILURE OF BIDDER TO COMPLY WITH REQUIREMENTS

A. Should Bidder, on receipt of Notice of Intent to Award, fail to comply with requirements of this Document 00495 within stated time, the City may declare award in default and require forfeiture of the Security Deposit.

B. After the City's written notice of default to Low Bidder, the City may award the Contract to Bidder whose offer is the next lowest bid, and Security Deposit of Bidder in default shall be forfeited to the City in accordance with provisions of Document 00200 - Instructions to Bidders.

6.0 NOTICE TO PROCEED

A. Upon the City's execution of the Agreement and delivery to Contractor, SCM will give Document 00551 - Notice to Proceed to Contractor, which establishes Date of Commencement of the Work.

END OF DOCUMENT

Document 00501

RESOLUTION OF CONTRACTOR

_____ ("Contractor"),
(Name of Contractor, e.g., "Biz. Inc.", "Biz LLP")

is a _____,
(Type of Organization, e.g.: Corporation, Limited Partnership, Limited Liability Partnership, Limited Liability Company, etc.)

which is bound by acts of _
_____,
(Name and Form of Governing Entity, e.g., "Biz Inc. Board of Directors", "Bill Smith, GP", etc.)

("Governing Entity").

On the_____day of_____, 20_____, the Governing Entity resolved, in accordance with all documents, rules, and laws applicable to the Contractor, that _____, is authorized to act as the
(Contractor's Representative)

Contractor's Representative in all business transactions (initial one)_____conducted in the State of Texas OR_____related to this Contract; and

The Governing Entity warrants that the above resolution (a) was entered into without dissent or reservation by the Governing Entity, (b) has not been rescinded or amended, and (c) is now in full force and effect; and

In authentication of the adoption of this resolution, I subscribe my name on this _____day of _____, 20___.

_____ _____
(Authorized Signature for Governing Entity) (Print or Type Name and Title of Authorized Signatory)

SWORN AND SUBSCRIBED before me on _____
Date

_____
Notary Public in and for the State of Texas

My Commission Expires: _____ _____
Expiration Date Print or Type Name of Notary Public

INSTRUCTIONS: Contractor must execute a Resolution of Contractor for each individual authorized to sign Contract Documents related to this Contract. Contractor may rescind Resolutions of Contractor through a written document in similar form.

END OF DOCUMENT

Document 00520

AGREEMENT

Project: IDO Building Standards Space Fit-Out

Project Location: 111 Standifer St, Humble, TX 77338

Project No: 913

The City: THE CITY OF HOUSTON, 900 Bagby Street, Houston, Texas 77002 (the "City")

and

Contractor: _____

(Address for Written Notice) _____

_____

Phone Number: _____

E-mail Address: _____

City Engineer, with respect to Section 4.1.9 and 4.3 thru 4.5 of the General Conditions, is:

Eren Selcen, P.E., – HAS City Engineer, City of Houston Airport. Aviation Department, Infrastructure Division (or his or her successor)

Address for Written Notice: 111 Standifer Street, Humble, TX 77338

Phone Number: 281-233-1605

Email Address: eren.selcen@houstontx.gov

City Engineer, City Employee designated by the Director of Department of Aviation to represent the City Engineer, with respect to all other terms of the General Conditions, is:

Roger Hebert

Address for Written Notice: P. O. Box 60106, Houston, Texas 77205-0106

Phone Number: 281-233-7839

Email Address: Roger.hebert@houstontx.gov

THE CITY AND CONTRACTOR AGREE AS FOLLOWS:

ARTICLE 1

THE WORK OF THE CONTRACT

1.1 Contractor shall perform the Work in accordance with the Contract.

ARTICLE 2
CONTRACT TIME

2.1 Contractor shall achieve Date of Substantial Completion within 210 days after Date of Commencement of the Work, subject to adjustments of Contract Time as provided in the Contract.

2.2 The Parties recognize that time is of the essence for this Agreement and that the City will suffer financial loss if the Work is not completed within the Contract Time. Parties also recognize delays, expense, and difficulties involved in proving in a legal or arbitration proceeding actual loss suffered by the City if the Work is not completed on time. Accordingly, instead of requiring any such proof, the Parties agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay the City the amount stipulated in Document 00800 – Supplementary Conditions, for each day beyond Contract Time.

ARTICLE 3
CONTRACT PRICE

3.1 Subject to terms of the Contract, the City will pay Contractor in current funds for Contractor's performance of the Contract, Contract Price of $ *Original Contract Price*], which includes Alternates, if any, accepted below.

3.2 The City accepts Alternates as follows:

Alternate No. 1 Not Applicable

ARTICLE 4
PAYMENTS

4.1 The City will make progress payments to Contractor as provided below and in Conditions of the Contract.

4.2 The Period covered by each progress payment is one calendar month ending on the 25th day of the month.

4.3 The City will issue Certificates for Payment and will make progress payments on the basis of such Certificates as provided in Conditions of the Contract.

4.4 Final payment, constituting entire unpaid balance of Contract Price, will be made by the City to Contractor as provided in Conditions of the Contract.

ARTICLE 5
CONTRACTOR REPRESENTATIONS

5.1 Contractor represents:

5.1.1 Contractor has examined and carefully studied Contract documents and other related data identified in Bid Documents.

5.1.2 Contractor has visited the site and become familiar with and is satisfied as to general, local, and site conditions that may affect cost, progress, and performance of the Work.

5.1.3 Contractor is familiar with and is satisfied as to all federal, state, and local laws and regulations that may affect cost, progress, and performance of the Work.

5.1.4 Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which have been identified in Contract documents and (2) reports and drawings of a hazardous environmental condition, if any, at the site which has been identified in Contract documents.

5.1.5 Contractor has obtained and carefully studied (or assumes responsibility for having done so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including applying specific means, methods, techniques, sequences, and procedures of construction, if any, expressly required by the Contract to be employed by Contractor, and safety precautions and programs incident thereto.

5.1.6 Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for performance of the Work at Contract Price, within Contract Time, and in accordance with the Contract.

5.1.7 Contractor is aware of general nature of work to be performed by the City and others at the site that relates to the Work as indicated in Contract documents.

5.1.8 Contractor has correlated information known to Contractor, information and observations obtained from visits to the site, reports and drawings identified in the Contract, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract.

5.1.9 Contractor has given City Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract, and written resolution thereof by City Engineer is acceptable to Contractor.

5.1.10 Contract documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 6

MISCELLANEOUS PROVISIONS

6.1 The Contract may be terminated by either Party as provided in Conditions of the Contract.

6.2 The Work may be suspended by the City as provided in Conditions of the Contract.

ARTICLE 7

ENUMERATION OF CONTRACT DOCUMENTS

7.1 The following documents are incorporated into this Agreement:

7.1.1 Document 00700 - General Conditions.

7.1.2 Document 00800 - Supplementary Conditions.

7.1.3 General Requirements Division 01.

7.1.4 Technical Specs: Divisions 02 through 17 of Specifications (Division 17 – Telecommunications - may be substituted by the Division 27 under the CSI Master format 04 numbering system.)

7.1.5 Drawings listed in Document 00015 - List of Drawings and bound separately.

7.1.6 Addenda which apply to the Contract, are as follows:

[Addendum No. 1, dated _____

Addendum No. 2, dated _____

Addendum No. 3, dated _____

7.1.7 Other documents:

	Document No.	Title
[X]	00410B	Bid Form – Part B
[ ]	00470	Pre-bid MWSBE Participation Plan
[ ]	00470D	Pre-bid DBE Participation Plan for Project Funded by AIP Grant
[ ]	00471	Pre-bid Good Faith Efforts
[ ]	00472	Pre-bid Goal Deviation Request
[X]	00501	Resolution of Corporation (if a corporation)
[ ]	00570	Post-bid MWSBE Participation Plan
[ ]	00571	Post-bid Good Faith Efforts
[ ]	00572	Post-bid Goal Deviation Request

[ ]	00607	Contractor's Certification Regarding Debarment, Suspension for Project Funded by AIP Grant
[ ]	00608	Contractor's Certification Regarding Non-Segregated Facilities for Project Funded by AIP Grant
[X]	00610	Performance Bond
[X]	00611	Statutory Payment Bond
[X]	00612	One-year Maintenance Bond
[ ]	00613	One-year Surface Correction Bond
[X]	00620	Affidavit of Insurance
[X]	00621	City of Houston Certificate of Insurance
[ ]	00628	Affidavit of Compliance with Disadvantaged Business Enterprise (DBE) Program for Project Funded By AIP Grant
[X]	00630	Agreement to Comply with Pay or Play Program
[X]	00631	List of Participating Subcontractors (POP-3)
[ ]	00801	FAA Supplementary Conditions (for AIP Only)
[ ]	00804	ARRA requirements (for ARRA grants Only)
[ ]	00805	EEO Program Requirements
[ ]	00806	Disadvantaged Business Enterprise (DBE) Program (For AIP Only)
[ ]	00807	Bidder/Contractor Requirements For Disadvantaged Business Enterprise (DBE) Program (For AIP Only)
[ ]	00808	Bidder Requirements for MWSBE Program
[ ]	00810	Federal Wage Rate - Highway
[ ]	00811	Federal Wage Rate - Building
[ ]	00812	Wage Rate for Engineering Heavy – Water & Sewer Line
[ ]	00814	Wage Rate for Engineering Heavy – Flood Control
[ ]	00820	Wage Rate for Engineering Construction
[X]	00821	Wage Rate for Building Construction
[X]	00840	Pay or Play Program
[ ]	00842	Letter of Intent
[ ]	00912	Rider (Contractor Initials:_____)

ARTICLE 8
SIGNATURES

8.1 This Agreement is executed in two original copies and is effective as of the date of countersignature by City Controller.

CONTRACTOR:

By:_ Name:_____

Title:_____

Date:_____

Tax Identification Number: _____

(If Joint Venture)

By:_ Name:_____

Title:_____

Date:_____

Tax Identification Number:

___

CITY OF HOUSTON, TEXAS

APPROVED:

By: _____
Director, Department of Aviation

SIGNED:

By: _____
Mayor

COUNTERSIGNED:

By: _____
City Controller

Date Countersigned:

_____

ATTEST/SEAL:

By: _____
City Secretary

8.2 This Contract and Ordinance have been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. Legal Department has not reviewed the content of these documents.

_____ _____
Legal Assistant Date

END OF DOCUMENT

Document 00601

DRUG POLICY COMPLIANCE AGREEMENT

I,_____, _____,
Name Title

of _____
Contractor

have authority to bind Contractor with respect to its Bid, Proposal, or performance of any and all contracts it may enter into with the City of Houston; and that by making this Agreement, I affirm that Contractor is aware of and by the time the Contract is awarded will be bound by and agree to designate appropriate safety impact positions for company employee positions, and to comply with the following requirements before the City issues a Notice to Proceed:

1. Develop and implement a written Drug Free Workplace Policy and related drug testing procedures for Contractor that meet the criteria and requirements established by the Mayor's Amended Policy on Drug Detection and Deterrence (Mayor's Drug Policy) and the Mayor's Drug Detection and Deterrence Procedures for Contractors (Executive Order No. 1-31).

2. Obtain a facility to collect urine samples consistent with Health and Human Services (HHS) guidelines and an HHS-certified drug-testing laboratory to perform drug tests.

3. Monitor and keep records of drug tests given and results; and upon request from the City of Houston, provide confirmation of such testing and results.

4. Submit semi-annual Drug Policy Compliance Declarations.

I affirm on behalf of Contractor that full compliance with the Mayor's Drug Policy and Executive Order No. 1-31 is a material condition of the Contract with the City of Houston,

I further acknowledge that falsification, failure to comply with or failure to timely submit declarations or documentation in compliance with the Mayor's Drug Policy or Executive Order No. 1-31 will be considered a breach of the Contract with the City and may result in non-award or termination of the Contract by the City.

_____ _____
Contractor Title

_____ _____
Signature Date

END OF DOCUMENT

Document 00604

HISTORY OF OSHA ACTIONS AND LIST OF ON-THE-JOB INJURIES

Prior to award of the Contract, Low Bidder will be required to file the following with the City:

1. A history of all OSHA actions, advisories, etc., Contractor has received on all jobs worked in any capacity, prime or subcontractor. The history shall be for the two-year period preceding the Bid Date of the Project.

2. A list of all on-the-job injuries, accidents, and fatalities suffered by any present or former employees of Contractor during the same two-year period.

3. If less than the two-year period, give the date Contractor started doing business.

This information must be submitted to the City within the time period stated in Document 00498 - Notice of Intent to Award. An officer of the company must certify in a notarized statement that the information submitted is true and correct.

END OF DOCUMENT

Document 00605

LIST OF SAFETY IMPACT POSITIONS

Employee Classification	**Number of Employees**

END OF DOCUMENT

Document 00610

PERFORMANCE BOND

THAT WE,_____, as Principal, (the "Contractor"), and the other subscriber hereto,_____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston (the "City"), a municipal corporation, in the penal sum of $_____ for the payment of which sum, well and truly to be made to the City, its successors and assigns, Contractor and Surety do bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a Contract in writing with the City for _____

_____, all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein.

NOW THEREFORE, if the said Contractor shall faithfully and strictly perform the Contract in all its terms, provisions, and stipulations in accordance with its true meaning and effect, and in accordance with the Contract documents referred to therein and shall comply strictly with each and every provision of the Contract and with this Bond, then this obligation shall become null and void and shall have no further force and effect; otherwise the same is to remain in full force and effect. Should the Contractor fail to faithfully and strictly perform the Contract in all its terms, including but not limited to the indemnifications thereunder, the Surety shall be liable for all damages, losses, expenses and liabilities that the City may suffer in consequence thereof, as more fully set forth herein.

It is further understood and agreed that the Surety does hereby relieve the City or its representatives from the exercise of any diligence whatever in securing compliance on the part of the Contractor with the terms of the Contract, and the Surety agrees that it shall be bound to take notice of and shall be held to have knowledge of all acts or omissions of the Contractor in all matters pertaining to the Contract. The Surety understands and agrees that the provision in the Contract that the City will retain certain amounts due the Contractor until the expiration of 30 days from the acceptance of the Work is intended for the City's benefit, and the City will have the right to pay or withhold such retained amounts or any other amount owing under the Contract without changing or affecting the liability of the Surety hereon in any degree.

It is further expressly agreed by Surety that the City or its representatives are at liberty at any time, without notice to the Surety, to make any change in the Contract

documents and in the Work to be done thereunder, as provided in the Contract, and in the terms and conditions thereof, or to make any change in, addition to, or deduction from the Work to be done thereunder; and that such changes, if made, shall not in any way vitiate the obligation in this Bond and undertaking or release the Surety therefrom.

It is further expressly agreed and understood that the Contractor and Surety will fully indemnify and save harmless the City from any liability, loss, cost, expense, or damage arising out of Contractor's performance of the Contract.

If the City gives Surety notice of Contractor's default, Surety shall, within 45 days, take one of the following actions:

1. Arrange for Contractor, with consent of the City, to perform and complete the Contract; or

2. Take over and assume completion of the Contract itself, through its agents or through independent contractors, and become entitled to the payment of the balance of the Contract Price.

If the Surety fails to take either of the actions set out above, it shall be deemed to have waived its right to perform and complete the Contract and receive payment of the balance of the Contract Price and the City shall be entitled to enforce any remedies available at law, including but not limited to completing the Contract itself and recovering any cost in excess of the Original Contract Price from the Surety.

This Bond and all obligations created hereunder shall be performable in Harris County, Texas. This Bond is given in compliance with the provisions of Chapter 2253, Texas Government Code, as amended, which is incorporated herein by this reference.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other Party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.

Any party wishing to file a claim may call the Texas Department of Insurance at 1-800-252-3439 to obtain Surety's address for claims processing.

IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

Name of Contractor

By:_____
Name:
Title:

By:_____
Name:
Title:
Date:

ATTEST/SURETY WITNESS:

(SEAL)

Full Name of Surety

Address of Surety for Notice

Telephone Number of Surety

By:_____
Name:
Title:
Date:

By:_____
Name:
Title: Attorney-in-Fact
Date:

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

Legal Assistant

Date

END OF DOCUMENT

Document 00611

STATUTORY PAYMENT BOND

THAT WE,_____, as Principal, hereinafter called Contractor and the other subscriber hereto,_____, as Surety, do hereby acknowledge ourselves to be held and firmly bound unto the City of Houston, a municipal corporation, in the sum of $_____for the payment of which sum, well and truly to be made to the City of Houston, and its successors, the said Contractor and Surety do bind themselves, their heirs, executors, administrators, successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a contract in writing with the City of Houston for _____

_____,

all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein;

NOW, THEREFORE, if the said Contractor shall pay all claimants supplying labor and materials to him or a Subcontractor in the prosecution of the Work provided for in the Contract, then, this obligation shall be void; otherwise the same is to remain in full force and effect;

PROVIDED HOWEVER, that this Bond is executed pursuant to the provisions of Chapter 2253, Texas Government Code, as amended, and all liabilities on this Bond shall be determined in accordance with the provisions of said Article to the same extent as if it were copied at length herein.

IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

Any party wishing to file a claim may obtain Surety's address for claims processing on file with the Texas Department of Insurance by calling 1-800-252-3439.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

Name of Contractor

By:_____
Name:
Title:

By:_____
Name:
Title:
Date:

ATTEST/SURETY WITNESS:

(SEAL)

Full Name of Surety

Address of Surety for Notice

Telephone Number of Surety

By:_____
Name:
Title:
Date:

By:_____
Name:
Title: Attorney-in-Fact
Date:

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

Legal Assistant

Date

END OF DOCUMENT

Document 00612

ONE-YEAR MAINTENANCE BOND

THAT WE,_____, as Principal, hereinafter called Contractor, and the other subscriber hereto,_____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston, a municipal corporation, in the sum of $_____, for the payment of which sum well and truly to be made to the City of Houston and its successors, the said Contractor and Surety do bind themselves, their heirs, executors, administrators, successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a Contract in writing with the City of Houston for _____

_____,
all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein.

NOW THEREFORE, if the said Contractor shall comply with the provisions of Paragraph 11.5.1 of the General Conditions, and correct work not in accordance with the Contract documents discovered within the established one-year period, then this obligation shall become null and void, and shall be of no further force and effect; otherwise, the same is to remain in full force and effect.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.

IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

_____
Name of Contractor

By:_____
Name:
Title:
Date:

By:_____
Name:
Title:
Date:

ATTEST/SURETY WITNESS:

(SEAL)

Full Name of Surety

Address of Surety for Notice

Telephone Number of Surety

By:
Name:
Title:
Date:

By:
Name:
Title: Attorney-in-Fact
Date:

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

Legal Assistant

Date

END OF DOCUMENT

Document 00620

AFFIDAVIT OF INSURANCE

BEFORE ME, the undersigned authority, on this day personally appeared

_____,
who
Affiant

being by me duly sworn on his oath stated that he is_____,
of
Title

_____,
Contractor's Company Name

the Contractor named and referred to within the Contract documents; that he is fully competent and authorized to give this affidavit and that the attached original insurance certificate truly and accurately reflects the insurance coverage that is now available and will be available during the term of the Contract.

_____
Affiant's Signature

SWORN AND SUBSCRIBED before me on_____.
Date

_____
Notary Public in and for the State of TEXAS

_____
Print or type Notary Public name

My Commission Expires: _____
Expiration Date

END OF DOCUMENT

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:	
	PHONE (A/C, No, Ext):	FAX (A/C, No):
	E-MAIL ADDRESS:	
	INSURER(S) AFFORDING COVERAGE	NAIC #
INSURED	INSURER A :	
	INSURER B :	
	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F :	

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
	GENERAL LIABILITY						EACH OCCURRENCE	$
	☐ COMMERCIAL GENERAL LIABILITY	☐	☐				DAMAGE TO RENTED PREMISES (Ea occurrence)	$
	☐ CLAIMS-MADE ☐ OCCUR						MED EXP (Any one person)	$
	☐ _____						PERSONAL & ADV INJURY	$
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$
	☐ POLICY ☐ PRO-JECT ☐ LOC						PRODUCTS - COMP/OP AGG	$
								$
	AUTOMOBILE LIABILITY	☐	☐				COMBINED SINGLE LIMIT (Ea accident)	$
	☐ ANY AUTO						BODILY INJURY (Per person)	$
	☐ ALL OWNED AUTOS ☐ SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	☐ HIRED AUTOS ☐ NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
	☐ **UMBRELLA LIAB** ☐ OCCUR	☐	☐				EACH OCCURRENCE	$
	☐ **EXCESS LIAB** ☐ CLAIMS-MADE						AGGREGATE	$
	☐ DED ☐ RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N						☐ WC STATU-TORY LIMITS ☐ OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICE/MEMBER EXCLUDED? ☐	N / A	☐				E.L. EACH ACCIDENT	$
	(Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$
							E.L. DISEASE - POLICY LIMIT	$
		☐	☐					

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

CERTIFICATE HOLDER

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Clear All

City of Houston
Pay or Play Program
Certification of Compliance

Prime Contractor: _____ Subcontractor: _____

Address: _____

Outline Number:_____Contract Amount: $_____

Project Name: [Legal Project Name]_____

Contracting Department: _____

In accordance with the City of Houston Pay or Play Program authorized by Ordinance 2007-534 and Executive Order 1-7, Prime/Subcontractor agrees to abide by the terms of this Program. This certification is required of all contractors for contracts subject to the program. You must agree either to PAY, PLAY or BOTH for all covered employees. If selecting BOTH, the Contractor/Subcontractor may Pay on behalf of some covered employees and Play on behalf of the remaining covered employees.

The Prime/Subcontractor will comply with all provisions of the Pay or Play Program Requirements and will furnish all information and reports requested to determine compliance of the Pay or Play Program (See Executive Order 1-7 for the terms of the Pay or Play program).

The Prime/Subcontractor may agree to **"Pay"** $1.00 per hour for work performed by covered employees under the contract with the City. If independent contract labor is utilized the Contractor/Subcontractor agrees to report hours worked by the independent contract laborer and pay $1.00 per hour for work performed.

The Prime/Subcontractor may agree to **"Play"** by providing health benefits to each covered employee. The health benefits must meet the following criteria:

- The employer contributes no less than 75% of the total premium costs per covered employee per month toward the total premium cost.
- The covered employee contributes, if any amount, no greater than 25% of the total monthly premium costs.

Please select whether you choose to:	Pay	Play	Both

The Prime/Subcontractor will file compliance reports with the City, which will include activity for covered employees subject to the program, in the form and to the extent requested by the administering department. Compliance reports shall contain information including, but not limited to, documentation showing employee health coverage and employee work records.
Note: The contractor is responsible to the City for compliance of covered employees of covered subcontractors.

Please indicate the estimated number of:	PRIME	SUB
Total Employees on City Job		
Covered Employees		
Non-Covered Employees		
Exempt Employees		

I hereby certify that the above information is true and correct.

_____ _____

Please Sign **Date**

_____

Please Print Name & Title

City of Houston
Pay or Play Program
Participating Subcontractors

Prime Contractor: _____ **POP Contact Person:** _____

Project Number/Description: _____ **Address:** _____

_____ _____

Email: _____

Phone: _____

Note: Include ALL subcontractors (use additional form if necessary)

			Check One							
Subcontractor Name	**Supplier Y/N?**	**Amount of Subcontract**	**Pay**	**Play**	**Both (Pay and Play)**	**N/A**	**Contact Person**	**Phone**	**Email Address**	**Mailing Address**

*If the above information is found to be submitted fraudulently with the intent to bypass or deceive the purpose of the Pay or Play Program the contractor will be held liable for all compliance requirements from the inception of the contract. All subcontracts that surpass the $200,000.00 threshold will be responsible for Pay or Play compliance from the inception of the contract.

Affidavit

I hereby solemnly affirm, certify and confirm that the total sub-contract value stated above is the final value of the contract **(*)** including all material costs, fuel, payroll, taxes, fees, profit sharing, labor or any payments in relation to the contracted work and no separate payment or contract has been made for the sub-contract under contract no._____ . The above sub-contract value includes all the costs related to work under the contract. The contractor and sub-contractor(s) agree to inform the Office of Business Opportunity of any related cost(s) added to the contracted work and re-submit POP-3 with the current value of the sub-contract. I understand that compliance with "Pay or Play" program is mandatory and nothing has been hidden to circumvent the program requirements.

_____

Contractor Authorized Representative & Title Date

Name & Signature

Document 00632

CERTIFICATION BY PROPOSED MATERIAL SUPPLIERS,
LESSORS, AND PROFESSIONAL SERVICE PROVIDERS
REGARDING EQUAL EMPLOYMENT OPPORTUNITY

Company Name:_____ $_____
(Supplier, Lessor, Professional Service Provider) (Amount of Contract)

Company Address: _____

Company Telephone Number:_____ Fax:_____

E-mail Address: _____

Web Page/URL Address:_____

Company Tax Identification Number: _____

Project Name & No.:_____

Materials/Services Provided: _____

In accordance with Chapter 15 of the City of Houston's Code of Ordinances, Supplier/Lessor/Professional Service Provider represents to be an equal opportunity employer and agrees to abide by the terms of the Ordinance. This certification is required of all Suppliers/Lessors/Professional Service Providers providing goods or service to this project with agreements $50,000 or more.

[ ] Yes [ ] No Supplier agrees not to discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, or age.

[ ] Yes [ ] No Supplier agrees that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin, or age.

[ ] Yes [ ] No Supplier will comply with all provisions of **Executive Order No. 11246** and rules, regulations and applicable orders of the Department of Labor or other Federal Agency responsible for enforcement of applicable equal opportunity and affirmative action provisions and will likewise furnish all information and reports required by the Mayor or Contract Compliance Officers for the purpose of investigation to ascertain and effect compliance with the City of Houston's Office of Business of Opportunity.

[ ] Yes [ ] No The Supplier shall file and cause their sub-tier contractors to file compliance reports with the City in the form and to the extent as may be prescribed by the Mayor or Contract Compliance Officers. Compliance reports filed at such times as directed shall contain information including, but not limited to, the practices, policies, programs, and employment policies.

I hereby certify that the above information is true and correct.

_____ _____
COMPANY OFFICER (Signature) DATE

_____
NAME AND TITLE (Print or type)

END OF DOCUMENT

Document 00636

Certificate of Interested Parties

In accordance with Texas Gov't Code §2252.908, the successful bidder must complete Form 1295, Certificate of Interested Parties. Form 1295 is available for downloading on the Texas Ethics Commission's (TEC) website: https://www.ethics.state.tx.us/forms/1295.pdf.

The successful bidder must use the application to enter the required information on Form 1295 and print a copy of the completed form, which will include a certification of filing that will contain a unique certification number.

No later than 30 days after the contract's effective date, the City will upload the successful bidder's completed Form 1295. The TEC will post the Contractor's completed Form 1295 within seven business days of receipt.

For your reference, Form 1295 is attached as part of this document.

END OF DOCUMENT

Document 00700

GENERAL CONDITIONS

March 7, 2022 EDITION

TABLE OF ARTICLES

1. GENERAL PROVISIONS
2. THE CITY
3. CONTRACTOR
4. ADMINISTRATION OF THE CONTRACT
5. SUBCONTRACTORS AND SUPPLIERS
6. CONSTRUCTION BY THE CITY OR BY SEPARATE CONTRACTORS
7. CHANGES IN THE WORK
8. TIME
9. PAYMENTS AND COMPLETION
10. SAFETY PRECAUTIONS
11. INSURANCE AND BONDS
12. UNCOVERING AND CORRECTION OF THE WORK
13. MISCELLANEOUS PROVISIONS
14. TERMINATION OR SUSPENSION OF THE CONTRACT

ARTICLE 1 - GENERAL PROVISIONS 3

1.1 DEFINITIONS 3
1.2 EXECUTION, CORRELATION, AND INTENT 5
1.3 OWNERSHIP AND USE OF DOCUMENTS 6
1.4 INTERPRETATION 6

ARTICLE 2 - THE CITY 6

2.1 LIMITATIONS OF THE CITY'S OFFICERS AND EMPLOYEES 6
2.2 DUTIES OF THE CITY 6
2.3 AVAILABILITY OF LAND AND USE OF SITE 6
2.4 THE CITY'S RIGHT TO STOP THE WORK 7
2.5 THE CITY'S RIGHT TO CARRY OUT WORK 7

ARTICLE 3 - CONTRACTOR 7

3.1 RESPONSIBILITIES 7
3.2 REVIEW OF CONTRACT AND FIELD CONDITIONS BY CONTRACTOR 7
3.3 SUPERVISION AND CONSTRUCTION PROCEDURES 7
3.4 SUPERINTENDENT 8
3.5 LABOR 8
3.6 PREVAILING WAGE RATES 9
3.7 LABOR CONDITIONS 9
3.8 DRUG DETECTION AND DETERRENCE 9
3.9 MATERIALS & EQUIPMENT 10
3.10 PRODUCT OPTIONS AND SUBSTITUTIONS 11
3.11 CASH ALLOWANCES 11
3.12 WARRANTY 11
3.13 TAXES 12
3.14 PERMITS, FEES, AND NOTICES 12
3.15 CONSTRUCTION SCHEDULES 12
3.16 DOCUMENTS AND SAMPLES AT THE SITE 12
3.17 MANUFACTURER'S SPECIFICATIONS 13
3.18 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES 13
3.19 CULTURAL RESOURCES AND ENDANGERED SPECIES 14
3.20 CUTTING AND PATCHING 14
3.21 CLEANING 14
3.22 SANITATION 14
3.23 ACCESS TO WORK AND TO INFORMATION 14
3.24 TRADE SECRETS 14
3.25 INDEMNIFICATION 14
3.26 RELEASE AND INDEMNIFICATION – PATENT, COPYRIGHT, TRADEMARK, AND TRADE SECRET INFRINGEMENT 15
3.27 INDEMNIFICATION PROCEDURES 15

ARTICLE 4 - ADMINISTRATION OF THE CONTRACT 17

4.1 CONTRACT ADMINISTRATION 17
4.2 COMMUNICATIONS IN ADMINISTRATION OF THE CONTRACT 17
4.3 CLAIMS AND DISPUTES 17
4.4 RESOLUTION OF CLAIMS AND DISPUTES 19

ARTICLE 5 - SUBCONTRACTORS AND SUPPLIERS 19

5.1 AWARD OF SUBCONTRACTS OTHER CONTRACTS FOR PORTIONS OF THE WORK 19
5.2 CONTRACTOR RESPONSIBILITY FOR SUBCONTRACTORS 20

ARTICLE 6 - CONSTRUCTION BY THE CITY OR BY SEPARATE CONTRACTORS 20

6.1 THE CITY'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS 20
6.2 COORDINATION 20
6.3 MUTUAL RESPONSIBILITY 20
6.4 THE CITY'S RIGHT TO CLEAN UP 21

ARTICLE 7 - CHANGES IN THE WORK 21

7.1 CHANGES 21
7.2 WORK CHANGE DIRECTIVES 21
7.3 ADJUSTMENTS IN CONTRACT PRICE 21
7.4 MINOR CHANGES IN THE WORK 23

ARTICLE 8 - TIME 23

8.1 PROGRESS AND COMPLETION 23
8.2 DELAYS AND EXTENSIONS OF TIME 23

ARTICLE 9 - PAYMENTS AND COMPLETION 24

9.1 UNIT PRICE WORK 24
9.2 ESTIMATES FOR PAYMENT, UNIT PRICE WORK 24
9.3 STIPULATED PRICE WORK 24
9.4 APPLICATIONS FOR PAYMENT, STIPULATED PRICE WORK 24
9.5 CERTIFICATES FOR PAYMENT 25
9.6 COMPUTATIONS OF CERTIFICATES FOR PAYMENT 25
9.7 DECISIONS TO WITHHOLD CERTIFICATION 25
9.8 PROGRESS PAYMENTS 25
9.9 DATE OF SUBSTANTIAL COMPLETION 26
9.10 PARTIAL OCCUPANCY OR USE 27
9.11 FINAL COMPLETION AND FINAL PAYMENT 27
9.12 LIQUIDATED DAMAGES 28

ARTICLE 10 - SAFETY PRECAUTIONS 28

10.1 SAFETY PROGRAMS 28
10.2 POLLUTANTS AND POLLUTANT FACILITIES 28
10.3 SAFETY OF THE ENVIRONMENT, PERSONS, AND PROPERTY 28
10.4 EMERGENCIES 29

ARTICLE 11 - INSURANCE AND BONDS..... 29

11.1 GENERAL INSURANCE REQUIREMENTS..... 29
11.2 INSURANCE TO BE PROVIDED BY CONTRACTOR..... 29
11.2 INSURANCE TO BE PROVIDED BY CONTRACTOR..... 29
11.3 PROOF OF INSURANCE..... 32
11.4 PERFORMANCE AND PAYMENT BONDS..... 33
11.5 MAINTENANCE BONDS..... 33
11.6 SURETY..... 33
11.7 DELIVERY OF BONDS..... 34

ARTICLE 12 - UNCOVERING AND CORRECTION OF THE WORK..... 34

12.1 UNCOVERING OF THE WORK..... 34
12.2 CORRECTION OF THE WORK..... 34
12.3 ACCEPTANCE OF NONCONFORMING WORK... 35

ARTICLE 13 - MISCELLANEOUS PROVISIONS..... 35

13.1 GOVERNING LAW AND VENUE..... 35
13.2 SUCCESSORS..... 35
13.3 BUSINESS STRUCTURE AND ASSIGNMENTS... 35
13.4 WRITTEN NOTICE..... 35
13.5 RIGHTS AND REMEDIES..... 35
13.6 TESTS AND INSPECTIONS..... 35
13.7 INTEREST..... 36
13.8 PARTIES IN INTEREST..... 36
13.9 ENTIRE CONTRACT..... 36
13.10 WRITTEN AMENDMENT..... 36
13.11 COMPLIANCE WITH LAWS..... 36
13.12 SEVERABILITY..... 36
13.13 COMPLIANCE WITH CERTAIN STATE LAW REQUIREMENTS..... 36
13.14 ZERO TOLERANCE POLICY FOR HUMAN TRAFFICKING & RELATED ACTIVITIES..... 36

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT..... 37

14.1 TERMINATION BY THE CITY FOR CAUSE..... 37
14.2 TERMINATION BY THE CITY FOR CONVENIENCE..... 38
14.3 SUSPENSION BY THE CITY FOR CONVENIENCE..... 38
14.4 TERMINATION BY CONTRACTOR..... 38

ARTICLE 1 - GENERAL PROVISIONS

1.1 DEFINITIONS

1.1.1 Agreement: Document signed by the Parties and binding the Parties, containing the name of Contractor, title and location of the Project, Original Contract Time, Original Contract Price, enumeration of documents included in the Contract, and other provisions.

1.1.2 Bonds: Performance Bond, Payment Bond, Maintenance Bond, and other Surety instruments executed by Surety. When in singular form, refers to individual instrument.

1.1.3 Business Enterprise: Any business entity registered in a program authorized by 49 C.F.R. § 26 (where applicable) or City Code of Ordinances, Chapter 15, Article II, relating to Equal Opportunity Employment and taking affirmative action to ensure that applicants are employed and employees are treated without regard to race, religion, color, sex, national origin, or age. The term "Business Enterprise" may include any Disadvantaged Business Enterprise ("DBE"), Minority Business Enterprise ("MBE"), Woman Business Enterprise ("WBE"), Small Business Enterprise ("SBE"), Person with Disability Enterprise ("PDBE"), and any Historically Underutilized Business ("HUB").

1.1.4 Business Enterprise Policy: Contract documents and applicable policies relating to Business Enterprises and authorized under 49 C.F.R. § 26 or City Code of Ordinances, Chapter 15, Article V.

1.1.5 Cash Allowance: An estimated sum of money to be used only for a limited class of expenditures such as utility relocation costs, fees for special licenses or permits, or other "pass-through" costs that would be the same for any contractor. Cash Allowances may not be used to purchase goods or services that are not specified in the Contract. The unspecified items must be purchased according to the terms of Article 7.

1.1.6 Change Order: Written instrument prepared by the City and signed by City Engineer and Contractor, specifying the following:

1.1.6.1 a change in the Work;
1.1.6.2 a change in Contract Price, if any; and
1.1.6.3 a change in Contract Time, if any.

The value of a Change Order is the net amount after offsetting all deductions against all additions effected by the Change Order.

1.1.7 City: The City of Houston, a home rule municipality located principally within Harris County, Texas, including its successors and its authorized representatives.

1.1.8 City Engineer: The City Engineer, or the City employee representing the City Engineer, designated in the Agreement and authorized to represent the City, or successors.

1.1.9 Claim: Written demand or written assertion by one Party seeking adjustment of the Contract, payment of money, extension of time, or other relief under the Contract and includes, but is not limited to, claims for materials, labor, equipment, delay, changes, adjustments, substitutions, fees and third party claims. The Party making the Claim has the responsibility to substantiate the Claim.

1.1.10 Conditions of the Contract: General Conditions and Supplementary Conditions.

1.1.11 Construction Manager: Person or firm under contract with the City as its authorized representative to oversee and administer construction of the Work, and who may perform the role of Project Manager and Inspector, as designated by City Engineer in writing.

1.1.12 Contract: The Agreement; documents enumerated in and incorporated into the Agreement, Modifications, and amendments.

1.1.13 Contract Price: The monetary amount stated in the Agreement adjusted by Change Order, and increases or decreases in Unit Price Quantities, if any.

1.1.14 Contract Time: The number of days stated in the Agreement to substantially complete the Work, plus days authorized by Change Order.

1.1.15 Contract Year: a twelve (12) month period during the term of the contract commencing on the Effective Date of this Agreement and each anniversary thereof.

1.1.16 Contractor: Person or firm identified as such in the Agreement including its successors and its authorized representatives.

1.1.17 Date of Commencement of the Work: Date established in Notice to Proceed on which Contract Time will commence. This date will not be changed by failure of Contractor, or persons or entities for whom Contractor is responsible, to act.

1.1.18 Date of Substantial Completion: Date that construction, or portion thereof designated by City Engineer, is certified by City Engineer to be substantially complete.

1.1.19 Design Consultant: Person or firm, under contract with the City, to provide professional services during construction and its authorized representatives. If a Design Consultant is not employed for services during construction, Project Manager will perform duties of Design Consultant designated in the Contract in addition to usual duties of Project Manager.

1.1.20 Drawings: Graphic and pictorial portions of the Contract that define the character and scope of the Work.

1.1.21 Extra Unit Price: Unit Prices, which may be required for completion of the Work. These Unit Prices and Unit Price Quantities are in the Contract and are included in Original Contract Price.

1.1.22 Furnish: To supply, pay for, deliver to the site, and unload.

1.1.23 General Requirements: The sections of Division 01 Specifications that specify administrative and procedural requirements and temporary facilities required for the Work.

1.1.24 Inspector: City's employee or agent authorized to assist with inspection of the Work.

1.1.25 Install: Unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, clean, protect, and similar operations.

1.1.26 Legal Holiday: Day established by the City Council as a holiday.

1.1.27 Major Unit Price Work: An individual Unit Price item,

1.1.27.1 whose value is greater than five percent of Original Contract Price,

1.1.27.2 whose value becomes greater than five percent of Original Contract Price as the result of an increase in quantity, or

1.1.27.3 whose value is $100,000, whichever is least.

1.1.28 Mayor's Office of Business Opportunity: any reference to, or use of, the "Office of Affirmative Action" shall mean the Mayor's Office of Business Opportunity, or any such future name to which it is changed.

1.1.29 Minor Change in the Work: A written change in the Work, ordered by City Engineer, that does not change Contract Price or Contract Time, and that is consistent with the general scope of the Contract.

1.1.30 Modification: Change Order, Work Change Directive, or Minor Change in the Work.

1.1.31 Notice of Noncompliance: A written notice by City Engineer to Contractor regarding defective or nonconforming work that does not meet the Contract requirements, and that establishes a time by which Contractor shall correct the defective or nonconforming work.

1.1.32 Notice to Proceed: A written notice by City Engineer to Contractor establishing Date of Commencement of the Work.

1.1.33 Original Contract Price: The monetary amount originally stated in the Agreement.

1.1.34 Parties: Contractor and the City. When in singular form, refers to Contractor or the City.

1.1.35 Pollutant: Any materials subject to the Texas Solid Waste Disposal Act.

1.1.36 Pollutant Facility: Any facility regulated by the State of Texas to protect the health and environment from contamination by Pollutants, including without limitation, landfills, oil and gas production and storage facilities, wastewater facilities, waste injection wells, and storage tanks (including drums).

1.1.37 Product: Materials, equipment, or systems incorporated into the Work or to be incorporated into the Work.

1.1.38 Product Data: Illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by Contractor to illustrate a Product.

1.1.39 Project: Total construction, of which the Work performed under the Contract may be the whole or a part, and which may include construction by the City or by separate contractors.

1.1.40 Project Manager: City Engineer's authorized representative for administration of the Work. Titles used within the City's departments may be different than those used in this definition.

1.1.41 Provide: Furnish and Install, complete, ready for intended use.

1.1.42 Samples: Physical examples that illustrate Products, or workmanship, and establish standards by which the Work is judged.

1.1.43 Shop Drawings: Drawings, diagrams, schedules, and other data specially prepared for the Work by Contractor, Subcontractor or Supplier, to illustrate a portion of the Work.

1.1.44 Specifications: Divisions 01 through 16 of the documents that are incorporated into the Agreement, consisting of written General Requirements and requirements for Products, standards, and workmanship for the Work, and performance of related services.

1.1.45 Stipulated Price: Single lump sum amount stated in the Contract for completion of the Work, or for designated portion of the Work.

1.1.46 Subcontractor: Person or firm that has direct or indirect contract with Contractor or with another Subcontractor to perform a portion of the Work and its authorized representatives.

1.1.47 Superintendent: Employee of Contractor having authority and responsibility to act for and represent Contractor.

1.1.48 Supplementary Conditions: Part of Conditions of the Contract that amends or supplements General Conditions.

1.1.49 Supplier: Manufacturer, distributor, materialman, or vendor having a direct agreement with Contractor or Subcontractor for Products, or services and its authorized representatives.

1.1.50 Surety: Corporate entity that is bound by one or more Bonds, and is responsible for completion of the Work, including the correction period, and for payment of debts incurred in fulfilling the Contract. Surety shall include co-surety or reinsurer, as applicable.

1.1.51 Underground Facilities: Pipes, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments and encasements containing such facilities that exist below ground level.

1.1.52 Unit Price: An amount stated in the Contract for an individual, measurable item of work, which, when multiplied by actual quantity incorporated into the Work, amounts to full compensation for completion of the item, including work incidental to it.

1.1.53 Unit Price Quantities: Quantities indicated in the Contract that are approximations made by the City for contracting purposes.

1.1.54 Work: Entire construction required by the Contract, including all labor, Products, and services provided by Contractor to fulfill Contractor's obligations. The Work may constitute the whole or a portion of the Project.

1.1.55 Work Change Directive: A written change in the Work, ordered by City Engineer, that is within the general scope of the Contract and consisting of additions, deletions, or other revisions. A Work Change Directive will state proposed basis for adjustment, if any, in Contract Price or Contract Time, or both.

1.2 EXECUTION, CORRELATION, AND INTENT

1.2.1 Execution of the Contract by Contractor is conclusive that Contractor has visited the Work site, become familiar with local conditions under which the Work will be performed, and fully informed itself as to conditions and matters which can affect the Work or costs. Contractor further agrees that it has carefully correlated personal observations with requirements of the Contract.

1.2.2 The Contract and Modifications have been read and carefully considered by Contractor, who understands and agrees to their sufficiency for the Work. The Contract may not be more strongly construed against the City than against Contractor and Surety.

1.2.3 Contractor shall include all items necessary for proper execution and completion of the Work.

1.2.4 Reference to standard specifications, manuals, or codes of a technical society, organization, or association, or to laws or regulations of a governmental authority, whether specific or implied, mean the latest edition in effect as of date of receipt of bids, except as may be otherwise specifically stated in the Contract.

1.2.5 No provision of any referenced standard, specification, or manual changes the duties and responsibilities of the City, City Engineer, Contractor, or Design Consultant from those set forth in the Contract. Nor do these provisions assign to Design Consultant any duty or authority to supervise or direct performance of the Work or any duty or authority to undertake any actions contrary to provisions of the Contract.

1.2.6 Organization of Specifications into divisions, sections, and articles and arrangement of Drawings does not control Contractor in dividing the Work among Subcontractors or in establishing the extent of work to be performed by any trade.

1.2.7 Unless otherwise defined in the Contract, words which have well-known construction industry technical meanings are used in the Contract in accordance with these recognized meanings.

1.3 OWNERSHIP AND USE OF DOCUMENTS

1.3.1 Drawings, Specifications, and other documents prepared by the City or by Design Consultant are instruments of service through which the Work to be executed by Contractor is described. Contractor may retain one Contract record set.

1.3.2 Neither Contractor, Subcontractor, nor Supplier will own or claim a copyright to documents contained in the Contract or any part of the Contract.

1.3.3 Documents contained in the Contract, prepared by the City or by Design Consultant, and copies furnished to Contractor, are for use solely with respect to the Work. They may not be used by Contractor, Subcontractor or Supplier on other projects or for additions to the Work, outside the scope of the Work, without the specific written consent of City Engineer, and Design Consultant, when applicable.

1.3.4 Contractor, Subcontractors, and Suppliers are granted a limited license to use and reproduce applicable portions of the Contract appropriate to and for use in execution of their work under the Contract.

1.4 *INTERPRETATION*

1.4.1 Specifications are written in an imperative streamlined form and are directed to Contractor, unless noted otherwise. When written in this form, words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

1.4.2 In the interest of brevity, the Contract frequently omits modifying words such as "all" and "any" and articles such as "the" and "an", but an absent modifier or article is not intended to affect interpretation of a statement.

ARTICLE 2 - THE CITY

2.1 *LIMITATIONS OF THE CITY'S OFFICERS AND EMPLOYEES*

2.1.1 No officer or employee of the City may authorize Contractor to perform an act or work contrary to the Contract, except as otherwise provided in the Contract.

2.2 *DUTIES OF THE CITY*

2.2.1 If a building permit is required, the City will process an application for, and Contractor shall purchase the building permit before Date of Commencement of the Work.

2.2.2 The City will make available to Contractor a reproducible set of Drawings. Additional copies will be furnished, on Contractor's request, at the cost of reproduction.

2.2.3 When necessary for performance of the Work, the City will provide surveys describing physical characteristics, legal limitations, legal description of site, and horizontal and vertical control adequate to lay out the Work.

2.2.4 Information or services that the City is required to provide under the Contract will be provided by the City with reasonable promptness to avoid delay in orderly progress of the Work.

2.2.5 The Contract imposes no implied duty on the City. The City does not warrant any plans or specifications associated with the Contract.

2.2.6 Except as expressly stated in this Article, the City owes no duty to the Contractor or any subcontractor.

2.3 *AVAILABILITY OF LAND AND USE OF SITE*

2.3.1 The City will furnish, as indicated in the Contract, rights-of-way, land on which the Work is to be performed, and other land designated in the Contract for use by Contractor unless otherwise provided in the Contract.

2.3.2 Contractor shall confine operations at site to those areas permitted by law, ordinances, permits, and the Contract, and may not unreasonably encumber site with materials or equipment.

2.3.3 In addition to land provided by the City under Section 2.3, Contractor shall provide all land and access to land that may be required for use by

Contractor for temporary construction facilities or for storage of materials and equipment, and shall indemnify the City during its use of the land as stated in Section 3.25.

2.4 *THE CITY'S RIGHT TO STOP THE WORK*

2.4.1 If Contractor fails to carry out the Work in accordance with the Contract, or fails to correct work which is not in accordance with requirements of the Contract as required in Sections 12.1 and 12.2, the City may, by Notice of Noncompliance, order Contractor to stop the Work or any portion of the Work until the cause for the order has been eliminated. However, the right of the City to stop the Work will not give rise to a Claim for delay or to a duty on the part of the City to exercise this right for the benefit of Contractor or any other person or entity, except to the extent required by Section 6.2. If Contractor corrects the defective or nonconforming work within the time established in Notice of Noncompliance, City Engineer will give written notice to Contractor to resume performance of the Work.

2.5 *THE CITY'S RIGHT TO CARRY OUT WORK*

2.5.1 If Contractor fails to carry out work in accordance with the Contract, and fails within the period established in a Notice of Noncompliance to correct the nonconforming work, the City may, after expiration of the required period, correct the deficiencies without prejudice to other remedies the City may have, including rights of the City under Section 14.1.

2.5.1.1 When the City corrects deficiencies, City Engineer will issue an appropriate Change Order and deduct from payments then or thereafter due Contractor the cost of correcting the deficiencies, including compensation for Design Consultant's and Construction Manager's additional services and expenses made necessary by such default, neglect, or failure. This action by the City and amounts charged to Contractor are both subject to prior approval of City Engineer. If payments, then or thereafter due Contractor, are not sufficient to cover these amounts, Contractor shall pay the difference to the City.

2.5.2 Notwithstanding the City's right to carry out work, maintenance and protection of the Work remains Contractor's responsibility, as provided in the Contract.

ARTICLE 3 - CONTRACTOR

3.1 *RESPONSIBILITIES*

3.1.1 Contractor shall maintain office with agent in the greater City of Houston area during the Contractor's performance under the Contract. Contractor shall file its street address with City Engineer.

3.1.2 Contractor and Contractor's employees shall not give or lend money or anything of value to an officer or employee of the City. Should this Paragraph 3.1.2 be violated, City Engineer may terminate the Contract under Section 14.1.

3.2 *REVIEW OF CONTRACT AND FIELD CONDITIONS BY CONTRACTOR*

3.2.1 Contractor shall carefully study and compare documents contained in the Contract with each other and with information furnished by the City pursuant to Section 2.2 and shall immediately report, in writing, any errors, inconsistencies, or omissions to City Engineer. If work is affected, Contractor shall obtain a written interpretation or clarification from City Engineer before proceeding with the affected work. However, Contractor will not be liable to the City for failure to report an error, inconsistency, or omission in the Contract unless Contractor had actual knowledge or should have had knowledge of the error, inconsistency, or omission.

3.2.2 Contractor shall take field measurements and verify field conditions, and shall carefully compare the conditions and other information known to Contractor with the Contract, before commencing activities. Contractor shall immediately report, in writing, to City Engineer for interpretation or clarification of discrepancies, inconsistencies, or omissions discovered during this process.

3.2.3 Contractor shall make a reasonable attempt to understand the Contract before requesting interpretation from City Engineer.

3.3 *SUPERVISION AND CONSTRUCTION PROCEDURES*

3.3.1 Contractor shall supervise, direct, and inspect the Work competently and efficiently, devoting the attention and applying the skills and expertise as necessary to perform the Work in accordance with the Contract. Contractor is solely responsible and has control over construction

means, methods, techniques, sequences, and procedures of construction; for safety precautions and programs in connection with the Work; and for coordinating all work under the Contract.

3.3.2 Regardless of observations or inspections by the City or City's consultants, Contractor shall perform and complete the Work in accordance with the Contract and submittals approved pursuant to Section 3.18. The City is not liable or responsible to Contractor or Surety for work performed by Contractor that is not in accordance with the Contract regardless of whether discovered during construction or after acceptance of the Work.

3.4 *SUPERINTENDENT*

3.4.1 Contractor shall employ a competent Superintendent and necessary assistants who shall be present at the site during performance of the Work. Communications given to Superintendent are binding on the Contractor.

3.4.2 Contractor shall notify City Engineer in writing of its intent to replace the Superintendent. Contractor may not replace the Superintendent if City Engineer makes a reasonable objection in writing.

3.5 *LABOR*

3.5.1 Contractor shall provide competent, qualified personnel to survey and lay out the Work and perform construction as required by the Contract. The City may, by written notice, require Contractor to remove from the Work any employee of Contractor or Subcontractors to whom City Engineer makes reasonable objection.

3.5.2 Contractor shall comply with the applicable Business Enterprise Policy set out in this Agreement and in the Supplementary Conditions, as set out in Chapter 15, Article V of the City of Houston Code of Ordinances.

3.5.3 When Original Contract Price is greater than $1,000,000, Contractor shall make Good Faith Efforts to award subcontracts or supply agreements in at least the percentages set out in the Supplementary Conditions for Business Enterprise Policy ("Stated MWBE goal"). If the Contractor is a certified MBE or WBE, Contractor may count toward goals the work that it commits to perform with its own work force, capped at 50% of the total advertised goal. Contractor acknowledges that it has reviewed the requirements for Good Faith Efforts on file with the City's Office of Business Opportunity and shall comply with them.

3.5.3.1 Contractor shall require written subcontracts with Business Enterprises and shall submit all disputes with Business Enterprises to voluntary mediation. Business Enterprise subcontracts complying with City Code of Ordinances Chapter 15, Article II must contain the terms set out in Subparagraph 3.5.3.2. If Contractor is an individual person, as distinguished from a corporation, partnership, or other legal entity, and the amount of the subcontract is $50,000 or less, the subcontract must also be signed by the attorneys of the respective parties.

3.5.3.2 Contractor shall ensure that subcontracts with Business Enterprise firms are clearly labeled **"THIS CONTRACT MAY BE SUBJECT TO MEDIATION ACCORDING TO THE TEXAS ALTERNATIVE DISPUTE RESOLUTION ACT"** and contain the following terms:

3.5.3.2.1 (Business Enterprise) shall permit representatives of the City of Houston, at all reasonable times, to perform (1) audits of the books and records of the Subcontractors and Suppliers, and (2) inspections of all places where work is to be undertaken in connection with this subcontract. (Business Enterprise) shall keep the books and records available for this purpose for at least four years after the end of its performance under this subcontract. Nothing in this provision shall affect the time for bringing a cause of action nor the applicable statute of limitations.

3.5.3.2.2 Within five business days of execution of this subcontract, Contractor and (Business Enterprise) shall designate in writing to the Director an agent for receiving any notice required or permitted to be given pursuant to Chapter 15 of the Houston City Code of Ordinances, along with the street and mailing address and phone number of the agent.

3.5.3.3 If the term of this Agreement exceeds one Contract Year and Contractor's MWBE participation level in a Contract Year is less than the Stated MWBE goal, then within 30 calendar days of the end of each Contract Year, Contractor must provide a written detailed explanation to both the

Director and OBO Director of the following: (1) the discrepancy between Contractor's MWBE participation level and the Stated MWBE goal, (2) the reason for the discrepancy, and (3) Contractor's good faith efforts (in accordance with the City's policy) towards achieving the Stated MWBE goal. As part of the good faith efforts assessment, the OBO Director may consider Contractor's failure to timely submit the notice or explanation required by this provision and the OBO Director may impose sanctions or other penalties on Contractor for said failures in accordance with Chapter 15 of the Code of Ordinances, OBO's policies and procedures, and the City's good faith efforts policy.

3.5.4 The requirements and terms of the City of Houston Pay or Play Program, as set out in Executive Order 1-7, as revised from time to time, are incorporated into the Contract for all purposes. Contractor has reviewed Executive Order 1-7 and shall comply with its terms and conditions. IF CONTRACTOR DOES NOT PAY IN ACCORDANCE WITH THE PAY OR PLAY PROGRAM WITHIN 30 DAYS OF THE DATE CITY ENGINEER SENDS CONTRACTOR WRITTEN NOTIFICATION, CITY CONTROLLER MAY DEDUCT FUNDS UP TO THE AMOUNT OWED FROM ANY PAYMENTS OWED TO CONTRACTOR UNDER THIS CONTRACT, AND CONTRACTOR WAIVES ANY RECOURSE.

3.6 *PREVAILING WAGE RATES*

3.6.1 Contractor shall comply with governing statutes providing for labor classification of wage scales for each craft or type of laborer, worker, or mechanic.

3.6.2 Prevailing wage rates applicable to the Work may be one or a combination of the following wage rates identified in Division 00:

- 3.6.2.1 Federal Wage Rate General Decisions
  - 3.6.2.1.1 Highway Rates
  - 3.6.2.1.2 Building Rates
  - 3.6.2.1.3 Heavy Construction Rates
  - 3.6.2.1.4 Residential Rates
- 3.6.2.2 City Prevailing Wage Rates
  - 3.6.2.2.1 Building Construction Rates
  - 3.6.2.2.2 Engineering Construction Rates
  - 3.6.2.2.3 Asbestos Worker Rates

3.6.3 Each week Contractor shall submit to the City's Mayor's Office of Business Opportunity certified copies of payrolls showing classifications and wages paid by Contractor, Subcontractors, and Suppliers for each employee under the Contract, for any day included in the Contract.

3.7 *LABOR CONDITIONS*

3.7.1 In the event of labor disputes affecting Contractor or Contractor's employees, Contractor shall utilize all possible means to resolve disputes in order that the Work not be delayed to any extent. These means will include seeking injunctive relief and filing unfair labor practice charges, and any other action available to Contractor.

3.7.2 When Contractor has knowledge that any actual or potential labor dispute is delaying or is threatening to delay timely performance of the Work, Contractor shall immediately notify City Engineer in writing. No Claims will be accepted by City Engineer for costs incurred as a result of jurisdictional or labor disputes.

3.8 *DRUG DETECTION AND DETERRENCE*

3.8.1 It is the policy of the City to achieve a drug-free work force and to provide a workplace that is free from the use of illegal drugs and alcohol. It is also the policy of the City that manufacture, distribution, dispensation, possession, sale, or use of illegal drugs or alcohol by contractors while on the City's premises is prohibited. By executing the Contract, Contractor represents and certifies that it meets and will comply with all requirements and procedures set forth in the Mayor's Policy on Drug Detection and Deterrence, City Council Motion No. 92-1971 ("Mayor's Policy") and the Mayor's Drug Detection and Deterrence Procedures for Contractors, Executive Order No. 1-31, (Revised) ("Executive Order"). Mayor's Policy is on file in the office of the City Secretary. Copies of Executive Order may be obtained at the location specified in the Advertisement for Bids.

- 3.8.1.1 The Executive Order applies to the City's contracts for labor or services except the following:
  - 3.8.1.1.1 contracts authorized by Emergency Purchase Orders,
  - 3.8.1.1.2 contracts in which imposition of requirements of the Executive Order would exclude all potential bidders or proposers, or would eliminate meaningful competition for the Contract,

3.8.1.1.3 contracts with companies that have fewer than 15 employees during any 20-week period during a calendar year and no safety impact positions,

3.8.1.1.4 contracts with non-profit organizations providing services at no cost or reduced cost to the public, and

3.8.1.1.5 contracts with federal, state, or local governmental entities.

3.8.1.2 Prior to execution of the Contract, Contractor shall have filed with the City:

3.8.1.2.1 a Drug Policy Compliance Agreement form (Attachment "A" to the Executive Order), and

3.8.1.2.2 a copy of Contractor's drug free workplace policy, and

3.8.1.2.3 a written designation of all safety impact positions, if applicable, or a Contractor's Certification of a No Safety Impact Positions form (Attachment "C" to the Executive Order).

3.8.1.3 Every six months during performance of the Contract and upon completion of the Contract, Contractor shall file a Drug Policy Compliance Declaration form (Attachment "B" to the Executive Order). The Contractor shall submit the Drug Policy Compliance Declaration within 30 days of expiration of each six-month period of performance and within 30 days of completion of the Contract. The first six-month period shall begin on Date of Commencement of the Work.

3.8.1.4 Contractor shall have a continuing obligation to file updated designation of safety impact positions when additional safety impact positions are added to Contractor's employee workforce during performance of the Work.

3.8.1.5 Contractor shall require its Subcontractors and Suppliers to comply with the Mayor's Policy and Executive Order. Contractor is responsible for securing and maintaining required documents from Subcontractors and Suppliers for the City inspection throughout the term of the Contract.

3.8.1.6 Failure of Contractor to comply with requirements will be a material breach of the Contract entitling the City to terminate in accordance with Section 14.1.

3.9 *MATERIALS & EQUIPMENT*

3.9.1 Unless otherwise provided in the Contract, Contractor shall provide and assume full responsibility for Products, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, transportation, temporary facilities, supplies, and other facilities and incidentals necessary for Furnishing, performing, testing, starting-up, and completing the Work.

3.9.1.1 Contractor, Subcontractors, and Suppliers shall use Ultra Low Sulfur Diesel Fuel in all diesel operating vehicles and motorized equipment utilized in performing the Work. Ultra Low Sulfur Diesel Fuel is defined as diesel fuel having 15 ppm or the applicable standard set by state or federal law or rules and regulations of the Texas Commission on Environmental Quality, or the Environmental Protection Agency, whichever is less in sulfur content. Off-road Ultra Low Sulfur Diesel Fuel may be used in lieu of on-road Ultra Low Sulfur Diesel Fuel. Contractor shall provide, upon request by City Engineer, proof that Contractor, Subcontractors, and Suppliers are using Ultra Low Sulfur Diesel Fuel.

3.9.2 Contractor shall provide Products that are:

3.9.2.1 new, unless otherwise required or permitted by the Contract, and

3.9.2.2 of specified quality.

If required by City Engineer, Contractor shall furnish satisfactory evidence, including reports of required tests, as to kind and quality of Products.

3.9.3 Contractor shall store Products in a safe, neat, compact, and protected manner. Contractor shall also store Products delivered during the work, along the right-of-way:

3.9.3.1 so as to cause the least inconvenience to property owners, tenants, and general public; and

3.9.3.2 so as not to block access to, or be closer than, three feet to any fire hydrant.

Contractor shall protect trees, lawns, walks, drives, streets, and other improvements that are to remain, from damage. If private or public property is damaged by Contractor, Contractor shall, at its sole expense, restore the damaged property to at least its original condition.

3.9.3.1 Contractor shall obtain City Engineer's approval for storage areas used for Products for which payment has been requested under Paragraph 9.6.1.

Contractor shall provide the City access to the storage areas for inspection purposes. Products, once paid for by the City, become the property of the City and may not be removed from place of storage, without City Engineer's written permission except for a movement to the site. Contractor's Installation Floater, required under Section 11.2, shall cover all perils, including loss or damage to Products during storage, loading, unloading, and transit to the site.

3.10 *PRODUCT OPTIONS AND SUBSTITUTIONS*

3.10.1 For Products specified by reference standards or by description only, Contractor may provide any Product meeting those standards or description.

3.10.2 For Products specified by naming one or more manufacturers with provision for substitutions or equal, Contractor may submit a request for substitution for any manufacturer not named.

3.10.3 City Engineer will consider requests for substitutions only within the first 15 percent of Contract Time, or first 90 days after date of Notice to Proceed, whichever is less.

3.10.4 Contractor shall document each request for substitution with complete data substantiating compliance of proposed substitution with the Contract.

3.10.5 A request for substitution constitutes a representation that Contractor:

3.10.5.1 has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified Product;

3.10.5.2 shall provide the same warranty for the substitution as for the specified Product;

3.10.5.3 shall coordinate installation of the proposed substitution and make changes to other work which may be required for the Work to be completed, with no additional cost or increase in time to the City;

3.10.5.4 confirms that cost data is complete and includes all related costs under the Contract;

3.10.5.5 waives Claim for additional costs or time extensions that may subsequently become apparent; and

3.10.5.6 shall provide review or redesign services by a design consultant with appropriate professional license and shall obtain re-approval and permits from authorities.

3.10.6 City Engineer will not consider and will not approve substitutions when:

3.10.6.1 they are indicated or implied on Shop Drawing or Product Data submittals without separate written request; or

3.10.6.2 acceptance will require revision to the Contract.

3.10.7 City Engineer may reject requests for substitution, and his decision will be final and binding on the Parties.

3.11 *CASH ALLOWANCES*

3.11.1 Contract Price includes Cash Allowances as identified in the Contract.

3.11.2 The City will pay the actual costs of Cash Allowance item exclusive of profit, overhead or administrative costs. If actual costs exceed the Cash Allowance, City Engineer must approve a Change Order for the additional costs.

3.12 *WARRANTY*

3.12.1 Contractor warrants to the City that Products furnished under the Contract are:

3.12.1.1 free of defects in title;

3.12.1.2 of good quality; and

3.12.1.3 new, unless otherwise required or permitted by the Contract.

If required by the City Engineer, Contractor shall furnish satisfactory evidence as to kind, quality and title of Products, and that Products conform to requirements of the Contract.

3.12.2 In the event of a defect in a Product, either during construction or warranty period, Contractor shall take appropriate action with manufacturer of Product to assure correction or replacement of defective Product with minimum delay.

3.12.3 Contractor warrants that the Work is free of defects not inherent in the quality required or permitted, and that the Work does conform with the requirements of the Contract. Contractor further warrants that the Work has been performed in a thorough and workmanlike manner.

3.12.4 Contractor warrants that the Work is free of concentrations on polychlorinated biphenyl (PCB) and other substances defined as hazardous by the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) or any other applicable law or regulation.

3.12.5 Work not conforming to requirements of Section 3.12, including substitutions not properly approved and authorized, may be considered nonconforming work.

3.12.6 Contractor's warranty excludes remedy for damage or defect caused by:

3.12.6.1 improper or insufficient maintenance by the City;

3.12.6.2 normal wear and tear under normal usage; or

3.12.6.3 claim that hazardous material was incorporated into the Work, if that material was specified in the Contract.

3.12.7 Contractor warrants that title to all work covered by Contractor's request for payment passes to the City upon incorporation into the Work or upon Contractor's receipt of payment, whichever occurs first. The Contractor further warrants that the title is free of all liens, claims, security interests or other interests ("Encumbrances"). If not, upon written demand from City Engineer, Contractor shall immediately take legal action necessary to remove Encumbrances.

3.13 *TAXES*

3.13.1 Contractor shall pay all sales, consumer, use, and similar taxes, which are in effect or scheduled to go into effect on or before bids are received, related to work provided by Contractor.

3.13.2 Contractor shall obtain, and require Subcontractors and Suppliers to obtain, necessary permits from the state and local taxing authorities to perform contractual obligations under the Contract, including sales tax permits.

3.13.3 The City is exempt from the Federal Transportation and Excise Tax. Contractor shall comply with federal regulations governing the exemptions.

3.13.4 Products incorporated into the Work are exempt from state sales tax according to provisions of the TEX. TAX CODE ANN. CH. 151, Subsection H.

3.14 *PERMITS, FEES, AND NOTICES*

3.14.1 Unless otherwise provided in the Contract, Contractor shall secure and pay for all construction permits, licenses, and inspections:

3.14.1.1 necessary for proper execution and completion of the Work; and

3.14.1.2 legally required at time bids are received.

3.15 *CONSTRUCTION SCHEDULES*

3.15.1 On receipt of Notice to Proceed, Contractor shall promptly prepare and submit construction schedule for the Work for City Engineer's review. The schedule must reflect the minimum time required to complete the Work not to exceed Contract Time.

3.15.2 Contractor shall give 24-hour written notice to City Engineer before commencing work or resuming work where work has been stopped. Contractor shall also give the same notice to inspectors.

3.15.3 Contractor shall incorporate milestones specified in Summary of Work Specification into the construction schedule. Contractor's failure to meet a milestone, as determined by City Engineer, may be considered a material breach of the Contract.

3.15.4 Each month, Contractor shall submit to City Engineer a copy of an updated construction schedule indicating actual progress, incorporating applicable changes, and indicating courses of action required to assure completion of the Work within Contract Time.

3.15.5 Contractor shall keep a current schedule of submittals that coordinates with the construction schedule, and shall submit the initial schedule of submittals to City Engineer for approval.

3.16 *DOCUMENTS AND SAMPLES AT THE SITE*

3.16.1 Contractor shall maintain at the site, and make available to City Engineer, one record copy of Drawings, Specifications, and Modifications. Contractor shall maintain the documents in good order and marked currently to record changes and selections made during construction. In addition, Contractor shall maintain at the site, approved Shop Drawings, Product Data, Samples, and similar submittals, which will be delivered to City Engineer prior to final inspection as required in Paragraph 9.11.4.

3.16.2 Contractor shall maintain all books, documents, papers, accounting records, and other

relevant documentation pursuant to the Work and shall make the books, documents, papers, and accounting records available to representatives of the City for review and audits during the Contract term and for the greater of three years following Date of Substantial Completion or until all litigation or audits are fully resolved.

3.16.3 Contractor shall provide to City Attorney all documents and records that City Attorney deems necessary to assist in determining Contractor's compliance with the Contract, with the exception of those documents made confidential by federal or state law or regulation.

3.17 *MANUFACTURER'S SPECIFICATIONS*

3.17.1 Contractor shall handle, store, and Install Products and perform all work in the manner required by Product manufacturer. Should the Contract and manufacturer's instructions conflict, Contractor shall report conflict to City Engineer for resolution prior to proceeding with the affected work.

3.17.2 References in the Contract to the manufacturer's specifications, directions, or recommendations, mean manufacturer's current published documents in effect as of date of receipt of bids, or in the case of a Modification, as of date of Modification.

3.18 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

3.18.1 Shop Drawings, Product Data, and Samples are not part of the Contract. The purpose of Contractor submittals is to demonstrate, for those portions of the Work for which submittals are required, the way Contractor proposes to conform to information given and design concept expressed in the Contract.

3.18.2 Contractor shall submit to Project Manager for review the Shop Drawings, Product Data, and Samples, which are required by the Contract. Review by Project Manager is subject to limitations of Paragraph 4.1.4. Contractor shall transmit the submittals to the Project Manager with reasonable promptness and in a sequence, so as to cause no delay in the Work or in activities of the City or of separate contractors. Contractor shall transmit submittals in time to allow a minimum of 30 days for Project Manager's review prior to date Contractor needs reviewed submittals returned. This time may be shortened for a particular job requirement if approved by Project Manager in advance of submittal.

3.18.3 Contractor shall certify that the content of submittals conforms to the Contract without exception by affixing Contractor's approval stamp and signature. By certifying and submitting Shop Drawings, Product Data, and Samples, Contractor represents, and Contractor's stamp of approval shall state, that Contractor has determined and verified materials, quantities, field measurements, and field construction criteria related to the submittal, and has checked and coordinated information contained within the submittals with requirements of the Contract.

3.18.4 Contractor may not perform any work requiring submittal and review of Shop Drawings, Product Data, or Samples until the submittal has been returned with appropriate review decision by the Project Manager. Contractor shall perform work in accordance with the review.

3.18.5 If Contractor performs any work requiring submittals prior to review and acceptance of the submittals by Project Manager, such work is at Contractor's risk and the City is not obligated to accept work if the submittals are later found to be unacceptable.

3.18.6 If, in the opinion of Project Manager, the submittals are incomplete, or demonstrate an inadequate understanding of the Work or lack of review by the Contractor, then submittals may be returned to the Contractor for correction and resubmittal.

3.18.7 Contractor shall direct specific attention in writing and on the resubmitted Shop Drawings, Product Data, or Samples to any additional proposed revisions, other than those revisions requested by Project Manager on previous submittals.

3.18.8 Contractor is not relieved of responsibility for deviations from requirements of the Contract by Project Manager's review of Shop Drawings, Product Data, or Samples unless Contractor has specifically informed Project Manager in writing of the deviation at the time of the submittal, and Project Manager has given written approval of the deviation.

3.18.9 When professional certification of performance criteria of Products is required by the Contract, the City may rely upon accuracy and completeness of the calculations and certifications.

3.18.10 For Product colors or textures to be selected by the City, Contractor shall submit all

samples together to allow preparation of a complete selection schedule.

3.18.11 Contractor shall submit informational submittals, on which Project Manager is not expected to take responsive action, as required by the Contract.

3.18.12 Submittals made by Contractor which are not required by the Contract may be returned to Contractor without action.

3.19 *CULTURAL RESOURCES AND ENDANGERED SPECIES*

3.19.1 Contractor may not remove or disturb, or cause to be removed or disturbed, any historical, archaeological, architectural, or other cultural artifacts, relics, vestiges, remains, or objects of antiquity. If Contractor discovers one of these items, Contractor shall immediately notify City Engineer and further comply with the requirements of 13 Tex. Admin. Code Chs. 25 and 26 (2002), or successor regulation. Contractor shall protect site and cultural resources from further disturbance until professional examination can be made or until clearance to proceed is authorized in writing by City Engineer.

3.19.2 Should either threatened or endangered plant or animal species be encountered, Contractor shall cease work immediately in the area of encounter and notify City Engineer.

3.20 *CUTTING AND PATCHING*

3.20.1 Contractor is responsible for necessary cutting, fitting, and patching to accomplish the Work and shall suitably support, anchor, attach, match, and trim or seal materials to work of other contractors. Contractor shall coordinate the Work with work of other contractors to minimize conflicts, as provided in Article 6.

3.20.2 Contractor may not endanger work by cutting, digging, or other action, and may not cut or alter work of other contractors except by written consent of City Engineer and affected contractor.

3.21 *CLEANING*

3.21.1 Contractor shall perform daily cleanup of all dirt, debris, scrap materials and other disposable items resulting from Contractor's operations, whether on-site or off-site. Unless otherwise authorized in writing by City Engineer, Contractor shall keep all streets, access streets, driveways, areas of public access, walkways, and other designated areas clean and open at all times.

3.21.2 Failure of Contractor to maintain a clean site, including access streets, is the basis for City Engineer to issue a Notice of Noncompliance. Should compliance not be attained within the time period in the Notice of Noncompliance, City Engineer may authorize necessary cleanup to be performed by others and the cost of the cleanup will be deducted from monies due Contractor.

Contractor shall legally dispose off-site, all waste materials and other excess materials resulting from Contractor's operations.

3.22 *SANITATION*

3.22.1 Contractor shall provide and maintain sanitary facilities at site for use of all construction forces under the Contract. Newly-constructed or existing sanitary facilities may not be used by Contractor.

3.23 *ACCESS TO WORK AND TO INFORMATION*

3.23.1 Contractor shall provide the City, Design Consultant, testing laboratories, and governmental agencies which have jurisdictional interests, access to the Work in preparation and in progress wherever located. Contractor shall provide proper and safe conditions for the access.

3.23.2 If required by City Engineer, Contractor shall furnish information concerning character of Products and progress and manner of the Work, including information necessary to determine cost of the Work, such as number of employees, pay of employees, and time employees worked on various classes of the Work.

3.24 *TRADE SECRETS*

3.24.1 Contractor will not make any claim of ownership of trade secrets as to products used in the Work, or preparation of any mixture for the Work. City Engineer will at all times have the right to demand and Contractor shall furnish information concerning materials or samples of ingredients of any materials used, or proposed to be used, in preparation of concrete placed or other work to be done. Mixtures, once agreed on, shall not be changed in any manner without knowledge and consent of City Engineer. The City will make its best efforts to protect confidentiality of proprietary information.

3.25 *INDEMNIFICATION*

3.25.1 CONTRACTOR AGREES TO AND SHALL DEFEND, INDEMNIFY, AND HOLD THE

CITY, ITS AGENTS, EMPLOYEES, OFFICERS, AND LEGAL REPRESENTATIVES (COLLECTIVELY THE "CITY") HARMLESS FOR ALL CLAIMS, CAUSES OF ACTION, LIABILITIES, FINES, AND EXPENSES (INCLUDING, WITHOUT LIMITATION, ATTORNEYS' FEES, COURT COSTS, AND ALL OTHER DEFENSE COSTS AND INTEREST) FOR INJURY, DEATH, DAMAGE, OR LOSS TO PERSONS OR PROPERTY SUSTAINED IN CONNECTION WITH OR INCIDENTAL TO PERFORMANCE UNDER THE CONTRACT INCLUDING, WITHOUT LIMITATION, THOSE CAUSED BY:

3.25.1.1 CONTRACTOR'S AND/OR ITS AGENTS', EMPLOYEES', OFFICERS', DIRECTORS', CONTRACTORS', OR SUBCONTRACTORS' (COLLECTIVELY IN NUMBERED SUBPARAGRAPHS .1 through .3, "CONTRACTOR") ACTUAL OR ALLEGED NEGLIGENCE OR INTENTIONAL ACTS OR OMISSIONS;

3.25.1.2 THE CITY'S AND CONTRACTOR'S ACTUAL OR ALLEGED CONCURRENT NEGLIGENCE, WHETHER CONTRACTOR IS IMMUNE FROM LIABILITY OR NOT;

3.25.1.3 THE CITY'S AND CONTRACTOR'S ACTUAL OR ALLEGED STRICT PRODUCTS LIABILITY OR STRICT STATUTORY LIABILITY, WHETHER CONTRACTOR IS IMMUNE FROM LIABILITY OR NOT.

CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE CITY HARMLESS DURING THE TERM OF THE CONTRACT AND FOR FOUR YEARS AFTER THE CONTRACT TERMINATES. CONTRACTOR SHALL NOT INDEMNIFY THE CITY FOR THE CITY'S SOLE NEGLIGENCE.

3.25.2 NOTWITHSTANDING ANYTHING TO THE CONTRARY, THE LIABILITY OF CONTRACTOR FOR THE CITY'S CONCURRENT NEGLIGENCE SHALL NOT EXCEED $1,000,000.

3.26 *RELEASE AND INDEMNIFICATION – PATENT, COPYRIGHT, TRADEMARK, AND TRADE SECRET INFRINGEMENT*

3.26.1 UNLESS OTHERWISE SPECIFICALLY REQUIRED BY THE CONTRACT, CONTRACTOR AGREES TO AND SHALL RELEASE AND DEFEND, INDEMNIFY, AND HOLD HARMLESS THE CITY, ITS AGENTS, EMPLOYEES, OFFICERS, AND LEGAL REPRESENTATIVES (COLLECTIVELY THE "CITY") FROM ALL CLAIMS OR CAUSES OF ACTION BROUGHT AGAINST THE CITY BY ANY PARTY, INCLUDING CONTRACTOR, ALLEGING THAT THE CITY'S USE OF ANY EQUIPMENT, SOFTWARE, PROCESS, OR DOCUMENTS CONTRACTOR FURNISHES DURING THE TERM OF THE CONTRACT INFRINGES ON A PATENT, COPYRIGHT, OR TRADEMARK, OR MISAPPROPRIATES A TRADE SECRET. CONTRACTOR SHALL PAY ALL COSTS (INCLUDING, WITHOUT LIMITATION, ATTORNEYS' FEES, COURT COSTS, AND ALL OTHER DEFENSE COSTS, AND INTEREST) AND DAMAGES AWARDED.

3.26.2 CONTRACTOR SHALL NOT SETTLE ANY CLAIM ON TERMS WHICH PREVENT THE CITY FROM USING THE EQUIPMENT, SOFTWARE, PROCESS, OR PRODUCT WITHOUT THE CITY ENGINEER'S PRIOR WRITTEN CONSENT.

3.26.3 UNLESS OTHERWISE SPECIFICALLY REQUIRED BY THE CONTRACT, WITHIN 60 DAYS AFTER BEING NOTIFIED OF THE CLAIM, CONTRACTOR SHALL, AT ITS OWN EXPENSE, EITHER:

3.26.3.1 OBTAIN FOR THE CITY THE RIGHT TO CONTINUE USING THE EQUIPMENT, SOFTWARE, PROCESS, OR PRODUCT, OR

3.26.3.2 IF BOTH PARTIES AGREE, REPLACE OR MODIFY THEM WITH COMPATIBLE AND FUNCTIONALLY EQUIVALENT PRODUCTS.

IF NONE OF THESE ALTERNATIVES IS REASONABLY AVAILABLE, THE CITY MAY RETURN THE EQUIPMENT, SOFTWARE, OR PRODUCT, OR DISCONTINUE THE PROCESS, AND CONTRACTOR SHALL REFUND THE PURCHASE PRICE.

3.27 *INDEMNIFICATION PROCEDURES*

3.27.1 *Notice of Indemnification Claims:* If the City or Contractor receives notice of any claim or circumstances which could give rise to an indemnified loss, the receiving party shall give written notice to the other Party within 10 days. The notice must include the following:

3.27.1.1 a description of the indemnification event in reasonable detail,

3.27.1.2 the basis on which indemnification may be due, and

3.27.1.3 the anticipated amount of the indemnified loss.

This notice does not estop or prevent the City from later asserting a different basis for indemnification or a different amount of indemnified loss than that

indicated in the initial notice. If the City does not provide this notice within the 10-day period, it does not waive any right to indemnification except to the extent that Contractor is prejudiced, suffers loss, or incurs expense because of the delay.

3.27.2 *Defense of Indemnification Claims:*

3.27.2.1 *Assumption of Defense:* Contractor may assume the defense of the claim at its own expense with counsel chosen by it that is reasonably satisfactory to the City. Contractor shall then control the defense and any negotiations to settle the claim. Within 10 days after receiving written notice of the indemnification request, Contractor must advise the City as to whether or not it will defend the claim. If Contractor does not assume the defense, the City shall assume and control the defense, and all defense expenses constitute an indemnified loss.

3.27.2.2 *Continued Participation:* If Contractor elects to defend the claim, the City may retain separate counsel to participate in, but not control, the defense and to participate in, but not control, any settlement negotiations. Contractor may settle the claim without the consent or agreement of the City, unless it:

3.27.2.2.1 would result in injunctive relief or other equitable remedies or otherwise require the City to comply with restrictions or limitations that adversely affect the City;

3.27.2.2.2 would require the City to pay amounts that Contractor does not fund in full; or

3.27.2.2.3 would not result in the City's full and complete release from all liability to the plaintiffs or claimants who are parties to or otherwise bound by the settlement.

3.28 CONTRACTOR DEBT

IF CONTRACTOR, AT ANY TIME DURING THE TERM OF THIS AGREEMENT, INCURS A DEBT, AS THE WORD IS DEFINED IN SECTION 15-122 OF THE HOUSTON CITY CODE OF ORDINANCES, IT SHALL IMMEDIATELY NOTIFY CITY CONTROLLER IN WRITING. IF CITY CONTROLLER BECOMES AWARE THAT CONTRACTOR HAS INCURRED A DEBT, IT SHALL IMMEDIATELY NOTIFY CONTRACTOR IN WRITING. IF CONTRACTOR DOES NOT PAY THE DEBT WITHIN 30 DAYS OF EITHER SUCH NOTIFICATION, CITY CONTROLLER MAY DEDUCT FUNDS IN AN AMOUNT EQUAL TO THE DEBT FROM ANY PAYMENTS OWED TO CONTRACTOR UNDER THIS AGREEMENT, AND CONTRACTOR WAIVES ANY RECOURSE THEREFOR. CONTRACTOR SHALL FILE A NEW AFFIDAVIT OF OWNERSHIP, USING THE FORM DESIGNATED BY CITY, BETWEEN FEBRUARY 1 AND MARCH 1 OF EVERY YEAR DURING THE TERM OF THE CONTRACT.

3.29 PRESERVATION OF CONTRACTING INFORMATION

3.29.1 The requirements of Subchapter J, Chapter 552, Texas Government Code, may apply to this Agreement and the Contractor agrees that this Agreement can be terminated if the Contractor knowingly or intentionally fails to comply with a requirement of that subchapter. If the requirements of Subchapter J, Chapter 552, Texas Government Code, apply to this Agreement, then for the duration of this Agreement (including the initial term, any renewal terms, and any extensions), Contractor shall preserve all Contracting Information, as defined by Section 552.003 of the Texas Government Code, related to this Agreement as provided by the records retention requirements applicable to the City pursuant to federal or state law or regulation, city ordinance or city policy, which record retention requirements include but are not limited to those set forth in Chapters 201 and 205 of the Texas Local Government Code and Texas Administrative Code Title 13, Chapter 7. Within five business days after receiving a request from the Director, Contractor shall provide any Contracting Information related to this Agreement that is in the custody or possession of Contractor. Upon the expiration or termination of this Agreement, Contractor shall, at the Director's election, either (a) provide, at no cost to the City, all Contracting Information related to this Agreement that is in the custody or possession of Contractor, or (b) preserve the Contracting Information related to this Agreement as provided by the records retention requirements applicable to the City pursuant to federal or state law or regulation, city ordinance or city policy.

3.29.2 If Contractor fails to comply with any one or more of the requirements of this Section, *PRESERVATION OF CONTRACTING INFORMATION*, or Subchapter J, Chapter 552, Texas Government Code, then, in accordance with and pursuant to the processes and procedures set forth in Sections 552.373 and 552.374 of the Texas Government Code, the Director shall provide notice to the Contractor and may terminate this Agreement. To effect final termination, the Director must notify Contractor in writing with a copy of the notice to the CPO. After receiving the notice, Contractor shall,

unless the notice directs otherwise, immediately discontinue all services under this Agreement, and promptly cancel all orders or subcontracts chargeable to this Agreement.

ARTICLE 4 - ADMINISTRATION OF THE CONTRACT

4.1 *CONTRACT ADMINISTRATION*

4.1.1 City Engineer will provide administration of the Contract and City Engineer is authorized to issue Change Orders, Work Change Directives, and Minor Changes in the Work.

4.1.2 City Engineer may act through Project Manager, Design Consultant, or Inspector. When the term "City Engineer" is used in the Contract, action by City Engineer is required unless City Engineer delegates his authority in writing. The City Engineer may not delegate authority to render decisions under Section 4.4.

The City does not have control over or charge of, and is not responsible for, supervision, construction, and safety procedures enumerated in Section 3.3. The City does not have control over or charge of and is not responsible for acts or omissions of Contractor, Subcontractors, or Suppliers.

4.1.3 The City and Design Consultant may attend project meetings and visit the site to observe progress and quality of the Work. The City and Design Consultant are not required to make exhaustive or continuous on-site inspections to check quality or quantity of the Work.

4.1.4 Project Manager will review and approve or take other appropriate action on Contractor's submittals, but only for limited purpose of checking for conformance with information given and design concept expressed in the Contract.

4.1.5 Project Manager's review of the submittals is not conducted for purpose of determining accuracy and completeness of other details, such as dimensions and quantities, or for substantiating instructions for installation or performance of Products, all of which remain the responsibility of Contractor.

4.1.6 Project Manager's review of submittals does not relieve Contractor of its obligations under Sections 3.3, 3.12, and 3.18. Review does not constitute approval of safety precautions or, unless otherwise specifically stated by Project Manager in writing, of construction means, methods, techniques, sequences, or procedures. Project Manager's review of a specific item does not indicate approval of an assembly of which the item is a component.

4.1.7 Based on field observations and evaluations, Project Manager will process Contractor's progress payments, certify amounts due Contractor, and issue Certificates for Payment in the amount certified.

4.1.8 Project Manager will receive and forward to City Engineer for his review and records, written warranties and related documents required by the Contract and assembled by Contractor.

4.1.9 Upon written request by Contractor or Project Manager, City Engineer will resolve matters of interpretation of or performance of the Contract, which are not Claims. City Engineer's decisions are final and binding on the Parties.

4.1.10 City Engineer may reject work which does not conform to the Contract.

4.1.11 When City Engineer considers it necessary to implement the intent of the Contract, City Engineer may require additional inspection or testing of work in accordance with Paragraphs 13.6.3 and 13.6.4, whether such work is fabricated, Installed, or completed.

4.2 *COMMUNICATIONS IN ADMINISTRATION OF THE CONTRACT*

4.2.1 Except as otherwise provided in the Contract or when authorized by City Engineer in writing, Contractor shall communicate with Project Manager. Contractor shall communicate with Design Consultant, Design Consultant's subconsultants, and separate contractors through Project Manager. The City will communicate with Subcontractors and Suppliers through Contractor.

4.3 *CLAIMS AND DISPUTES*

4.3.1 *Documentation by Project Manager:* Contractor shall submit Claims, including those alleging an error or omission by Project Manager or Design Consultant, to Project Manager for documentation and recommendation to City Engineer.

4.3.2 *Decision of City Engineer:* Upon submission of Claim by Project Manager or Contractor, City Engineer will resolve Claims in accordance with Section 4.4.

4.3.3 *Time Limits on Claims:* Claims by Contractor must be made within 90 days after occurrence of event giving rise to the Claim.

4.3.4 *Continuing the Contract Performance:* Pending final resolution of a Claim including referral to non-binding mediation, unless otherwise agreed in writing, Contractor shall proceed diligently with the performance of the Contract and the City will continue to make payments in accordance with the Contract.

4.3.4.1 Pending final resolution of a Claim including referral to non-binding mediation, Contractor is responsible for safety and protection of physical properties and conditions at site.

4.3.5 *Claims for Concealed or Unknown Conditions:* Concealed or unknown physical conditions include utility lines, other man-made structures, storage facilities, Pollutants and Pollutant Facilities, and the like, but do not include conditions arising from Contractor operations, or failure of Contractor to properly protect and safeguard subsurface facilities. Concealed conditions also include naturally-occurring soil conditions outside the range of soil conditions identified through geotechnical investigations, but do not include conditions arising from groundwater, rain, or flood.

4.3.5.1 If conditions are encountered at the site which are Underground Facilities or otherwise concealed or unknown conditions which differ materially from:

4.3.5.1.1 those indicated by the Contract; or

4.3.5.1.2 conditions which Contractor could have discovered through site inspection, geotechnical testing, or otherwise;

then Contractor will give written notice to City Engineer no later than five days after Contractor's first observation of the condition and before condition is disturbed. Contractor's failure to provide notice constitutes a waiver of a Claim.

4.3.5.2 City Engineer will promptly investigate concealed or unknown conditions. If City Engineer determines that conditions at the site are not materially different and that no change in Contract Price or Contract Time is justified, City Engineer will notify Contractor in writing, stating reasons. If City Engineer determines the conditions differ materially and cause increase or decrease in Contractor's cost or time required for performance of part of the Work, City Engineer will recommend an adjustment in Contract Price or Contract Time, or both, as provided in Article 7. Opposition by a Party to the City Engineer's determination must be made within 21 days after City Engineer has given notice of the decision. If the Parties cannot agree on adjustment to Contract Price or Contract Time, adjustment is subject to further proceedings pursuant to Section 4.4.

4.3.6 *Claims for Additional Cost:* If Contractor wishes to make a Claim for increase in Contract Price, Contractor shall give written notice before proceeding with work for which Contractor intends to submit a Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

4.3.6.1 Contractor may file a Claim in accordance with Section 4.4 if Contractor believes it has incurred additional costs, for the following reasons:

4.3.6.1.1 written interpretation of City Engineer;

4.3.6.1.2 order by City Engineer to stop the Work when Contractor is not at fault;

4.3.6.1.3 suspension of the Work by City Engineer;

4.3.6.1.4 termination of the Contract by City Engineer; or

4.3.6.1.5 The City's non-compliance with another provision of the Contract.

4.3.6.2 No increase in Contract Price is allowed for delays or hindrances to the Work, except for direct and unavoidable extra costs to Contractor caused by failure of the City to provide information and services, or to make land and materials available, when required of the City under the Contract. Any increase claimed is subject to the provisions of Section 4.4 and Article 7.

4.3.6.3 The City is not liable for Claims for delay when Date of Substantial Completion occurs prior to expiration of Contract Time.

4.3.7 *Claims for Additional Time:* If Contractor wishes to make a Claim for an increase in Contract Time, Contractor shall give written notice as provided in Section 8.2. In case of continuing delay, only one Claim is necessary.

4.4 *RESOLUTION OF CLAIMS AND DISPUTES*

4.4.1 City Engineer will review Claims and take one or more of the following preliminary actions within 30 days of receipt of Claim:

4.4.1.1 submit a suggested time to meet and discuss the Claim with City Engineer;

4.4.1.2 reject Claim, in whole or in part, stating reasons for rejection;

4.4.1.3 recommend approval of the Claim by the other Party;

4.4.1.4 suggest a compromise; or

4.4.1.5 take other actions as City Engineer deems appropriate to resolve the Claim.

4.4.2 City Engineer may request additional supporting data from claimant. Party making Claim shall, within 10 days after receipt of City Engineer's request, submit additional supporting data requested by City Engineer.

4.4.3 At any time prior to rendering a written decision regarding a Claim, City Engineer may refer Claim to non-binding mediation. If Claim is resolved, City Engineer will prepare and obtain all appropriate documentation. If Claim is not resolved, City Engineer will take receipt of Claim and begin a new review under Section 4.4.

4.4.4 If Claim is not referred to or settled in non-binding mediation, City Engineer may conduct a hearing and will render a written decision, including findings of fact, within 75 days of receipt of Claim, or a time mutually agreed upon by the Parties in writing. City Engineer may notify Surety and request Surety's assistance in resolving Claim. City Engineer's decision is final and binding on the Parties.

4.5 *CONDITION PRECEDENT TO SUIT; WAIVER OF ATTORNEY FEES AND INTEREST*

4.5.1 A final decision by the City Engineer is a condition precedent to file suit in any jurisdiction for a claim made in connection with this Contract.

4.5.2 Neither the City nor Contractor may recover attorney fees for any claim brought in connection with this Contract.

4.5.3 Neither the City nor the Contractor may recover interest for any damages claim brought in connection with this Contract except as allowed by TEXAS LOCAL GOVERNMENT CODE Chapter 2251.

4.6 *INTERIM PAYMENT WAIVER & RELEASE*

4.6.1 In accordance with section 4.3, the Contractor shall use due diligence in the discovery and submission of any Claim against the City related to the Contractor's work.

4.6.2 The Contractor shall submit any Claim to the City not later than the 90th day after the occurrence of the event giving rise to the Claim.

4.6.3 Any failure to timely comply with the requirements of section 4.6.2 waives and releases any Claim when the Contractor submits an application for payment after the 90th day.

4.6.4 This waiver does not cover any retainage. In case of any conflict of law, this language shall be revised to the minimum extent necessary to avoid legal conflict. This waiver is made specifically for the benefit of the City.

ARTICLE 5 - SUBCONTRACTORS AND SUPPLIERS

5.1 *AWARD OF SUBCONTRACTS OTHER CONTRACTS FOR PORTIONS OF THE WORK*

5.1.1 Contractor may not contract with a Subcontractor, Supplier, person, or entity that City Engineer has made a reasonable and timely objection to.

5.1.2 If City Engineer has a reasonable objection to person or entity proposed by Contractor, Contractor shall propose another with whom City Engineer has no reasonable objection.

5.1.3 Contractor shall execute contracts with approved Subcontractors, Suppliers, persons, or entities before the Subcontractors or Suppliers begin work under the Contract. All such contracts must be executed and sent to the OBO Director and Contracting Department within 30 days after the date of the Notice to Proceed and must include provisions set forth in Articles 3 and 5 of this Document.

5.1.4 Contractor shall notify City Engineer in writing of any proposed change of Subcontractor, Supplier, person, or entity previously accepted by the City.

5.1.5 Contractor shall make timely payments to Subcontractors and Suppliers for performance of

the Contract. Contractor shall protect, defend, and indemnify the City from any claim or liability arising out of Contractor's failure to make the payments. Disputes relating to payment of Business Enterprise Subcontractors or Suppliers will be submitted to arbitration in same manner as other disputes under Business Enterprise subcontracts. Failure of Contractor to comply with decisions of arbitrator may be determined by City Engineer a material breach leading to termination of the Contract.

5.2 *CONTRACTOR RESPONSIBILITY FOR SUBCONTRACTORS*

5.2.1 Contractor is responsible to the City, as may be required by laws and regulations, for all acts and omissions of Subcontractors, Suppliers, and other persons and organizations performing or furnishing any of the Work under direct or indirect contract with Contractor.

5.2.2 Contractor shall make available to each proposed Subcontractor, prior to execution of subcontract, copies of the Contract to which Subcontractor is bound by this Section 5.2. Contractor shall notify Subcontractor of any terms of proposed subcontract which may be at variance with the Contract.

5.2.3 The City's approval of Subcontractor or Suppliers does not relieve Contractor of its obligation to perform, or to have performed to the full satisfaction of the City, the Work required by the Contract.

5.2.4 Unless there is a contractual relationship between Contractor and a Subcontractor or Supplier to the contrary, Contractor shall withhold no more retainage from Subcontractors or Suppliers than City withholds from Contractor under this Agreement. However, once a Subcontractor or Supplier completes performance, Contractor shall release all retainage to that Subcontractor or Supplier regardless if City continues to retain under this Agreement.

5.2.5 Prior to a Subcontractor or Supplier commencing performance for Contractor, Contractor shall meet with that Subcontractor or Supplier to provide instructions on invoicing procedures, dispute resolution procedures, and statutory rights, such as claim filing procedures under the McGregor Act. Subcontractors and Suppliers must certify to the City Engineer that Contractor has fulfilled the requirements of this Section.

ARTICLE 6 - CONSTRUCTION BY THE CITY OR BY SEPARATE CONTRACTORS

6.1 *THE CITY'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS*

6.1.1 The City may perform on-site construction operations related to the Work and as part of the Project with the City's workforce or with separate contractors.

6.2 *COORDINATION*

6.2.1 The City will coordinate activities of the City's workforce and of each separate contractor with work of Contractor, and Contractor shall cooperate with the City and separate contractors.

6.2.1.1 Contractor shall participate with other separate contractors and the City in reviewing their construction schedules when directed to do so by the Project Manager. Contractor shall make revisions to construction schedule and Contract Price deemed necessary after joint review and mutual agreement. Construction schedules shall then constitute schedules to be used by Contractor, separate contractors, and the City, until subsequently revised.

6.2.2 Contractor shall afford to the City and to separate contractors reasonable opportunity for introduction and storage of their materials and equipment, and for performance of their activities.

6.2.3 If part of Contractor's work depends on proper execution of construction or operations by the City or a separate contractor, Contractor shall, prior to proceeding with that portion of the Work, inspect the other work and promptly report to City Engineer apparent discrepancies or defects in the other construction that would render it unsuitable for the proper execution of the Work. Failure of Contractor to report apparent discrepancies or defects in the other construction shall constitute acknowledgment that the City's or separate contractor's completed or partially completed construction is fit and proper to receive Contractor's work, except as to discrepancies or defects not then reasonably discoverable.

6.3 *MUTUAL RESPONSIBILITY*

6.3.1 The responsible party bears the costs caused by delays, by improperly timed activities, or by nonconforming construction.

6.3.2 Contractor shall promptly remedy damage caused by Contractor to completed or

partially completed construction or to property of the City or separate contractor.

6.3.3 Claims or disputes between Contractor and other City contractors, or subcontractors of other City contractors, working on the Project must be submitted to binding arbitration in accordance with Construction Industry Arbitration Rules of the American Arbitration Association upon demand by any party to the dispute or by the City.

6.4 *THE CITY'S RIGHT TO CLEAN UP*

6.4.1 If dispute arises among Contractor, separate contractors, and the City as to responsibility under their respective contracts for maintaining premises and surrounding area free from waste materials and rubbish as described in Section 3.21, the City may clean up and allocate cost among those responsible, as determined by City Engineer.

ARTICLE 7 - CHANGES IN THE WORK

7.1 *CHANGES*

7.1.1 Changes in scope of the Work, subject to limitations in Article 7 and elsewhere in the Contract, may be accomplished without invalidating the Contract, or without notifying Surety by:

7.1.1.1 Change Order;
7.1.1.2 Work Change Directive; or
7.1.1.3 Minor Change in the Work.

7.1.2 The following types of Change Orders require City Council approval:

7.1.2.1 a single Change Order that exceeds five percent of Original Contract Price,
7.1.2.2 a Change Order which, when added to previous Change Orders, exceeds five percent of Original Contract Price,
7.1.2.3 a Change Order, in which the total value of increases outside of the general scope of work approved by City Council, when added to increases outside the general scope of work approved by City Council in previous Change Orders, exceeds 40 percent of the Original Contract Price, even if the net increase to the Original Contract Price is five percent or less.

In this context, “increase” means an increase in quantity resulting from the addition of locations not within the scope of work approved by City Council, or the addition of types of goods or services not bid as unit price items.

Nothing in this Section is intended to permit an increase of the Contract Price in excess of the limit set out in TEX. LOC. GOV’T CODE ANN. §252.048 or its successor statute.

7.1.3 Contractor shall proceed promptly to execute changes in the Work provided in Modifications, unless otherwise stated in the Modification.

7.2 *WORK CHANGE DIRECTIVES*

7.2.1 A Work Change Directive cannot change Contract Price or Contract Time, but is evidence that the Parties agree that a change, ordered by directive, will be incorporated in a subsequently issued Change Order as to its effect, if any, on Contract Price or Contract Time.

7.2.2 Failure by Contractor to commence work identified in a Work Change Directive within the time specified by City Engineer, or to complete the work in a reasonable period of time, may be determined by City Engineer to be a material breach of Contract.

7.2.3 A Work Change Directive is used in the absence of total agreement of the terms of a Change Order. Interim payments are made in accordance with Paragraph 9.6.1.

7.2.4 If Contractor signs a Work Change Directive, then Contractor agrees to its terms including adjustment in Contract Price and Contract Time or method for determining them. Agreement by the Parties to adjustments in Contract Price and Contract Time are immediately recorded as a Change Order.

7.2.5 City Engineer, by Work Change Directive, may direct Contractor to take measures as necessary to expedite construction to achieve Date of Substantial Completion on or before expiration of Contract Time. When the Work is expedited solely for convenience of the City and not due to Contractor’s failure to prosecute timely completion of the Work, then Contractor is entitled to an adjustment in Contract Price equal to actual costs determined in accordance with Article 7.

7.3 *ADJUSTMENTS IN CONTRACT PRICE*

7.3.1 Adjustments in Contract Price are accomplished by Change Order and are based on one of the following methods:

7.3.1.1 mutual acceptance of fixed price, properly itemized and supported by sufficient data to permit evaluation;
7.3.1.2 unit prices stated in the Contract or subsequently agreed upon;

7.3.1.3 cost to be determined in a manner agreed upon by the Parties and mutually acceptable fixed or percentage fee; or

7.3.1.4 as provided in Paragraph 7.3.2.

7.3.2 If Contractor does not agree with a change in Contract Price or Contract Time or the method for adjusting them specified in the Work Change Directive within 21 days from date of the Work Change Directive's issuance, method and adjustment are determined by City Engineer. If Project Manager or Contractor disagree with City Engineer's determination they then may file a Claim in accordance with Section 4.4.

7.3.2.1 If City Engineer determines a method and adjustment in Contract Price under Paragraph 7.3.2, Contractor shall provide, in a form as City Engineer may prescribe, appropriate supporting data for items submitted under Paragraph 7.3.2. Failure to submit the data within 21 days of request for the data by City Engineer shall constitute waiver of a Claim.

	Overhead	Profit
to Contractor for change in the Work performed by Subcontractors:	10 percent	0 percent
to first tier Subcontractors for change in the Work performed by its Subcontractors:	10 percent	0 percent
to Contractor and Subcontractor for change in the Work performed by their respective firms:	10 percent	5 percent

7.3.2.2 Unless otherwise provided in the Contract, costs for the purposes of this Paragraph 7.3.2 are limited to the following:

7.3.2.2.1 costs of labor, including labor burden as stated below for social security, unemployment insurance, customary and usual fringe benefits required by agreement or custom, and Workers' Compensation insurance;

7.3.2.2.1.1 the maximum labor burden applied to costs of labor for changes in the Work is 55 percent;

7.3.2.2.2 costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

7.3.2.2.3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from Contractor or others, with prior approval of City Engineer;

7.3.2.2.4 costs of premiums for Bonds and insurance and permit fees related to the change in the Work;

7.3.2.2.5 additional costs of direct supervision of work and field office personnel directly attributable to the change; and

7.3.2.2.6 allowances for overhead and profit as stated below.

7.3.2.2.6.1 the maximum allowances for overhead and profit on increases due to Change Orders:

7.3.2.2.6.2 for changes in the Work performed by Contractor and Subcontractors, allowance for overhead and profit are applied to an amount equal to cost of all additions less cost of all deletions to the Work. Allowance for overhead to Contractor and first tier Subcontractors on changes performed by Subcontractors are applied to an amount equal to the sum of all increases to the Work by applicable Subcontractors.

7.3.3 If the City deletes or makes a change, which results in a net decrease in Contract Price, the City is entitled to a credit calculated in accordance with Paragraphs 7.3.1 and 7.3.2 and Subparagraphs 7.3.2.1, and 7.3.2.2.1 through 7.3.2.2.5. When both additions and credits covering related work or substitutions are involved in a change, allowance for overhead and profit is figured on the basis of a net increase, if any, with respect to that change in accordance with Subparagraph 7.3.2.2.6.

7.3.4 When Contractor agrees with the determination made by City Engineer concerning adjustments in Contract Price and Contract Time, or the Parties otherwise reach agreement upon the adjustments, the agreement will be immediately recorded by Change Order.

7.4 *MINOR CHANGES IN THE WORK*

7.4.1 A Minor Change in Work is binding on the Parties. Contractor shall acknowledge, in a written form acceptable to City Engineer, that there is no change in Contract Time or Contract Price and shall carry out the written orders promptly.

ARTICLE 8 - TIME

8.1 *PROGRESS AND COMPLETION*

8.1.1 Time is of the essence in the Contract. By executing the Contract, Contractor agrees that Contract Time is a reasonable period for performing the Work.

8.1.2 *Computation of Time:* In computing any period of time prescribed or allowed by the General Conditions, the day of the act, event, or default after which designated period of time begins to run is not to be included. Last day of the period so computed is to be included, unless it is a Sunday or Legal Holiday, in which event the period runs until end of next day which is not a Sunday or Legal Holiday. Sundays and Legal Holidays are considered to be days and are to be included in all other time computations relative to Contract Time.

8.1.3 Contractor may not commence the Work prior to the effective date of insurance and Bonds required by Article 11.

8.1.4 Contractor shall proceed expeditiously and without interruption, with adequate forces, and shall achieve Date of Substantial Completion within Contract Time.

8.1.5 Should progress of the Work fall behind construction schedule, except for reasons stated in Paragraph 8.2.1, Contractor shall promptly submit at the request of Project Manager, updated construction schedule to City Engineer for approval. Contractor's failure to submit updated schedule may, at City Engineer's discretion, constitute a material breach of the Contract. Contractor shall take action necessary to restore progress by working the hours, including night shifts and lawful overtime operations as necessary, to achieve Date of Substantial Completion within Contract Time.

8.1.6 Except in connection with safety or protection of persons or the Work or property at the site or adjacent to the site, and except as otherwise indicated in the Contract, all the Work at the site will be performed Monday through Saturday between the hours of 7:00 a.m. and 7:00 p.m. Contractor may not perform work between 7:00 p.m. and 7:00 a.m., on a Sunday, or on a Legal Holiday, without giving City Engineer 24-hour prior written notice and receiving written consent of City Engineer.

8.2 *DELAYS AND EXTENSIONS OF TIME*

8.2.1 Contractor may request extension of Contract Time for a delay in performance of work that arises from causes beyond control and without fault or negligence of Contractor. Examples of these causes are:

8.2.1.1 acts of God or of the public enemy;
8.2.1.2 acts of government in its sovereign capacity;
8.2.1.3 fires;
8.2.1.4 floods;
8.2.1.5 epidemics;
8.2.1.6 quarantine restrictions;
8.2.1.7 strikes;
8.2.1.8 freight embargoes;
8.2.1.9 unusually severe weather; and
8.2.1.10 discovery of Pollutants or Pollutant Facilities at the site.

8.2.2 For any reason other than those listed in Section 4.3.6.2, if the Contractor’s work is delayed in any manner or respect, the Contractor shall have no claim for damages and shall have no right of additional compensation from the City by reason of any delay or increased expense to the Contractor’s work, except for an extension of time as provided in this provision.

8.2.3 Contractor may request an extension of Contract Time for delay only if:

8.2.3.1 delay is caused by failure of Subcontractor or Supplier to perform or make progress; and
8.2.3.2 cause of failure is beyond control of both Contractor and Subcontractor or Supplier.

8.2.4 Claims relating to Contract Time must be made in accordance with Paragraph 4.3.7.

8.2.5 Claims for extending or shortening Contract Time are based on written notice promptly delivered by the Party making Claim to other Party. Claim must accurately describe occurrence generating Claim, and a statement of probable effect on progress of the Work.

8.2.6 Claims for extension of Contract Time are considered only when a Claim is filed within the time limits stated in Paragraph 4.3.3.

8.2.6.1 Notwithstanding paragraph 4.3.3, an extension of time for delays under this paragraph may be granted only upon

written application by the Contractor within 48 hours from the claimed delay.

8.2.7 Written notice of Claim must be accompanied by claimant's written statement that adjustment claimed is entire adjustment to which claimant is entitled as a result of the occurrence of the event. When the Parties cannot agree, Claims for adjustment in Contract Time are determined by City Engineer in accordance with Section 4.4.

8.2.8 Adjustments to Contract Time are accomplished by Change Order.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.1 *UNIT PRICE WORK*

9.1.1 Where the Contract provides that all or part of the Work is based on Unit Prices, the Original Contract Price includes, for all Unit Price work, an amount equal to the sum of Unit Prices times Unit Price Quantities for each separately identified item of Unit Price work.

9.1.2 Each Unit Price includes an amount to cover Contractor's overhead and profit for each separately identified item.

9.1.3 The Contractor may not make a Claim against the City for excess or deficiency in Unit Price Quantities provided in the Contract, except as provided in Subparagraph 9.1.4. Payment at the prices stated in the Contract is in full for the completed work. Contractor is not entitled to additional payment for materials, supplies, labor, tools, machinery and all other expenditures incidental to satisfactory completion of the Work.

9.1.4 City Engineer may increase or decrease quantities of the Work within limitations stated in Paragraph 7.1.2. Contractor is entitled to payment for actual quantities of items provided at Unit Prices set forth in the Contract.

9.1.5 Where the final quantity of work performed by Contractor on Major Unit Price Work item differs by more than 25 percent from quantity of the item stated in the Contract, a Party may request an adjustment in Unit Price, for the portion that differs by more than 25 percent, by a Change Order under Section 7.3.

9.2 *ESTIMATES FOR PAYMENT, UNIT PRICE WORK*

9.2.1 Following the day of each month indicated in the Contract, Project Manager will prepare a Certificate for Payment for the preceding monthly period based on estimated units of work completed. Prior to preparing Certificate of Payment, Contractor shall have submitted to City Engineer, on a form approved by the Director of the Office of Business Opportunity, evidence satisfactory to the City Engineer of payments made to Subcontractors and Suppliers for the month preceding the month for which the Certificate for Payment is prepared, including evidence of electronic submission of certified payrolls.

9.2.2 Before final completion, City Engineer will review and confirm with Contractor the actual final installed Unit Price quantities. City Engineer's determination of actual final installed Unit Price quantities will be included in the final Certificate for Payment and any previous underpayments and overpayments will be reconciled with the actual final Unit Price quantities. Contractor shall file written notice of intent to appeal, if any, City Engineer's determination within 10 days of receipt of final Certificate for Payment. Upon expiration of the 10-day period, City Engineer's decision is final and binding on the Parties. If Contractor submits notice within the 10-day period, Contractor shall submit a Claim in accordance with Section 4.4.

9.3 *STIPULATED PRICE WORK*

9.3.1 For work contracted on a Stipulated Price basis, 10 days before submittal of first Application for Payment, Contractor shall submit to City Engineer a Schedule of Values allocated to various portions of the Work, prepared in the form and supported by the data as City Engineer may require to substantiate its accuracy. This schedule, as approved by City Engineer, is used as a basis for approval of Contractor's Applications for Payment.

9.4 *APPLICATIONS FOR PAYMENT, STIPULATED PRICE WORK*

9.4.1 For work contracted on a Stipulated Price basis, Contractor shall submit Applications for Payment to City Engineer each month on a form acceptable to City Engineer in accordance with Schedule of Values. Application must indicate percentages of completion of each portion of the Work listed in Schedule of Values as of the end of the period covered by the Application for Payment.

9.4.2 Applications for Payment must be supported by substantiating data as City Engineer may require and must reflect retainages as provided below. Evidence satisfactory to the City Engineer of payments made to Subcontractors and Suppliers for the month preceding the month for which the Application for Payment is submitted must

accompany each Application for Payment on a form approved by the Director of the Office of Business Opportunity. Evidence of electronic submission of certified payrolls must be included. Application must be sworn and notarized.

9.5 *CERTIFICATES FOR PAYMENT*

9.5.1 City Engineer will, within 10 days after the date specified in the Contract for Unit Price work, or upon receipt of Contractor's Application for Payment for Stipulated Price work, issue a Certificate for Payment for work based on amount which City Engineer determines is properly due, with copy to Contractor.

9.5.2 Unless otherwise provided in the Contract, payment for completed work and for properly stored Products is conditioned upon compliance with procedures satisfactory to City Engineer to protect the City's interests. Procedures will include applicable insurance, storage, and transportation to site for materials and equipment stored off-site. Contractor is responsible for maintaining materials and equipment until Date of Substantial Completion.

9.5.3 Contractor shall document its use of Ultra Low Sulfur Diesel Fuel by providing invoices and receipts evidencing Contractor’s use.

9.6 *COMPUTATIONS OF CERTIFICATES FOR PAYMENT*

9.6.1 Subject to the provisions of the Contract, the amount of each Certificate for Payment is calculated as follows:

- 9.6.1.1 that portion of Contract Price allocated to completed work as determined by:
  - 9.6.1.1.1 multiplying the percentage of completion of each portion of the Work listed in the Schedule of Values by the value of that portion of the Work, or
  - 9.6.1.1.2 multiplying Unit Price quantities Installed times the Unit Prices listed in the Contract;
- 9.6.1.2 plus progress payments for completed work that has been properly authorized by Modifications;
- 9.6.1.3 less retainage of five percent;
- 9.6.1.4 plus actual costs, properly substantiated by certified copies of invoices and freight bills, of non-perishable materials and equipment delivered and properly stored, if approved in advance by Project Manager, less 15 percent;
- 9.6.1.5 less any previous payments by the City.

9.7 *DECISIONS TO WITHHOLD CERTIFICATION*

9.7.1 City Engineer may decline to certify payment and may withhold payment in whole or in part to the extent reasonably necessary to protect the City if, in City Engineer's opinion, there is reason to believe that:

- 9.7.1.1 nonconforming work has not been remedied;
- 9.7.1.2 the Work cannot be completed for unpaid balance of Contract Price;
- 9.7.1.3 there is damage to the City or another contractor;
- 9.7.1.4 the Work will not be completed within Contract Time and that unpaid balance will not be adequate to cover actual and liquidated damages;
- 9.7.1.5 probable evidence that third party claims will be filed in court, in arbitration, or otherwise;
- 9.7.1.6 Contractor has failed to make payments to Subcontractors or Suppliers for labor, material, or equipment; or
- 9.7.1.7 Contractor has persistently failed to carry out work in accordance with the Contract.
- 9.7.1.8 Contractor has not paid Subcontractors or Suppliers because of a payment dispute; or
- 9.7.1.9 Contractor has failed to provide satisfactory evidence described in Paragraphs 9.2.1, 9.4.2, and 9.8.2.

9.7.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

9.7.3 City Engineer may decline to certify payment and may withhold request for payment in whole or in part upon failure of Contractor to submit initial construction schedule or monthly schedule updates, as required in Paragraphs 3.15.1 and 3.15.3.

9.8 *PROGRESS PAYMENTS*

9.8.1 The City will make payment, in an amount certified by City Engineer, within 20 days after City Engineer has issued a Certificate for Payment.

9.8.2 The City has no obligation to pay or to facilitate the payment to a Subcontractor or Supplier, except as may otherwise be required by law. Contractor shall comply with the prompt payment requirements of Chapter 2251 of the Government Code. State law requires payment of Subcontractors and Suppliers by Contractor within 7

calendar days of Contractor's receipt of payment from the City, unless there is a payment dispute between Contractor and a Subcontractor or Supplier evidenced on a form approved by the Director of Mayor's Office of Business Opportunity and submitted to the City Engineer each month with Application for Payment or Estimate for Payment. **CONTRACTOR SHALL DEFEND AND INDEMNIFY THE CITY FROM ANY CLAIMS OR LIABILITY ARISING OUT OF CONTRACTOR'S FAILURE TO MAKE THESE PAYMENTS.**

9.8.2.1 The City may, upon request and at the discretion of City Engineer, furnish to Subcontractor information regarding percentages of completion or the amounts applied for by Contractor, and action taken thereon by the City because of work done by the Subcontractor.

9.8.2.2 Contractor shall prepare and submit to City Engineer a Certification of Payment to Subcontractors and Suppliers form to be attached to each monthly Estimate for Payment or Application for Payment.

9.8.3 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Work by the City, does not constitute acceptance of work which is not in accordance with the Contract.

9.9 *DATE OF SUBSTANTIAL COMPLETION*

9.9.1 When Contractor considers the Work, or a portion thereof designated by City Engineer, to be substantially complete, Contractor shall prepare and submit to Project Manager a comprehensive punch list of items to be completed or corrected. Failure to include an item on the punch list does not alter the responsibility of Contractor to comply with the Contract.

9.9.1.1 By submitting the punch list to Project Manager, Contractor represents that work on the punch list will be completed within the time provided for in Subparagraph 9.9.4.3.

9.9.2 Upon receipt of Contractor's punch list, Project Manager will inspect the Work, or designated portion thereof, to verify that the punch list contains all items needing completion or correction. If Project Manager's inspection discloses items not on Contractor's punch list, the items must be added to the punch list of items to be completed or corrected. If Project Manager's inspection reveals that Contractor is not yet substantially complete, Contractor shall complete or correct the deficiencies and request another inspection by Project Manager. The City may recover the costs of re-inspection from Contractor.

9.9.3 Prior to City Engineer's issuing a Certificate of Substantial Completion, Contractor shall also provide:

9.9.3.1 Certificate of Occupancy for new construction, or Certificate of Compliance for remodeled work, as applicable, and

9.9.3.2 compliance with Texas Accessibility Standards through state inspection of the Work, if required. If Contractor calls for inspection in a timely manner and the inspection is delayed through no fault of Contractor, and City Engineer so confirms, City Engineer may, upon request by Contractor, add the inspection to the punch list in Paragraph 9.9.2 and issue a Certificate of Substantial Completion.

9.9.4 When the Work, or designated portion thereof, is determined by City Engineer to be sufficiently complete in accordance with the Contract so the City can occupy or utilize the Work, or designated portion thereof, for the purpose for which it is intended, City Engineer will prepare a Certificate of Substantial Completion that incorporates the punch list in Paragraph 9.9.2 and establishes:

9.9.4.1 Date of Substantial Completion;

9.9.4.2 responsibilities of the Parties for security, maintenance, heating, ventilating and air conditioning, utilities, damage to the Work, and insurance; and

9.9.4.3 fixed time within which Contractor shall complete all items on punch list of items to be corrected accompanying the certificate.

9.9.5 Warranties required by the Contract shall commence on the Date of Substantial Completion unless otherwise provided by City Engineer in Certificate of Substantial Completion. Warranties may not commence on items not substantially completed.

9.9.6 After Date of Substantial Completion and upon application by Contractor and approval by City Engineer, the City may make payment, reflecting adjustment in retainage, if any, as follows:

9.9.6.1 with the consent of Surety, the City may increase payment to Contractor to 96 percent of Contract Price, less value of items to be completed and accrued liquidated damages.

9.9.7 Contractor shall complete or correct the items in Paragraph 9.9.2 within the time period set out in the Certificate of Substantial Completion. If

Contractor fails to do so, the City may issue a Notice of Noncompliance and proceed according to Section 2.5.

9.10 *PARTIAL OCCUPANCY OR USE*

9.10.1 The City may occupy or use any completed or partially completed portion of the Work at any stage, provided the occupancy or use is consented to by Contractor and Contractor's insurer and authorized by public authorities having jurisdiction over the Work. Consent of Contractor to partial occupancy or use may not be unreasonably withheld.

9.10.2 Immediately prior to the partial occupancy or use, Project Manager and Contractor shall jointly inspect the area to be occupied or portion of the Work to be used to determine and record condition of the Work.

9.10.3 Partial occupancy or use of a portion of the Work does not constitute acceptance of work not in compliance with requirements of the Contract.

9.11 *FINAL COMPLETION AND FINAL PAYMENT*

9.11.1 Contractor shall review the Contract and inspect the Work prior to Contractor notification to City Engineer that the Work is complete and ready for final inspection. Contractor shall submit affidavit that the Work has been inspected and that the Work is complete in accordance with requirements of the Contract.

9.11.2 Project Manager will make final inspection within 15 days after receipt of Contractor's written notice that the Work is ready for final inspection and acceptance. If Project Manager finds the Work has been completed in accordance with the Contract, Contractor shall submit items set out in Paragraph 9.11.4 and, for stipulated price contracts, a final Application for Payment. City Engineer will, within 10 days, issue Certificate of Final Completion stating that to the best of City Engineer's knowledge, information, and belief, the Work has been completed in accordance with the Contract, and will recommend acceptance of the Work by City Council.

9.11.3 Should work be found not in compliance with requirements of the Contract, City Engineer will notify Contractor in writing of items of noncompliance. Upon inspection and acceptance of the corrections by Project Manager, compliance with all procedures of Paragraph 9.11.2, and Contractor's submission of the items set out in Paragraph 9.11.4, the City Engineer will issue Certificate of Final Completion to Contractor as provided in Paragraph 9.11.2.

9.11.4 Contractor shall submit the following items to City Engineer before City Engineer will issue a Certificate of Final Completion:

9.11.4.1 affidavit that payrolls, invoices for materials and equipment, and other indebtedness of Contractor connected with the Work, less amounts withheld by the City, have been paid or otherwise satisfied. If required by City Engineer, Contractor shall submit further proof including waiver or release of lien or claims from laborers or Suppliers of Products;

9.11.4.2 certificate evidencing that insurance required by the Contract to remain in force after final payment is currently in effect, will not be canceled or materially changed until at least 30 days written notice has been given to the City;

9.11.4.3 written statement that Contractor knows of no substantial reason that insurance will not be renewable to cover correction and warranty period required by the Contract;

9.11.4.4 consent of Surety to final payment; and

9.11.4.5 copies of record documents, maintenance manuals, tests, inspections, and approvals.

Upon City Engineer's issuance of a Certificate of Final Completion, Contractor may request increase in payment to 99 percent of Contract Price, less accrued liquidated damages.

9.11.5 If Contractor fails to submit required items in Paragraph 9.11.4 within 10 days of Project Manager's inspection of the Work under Paragraph 9.11.2 or Paragraph 9.11.3, City Engineer may, but is not obligated to:

9.11.5.1 deduct liquidated damages accrued from monies held;

9.11.5.2 proceed to City Council for acceptance of the Work, minus some or all of the items Contractor fails to submit under Paragraph 9.11.4; and,

9.11.5.3 upon acceptance by City Council of the portion of the Work completed, make final payment as set out in Paragraph 9.11.8.

9.11.6 If final completion is materially delayed through no fault of Contractor, or by issuance of Change Orders affecting date of final completion, and City Engineer so confirms, the City may, upon

application by Contractor and certification by City Engineer, and without terminating the Contract, make payment of balance due for that portion of the Work fully completed and accepted.

9.11.7 If remaining balance due for work not corrected is less than retainage stipulated in the Contract, Contractor shall submit to City Engineer written consent of Surety to payment of balance due for that portion of the Work fully completed and accepted, prior to certification of the payment. The payment is made under terms governing final payment, except that it does not constitute waiver of Claims.

9.11.8 The City will make final payment to Contractor within 30 days after acceptance of the Work by City Council, subject to limitations, if any, as stated in the Contract.

9.11.9 Acceptance of final payment by Contractor shall constitute a waiver of all Claims, whether known or unknown, by Contractor, except those previously made in writing and identified by Contractor as unsettled at the time of final payment.

9.12 *LIQUIDATED DAMAGES*

9.12.1 Contractor, Surety, and the City agree that failure to complete the Work within Contract Time will cause damages to the City and that actual damages from harm are difficult to estimate accurately. Therefore, Contractor, Surety, and the City agree that Contractor and Surety are liable for and shall pay to the City the amount stipulated in Supplementary Conditions as liquidated damages, and that the amount of damages fixed therein is a reasonable forecast of just compensation for harm to the City resulting from Contractor's failure to complete the Work within Contract Time. The amount stipulated will be paid for each day of delay beyond Contract Time until Date of Substantial Completion.

9.12.2 Contractor shall pay the City an amount equal to $1,200.00 per diesel operating vehicle or piece of motorized equipment per incident of high sulfur diesel fuel usage.

ARTICLE 10 - SAFETY PRECAUTIONS

10.1 *SAFETY PROGRAMS*

10.1.1 Contractor is responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with performance of the Contract. Contractor shall submit a safety program to City Engineer prior to mobilizing for the Work, and is solely responsible for safety, efficiency, and adequacy of ways, means, and methods, and for damage which might result from failure or improper construction, maintenance, or operation performed by Contractor.

10.2 *POLLUTANTS AND POLLUTANT FACILITIES*

10.2.1 If Contractor encounters material on-site which it reasonably believes to be a Pollutant or facilities which it reasonably believes to be a Pollutant Facility, Contractor shall immediately stop work in affected area and immediately notify City Engineer, confirming the notice thereafter in writing.

10.2.2 If City Engineer determines that the material is a Pollutant or facility is a Pollutant Facility, work in affected area may not be resumed except by Modification, and only if the work would not violate applicable laws or regulations.

10.2.3 If City Engineer determines that the material is not a Pollutant or a facility is not a Pollutant Facility, work in affected area will be resumed upon issuance of a Modification.

10.2.4 Contractor is not required to perform, unless authorized by Change Order, work relating to Pollutants or Pollutant Facilities except for that work relating to Pollutants or Pollutant Facilities specified in the Contract.

10.3 *SAFETY OF THE ENVIRONMENT, PERSONS, AND PROPERTY*

10.3.1 Contractor shall take reasonable precautions for safety and shall provide reasonable protection to prevent damage, injury, or loss from all causes, to:

10.3.1.1 employees performing work on-site, and other persons who may be affected thereby;

10.3.1.2 work, including Products to be incorporated into the Work, whether in proper storage, under control of Contractor or Subcontractor; and

10.3.1.3 other property at or adjacent to the site, such as trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal or replacement in course of construction.

10.3.2 Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons, property, or environment.

10.3.2.1 Contractor shall comply with requirements of Underground Facility Damage Prevention and Safety Act TEX. UTIL. CODE ANN. Ch. 251 (Vernon Supp. 2002).

10.3.2.2 Contractor shall comply with all safety rules and regulations of the Federal Occupational Health and Safety Act of 1970 and subsequent amendments (OSHA).

10.3.3 Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection of persons and property, including posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities.

10.3.4 Contractor shall designate responsible member of Contractor's organization at site whose duty is prevention of accidents. This person will be Contractor's Superintendent unless otherwise designated by Contractor in writing to City Engineer.

10.3.5 Contractor shall prevent windblown dust and may not burn or bury trash debris or waste products on-site. Contractor shall prevent environmental pollution, including but not limited to particulates, gases and noise, as a result of the Work.

10.3.6 When use or storage of hazardous materials or equipment, or unusual methods are necessary for execution of the Work, Contractor shall exercise utmost care and carry on the activities under supervision of properly qualified personnel.

10.3.7 Contractor shall promptly remedy damage and loss to property referred to in Subparagraphs 10.3.1.2 and 10.3.1.3, caused in whole or in part by Contractor, or Subcontractors, which is not covered by insurance required by the Contract. Contractor is not required to remedy damage or loss attributable to the City, Design Consultant, or other contractors.

10.4 *EMERGENCIES*

10.4.1 In emergencies affecting safety of persons or property, Contractor shall act at Contractor's discretion to prevent imminent damage, injury, or loss. Additional compensation or extension of time claimed by Contractor because of emergencies are determined as provided in Article 7.

ARTICLE 11 - INSURANCE AND BONDS

11.1 *GENERAL INSURANCE REQUIREMENTS*

11.1.1 With no intent to limit Contractor's liability under indemnification provisions set forth in Paragraphs 3.25 and 3.26, Contractor shall provide and maintain in full force and effect during term of the Contract and all extensions and amendments thereto, at least the following insurance and available limits of liability.

11.1.2 If any of the following insurance is written as "claims made" coverage and the City is required to be carried as additional insured, then Contractor's insurance shall include a two-year extended discovery period after last date that Contractor provides any work under the Contract.

11.1.3 Aggregate amounts of coverage, for purposes of the Contract, are agreed to be amounts of coverage available during fixed 12-month policy period.

11.2 *INSURANCE TO BE PROVIDED BY CONTRACTOR*

11.2.1 *Risks and Limits of Liability:* Contractor shall maintain the insurance coverages in the listed amounts, as set out in Table 1.

11.2.2 If Limit of Liability for Excess Coverage is $2,000,000 or more, Limit of Liability for Employer's Liability may be reduced to $500,000.

11.2.3 *Insurance Coverage***:** At all times during the term of this Contract and any extensions or renewals, Contractor shall provide and maintain insurance coverage that meets the Contract requirements. Prior to beginning performance under the Contract, at any time upon the Director's request, or each time coverage is renewed or updated, Contractor shall furnish to the Director current certificates of insurance, endorsements, all policies, or other policy documents evidencing adequate coverage, as necessary. Contractor shall be responsible for and pay (a) all premiums and (b) any claims or losses to the extent of any deductible amounts. Contractor waives any claim it may have for premiums or deductibles against the City, its officers, agents, or employees. Contractor shall also require all subcontractors or consultants whose subcontracts exceed $100,000 to provide proof of insurance coverage meeting all requirements stated above except amount. The amount must be

commensurate with the amount of the subcontract, but no less than $500,000 per claim.

11.2.4 *Form of insurance***:** The form of the insurance shall be approved by the Director and the City Attorney; such approval (or lack thereof) shall never (a) excuse non-compliance with the terms of this Section, or (b) waive or estop the City from asserting its rights to terminate this Contract. The policy issuer shall (1) have a Certificate of Authority to transact insurance business in Texas, or (2) be an eligible non-admitted insurer in the State of Texas and have a Best's rating of at least B+, and a Best's Financial Size Category of Class VI or better, according to the most current Best's Key Rating Guide. Each insurer is subject to approval by City Engineer in City Engineer's sole discretion as to conformance with these requirements.

11.2.5 *Required Coverage***:** The City shall be an Additional Insured under this Contract, and all policies except Professional Liability and Worker's Compensation must name the City as an Additional Insured. Contactor waives any claim or right of subrogation to recover against the City, its officers, agents, or employees, and each of Contractor's insurance policies except professional liability must contain coverage waiving such claim. Each policy, except Workers' Compensation and Professional Liability, must also contain an endorsement that the policy is primary to any other insurance available to the Additional Insured with respect to claims arising under this Contract. If professional liability coverage is written on a "claims made" basis, Contractor shall also provide proof of renewal each year for two years after substantial completion of the Project, or in the alternative: evidence of extended reporting period coverage for a period of two years after substantial completion, or a project liability policy for the Project covered by this Contract with a duration of two years after substantial completion.

11.2.6 *Deductibles:* Contractor assumes and bears any claims or losses to extent of deductible amounts and waives any claim it may ever have for same against the City, its officers, agents, or employees.

11.2.7 *Notice***: CONTRACTOR SHALL GIVE 30 DAYS' ADVANCE WRITTEN NOTICE TO THE DIRECTOR IF ANY OF ITS INSURANCE POLICIES ARE CANCELED OR NON-RENEWED**. Within the 30-day period, Contractor shall provide other suitable policies in order to maintain the required coverage. If Contractor does not comply with this requirement, the Director, at his or her sole discretion, may immediately suspend Contractor from any further performance under this Agreement and begin procedures to terminate for default.

11.2.8 *Subrogation:* Contractor waives any claim or right of subrogation to recover against the City, its officers, agents, or employees. Each policy, except professional liability, must contain an endorsement waiving such claim.

11.2.9 *Endorsement of Primary Insurance:* Each policy, except Workers' Compensation policies, must contain an endorsement that the policy is primary insurance to any other insurance available to additional insured with respect to claims arising hereunder.

11.2.10 *Liability for Premium:* Contractor is solely responsible for payment of all insurance premium requirements hereunder and the City is not obligated to pay any premiums.

11.2.11 *Additional Requirements for Workers' Compensation Insurance Coverage:* Contractor shall, in addition to meeting the obligations set forth in Table 1, maintain throughout the term of the Contract Workers' Compensation coverage as required by statute, and Contractor shall specifically comply with requirements set forth in Paragraph 11.2.10. The definitions set out below shall apply only for purposes of this Paragraph 11.2.10.

11.2.12 Definitions:

11.2.12.1 *Certificate of Coverage:* A copy of certificate of insurance, or coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory Workers' Compensation insurance coverage for Contractor's, Subcontractor's, or Supplier's employees providing services for the duration of the Contract.

11.2.12.2 *Duration of the Work:* Includes the time from Date of Commencement of the Work until Contractor's work under the Contract has been completed and accepted by City Council.

11.2.12.3 *Persons providing services for the Work (Subcontractor in Texas Labor Code § 406.096):* includes all persons or entities performing all or part of services Contractor has undertaken to perform on the Work, regardless of whether that person contracted directly with Contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of the entity, or employees of entity which furnishes persons to provide services on the Work. Services include, without

limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to the Work. Services do not include activities unrelated to the Work, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

11.2.13 Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of coverage agreements, which meets the statutory requirements of TEX. LAB. CODE ANN., Section 401.011(44) for employees of Contractor providing services on the Work, for duration of the Work.

11.2.14 Contractor shall provide a Certificate of Coverage to the City prior to being awarded the Contract.

11.2.15 If coverage period shown on Contractor's original Certificate of Coverage ends during duration of the Work, Contractor shall file new Certificate of Coverage with the City showing that coverage has been extended.

11.2.16 Contractor shall obtain from each person providing services on the Work, and provide to City Engineer:

11.2.16.1 Certificate of Coverage, prior to that person beginning work on the Work, so the City will have on file Certificates of Coverage showing coverage for all persons providing services on the Work; and

11.2.16.2 no later than seven days after receipt by Contractor, new Certificate of Coverage showing extension of coverage, if coverage period shown on current Certificate of Coverage ends during the duration of the Work.

11.2.17 Contractor shall retain all required Certificates of Coverage for the duration of the Work and for one year thereafter.

11.2.18 Contractor shall notify City Engineer in writing by certified mail or personal delivery, within 10 days after Contractor knew or should have known, of any change that materially affects provision of coverage of any person providing services on the Work.

11.2.19 Contractor shall post on-site a notice, in text, form and manner prescribed by Texas Workers' Compensation Commission, informing all persons providing services on the Work that they are required to be covered, and stating how person may verify coverage and report lack of coverage.

11.2.20 Contractor shall contractually require each person with whom it contracts to provide services on the Work to:

11.2.20.1 provide coverage, based on proper reporting of classification codes, payroll amounts and filing of any coverage agreements, which meets statutory requirements of TEX. LAB. CODE ANN., Section 401.011(44) for all its employees providing services on the Work, for the duration of the Work;

11.2.20.2 provide to Contractor, prior to that person's beginning work on the Work, a Certificate of Coverage showing that coverage is being provided for all employees of the person providing services on the Work, for the duration of the Work;

11.2.20.3 provide Contractor, prior to the end of the coverage period, a new Certificate of Coverage showing extension of coverage, if the coverage period shown on the current Certificate of Coverage ends during the duration of the Work;

11.2.20.4 obtain from each other person with whom it contracts, and provide to Contractor: (1) Certificate of Coverage, prior to other person's beginning work on the Work; and (2) new Certificate of Coverage showing extension of coverage, prior to end of coverage period, if coverage period shown on the current Certificate of Coverage ends during duration of the Work.

11.2.20.5 retain all required Certificates of Coverage on file for the duration of the Work and for one year thereafter;

11.2.20.6 notify City Engineer in writing by certified mail or personal delivery within 10 days after person knew, or should have known, of change that materially affects provision of coverage of any person providing services on the Work; and

11.2.20.7 contractually require each person with whom it contracts to perform as required by Paragraphs 11.2.10.1 through 11.2.10.7, with Certificates of Coverage to be provided to person for whom they are providing services.

11.2.21 By signing the Contract or providing or causing to be provided a Certificate of Coverage, Contractor is representing to the City that all

employees of Contractor who will provide services on the Work will be covered by Workers' Compensation coverage for the duration of the Work, that coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with appropriate insurance carrier. Contractor is not allowed to self-insure Workers' Compensation. Contractor may be subject to administrative penalties, criminal penalties, civil penalties, or other civil actions for providing false or misleading information.

11.2.22 Contractor's failure to comply with Paragraph 11.2.10 is a breach of the Contract by Contractor, which entitles the City to declare the Contract void if Contractor does not remedy breach within 10 days after receipt of notice of breach from City Engineer.

11.2.23 *Subcontractor Insurance Requirements:* Contractor shall require Subcontractors and Suppliers to obtain Commercial General Liability, Workers' Compensation, Employer's Liability and Automobile Liability coverage that meets all the requirements of Paragraph 11.2. The amount must be commensurate with the amount of the subcontract, but not less than $500,000 per occurrence. Contractor shall require all Subcontractors with whom it contracts directly, whose subcontracts exceed $100,000, to provide proof of Commercial General Liability and Automobile Liability insurance coverage meeting the above requirements. Contractor shall comply with all requirements set out under Paragraph 11.2.10 as to Workers' Compensation Insurance for all Subcontractors and Suppliers.

TABLE 1
REQUIRED COVERAGE

Coverage	Limit of Liability
1. Workers' Compensation	• Texas Statutory Limits for Workers' Compensation
2. Employer's Liability	• Bodily Injury by Accident $1,000,000 (each accident) • Bodily Injury by Disease $1,000,000 (policy limit) • Bodily Injury by Disease $1,000,000 (each employee)
3. Commercial General Liability: Including Broad Form Property Damage, Contractual Liability, Explosion, Underground and Collapse, Bodily Injury, Personal Injury, Products, and Completed Operations (for a period of one year following completion of the Work).	• $1,000,000 Limit (each occurrence), subject to general aggregate Limit of $2,000,000 • Products and Completed Operations $2,000,000 aggregate Limit
4. Owner's and Contractor's Protective Liability	• $1,000,000 each Occurrence/ aggregate
5. Installation Floater (Unless alternative coverage approved by City Attorney)	• Value of stored material or equipment, listed on Certificates of Payments, but not yet incorporated into the Work
6. Automobile Liability Insurance: (For automobiles furnished by Contractor in course of his performance under the Contract, including Owned, Non-owned, and Hired Auto coverage)	• $1,000,000 combined single limit each occurrence for (1) Any Auto or (2) All Owned, Hired, and Non-Owned Autos
7. Excess Coverage	• $1,000,000 each occurrence/ aggregate in excess of limits specified for Commercial General Liability, and Automobile Liability
Aggregate Limits are per 12-month policy period unless otherwise indicated.	

11.3 *PROOF OF INSURANCE*

11.3.1 Prior to commencing services and at time during the term of the Contract, Contractor shall furnish City Engineer with Certificates of Insurance, along with Affidavit from Contractor confirming that

Certificate accurately reflects insurance coverage that is available during term of the Contract. If requested in writing by City Engineer, Contractor shall furnish City Engineer with certified copies of Contractor's actual insurance policies. Failure of Contractor to provide certified copies, as requested, may be deemed, at City Engineer's or City Attorney's discretion, a material breach of the Contract.

11.3.2 Notwithstanding the proof of insurance requirements, Contractor shall continuously maintain in effect required insurance coverage set forth in Paragraph 11.2. Failure of Contractor to comply with this requirement does constitute a material breach by Contractor allowing the City, at its option, to immediately suspend or terminate work, or exercise any other remedy allowed under the Contract. Contractor agrees that the City has not waived or is not estopped to assert a material breach of the Contract because of any acts or omissions by the City regarding its review or non-review of insurance documents provided by Contractor, its agents, employees, or assigns.

11.3.3 Contractor shall provide updated certificates of insurance to the Director upon request. The Contractor shall be responsible for delivering a current certificate of insurance in the proper form to the Director as long as Contractor is required to furnish insurance coverage under Paragraph 11.2.

11.3.4 Every certificate of insurance Contractor delivers in connection with this Contract shall

11.3.4.1 be less than 12 months old;

11.3.4.2 include all pertinent identification information for the Insurer, including the company name and address, policy number, NAIC number or AMB number, and authorized signature;

11.3.4.3 include in the Certificate Holder Box the Project name and reference numbers, contractor's email address, and indicates the name and address of the Project Manager;

11.3.4.4 include the Contractor's email address in the Certificate Holder Box;

11.3.4.5 include the Project reference numbers on the City address so the Project reference number is visible in the envelope window; and

11.3.4.6 be appropriately marked to accurately identify all coverages and limits of the policy, effective and expiration dates, and waivers of subrogation in favor of the City for Commercial General Liability, Automobile Liability, and Worker's Compensation/Employers' Liability.

11.4 *PERFORMANCE AND PAYMENT BONDS*

11.4.1 For Contracts over the value of $25,000, Contractor shall provide Bonds on the City's standard forms covering faithful performance of the Contract and payment of obligations arising thereunder as required in the Contract pursuant to Chapter 2253 of the Government Code. The Bonds must be for 100 percent of Original Contract Price and in accordance with conditions stated on standard City Performance and Payment Bond and Statutory Payment Bond forms. Bonds may be obtained from Contractor's usual source and cost for the Bonds are included in Contract Price.

11.5 *MAINTENANCE BONDS*

11.5.1 *One-year Maintenance Bond:* Contractor shall provide Bond on standard City One-year Maintenance Bond form, providing for Contractor's correction, replacement, or restoration of any portion of the Work which is found to be not in compliance with requirements of the Contract during one-year correction period required in Paragraph 12.2. The Maintenance Bond must be for 100 percent of the Original Contract Price.

11.6 *SURETY*

11.6.1 A Bond that is given or tendered to the City pursuant to the Contract must be executed by a surety company that is authorized and admitted to write surety Bonds in the State of Texas.

11.6.2 If a Bond is given or tendered to the City pursuant to the Contract in an amount greater than 10 percent of Surety's capital and surplus, Surety shall provide certification that Surety has reinsured that portion of the risk that exceeds 10 percent of Surety's capital and surplus. The reinsurance must be with one or more reinsurers who are duly authorized, accredited, or trusted to do business in the State of Texas. The amount reinsured by reinsurer may not exceed 10 percent of reinsurer's capital and surplus. The amount of allowed capital and surplus must be based on information received from State Board of Insurance.

11.6.3 If the amount of a Bond is greater than $100,000, Surety shall:

11.6.3.1 also hold certificate of authority from the United States Secretary of Treasury to qualify as surety on

obligations permitted or required under federal law; or,

11.6.3.2 Surety may obtain reinsurance for any liability in excess of $100,000 from reinsurer that is authorized and admitted as a reinsurer in the State of Texas and is the holder of a certificate of authority from the United States Secretary of the Treasury to qualify as surety or reinsurer on obligations permitted or required under federal law.

11.6.4 Determination of whether Surety on the Bond or the reinsurer holds a certificate of authority from the United States Secretary of the Treasury is based on information published in Federal Register covering the date on which Bond was executed.

11.6.5 Each Bond given or tendered to the City pursuant to the Contract must be on City forms with no changes made by Contractor or Surety, and must be dated, executed, and accompanied by power of attorney stating that the attorney in fact executing such the bond has requisite authority to execute such Bond. The Bonds must be dated and must be no more than 30 days old.

11.6.6 Surety shall designate in its Bond, power of attorney, or written notice to the City, an agent resident in Harris County to whom any requisite notices may be delivered and on whom service of process may be had in matters arising out of the suretyship.

11.6.7 Contractor shall furnish information to a payment bond beneficiary as required by TEX. GOV'T CODE ANN. CH. 2253.

11.7 *DELIVERY OF BONDS*

11.7.1 Contractor shall deliver required Bonds to the City within time limits stated in Notice of Intent to Award and prior to Date of Commencement of the Work.

ARTICLE 12 - UNCOVERING AND CORRECTION OF THE WORK

12.1 *UNCOVERING OF THE WORK*

12.1.1 If a portion of the Work has been covered which City Engineer has not specifically requested to observe prior to its being covered, City Engineer may request to see such work and it must be uncovered by Contractor. If such work is in accordance with the Contract, the costs of uncovering and covering such work are charged to the City by Change Order. If such work is not in accordance with the Contract, Contractor shall pay for uncovering and shall correct the nonconforming Work promptly after receipt of Notice of Noncompliance to do so.

12.2 *CORRECTION OF THE WORK*

12.2.1 Contractor shall promptly correct or remove work rejected by City Engineer or work failing to conform to requirements of the Contract, whether observed before or after Date of Substantial Completion and whether fabricated, Installed, or completed.

12.2.2 Contractor bears costs of correcting the rejected or nonconforming work including additional testing and inspections, and compensation for Design Consultant's services and expenses made necessary thereby.

12.2.3 If within one year after Date of Substantial Completion, or after date for commencement of warranties established under Paragraph 9.9.5 or by other applicable special warranty required by the Contract, whichever is later in time, any of the Work is found not to be in accordance with the requirements of the Contract, Contractor shall correct such work promptly after receipt of Notice of Noncompliance to do so.

12.2.4 One-year correction period for portions of the Work completed after Date of Substantial Completion will begin on the date of acceptance of that portion of the Work. This obligation under this Paragraph survives acceptance of the Work under the Contract and termination of the Contract.

12.2.5 The one-year correction period does not establish a duration for the Contractor's general warranty under Paragraph 3.12. The City retains the right to recover damages from the Contractor as long as may be permitted by the applicable statute of limitations.

12.2.6 If Contractor does not proceed with correction of the nonconforming work within time fixed by Notice of Noncompliance, the City may correct nonconforming work or remove nonconforming work and store salvageable Products at Contractor's expense. Contractor shall pay the costs of correction of nonconforming work and removal and storage of salvageable Products to the City. If Contractor does not pay costs of the correction or removal and storage within 10 days after written notice, the City may sell the Products at auction or at private sale. The City will account for proceeds thereof after deducting costs and damages that would have been borne by Contractor, including compensation for services of Design Consultant and necessary expenses. If the proceeds of sale do not cover costs which Contractor should have borne,

Contractor shall pay the value of the deficiency to the City.

12.2.7 Contractor bears cost of correcting work originally installed by Contractor, the City, or by separate contractors and damaged by Contractor's correction or removal of Contractor's work.

12.3 *ACCEPTANCE OF NONCONFORMING WORK*

12.3.1 If City Engineer prefers to accept work which is not in accordance with requirements of the Contract, City Engineer may do so only by issuance of Change Order, instead of requiring its removal and correction. City Engineer will determine Contract Price reduction. The reduction will become effective even if final payment has been made.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

13.1 *GOVERNING LAW AND VENUE*

13.1.1 This Contract shall be construed and interpreted in accordance with the applicable laws of the State of Texas and City of Houston. Venue for any disputes relating in any way to this Contract shall lie exclusively in Harris County, Texas.

13.2 *SUCCESSORS*

13.2.1 The Contract binds and benefits the Parties and their legal successors and permitted assigns; however, this Paragraph 13.2.1 does not alter the restrictions on assignment and disposal of assets set out in Paragraph 13.3.1. The Contract does not create any personal liability on the part of any officer or agent of the City.

13.3 *BUSINESS STRUCTURE AND ASSIGNMENTS*

13.3.1 Contractor may not assign the Contract at law or otherwise, or dispose of all or substantially all of its assets without City Engineer's prior written consent. Nothing in this Section, however, prevents the assignment of accounts receivable or the creation of a security interest as described in §9.406 of the Texas Business & Commerce Code. In the case of such an assignment, Contractor shall immediately furnish the City with proof of the assignment and the name, telephone number, and address of the assignee and a clear identification of the fees to be paid to the assignee.

13.3.2 Any series, as defined by the TEX. BUS. ORG. CODE ANN., affiliate, subsidiary, or successor to which Contractor assigns or transfers assets shall join in privity and be jointly and severally liable under this Contract.

13.4 *WRITTEN NOTICE*

13.4.1 All notices required or permitted by the Contract must be in writing and must be effected by hand delivery; registered or certified mail, return receipt requested; or facsimile with confirmation copy mailed to receiving Party. Notice is sufficient if made or addressed with proper postage to the address stated in the Agreement for each Party ("Notice Address") or faxed to the facsimile number stated in the Agreement for each Party. The notice is deemed delivered on the earlier of:

13.4.1.1 the date the Notice is actually received;

13.4.1.2 the third day following deposit in a United States Postal Service post office or receptacle; or

13.4.1.3 the date the facsimile is sent unless the facsimile is sent after 5:00 p.m. local time of the recipient and then it is deemed received on the following day.

Any Party may change its Notice Address or facsimile number at any time by giving written notice of the change to the other Party in the manner provided for in this Paragraph at least 15 days prior to the date the change is affected.

13.5 *RIGHTS AND REMEDIES*

13.5.1 Duties and obligations imposed by the Contract and rights and remedies available thereunder are in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

13.5.2 No act or failure to act by the City or Contractor is a waiver of rights or duties afforded them under the Contract, nor is the act or failure to act constitute approval of or acquiescence in a breach of the Contract. No waiver, approval or acquiescence is binding unless in writing and, in the case of the City, signed by City Engineer.

13.6 *TESTS AND INSPECTIONS*

13.6.1 Contractor shall give City Engineer, Construction Manager, and Design Consultant timely notice of the time and place where tests and inspections are to be made. Contractor shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

13.6.2 The City will employ and pay for services of an independent testing laboratory to

perform inspections or acceptance tests required by the Contract except:

13.6.2.1 inspections or tests covered by Paragraph 13.6.3;

13.6.2.2 those otherwise specifically provided in the Contract; or

13.6.2.3 costs incurred in connection with tests or inspections conducted pursuant to Paragraph 12.2.2.

13.6.3 Contractor is responsible for and shall pay all costs in connection with inspection or testing required in connection with City Engineer's acceptance of a Product to be incorporated into the Work, or of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation into the Work.

13.6.4 Neither observations by the City, Construction Manager, or Design Consultant, nor inspections, tests, or approvals by others, relieves Contractor from Contractor's obligations to perform the Work in accordance with the Contract.

13.7 *INTEREST*

13.7.1 No interest will accrue on late payments by the City except as provided under Chapter 2251 of the Government Code.

13.8 *PARTIES IN INTEREST*

13.8.1 The Contract does not bestow any rights upon any third party, but binds and benefits the Parties only.

13.9 *ENTIRE CONTRACT*

13.9.1 The Contract merges the prior negotiations and understandings of the Parties and embodies the entire agreement of the Parties. No other agreements, assurances, conditions, covenants, express or implied, or other terms of any kind, exist between the Parties regarding the Contract.

13.10 *WRITTEN AMENDMENT*

13.10.1 Changes to the Contract that cannot be effected by Modifications, must be made by written amendment, which will not be effective until approved by City Council.

13.11 *COMPLIANCE WITH LAWS*

13.11.1 Contractor shall comply with the Americans with Disabilities Act of 1990 as amended (ADA) and Texas Architectural Barriers Act and all regulations relating to either statute.

13.11.2 Contractor shall comply with all applicable federal, state, and city laws, rules and regulations.

13.12 *SEVERABILITY*

13.12.1 If any part of the Contract is for any reason found to be unenforceable, all other parts remain enforceable to the extent permitted by law.

13.13 *COMPLIANCE WITH CERTAIN STATE LAW REQUIREMENTS*

13.13.1 *Anti-Boycott of Israel*. Contractor certifies that Contractor is not currently engaged in, and agrees for the duration of this Agreement not to engage in, the boycott of Israel as defined by Section 808.001 of the Texas Government Code.

13.13.2 *Anti-Boycott of Energy Companies*. Contractor certifies that Contractor is not currently engaged in, and agrees for the duration of this Agreement not to engage in, the boycott of energy companies as defined by Section 809.001 of the Texas Government Code.

13.13.3 *Anti-Boycott of Firearm Entities or Firearm Trade Associations*. Contractor certifies that Contractor does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association, or will not discriminate against a firearm entity or firearm trade association for the duration of this Agreement, as defined by Section 2274.001 of the Texas Government Code.

13.13.4 *Certification of No Business with Foreign Terrorist Organizations*. For purposes of Section 2252.152 of the Code, Contractor certifies that, at the time of this Agreement neither Contractor nor any wholly owned subsidiary, majority-owned subsidiary, parent company or affiliate of Contractor, is a company listed by the Texas Comptroller of Public Accounts under Sections 2252.153 or 2270.0201 of the Code as a company known to have contracts with or provide supplies or to a foreign terrorist organization.

13.14 *ZERO TOLERANCE POLICY FOR HUMAN TRAFFICKING & RELATED ACTIVITIES*

13.14.1 The requirements and terms of the City of Houston's Zero Tolerance Policy for Human Trafficking and Related Activities, as set forth in Executive Order 1-56, as revised from time to time, are incorporated into this Agreement for all purposes. Contractor has reviewed Executive

Order 1-56, as revised, and shall comply with its terms and conditions as they are set out at the time of this Agreement's effective date. Contractor shall notify the City's Chief Procurement Officer, City Attorney, and the Director of any information regarding possible violation by the Contractor or its subcontractors providing services or goods under this Agreement.

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 *TERMINATION BY THE CITY FOR CAUSE*

14.1.1 Each of the following acts or omissions of Contractor or occurrences shall constitute an "Event of Default" under the Contract:

14.1.1.1 Contractor refuses or fails to supply enough properly skilled workers or proper Products;

14.1.1.2 Contractor disregards laws, ordinances, rules, regulations, or orders of a public authority having jurisdiction;

14.1.1.3 Contractor is guilty of material breach of any duty or obligation of Contractor under the Contract, including, but not limited to, failure to submit certified payrolls electronically;

14.1.1.4 Contractor has had any other contract with the City terminated for cause at any time subsequent to the effective date of the Contract as set out in the Agreement; or

14.1.1.5 Contractor fails to utilize Ultra Low Sulfur Diesel Fuel, as required in Paragraph 3.9.1.1.

14.1.2 If an Event of Default occurs, City Engineer may, at his option and without prejudice to any other rights or remedies which the City may have, deliver a written notice to Contractor and Surety describing the Event of Default and giving the Contractor 10 days to cure the Event of Default. If after the cure period, Contractor has failed or refused to cure the Event of Default, then City Engineer may deliver a second written notice to Contractor giving notice of the termination of the Contract or of the termination of Contractor's performance under the Contract ("Notice of Termination"). If City Engineer issues a Notice of Termination, then City Engineer may, subject to any prior rights of Surety and any other rights of the City under the Contract or at law:

14.1.2.1 request that Surety complete the Work; or

14.1.2.2 take possession of the site and all materials, equipment, tools, and construction equipment and machinery on the site owned by Contractor; and

14.1.2.3 finish the Work by whatever reasonable method City Engineer may deem expedient.

14.1.3 After Contractor's receipt of a Notice of Termination, and except as otherwise directed in writing by City Engineer, Contractor shall:

14.1.3.1 stop the Work on the date and to the extent specified in the Notice of Termination;

14.1.3.2 place no further orders or subcontracts for Products or services;

14.1.3.3 terminate all orders and subcontracts to the extent that they relate to performance of work terminated;

14.1.3.4 assign to the City, in the manner, at the times, and to the extent directed by City Engineer, all rights, title, and interest of Contractor, under the terminated supply orders and subcontracts. The City may settle or pay claims arising out of termination of the orders and subcontracts;

14.1.3.5 settle all outstanding liabilities and all claims arising out of the termination of supply orders and subcontracts with approval of City Engineer;

14.1.3.6 take action as may be necessary, or as City Engineer may direct, for protection and preservation of property related to the Work that is in possession of Contractor, and in which the City has or may acquire an interest; and

14.1.3.7 secure the Work in a safe state before leaving the site, providing any necessary safety measures, shoring, or other devices.

14.1.4 If the City terminates the Contract or terminates Contractor's performance under the Contract for any one or more of the reasons stated in Paragraph 14.1.1, Contractor may not receive any further payment until the Work is complete, subject to Paragraph 14.1.5.

14.1.5 If the unpaid balance of Contract Price exceeds the costs of finishing the Work, including liquidated damages and other amounts due under the Contract, the balance will be paid to Contractor. If the costs of finishing the Work exceed the unpaid balance, Contractor shall, within 10 days of receipt of written notice setting out the amount of the excess costs, pay the difference to the City. The amount to

be paid to Contractor or the City will be certified by City Engineer in writing, and this obligation for payment shall survive termination of the Contract or termination of Contractor's performance under the Contract. Termination of the Contractor for cause shall not relieve the Surety from its obligation to complete the project.

14.2 *TERMINATION BY THE CITY FOR CONVENIENCE*

14.2.1 City Engineer may, without cause and without prejudice to other rights or remedies of the City, give Contractor and Surety a Notice of Termination with a seven days written notice.

14.2.2 After receipt of the Notice of Termination, and except as otherwise approved by City Engineer, Contractor shall conform to requirements of Paragraph 14.1.3.

14.2.3 After receipt of the Notice of Termination, Contractor shall submit and substantiate to the City its termination Claim, in forms required by City Engineer. The Claim will be submitted and substantiated to the City promptly, but no later than six months from the effective date of termination, unless one or more extensions are granted by City Engineer in writing. If Contractor fails to submit its termination Claim within the time allowed, in accordance with Paragraph 14.2.4, City Engineer will determine, on the basis of available information, the amount, if any, due to Contractor because of termination, and City Engineer's determination is final and binding on the Parties. The City will then pay to Contractor the amount so determined.

14.2.4 City Engineer will determine, on the basis of information available to City Engineer, the amount due, if any, to Contractor for the termination as follows:

14.2.4.1 Contract Price for all work performed in accordance with the Contract up to the date of termination determined in the manner prescribed for monthly payments in Article 9, except no retainage is withheld by the City either for payment determined by percentage of completion or for materials and equipment delivered to the site, in storage or in transit.

14.2.4.2 Reasonable termination expenses, including costs for settling and paying Subcontractor and Supplier claims arising out of termination of the Work, reasonable cost of preservation and protection of the City's property after termination, if required, and the cost of Claim preparation. Termination expenses do not include field or central office overhead, salaries of employees of Contractor, or litigation costs, including attorneys' fees.

No amount is allowed for anticipated profit or central office overhead on uncompleted work, or any cost or lost profit for other business of Contractor alleged to be damaged by the termination.

14.2.5 Contractor shall promptly remove from the site any construction equipment, tools, and temporary facilities, except the temporary facilities which City Engineer may wish to purchase and retain.

14.2.6 Contractor shall cooperate with City Engineer during the transition period.

14.2.7 The City will take possession of the Work and materials delivered to the site, in storage, or in transit, as of date or dates specified in the Notice of Termination, and is responsible for maintenance, utilities, security, and insurance, as stated in Notice of Termination.

14.3 *SUSPENSION BY THE CITY FOR CONVENIENCE*

14.3.1 City Engineer may, without cause, after giving Contractor and Surety 24-hour prior written notice, order Contractor to suspend, delay, or interrupt the Work in whole or in part for a period of time as City Engineer may determine.

14.3.2 An adjustment will be made in Contract Time equivalent to the time of suspension.

14.3.3 Adjustment will be made to Contract Price for increases in the cost of performance of the Work, including profit on increased cost of performance caused by suspension, delay, or interruption of the Work in accordance with Paragraph 7.3. No adjustment will be made to the extent that:

14.3.3.1 performance was, or would have been, suspended, delayed, or interrupted by another cause for which Contractor is responsible; or

14.3.3.2 adjustment is made or denied under another provision of the Contract.

14.4 *TERMINATION BY CONTRACTOR*

14.4.1 Contractor may terminate the Contract if the Work is stopped for a period of 30 days through no act or fault of Contractor, directly related to one of these events:

14.4.1.1 issuance of an order of a court or other public authority having jurisdiction;

14.4.1.2 act of government, such as a declaration of national emergency which makes material unavailable; or

14.4.1.3 if repeated suspensions, delays, or interruptions by the City as described in Paragraph 14.3 constitute, in the aggregate, more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less;

No termination will be effective for the above reasons if Contractor delivers written notice to City Engineer describing the reason for termination, giving the proposed termination date, and granting the City a reasonable opportunity to respond and cure any City default before termination is effective.

14.4.2 If the Contract is terminated pursuant to this Paragraph 14.4, Contractor shall comply with the requirements of Paragraphs 14.2.2 through 14.2.7.

[END OF DOCUMENT]

Document 00800

SUPPLEMENTARY CONDITIONS

ARTICLE 1 - GENERAL PROVISIONS:

1.1 *DEFINITIONS*: *Insert the following Paragraphs 1.1.9.1, 1.1.23, and 1.1.25, and reorder the remaining definitions accordingly. Please insert the amended definition of "Specifications".*

1.1.9.1 The firm of Molina Walker Almaguer Architects, Inc. has been employed by the City as Construction Manager for the Work.

1.1.23 *Good Faith Efforts*: Steps taken to achieve an MBE, WBE, SBE, or PDBE goal or other requirements which, by their scope, intensity, and usefulness, demonstrate the bidder's responsiveness to fulfill the business opportunity objective, as well as the Contractor's responsibility to put forth measures to meet or exceed the MBE, WBE, SBE, or PDBE goal (Contract Goal). These steps apply from before a contract's award, through its duration, and after its conclusion, in the event the Contractor has been unsuccessful in meeting the Contract Goal. These efforts are required whether a Goal Oriented Contract or a Regulated Contract, as defined in the Office of Business Opportunity's Policy & Procedures Manual, available at http://www.houstontx.gov/obo.

1.1.25 *Incidental Work:* Work described as incidental shall be work defined in Document 01110 - Summary of Work, that do not have a direct pay item listed in the Document 00410B - Bid Form Part B, or less than 1% of the Contract Price and not capable of being measured. If Work is identified as Incidental Work and also covered by Bid Form Part B quantities, then the unit price item quantities in the Bid Form Part B shall govern.

1.1.45 *Specifications:* Divisions 01 through 16 of the documents that are incorporated into the Agreement, consisting of written General Requirements and requirements for Products, standards, and workmanship for the Work, and performance of related services. All specifications are amended to include, under the Measurement and Payment Section, the following sentence: "Work described as Incidental Work shall not be paid as a separate unit price item."

1.1.11 Consent Decree: The document entitled Consent Decree between the City of Houston, the United States and the State of Texas, entered on April 1, 2021 in *United States v. City of Houston*, C.A. No. 4:18-cv-03368, in the United States District Court for the Southern District of Texas, Houston Division. A copy of the Consent Decree is attached as Appendix A and electronically available at:

http://www.publicworks.houstontx.gov/wastewater-cd

1.1.12 Consent Decree Obligations: Any and all obligations or requirements set forth in the Consent Decree that are applicable to all or any part of the Scope of Work and any other Work performed by Contractor under the Agreement or amendments thereto, including Additional Services, if any.

ARTICLE 3 - THE CONTRACTOR

3.5 *LABOR*: *Insert the following Paragraphs, 3.5.3.1.1, 3.5.3.1.2, and 3.5.3.1.3.*

3.5.3.1.1 If the Original Contract Price is greater than One Million Dollars, Contractor shall make Good Faith Efforts to comply with the City ordinances regarding Minority Business Enterprises (MBE), Women Business Enterprises (WBE), Persons with Disabilities Business Enterprises (PDBE) and Small Business Enterprise (SBE) participation goals which are as follows:

3.5.3.1.1.1 the MBE goal is_____percent,

3.5.3.1.1.2 the WBE goal is_____percent, and

3.5.3.1.1.3 the PDBE goal is_____percent.

3.5.3.1.1.4 The bidder may substitute SBE participation of no more than four percent of the MBE goal, the WBE goal, or portions of the MBE Goal and WBE Goal.

3.5.3.1.1.5 The bidder may not use Native-American-owned firms that are certified as MBEs to meet MBE contract goals. Native-Americans firms can only be used as SBEs in fulfillment of the above stated goals.

3.5.3.1.1.6 The bidder may not use MWSBE Suppliers to account for more than 50% of the MWSBE participation plan.

3.5.3.1.2 The MBE, WBE, PDBE, and SBE goals are specific to this Agreement. The Contractor shall make reasonable efforts to achieve these goals.

3.5.3.1.3 Failure by Contractor to comply with the goals for MBE, WBE, SBE, or PDBE is a material breach of the Agreement, which may result in termination of the Agreement, or such other remedy permitted as the City deems appropriate.

8.1 *PROGRESS AND COMPLETION: Add the following Paragraph 8.1.6.1.*

8.1.6.1 Contractor shall credit the City by Change Order for inspection services for overtime work or work performed on Sundays or Legal Holidays. The amount Contractor credits the City will be $50.00 per hour per inspector for inspection services.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.1 *UNIT PRICE WORK*: *Delete Section 9.1 in its entirety and insert the following Section 9.1.*

9.1 References to Unit Prices in individual Specification sections are not applicable to the Contract. Include payment for portions of the Work required by these sections in the Stipulated Price for the Contract.

9.4 *APPLICATIONS FOR PAYMENT, STIPULATED PRICE WORK: Insert the following Paragraph 9.4.3.*

9.4.3 The City of Houston's standard payment term is to pay 30 days after receipt of invoice or receipt of goods or services, whichever is later, according to the requirements of the Texas Prompt Payment Act (Texas Government Code, Chapter 2251). However, the City will pay in less than 30 days in return for an early payment discount from vendor as follows:

9.4.3.1 Payment Time - 10 Days: 2% Discount
9.4.3.2 Payment Time - 20 Days: 1% Discount

If the City fails to make a payment according to the early payment schedule above, but does make the payment within the time specified by the Prompt Payment Act, the City shall not receive the discount, but shall pay no other penalty. When the payment date falls on a Saturday, Sunday, or official holiday when City offices are closed and City business is not expected to be conducted, payment may be made on the following business day.

9.12 *LIQUIDATED DAMAGES*: *Insert the following Paragraph 9.12.1.1.*

9.12.1.1 The amount of liquidated damages payable by Contractor or Surety for each and every day of delay beyond Contract Time, are $800 per day.

9.12.1.1.2.1. Retention of documents.

Contractor shall retain and preserve all non-identical copies of all documents, reports, research, analytical or other data, records or other information of any kind or character (including documents, records, or other information in electronic form including, but not limited to e-mails) in its or its sub-contractors' or agents' possession or control, or that come into its or its sub-contractors' or agents' possession or control, and that relate in any manner to this contract, or the performance of any work described in this contract (the "Information"). This retention requirement shall apply regardless of any contrary corporate or institutional policy or procedure or legal requirement. Contractor, Contractor's sub-contractors and agents shall retain and shall not destroy any of the Information until such time as Contractor has received written approval from the City Attorney of the City of Houston that the Information or any part of the Information may be destroyed. Contractor shall, within 30 days after receipt of a written request by the City, deliver the Information to the City. Contractor shall instruct and require its

agents and sub-contractors performing any part of the work described in this contract to comply with the requirements of this paragraph.

9.12.1.1.2.2. Notification of events that may cause delay.

If any event occurs that may delay performance by Contractor, or Contractor's agents or sub-contractors of any work or obligation of any kind under this contract, Contractor shall provide notice in accordance with the Notice Provisions of this contract to the City within two (2) business days of the date Contractor or Contractor's agents or sub-contractors first knew that the event might cause a delay. Contractor shall provide a written explanation and description of the reasons for the delay, the anticipated duration of the delay, all actions taken or to be taken to prevent or minimize the delay, and a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay. **TIME IS OF THE ESSENCE** in the performance of the requirements of this paragraph and of any work to be performed by the Contractor in this contract.

9.12.1.2.3. Liability for stipulated penalties

The Consent Decree provides that the City may be assessed stipulated penalties under Section X of the Consent Decree upon the occurrence of certain events. Contractor acknowledges that, under the Consent Decree, stipulated penalties accrue beginning the day after performance is due or on the day a violation occurs, as applicable. Contractor agrees that, in addition to any liquidated or other damages for which it may be responsible under this Contract, it shall pay to the City the full amount of any stipulated penalty which accrues against the City that is caused or contributed to, in whole or in part, by any of Contractor's or its Subcontractors' or agents' acts, failures to act, or failures to act within the time required by any provision of this Contract or the Consent Decree. Contractor shall also pay to the City all costs, attorney fees, expert witness fees and all other fees and expenses incurred by the City in connection with any such stipulated penalties, or in contesting any such stipulated penalties pursuant to the Dispute Resolution procedures in the Consent Decree. It is within the City's sole and absolute discretion whether to invoke the Dispute Resolution procedures of the Consent Decree regarding any stipulated penalties. Payment of stipulated penalties for which Engineer is responsible under this Contact is due within 30 days of demand, in writing, by the City. In addition to any and all other remedies to which the City may be entitled at law or in equity, Contractor expressly authorizes the City to withhold the amount of any stipulated penalties for which Contractor is responsible under this Contract, and all associated costs, fees, or expenses from any amount unpaid to Contractor under the terms of this Contract, or from any retainage provided in the Contract.

Without limiting anything set forth elsewhere in this construction contract regarding liquidated damages, Contractor acknowledges that damages are an intended factor in the calculation of the amount of the liquidated damages under this construction contract.

ARTICLE 11 - INSURANCE AND BONDS

Delete Table 1 and add following Table 1 in place thereof:

TABLE 1
REQUIRED COVERAGES

(Coverage)	(Limit of Liability)
.1 Workers' Compensation	Statutory Limits for Workers' Compensation
.2 Employer's Liability	Bodily Injury by Accident $1,000,000 (each accident) Bodily Injury by Disease $1,000,000 (policy limit) Bodily Injury by Disease $1,000,000 (each employee)
.3 Commercial General Liability: Including Contractor's Protective, Broad Form Property Damage, Contractual Liability, Explosion, Underground and Collapse, Bodily Injury, Personal Injury, Products, and Completed Operations (for a period of one year following completion of the Work).	Combined single limit of $1,000,000 (each occurrence), subject to general aggregate of $2,000,000; Products and Completed Operations $1,000,000 aggregate.
.4 Owner's and Contractor's Protective Liability	$1,000,000 combined single limit each Occurrence/ aggregate
.5 Installation Floater (Unless alternative coverage by City Attorney)	Value of stored equipment or material, listed on Certificates of Payments, but not yet incorporated into the Work
.6 Automobile Liability Insurance: (For automobiles furnished by Contractor in course of his performance under the Contract, including Owned, Non-owned, and Hired Auto coverage)	$1,000,000 combined single limit each occurrence
.7 Excess Coverage	$1,000,000 each occurrence/combined aggregate in excess of limits specified for Employer's Liability, Commercial General Liability, and Automobile Liability
.8 Optional Coverages	**(Required when checked)**
___(a)Contractor's Pollution Liability including pollution coverage for Contractual Liability, Clean-up costs, Abatement, Transport and Non-owned disposal sites. Including Bodily Injury Liability, Property Damage Liability and environmental damage arising from pollution conditions caused in performance of operations. Include Asbestos and Lead if part of operations. (MCS-90 endorsement: To Auto Policy and removal of Pollution Exclusion)	$1,000,000 each occurrence $1,000,000 CSL

____(b) Property & Casualty Coverage: "All Causes of Loss" Builders Risk Form for directing physical change to building or plant construction on Work site and/or all land improvements including all work. [Including but not limited to earthquake, flood, boiler and machinery--including testing, damage to existing or adjoining property, time element coverage, collapse, soft costs (management, architecture, financial costs, pre-opening costs, etc.), transit coverage, off-site storage].	100% Contract price, including all change orders
____(c)Increased Excess Coverage	$_____each occurrence aggregate in excess of limits specified for Employer's Liability, Commercial General Liability, and Automotive Liability
*Defense costs are excluded from face amount of policy. Aggregate Limits are per 12-month policy period unless otherwise indicated. *Use Builder's Risk insurance for projects that include lift stations, plant or facility work. Include Building Wage rates in the project manual *Flood Hazard Insurance: Contractor shall apply for flood insurance on all insurable structures built under the Contract. A copy of the completed application must be provided to City Engineer before commencing construction of the Work. Contractor shall obtain flood hazard insurance as soon as possible and submit a copy of the policy to City Engineer. Use Flood Hazard Insurance only for projects that include structures. Do not include Flood Insurance for line projects, projects outside of the 100-year floodplain, or projects with structures less than $10,000 in value.	

ARTICLE 11 - INSURANCE AND BONDS

Use Paragraph 11.2.1.2 if any of the following additional insurance is required by the nature of the contract. DO NOT require any additional insurance that is unnecessary; notify the Legal Department when requiring any additional insurance. When inserting additional insurance requirements into Table 2, number them consecutively, starting with .1 as follows:

Example:

Table 2

.1 Property and Casualty Coverage
.2 Contractor's Pollution Liability Coverage
.3 Etc.

11.2 *INSURANCE TO BE PROVIDED BY CONTRACTOR: Insert the following Paragraph 11.2.1.2., and Table 2, "Additional Required Coverage".*

11.2.1.2 Contractor shall purchase for the duration of the Contract the insurance set out in Table 2 in addition to the minimum insurance coverage set out in section 11.2.1.

11.2.8 Delete Paragraph 11.2.8 and replace with the following:

"11.2.8 Endorsement of Primary Insurance: Each policy except Workers' Compensation Insurance must contain an endorsement that the policy is primary insurance to any other insurance available to additional insured with respect to claims arising under the Contract."

ARTICLE 13 – MISCELLANEOUS PROVISIONS

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

END OF DOCUMENT

Document 00805

EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS
(City of Houston Information Requirements
for the Successful Bidder on All Construction Contracts)

DOCUMENTS THAT MUST BE SIGNED AND RETURNED TO THE CITY OF HOUSTON PRIOR TO FINAL EXECUTION OF CONTRACT

Certification by Bidder Regarding Equal Employment Opportunity EEO-3

Total Work Force Composition of the Company..... EEO-6
or in lieu thereof, a copy of the latest Equal Employment Opportunity Commission's EEO-1 form (This information is required only if the Contractor has a work force of 50 or more people and the Contract is $50,000 or more.)

Company's Equal Employment Opportunity Compliance Program EEO-7

INFORMATION THAT MUST BE SUPPLIED DURING THE COURSE OF THE WORK

Certification By Proposed Subcontractor Regarding
Equal Employment Opportunity EEO-26

Subcontractor's Equal Employment Opportunity
Compliance Program EEO-29

Certification by Proposed Material Suppliers, Lessors, and Professional Service Providers Regarding Equal Employment Opportunity EEO-30

PLEASE COMPLETE PAGES EEO-3 THROUGH EEO-7 AND MAIL TO:

Houston Airport System
Office of Business Opportunity
Contract Compliance Section
18600 Lee Road, Suite 131
Humble, Texas 77338

The remainder of the reports can be mailed at the appropriate time.

EQUAL EMPLOYMENT OPPORTUNITY PROGRAM REQUIREMENTS

The following are Equal Employment Opportunity requirements to be met and documents to be submitted to:

Houston Airport System
Office of Business Opportunity
Contract Compliance Section
18600 Lee Road, Suite 131
Humble, Texas 77338

Under the conditions and terms of all City construction contract, the prime contractor is responsible for all Equal Employment Opportunity compliance, including subcontractor compliance.

EQUAL EMPLOYMENT OPPORTUNITY FORMS (EEO Forms)

These forms are submitted by the prime contractors at the beginning of the Project and as requested:

- EEO Forms 3, 6, and 7 by prime contractors.

These forms are submitted by all subcontractors before they begin work on the project.

- EEO Forms 26 - 29 by subcontractors.

This form is submitted by all suppliers, lessors, or professional services providers before they begin work on the project:

- EEO Form 30

POSTING

The following poster should be clearly displayed on each job site, or in case of annual service agreements, in the Contractor's office:

Equal Employment Opportunity is the Law Poster

JOB SITE VISITS

Site visits will be made by a Contract Compliance Officer who will make their presence known to the Project Manager, Supervisor, or Foreman, and will conduct interviews with employees on site.

PAYMENT AND EVALUATION

Upon completion of the Project, as part of the contract-awarding department's total clearance process, the Office of Business Opportunity's Contract Compliance Section must certify to the department that all EEO compliance requirements have been met.

CERTIFICATION BY BIDDER REGARDING
EQUAL EMPLOYMENT OPPORTUNITY

GENERAL

In accordance with Executive Order 11246 (30 F.R. 12319-25), the implementing rules and regulations thereof, and orders of the Secretary of Labor, a certification regarding Equal Opportunity is required of bidders or prospective contractors and their proposed subcontractors prior to the award of contracts or subcontracts.

CERTIFICATION OF BIDDER

Bidder's Name: _____

Address: _____

Telephone Number: _____ Fax : _____

Name of the company's EEO Officer: _____

E-mail Address: _____

Web Page/URL Address: _____

IRS Employer Identification Number: _____

Work to be performed: _____

Project No: _____

1. Participation in a previous contract or subcontract.

   a. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause. ☐ YES ☐ NO

   b. Compliance reports were required to be filed in connection with such contract or subcontract. ☐ YES ☐ NO

   c. Bidder has filed all compliance reports required by Executive Orders 10925, 11114, 11246, or by regulations of the Equal Employment Opportunity Commission issued pursuant to Title VII of the Civil Rights Act of 1964. ☐ YES ☐ NO

   d. If answer of Item c. is "No", please explain in detail on reverse side of this certification.

2. Dollar amount of bid:$ _____

3. Anticipated performance period in days: _____

4. Expected total number of employees to perform the proposed construction: _____

5. Nonsegregated facilities.

   a. Notice to prospective federally-assisted construction contractors

      (1) A Certification of Nonsegregated Facilities, as required by the May 9, 1967, Order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted to the recipient prior to the award of a federally-assisted construction contract exceeding $50,000 which is not exempt from the provisions of the Equal Opportunity Clause.

      (2) Contractors receiving federally-assisted construction contract awards exceeding $50,000 which are not exempt from the provisions of the Equal Opportunity Clause will be required to provide the forwarding of the following notice to prospective subcontractors for supplies and construction contracts where the subcontracts exceed $50,000 and are not exempt from the provisions of the Equal Opportunity Clause.

      The federally-assisted construction Contractor certifies that he/she does not maintain or provide any segregated facilities at any of his/her establishments, and does not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The federally-assisted construction Contractor certifies further that he/she will not maintain or provide segregated facilities at any of his/her establishments, and will not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The federally-assisted construction Contractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this Contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin because of habit, local custom, or otherwise. The federally-assisted construction Contractor agrees that (except where he/she has obtained identical certifications from proposed Subcontractors for specific time periods) he/she will obtain identical certifications in duplicate from proposed Subcontractors prior to the award of subcontracts exceeding $50,000 which are not exempt from the provisions of the Equal Opportunity Clause, and that he/she will retain the duplicate of such certifications in his/her files. The Subcontractor will include the original in his/her bid package.

6. Race or ethnic group designation of bidder. Enter race or ethnic group in appropriate box:

☐ White ☐ Black ☐ Hispanic

☐ Pacific Islander, Asian ☐ American Indian, Aleut.

7. Gender of Owner ☐ Male ☐ Female

REMARKS: _____

Certification - The information above is true and complete to the best of my knowledge and belief.

_____
Company Officer (Please Type)

_____ _____
Signature Date

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

CITY OF HOUSTON

Company Wide EEO Report

OBO-01-13-001
Office of Business Opportunity
04/13

1. Check One	2. Name and Address	3. FEID No.
__Prime ___Subcontractor		
4. County		5. TX CSJ DOT Project No. (if Applicable)

6. Contractor's Beginning Work Date on Project	7.City Of Houston Contract No.	8. This Report is based on Pay Period ending MM/DD/YYYY

9. TEXAS CONSTRUCTION EMPLOYMENT

TABLE A **TABLE B**

JOB CATEGORIES	TOTAL EMPLOYEES		TOTAL MINORITIES		WHITE (Not of Hispanic Origin)		BLACK (Not of Hispanic Origin)		HISPANIC		AMERICAN INDIAN or ALASKAN NATIVE		ASIAN		NATIVE HAWAIIAN OR OTHER PACIFISL		TWO OR MORE RACES		*On-The-Job Trainees (OJT)*	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
OFFICIALS (MANAGERS)	0	0	0	0																
SUPERVISORS	0	0	0	0																
FOREMEN/WOMEN	0	0	0	0																
ADMIN SUPPORT	0	0	0	0																
EQUIPMENT OPERATORS	0	0	0	0																
MECHANICS	0	0	0	0																
TRUCK DRIVERS	0	0	0	0																
IRONWORKERS	0	0	0	0																
CARPENTERS	0	0	0	0																
CEMENT MASONS	0	0	0	0																
ELECTRICIANS	0	0	0	0																
PIPEFITTERS, PLUMBERS	0	0	0	0																
PAINTERS	0	0	0	0																
LABORERS, SEMI-SKILLED	0	0	0	0																
LABORERS, UNSKILLED	0	0	0	0																
TOTALS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

TABLE C

																		OJT TOTALS M	OJT TOTALS F
On-The-Job Trainee																		0	0

10.IF ANY EMPLOYEES REPORTED IN 'TABLE A' ARE APPRENTICES, NAME OF THE PROGRAM, JOB CATEGORY, COUNT, RACE & SEX.

11. SUMMARIZE ALL HIRES FOR THE ENTIRE ACTIVE MONTH BY JOB CATEGORY, RACE, SEX (USE ADDITIONAL SHEET IF NEEDED).

	PRINTED NAME-FIRST/LAST	EMAIL ADDRESS	PHONE	SIGNATURE	DATE
12. PREPARER					
13. REVIEWER					

EQUAL EMPLOYMENT OPPORTUNITY COMPLIANCE PROGRAM FOR

_____

Name of Company

The Company's Office of Business Opportunity Program shall consist of documented good faith efforts to comply with the goals, timetables, and objectives set forth in the following Affirmative Action steps:

A. City of Houston's Specific Equal Employment Opportunity Policy and Clause as contained in City Council Ordinance No. 78-1538, passed August 9, 1978.

B. Notice of Requirement for Office of Business Opportunity to ensure Equal Employment Opportunity (Executive Order 11246).

C. Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246).

Project: _____

_____
Company Officer (Please Type)

_____ _____
Signature Date

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

SPECIAL PROVISIONS
SPECIFIC EQUAL EMPLOYMENT OPPORTUNITY POLICY

1. GENERAL

a. Equal employment opportunity requirements not to discriminate and to take affirmative action to assure equal employment opportunity are required by Executive Order 11246, as amended. The requirements set forth in these Special Provisions shall constitute the specific affirmative action requirements for Project activities under this Contract and shall supplement the notice of requirement for affirmative action to ensure equal employment opportunity and standard federal equal employment opportunity construction contract specifications.

b. The Contractor shall work with the City and the Federal Government in carrying out equal employment opportunity obligations and in their review of his/her activities under the Contract.

c. The prime Contractor and all Subcontractors holding subcontracts of $50,000 or more shall comply with the following minimum specific requirement activities of equal employment opportunity. The Contractor shall include these requirements in every subcontract of $50,000 or more with such modification of language as is necessary to make them binding on the Subcontractor.

2. EQUAL EMPLOYMENT OPPORTUNITY POLICY

The Contractor shall accept as his/her operating policy the following statement which is designed to further the provision of equal employment opportunity to all persons without regard to their race, age, color, religion, sex, or national origin, and to promote the full realization of equal employment opportunity through a positive continuing program:

> It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, color, sex, or national origin. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

3. EQUAL EMPLOYMENT OPPORTUNITY OFFICER

The Contractor shall designate and make known to the City contracting officers an equal employment opportunity officer (hereinafter referred to as the EEO Officer) who must be capable of effectively administering and promoting an active Contractor program of equal employment opportunity and who must be assigned adequate authority and responsibilities to do so.

4. DISSEMINATION OF POLICY

a. All members of the Contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement the Contractor's equal employment opportunity policy and contractual responsibilities to provide equal employment opportunity in each grade and classification of employment. To ensure that the above agreement will be met, the following actions shall be taken as a minimum:

(1) Periodic meetings of supervisory and personnel office employees shall be conducted before the start of work and then not less often than once every six months, at which time the Contractor's equal employment opportunity policy and its implementation will be reviewed and explained. The meetings shall be conducted by the EEO Officer or other knowledgeable company official.

(2) All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, or other knowledgeable company official, covering all major aspects of the Contractor's equal employment opportunity obligations, within 30 days following their reporting for duty with the Contractor.

(3) The EEO Officer or appropriate company official shall instruct all employees engaged in the direct recruitment of employees for the Project relative to the methods followed by the Contractor in locating and hiring minorities and females.

b. In order to make the Contractor's equal employment opportunity policy known to all employees, prospective employees, and potential sources of employees, i.e., schools, employment agencies, labor unions (where appropriate), college placement officers, etc., the Contractor shall take the following actions:

(1) Notices and posters setting forth the Contractor's equal employment opportunity policy shall be placed in areas readily accessible to employees, applicants for employment, and potential employees.

(2) The Contractor's equal employment opportunity policy and the procedures to implement such policy shall be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

5. RECRUITMENT

a. When advertising for employees, the Contractor shall include in all advertisements for employees the notation "An Equal Opportunity Employer". All such advertisements will be published in newspapers, or other publications, having a large circulation among minority groups in the area from which the Project work force would normally be derived.

b. The Contractor shall, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee-referral sources likely to yield qualified minority-group applicants, including, but not limited to, State employment agencies, schools, colleges, minority-group organizations, and female recruitment agencies. To meet this requirement, the Contractor shall, through his/her EEO Officer, identify sources of potential minority and female employees, and establish with such identified sources procedures whereby such group applicants may be referred to the Contractor for employment consideration.
In the event the Contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he/she is expected to observe the provisions of that agreement to the extent that the system permits the Contractor's compliance with equal employment opportunity Contract provisions. (The U. S. Department of Labor has held that where implementation of such agreements has the effect of discriminating against minorities or women, or obligates the Contractor to do the same, such implementation violates Executive Order 11246 as amended).

c. The Contractor shall encourage his/her present employees to refer female or minority-group applicants for employment by posting appropriate notices or bulletins in areas accessible to all such employees. In addition, information and procedures with regard to referring such applicants will be discussed with employees.

6. PERSONNEL ACTIONS

a. Wage, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff and termination, shall be taken without regard to race, color, religion, sex, national origin, or age. The following procedures shall be followed:

(1) The Contractor shall conduct periodic inspections of Project sites to ensure that working conditions and employee facilities do not indicate discriminatory treatment of Project-site personnel.

(2) The Contractor shall periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

(3) The Contractor shall periodically review selected personnel actions in depth to determine whether there is evidence of discrimination.

Where evidence is found, the Contractor shall promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

(4) The Contractor shall promptly investigate all complaints of alleged discrimination made in connection with his/her obligations under this Contract, shall attempt to resolve such complaints, and shall take appropriate corrective action. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the Contractor shall inform every complainant of all avenues of appeal.

7. TRAINING AND PROMOTION

a. The Contractor shall assist in locating, qualifying, and increasing the skills of minority-group and women employees and applicants for employment.

b. Consistent with the Contractor's work force requirements and as permissible under Federal and State regulations, the Contractor shall make full use of training programs, i.e., apprenticeship and on-the-job training programs, for the geographical area of Contract performance.

c. The Contractor shall advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The Contractor shall periodically review the training and promotion potential of minority-group and women employees and shall encourage eligible employees to apply for such training and promotion.

8. UNIONS

If the Contractor relies in whole or in part upon unions as a source of employees, he/she shall use his/her best efforts to obtain the cooperation of such unions to increase minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the Contractor, either directly or through a contractor's association acting as his/her agent, will include the procedures set forth below:

a. The Contractor shall use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority-group members and women for membership in the unions and increasing the skills of minority-group employees and women so that they may qualify for higher-paying employment.

b. The Contractor shall use best efforts to incorporate an equal employment opportunity clause into all union agreements to the end that such unions will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, or age.

c. The Contractor is to obtain information as to the referral practices and policies of the labor union, except that to the extent such information is within the exclusive possession of the labor union, and such labor union refuses to furnish such information to the Contractor, the Contractor shall

so certify to the City and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the Contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the Contractor shall, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, age, sex, or national origin, making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The U. S. Department of Labor has held that it shall be no excuse that the union with which the Contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) In the event the union referral practice prevents the Contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such Contractor shall immediately notify the City.

9. SUBCONTRACTING

a. The Contractor shall use his/her best efforts to solicit bids from and to utilize minority-group and female subcontractors or subcontractors with meaningful minority-group and/or female representation among their employees.

b. The Contractor shall use his/her best efforts to assure Subcontractors' compliance with their equal employment opportunity obligations.

10. RECORDS AND REPORTS

a. The Contractor shall keep such records as are necessary to determine compliance with the Contractor's equal employment opportunity obligations. The records kept by the Contractor will be designed to indicate:

(1) The number of minority and non-minority group members and women employed in each work classification on the Project.

(2) The progress and efforts being made in cooperation with unions to increase employment opportunities for minorities and women (applicable only to contractors who rely in whole or in part on unions as a source of their work force).

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees.

(4) The progress and efforts being made in securing the services of female and minority subcontractors.

b. All records, including payrolls, must be retained for a period of three years following completion of the Contract work and shall be available at

reasonable times and places for inspection by authorized representatives of the City and/or the appropriate federal agency.

CITY OF HOUSTON, TEXAS

EQUAL EMPLOYMENT OPPORTUNITY CLAUSE

Pursuant to City Council Ordinance No. 78-1538, passed August 9, 1978, all contracts entered into by the City of Houston involving the expenditure of $50,000 or more, shall incorporate the following Equal Employment Opportunity Clause:

1. The Contractor, Subcontractor, vendor, Supplier, or lessee shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, or age. The Contractor, Subcontractor, vendor, Supplier, or lessee shall take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, sex, national origin, or age. Such action will include, but not be limited to, the following: employment; upgrading; demotion or transfer; recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor, Subcontractor, vendor, Supplier, or lessee agrees to post in conspicuous places available to employees, and applicants for employment, notices to be provided by the City setting forth the provisions of this Equal Employment Opportunity Clause.

2. The Contractor, Subcontractor, vendor, Supplier, or lessee states that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin, or age.

3. The Contractor, Subcontractor, vendor, Supplier, or lessee shall send to each labor union or representatives of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided by the agency contracting officer advising the said labor union or workers' representative of the Contractor's and Subcontractor's commitments under Section 202 of Executive Order No. 11246, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

4. The Contractor, Subcontractor, vendor, Supplier, or lessee will comply with all provisions of Executive Order No. 11246 and the rules, regulations, and relevant orders of the Secretary of Labor or other Federal Agency responsible for enforcement of the equal opportunity and affirmative action provisions applicable, and shall likewise furnish all information and reports required by the Mayor and/or Contractor Compliance Officers for purposes of investigation to ascertain and effect compliance with this program.

5. The Contractor, Subcontractor, vendor, Supplier, or lessee shall furnish all information and reports required by Executive Order No. 11246, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant

thereto, and shall permit access to all books, records, and accounts by the appropriate City and Federal officials for purposes of investigation to ascertain compliance with such rules, regulations, and orders. Compliance reports filed at such times as directed shall contain information as to the employment practice policies, program, and work force statistics of the Contractor, Subcontractor, vendor, Supplier, or lessee.

6. In the event of a Contractor's, Subcontractor's, vendor's, Supplier's, or lessee's non-compliance with the non-discrimination clause of this Contract or with any of such rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part, and the Contractor, Subcontractor, vendor, Supplier, or lessee may be declared ineligible for further City contracts in accordance with procedures provided in Executive Order No. 11246, and such other sanctions may be imposed and remedies invoked as provided in said Executive Order, or by rule, regulation, or order of the Secretary of Labor, or as may otherwise be provided by law.

7. The Contractor shall include the provisions of paragraphs 1 through 8 of this Equal Employment Opportunity Clause in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965 so that such provisions will be binding upon each Subcontractor or vendor. The Contractor shall take such action with respect to any subcontractor or purchase order as the contracting agency may direct as a means of enforcing such provisions, including sanctions for noncompliance; provided, however, that in the event the Contractor becomes involved in, or is threatened with litigation with a Subcontractor or vendor as a result of such direction by the contracting agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

8. The Contractor shall file and shall cause each of his Subcontractors, if any, to file compliance reports with the City in the form and to the extent as may be prescribed by the Office of Business Opportunity. Compliance reports filed at such times as directed shall contain information as to the practices, policies, programs, employment policies, and employment statistics of the Contractor and each Subcontractor.

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION
TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY
(EXECUTIVE ORDER 11246)

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

Timetables	Goals for Minority Participation for Each Trade (Refer to Document 00800)	Goals for Female Participation for Each Trade (Refer to Document 00800)

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally-assisted) performed in the covered area.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals established for the geographical area where the Contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the Contract, the Executive Order, and regulations in 41 CFR part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $50,000 at any tier for construction work under the Contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the Subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the Contract is to be performed.

4. As used in this Notice, and in the Contract resulting from this solicitation, the "covered area" is The Houston, Texas Standard Metropolitan Statistical Area.

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
CONSTRUCTION CONTRACT SPECIFICATIONS
(EXECUTIVE ORDER 11246)

1. As used in these specifications:

   a. "Covered area" means the geographical area described in the solicitation from which this Contract resulted;

   b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;

   c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U. S. Treasury Department Form 941.

   d. "Minority" includes:

      (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

      (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin regardless of race);

      (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

      (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $50,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this Contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U. S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of

any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in Paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this Contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement to refer either minorities or women, shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U. S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

   a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which Contractor's employees are assigned to work. The Contractor, where possible, shall assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

   b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions

have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source, or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy: by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decisions, including specific review of these items with on-site supervisory personnel such as superintendents, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the

Contractor's EEO policy with other contractors and subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer, and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare, through appropriate training, etc., for such opportunities.

m. Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor union, contractor-community, or other similar group of which the Contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of

these Specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female work force participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is under-utilized).

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination, and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in Paragraph 7 of these Specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.B.

14. The Contractor shall designate a responsible official to monitor all employment-related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government, and to keep records. Records shall at least include for each employee the name, address, telephone number, construction trade, union affiliation, if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer),

dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily-understandable and retrievable form; however to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

DESCRIPTION OF JOB CATEGORIES

Officials, Managers, and Administrators

Occupations requiring administrative personnel who set board policies, exercise overall responsibility for the execution of these policies, or provide specialized consultation on a regional, district, area basis, or direct individual departments or special phases of a firm's operations.

Includes: Officials, executives, middle management, plant managers, department managers, superintendents, salaried foremen who are members of management, purchasing agents, buyers, bureau chiefs, directors, deputy directors, wardens, examiners, sheriffs, police and fire chiefs, and kindred workers.

Professionals

Occupations which require specialized and theoretical knowledge which is usually acquired through college or experience of such kind and amount as to provide a comparable background.

Includes: Accountants, auditors, airplane pilots and navigators, architects, artists, chemists, designers, dieticians, editors, engineers, lawyers, librarians, mathematicians, natural scientists, registered professional nurses, personnel and labor relations workers, physical scientists, teachers, social workers, doctors, psychologists, economists, systems analysts, employment and vocational rehabilitation counselors, instructors, police and fire captains and lieutenants, and kindred workers.

Paraprofessionals

Occupations in which workers perform some of the duties of a professional or technician in a supportive role, which usually requires less formal training and/or experience normally required for professional or technical status. Such positions may fall within an identified pattern of a "New Careers" concept.

Includes: Library assistants, medical aides, child support workers, police auxiliary, welfare service aides, recreation assistants, homemakers aides, home health aides, and kindred workers.

Technicians

Occupations requiring a combination of basic scientific knowledge and manual skill which can be obtained through about two (2) years of post high school education, such as is offered in many technical institutes and junior colleges, or through equivalent on-the-job training.

Includes: Computer programmers and operators, draftsmen, engineering aides, junior engineers, mathematical aides, licensed practical or vocational nurses,

photographers, radio operators, scientific assistants, surveyors, technical illustrators, technicians (medical, dental, electronics, physical sciences), police and fire sergeants, and kindred workers.

Protective Service Workers

Occupations in which workers are entrusted with public safety, security, and protection from destructive forces.

Includes: Police patrol officers, fire fighters, guards, deputy sheriffs, bailiffs, correctional officers, detectives, marshals, harbor patrol officers, and kindred workers.

Sales Workers

Occupations engaging wholly or primarily in direct selling.

Includes: Advertising agents and salespersons, insurance agents and brokers, real estate agents and brokers, stock and bond salespersons, demonstrators, salespersons and sales clerks, grocery clerks, cashiers, and kindred workers.

Office and Clerical

Occupations in which workers are responsible for internal and external communications, recording and retrieval of data and/or information and other paper work required in an office predominantly non-manual, though some manual work not directly involved with altering or transporting the products is included.

Includes: Bookkeepers, cashiers, collectors (bills and accounts), messengers and office helpers, office machine operators, shipping and receiving clerks, stenographers, typists and secretaries, telegraph and telephone operators, court transcribers, hearing reporters, statistical clerks, dispatchers, license distributors, payroll clerks, and kindred workers.

Skilled Craft Workers

Occupations in which workers perform jobs which require special manual skill through on-the-job training and experience, or through apprenticeship or other formal training programs. These workers exercise considerable independent judgment and usually receive an extensive period of training.

Includes: The building trades, hourly paid foremen and leadmen who are not members of management, mechanics and repairmen, skilled machining occupations, compositors and typesetters, electricians, engravers, job setters (metal), motion picture projectionists, pattern and model makers, stationary engineers, tailors, heavy equipment operators, carpenters, and kindred workers.

Operatives (semi-skilled)

Workers who operate machine or processing equipment or perform other factory-type duties of intermediate skill level which can be mastered in a few weeks and require only limited training.

Includes: Apprentices (auto mechanics), plumbers, bricklayers, carpenters, electricians, mechanics, building trades, metal workers, machinists, printing trades, operatives, attendants (auto service and parking), blasters, chauffeurs, deliverymen, dressmakers and seamstresses (except factory), dryers, furnacemen, heaters (metal), laundry and dry cleaning operatives, milliners, miners, motormen, oilers, greasers, etc. (except auto), painters (except construction and maintenance), photographic process workers, stationary firemen, truck and tractor drivers, weavers (textile), welders and flame cutters, and kindred workers.

Laborers (unskilled)

Workers in manual occupations which generally require no special training. These workers perform elementary duties that may be learned in a few days and require the application of little or no independent judgment.

Includes: Garage workers, car washers and greasers, gardeners (except farm) and groundskeepers, longshoremen and stevedores, lumbermen, craftsmen, and wood choppers, laborers performing lifting, digging, mixing, loading, and pulling operations, and kindred workers.

Service/Maintenance Workers

Occupations in which workers perform duties which result in or contribute to the comfort, convenience, hygiene, or safety for the general public, or which contribute to the upkeep and care of buildings, facilities or grounds, or public property. Workers in this group may operate machinery.

Includes: Chauffeurs, laundry and dry cleaning operatives, truck drivers, trash collectors, custodial personnel, gardeners and groundskeepers, construction laborers, attendants (hospital and other institutions), professional and personal service, counter and fountain workers, elevator operators, firemen and fire protection, guards, watchmen and doorkeepers, stewards, porters, waiters, and kindred workers.

CERTIFICATION BY PROPOSED SUBCONTRACTOR REGARDING EQUAL EMPLOYMENT OPPORTUNITY

Name of Prime Contractor | Project WBS & OA Number

Address

GENERAL

In accordance with Executive Order 11246 (30 F.R. 12319-25), the implementing rules and regulations thereof, and orders of the Secretary of Labor, a certification regarding Equal Opportunity is required of bidders or prospective contractors and their proposed subcontractors prior to the award of contracts or subcontracts.

SUBCONTRACTOR'S CERTIFICATION

Subcontractor's Name: _____

Address: _____

E-Mail Address: _____

IRS Employer Identification Number: _____

Job Description: _____
(Work performed by your company for this project)

1. Participation in a previous contract or subcontract.

   a. Subcontractor has participated in a previous contract or subcontract subject to the Equal Opportunity Clause. ____YES_____NO

   b. Compliance reports were required to be filed in connection with such contract or subcontract. ____YES_____NO

   c. Subcontractor has filed all compliance reports required by Executive Orders 10925, 11114, 11246, or by regulations of the Equal Employment Opportunity Commission issued pursuant to Title VII of the Civil Rights Act of 1964. _YES NO

   d. If answer of Item c. is "No", please explain in detail on reverse side of this certification.

2. Dollar amount of proposed subcontract: $ _____

3. Anticipated performance period in days: _____

4. Expected total number of employees to perform the proposed subcontract: _____

5. Nonsegregated facilities.

   a. Notice to prospective federally-assisted construction contractors
      (1) A Certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted to the Contractor prior to the award of a subcontract exceeding $50,000 which is not exempt from the provisions of the Equal Opportunity Clause.
      (2) Contractors receiving subcontract awards exceeding $50,000 which are not exempt from the provisions of the Equal Opportunity Clause will be required to provide for the forwarding of this notice to prospective subcontractors for supplies and construction contracts where the subcontracts exceed $50,000 and are not exempt from the provisions of the Equal Opportunity clause.

   b. Certification of non-segregated facilities

      The federally-assisted construction contractor certified that he/she does not maintain or provide any segregated facilities at any of his/her establishments, and does not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The federally-assisted construction Contractor certifies further that he/she will not maintain or provide any segregated facilities at any of his/her establishments, and will not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The federally-assisted construction Contractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this Contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants, and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin because of habit, local custom, or otherwise. The federally-assisted construction Contractor agrees that (except where he/she has obtained identical certifications from proposed Subcontractors for specific time periods) he/she will obtain identical certifications in duplicate from proposed Subcontractors prior to the award of subcontracts exceeding $50,000 which are not exempt from the provisions of the Equal Opportunity Clause, and that he/she will retain the duplicate of such certifications in his/her files. The Contractor will include the original in his/her Bid Package.

6. Race or ethnic group designation of bidder. Enter race or ethnic group in

appropriate box:

☐ White ☐ Black ☐ Hispanic

☐ Pacific Islander, Asian ☐ American Indian, Aleut.

7. Gender

☐ Male ☐ Female

REMARKS:

Certification - The information above is true and complete to the best of my knowledge and belief.

_____

Company Officer (Please Type)

_____ _____

Signature Date

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

CITY OF HOUSTON

Company Wide EEO Report

OBO-01-13-001
Office of Business Opportunity
04/13

1. Check One	2. Name and Address	3. FEID No.
__Prime ___Subcontractor		
4. County		5. TX CSJ DOT Project No. (if Applicable)

6. Contractor's Beginning Work Date on Project	7.City Of Houston Contract No.	8. This Report is based on Pay Period ending MM/DD/YYYY

9. TEXAS CONSTRUCTION EMPLOYMENT

TABLE A

JOB CATEGORIES	TOTAL EMPLOYEES		TOTAL MINORITIES		WHITE (Not of Hispanic Origin)		BLACK (Not of Hispanic Origin)		HISPANIC		AMERICAN INDIAN or ALASKAN NATIVE		ASIAN		NATIVE HAWAIIAN OR OTHER PACIFISL		TWO OR MORE RACES		**TABLE B** *On-The-Job Trainees (OJT)*	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
OFFICIALS (MANAGERS)	0	0	0	0																
SUPERVISORS	0	0	0	0																
FOREMEN/WOMEN	0	0	0	0																
ADMIN SUPPORT	0	0	0	0																
EQUIPMENT OPERATORS	0	0	0	0																
MECHANICS	0	0	0	0																
TRUCK DRIVERS	0	0	0	0																
IRONWORKERS	0	0	0	0																
CARPENTERS	0	0	0	0																
CEMENT MASONS	0	0	0	0																
ELECTRICIANS	0	0	0	0																
PIPEFITTERS, PLUMBERS	0	0	0	0																
PAINTERS	0	0	0	0																
LABORERS, SEMI-SKILLED	0	0	0	0																
LABORERS, UNSKILLED	0	0	0	0																
TOTALS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

TABLE C

																		OJT TOTALS M	OJT TOTALS F
On-The-Job Trainee																		0	0

10.IF ANY EMPLOYEES REPORTED IN 'TABLE A' ARE APPRENTICES, NAME OF THE PROGRAM, JOB CATEGORY, COUNT, RACE & SEX.

11. SUMMARIZE ALL HIRES FOR THE ENTIRE ACTIVE MONTH BY JOB CATEGORY, RACE, SEX (USE ADDITIONAL SHEET IF NEEDED).

	PRINTED NAME-FIRST/LAST	EMAIL ADDRESS	PHONE	SIGNATURE	DATE
12. PREPARER					
13. REVIEWER					

CERTIFICATION BY PROPOSED MATERIAL SUPPLIERS,
LESSORS, AND PROFESSIONAL SERVICE PROVIDERS
REGARDING EQUAL EMPLOYMENT OPPORTUNITY

Company Name:_____ $_____
(Supplier, Lessor, Professional Service Provider) (Amount of Contract)

Company Address: _____

Company Telephone Number:_____ Fax:_____

E-mail Address: _____

Web Page/URL Address:_____

Company Tax Identification Number: _____

Project Name & No.:_____

Materials/Services Provided: _____

In accordance with Chapter 15 of the City of Houston's Code of Ordinances, Supplier/Lessor/Professional Service Provider represents to be an equal opportunity employer and agrees to abide by the terms of the Ordinance. This certification is required of all Suppliers/Lessors/Professional Service Providers providing goods or service to this project with agreements $50,000 or more.

[ ] Yes [ ] No Supplier agrees not to discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, or age.

[ ] Yes [ ] No Supplier agrees that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin, or age.

[ ] Yes [ ] No Supplier will comply with all provisions of **Executive Order No. 11246** and rules, regulations and applicable orders of the Department of Labor or other Federal Agency responsible for enforcement of applicable equal opportunity and affirmative action provisions and will likewise furnish all information and reports required by the Mayor or Contract Compliance Officers for the purpose of investigation to ascertain and effect compliance with the City of Houston's Office of Business of Opportunity.

[ ] Yes [ ] No The Supplier shall file and cause their sub-tier contractors to file compliance reports with the City in the form and to the extent as may be prescribed by the Mayor or Contract Compliance Officers. Compliance reports filed at such times as directed shall contain information including, but not limited to, the practices, policies, programs, and employment policies.

I hereby certify that the above information is true and correct.

_____ _____
COMPANY OFFICER (Signature) DATE

_____
NAME AND TITLE (Print or type)

END OF DOCUMENT

Document 00821

WAGE SCALE AND PAYROLL REQUIREMENTS FOR BUILDING CONSTRUCTION

Wage Scale Requirements

1.1 Contractor and its Subcontractors must pay the general prevailing wage rates for building construction for each craft or type of worker or mechanic employed in the execution of any building construction or repair under the Contract in accordance with Chapter 2258 of the Texas Government Code and City of Houston, Texas Ordinance Nos. 85-2070, 2000-1114, 2001-152, 2006-91 and 2006-168, and 2009- 247 all as amended from time to time. City Council has determined the prevailing wage rate in the locality in which the work is being performed, which is set forth in Exhibit "A".

1.2 This prevailing wage rate does not prohibit the payment of more than the rates stated.

1.3 In bidding, Contractor warrants and represents that it has carefully examined the classifications for each craft or type of worker needed to execute the Contract and determined that such classifications in Exhibit "A" include all necessary categories to perform the work under the Contract.

1.4 The wage scale for building construction is to be applied to work on a building including an area within 5 feet of the exterior wall.

1.5 If Contractor believes that an additional classification for a craft or type of worker is necessary to perform work under the Contract, it must submit with its bid a request to the Contract Compliance Division of the Office of Business Opportunity ("OBO") to use an additional labor classification not listed in Exhibit "A" and specify the proposed new classification. OBO shall determine whether a proposed classification is already covered in Exhibit "A", and, if it is, specify which classification is appropriate. OBO's decision is conclusive. If OBO decides that a new classification is necessary, it will determine the appropriate prevailing wage rate for any resurveyed, amended, new, or additional craft or type of worker not covered by Exhibit "A". Such determination must be decided in accordance with procedures established by OBO, and in compliance with Chapter 2258 of the Texas Government Code and City of Houston, Texas Ordinance Nos. 85-2070, 2000-1114, 2001-152, 2006-91, 2006-168, and 2009-247 subject to City Council approval.

1.6 Contractor must not use any labor classification not covered by Exhibit "A" until such classification is established and approved for use by OBO.

1.7 A Contractor or Subcontractor who violates Chapter 2258 of the Texas Government Code must pay to the City, $60 per each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates set forth in Exhibit "A".

1.8 The City may withhold money required to be withheld under Chapter 2258 of the Texas Government Code from the final payment to Contractor or earlier payments if City Council makes a determination that there is good cause to believe that Contractor has not complied with these provisions and Chapter 2258 of the Government Code, in which case the City may

withhold the money at any time subsequent to the finding by City Council.

1.9 Contractor and Subcontractors must keep records specifying:

(1) the name and classification of each worker employed under the Contract; and

(2) the actual per diem wages paid to each worker, and the applicable hourly rate.

The records must be open at all reasonable hours for inspection by the officers and agents of the City.

1.10 The hourly cost of salary for non-exempt workers for labor in excess of 40 hours per worker per week, shall be calculated at 1.5 times the worker's base pay, plus 1.0 times fringe benefits, for the applicable craft and level.

Certified Payroll Requirements

2.1 Employees are paid weekly, and payrolls are submitted weekly using the City of Houston's electronic payroll submission module, unless the prime Contractor has been instructed to do otherwise by the Office of Business Opportunity. When no work is done after a Contractor has started work, the Contractor is required to submit a weekly compliance statement indicating no work was performed. The payrolls must reflect the exact work and classification of the workers, the exact amount that they were paid. Workers must be paid the contracted amount (prevailing wage rates). The Contractor will be penalized $60.00 a day for each employee who is underpaid per Texas Government Code §2258-023 for all contracts.

2.2 Payrolls must be submitted electronically & indicate whether the worker worked inside or outside the building area when both wage rates are applicable to the project.

2.3 Payrolls must be submitted each week until all work by the contractor is complete and the electronic payroll submission is marked as final in the system.

2.4 Payrolls must cover a seven-day period from the start of the work week and must be consecutive seven-day periods until all work is complete.

2.5 Payrolls must have employees' names, addresses, last four digits of the social security numbers, and job classifications. The job classifications must be the same as the classifications on the prevailing wage rate schedule.

2.6 A payroll deduction authorization form must be submitted for each employee for any deductions other than Federal and FICA taxes and court ordered child support.

2.7 Employees must be paid overtime (time and a half) for all hours worked over 40 hours a week on both federally and City-funded contracts.

2.8 The Contractor has the responsibility to comply with all Internal Revenue Service rules and regulations. Contractors who submit certified payrolls with **Owner Operators (truckers)** must submit a signed tax liability statement from each Owner Operator acknowledging their responsibility for Federal Income Tax and FICA reporting obligations.

2.9 If the Contractor wants to use the apprentice wage rates for an employee, the apprenticeship

certificates must be submitted to the Office of Business Opportunity in advance of the employee working on the project and appearing on the payroll. Contractor must comply with posted number of journeymen to apprentices as listed on the wage rate.

2.10 A poster of the Prevailing Wage Rate Schedule should be clearly displayed on each job site from the time the project starts until the work is completed, or in case of annual service agreements, in the Contractor's office.

2.11 The Contractor shall submit the “Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees” (Exhibit “B”) to the Monitoring Authority listed in Document 00495 prior to final execution of the contract.

2.12 During the course of the work, Subcontractors shall submit the “Certificate from Subcontractor Appointing Officer or Employee to Supervise Payment of Employees” (Exhibit “C”) to the Monitoring Authority listed in Document 00495.

2.13 Upon completion of the Project, as part of the contract-awarding department's total clearance process, the Office of Business Opportunity’s Contract Compliance Section must review whether the Wage Rate and Payroll Requirements were met and report the results to the department.

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EXHIBIT "A"

CITY OF HOUSTON, TEXAS
LABOR CLASSIFICATIONS AND PREVAILING WAGE RATES FOR BUILDING CONSTRUCTION
2022

Worker Classification	Ratio	Base Rate	Fringe Benefit	Wage Total
Acoustical Ceiling Mechanic		$17.27	$3.98	$21.25
Asbestos Abatement Worker (ceilings, walls, floors only)	Ratio 1/3	$14.00	$0.00	$14.00
Asbestos Worker/ Heat & Frost Insulator (Duct, Pipe and Mechanical System Insulation) *	Ratio 1/1 – Apprentice	$24.28	$14.16	$38.44
Boilermaker *	Ratio 5/1 – Apprentice	$29.47	$24.10	$50.35
Bricklayer *	Ratio 1/3 – Mason Tender Brick	$18.87	$0.00	$18.87
Carpenter (excludes acoustical ceiling installation, drywall hanging, form work and metal stud installation work) *	Ratio 2/1 – Apprentice	$23.05	$8.78	$31.83
Caulker		$15.36	$0.00	$15.36
Cement Mason/Concrete Finisher *	Ratio 1/3 – Mason Tender Concrete	$13.93	$0.00	$13.93
Drywall Finisher/Taper *	Ratio 1/3 – Apprentice	$16.27	$3.66	$19.93
Drywall Hanger and Metal Stud Installer *	Ratio 1/3 – Apprentice	$17.44	$3.93	$21.37
Electrician (Excludes Low Voltage Wiring and Installation of Alarms)	Ratio 3/2 – Apprentice	$32.55	$10.35	$42.90
Electrician (Alarm Installation Only) *	Ratio 1/1 – Apprentice	$17.97	$3.37	$21.34
Electrician (Low Voltage Wiring Only) *		$18.00	$1.68	$19.68
Elevator Mechanic *, +, ++	Ratio 1/1 – Apprentice	$45.48	$36.365	$81.845
Floor Layer: Carpet		$20.00	$0.00	$20.00
Form worker *		$12.77	$0.00	$12.77
Glazier *	Ratio 1/3 – Apprentice	$23.27	$7.12	$30.39
Insulator – Batt *		$14.87	$0.73	$15.60
Ironworker, Ornamental		$25.14	$7.43	$32.57
Ironworker, Reinforcing *	Ratio 1/3 – Apprentice	$12.14	$0.00	$12.14
Ironworker, Structural *	Ratio 1/3 – Apprentice	$25.26	$7.13	$32.39
Laborer, Common or General		$11.76	$0.00	$11.76
Laborer, Landscape and Irrigation		$9.52	$0.00	$9.52
Laborer, Mason Tender - Brick		$13.47	$0.00	$13.47
Laborer, Mason Tender - Cement /Concrete		$10.48	$0.00	$10.48
Laborer, Pipelayer		$12.94	$0.00	$12.94
Laborer, Roof Tearoff		$11.28	$0.00	$11.28
Lather *	Ratio 1/3	$19.73	$0.00	$19.73
Operator, Backhoe / excavator / trackhoe		$13.94	$0.00	$13.94
Operator, Bobcat / skid steer / skid loader		$13.93	$0.00	$13.93
Operator, Bulldozer		$22.75	$0.00	$22.75
Operator, Drill		$16.22	$0.34	$16.56
Operator, Forklift		$16.00	$0.00	$16.00
Operator, Grader/blade		$13.37	$0.00	$13.37
Operator, Loader		$13.55	$0.94	$14.49
Operator, Mechanic		$17.52	$3.33	$20.85

Operator, Paver (asphalt, aggregate, and concrete)		$16.03	$0.00	$16.03
Operator, Roller		$16.00	$0.00	$16.00
Painter * (brush, roller, and spray) excludes drywall finishing/taping	Ratio 1/3 – Apprentice	$17.24	$4.41	$21.65
Pipe Fitter (including HVAC Pipe installation) *	Ratio 1/1 – Apprentice	$35.68	$12.46	$48.14
Plasterer	Ratio 1/3 – Plasterer Tenders	$26.04	$9.02	$35.06
Plumber *	Ratio 3/2 – Apprentice	$36.15	$11.88	$48.03
Power Equipment Operator, Crane		$34.85	$9.85	$44.70
Roofer *	Ratio 1/3 – Apprentice	$15.40	$0.00	$15.40
Sheet Metal Worker (excludes HVAC Unit Installation) *	Ratio 2/1 – Apprentice	$29.70	$13.85	$43.55
Sheet Metal Worker (HVAC Duct Installation only) *	Ratio 2/1 – Apprentice	$29.70	$13.85	$43.55
Sheet Metal Worker (HVAC Unit Installation only) *	Ratio 2/1 – Apprentice	$20.05	$2.24	$22.29
Sprinkler Fitter (Fire sprinklers) *	Ratio 1/1 – Apprentice	$31.68	$22.50	$54.18
Tile Finisher *	Ratio 1/3 – Apprentice	$12.00	$0.00	$12.00
Tile Setter *	Ratio 1/3 – Apprentice	$16.17	$0.00	$16.17
Truck Driver, 1/Single Axle Truck		$14.18	$0.00	$14.18
Truck Driver, Dump Truck		$12.39	$1.18	$13.57
Truck Driver, Flatbed Truck		$19.65	$8.57	$28.22
Truck Driver, Semi-Trailer Truck		$12.50	$0.00	$12.50
Truck Driver, Water Truck		$12.00	$4.11	$16.11
Waterproofer		$14.39	$0.00	$14.39
Welders - Receive rate prescribed for craft performing operation in which welding is incidental.				

* **Apprentices must be part of an approved Department of Labor apprenticeship program.**

[+] -- 6% under 5 years based on regular hourly rate for all hours worked. 8% over 5 years based on regular hourly rate for all hours worked.

[++] -- Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; Friday after Thanksgiving Day; Christmas Day; and Veterans Day.

Building Construction Prevailing Wages Classification Definitions

Asbestos Worker/Insulator * - Ratio 1Journeyman /1 Apprentice (1 Journeyman / 1 Apprentice)
(Including application of all insulating materials, protective coverings, coatings and finishing to all type of mechanical systems). Applies insulating material to exposed surfaces of structures, such as air ducts, hot and cold pipes, storage tanks, and cold storage rooms: Reads blueprints and selects required insulation material (in sheet, tubular, or roll form), such as fiberglass, foam rubber, styrofoam, cork, or urethane, based on material's heat retaining or excluding characteristics. Brushes adhesives on or attaches metal adhesive-backed pins to flat surfaces as necessary to facilitate application of insulation material. Measures and cuts insulation material to specified size and shape for covering flat or round surfaces, using tape measure, knife, or scissors. Fits, wraps, or attaches required insulation material around or to structure, following blueprint specifications. Covers or seals insulation with preformed plastic covers, canvas strips, sealant, or tape to secure insulation to structure, according to type of insulation used and structure covered, using staple gun, trowel, paintbrush, or caulking gun.

Asbestos Abatement Worker * (Ceilings, Floors, & Walls only)
Removes asbestos from ceilings, walls, beams, boilers, and other structures, following hazardous waste handling guidelines: Assembles scaffolding and seals off work area, using plastic sheeting and duct tape. Positions mobile decontamination unit or portable showers at entrance of work area. Builds connecting walkway between mobile unit or portable showers and work area, using hand tools, lumber, nails, plastic sheeting, and duct tape. Positions portable air evacuation and filtration system inside work area. Sprays chemical solution over asbestos covered surfaces, using tank with attached hose and nozzle, to soften asbestos. Cuts and scrapes asbestos from surfaces, using knife and scraper. Shovels asbestos into plastic disposal bags and seals bags, using duct tape. Cleans work area of loose asbestos, using vacuum, broom, and dustpan. Places asbestos in disposal bags and seals bags, using duct tape. Dismantles scaffolding and temporary walkway, using hand tools, and places plastic sheeting and disposal bags into transport bags. Seals bags, using duct tape, and loads bags into truck.

Boilermaker * - Ratio 5 Journeymen /1 Apprentice
Assembles, analyzes defects in, and repairs boilers, pressure vessels, tanks, and vats in field, following blueprints and using hand tools and portable power tools and equipment: Locates and marks reference points for columns or plates on foundation, using master straightedge, squares, transit, and measuring tape, and applying knowledge of geometry. Attaches rigging or signals crane operator to lift parts to specified position. Aligns structures or plate sections to assemble boiler frame, tanks, or vats, using plumb bobs, levels, wedges, dogs, or turnbuckles. Hammers, flame cuts, files, or grinds irregular edges of sections or structural parts to facilitate fitting edges together. Bolts or arc-welds structures and sections together. Positions drums and headers into supports and bolts or welds supports to frame. Aligns water tubes and connects and expands ends to drums and headers, using tube expander. Bells, beads with power hammer, or welds tube ends to ensure leak proof joints. Bolts or welds casing sections, uptakes, stacks, baffles, and such fabricated parts as chutes, air heaters, fan stands, feeding tube, catwalks, ladders, coal hoppers, and safety hatch to frame, using wrench. Installs manholes, hand holes, valves, gauges, and feed water connection in drums to complete assembly of water tube boilers. Assists in testing assembled vessels by pumping water or gas under specified pressure into vessel and observing instruments for evidence of leakage. Repairs boilers or tanks in field by unbolting or flame cutting defective sections or tubes, straightening plates, using torch or jacks, installing new tubes, fitting and welding new sections and replacing worn lugs on bolts. May rivet and caulk sections of vessels, using pneumatic riveting and caulking hammers.

Bricklayer * (See Mason Tender) - Ratio 1Journeyman /3 Mason Tender Brick
Lays building materials, such as brick, structural tile, and concrete cinder, glass, gypsum, and terra cotta block (except stone) to construct or repair walls, partitions, arches, sewers, and other structures: Measures distance from reference points and marks guidelines on working surface to lay out work. Spreads soft bed (layer) of mortar that serves as base and binder for block, using trowel. Applies mortar to end of block and positions block in mortar bed. Taps block with trowel to level, align, and embed in mortar, allowing specified thickness of joint. Removes excess mortar from face of block, using trowel. Finishes mortar between brick with pointing tool or trowel. Breaks bricks to fit spaces too small for whole brick, using edge of trowel or brick hammer. Determines vertical and horizontal alignment of courses, using plumb bob, gauge line (tightly stretched cord), and level. Fastens brick or terra cotta veneer to face of structures, with tie wires embedded in mortar between bricks, or in anchor holes in veneer brick. May weld metal parts to steel structural members. May apply plaster to walls and ceiling, using trowel, to complete repair work.

Carpenter * (Including Acoustical Ceiling Work) - Ratio 2 Journeymen /1 Apprentice
Constructs, erects, installs, and repairs structures and fixtures of wood, plywood, and wallboard, using carpenter's hand tools and power tools, and conforming to local building codes: Studies blueprints, sketches, or building plans for information pertaining to type of material required, such as lumber or fiberboard, and dimensions of structure or fixture to be fabricated. Selects specified type of lumber or other materials. Prepares layout, using rule, framing square, and calipers. Marks cutting and assembly lines on materials, using pencil, chalk, and marking gauge. Shapes materials to prescribed measurements, using saws, chisels, and planes. Assembles cut and shaped materials and fastens them together with nails, dowel pins, or glue. Verifies trueness of structure with plumb bob and carpenter's level. Erects framework for structures and lays subflooring. Builds stairs and lays out and installs partitions and cabinetwork. Covers sub floor with building paper to keep out moisture and lays hardwood, parquet, and wood-strip-block floors by nailing floors to sub floor or cementing them to mastic or asphalt base. Applies shock-absorbing, sound-deadening, and decorative paneling to ceilings and walls. Fits and installs prefabricated window frames, doors, doorframes, weather stripping, interior and exterior trim, and finish hardware, such as locks, letter drops, and kick plates. Constructs forms and chutes for pouring concrete. Erects scaffolding and ladders for assembling structures above ground level. May weld metal parts to steel structural members.

Cement Mason/Concrete Finisher *(Mason Tender Cement/Concrete) - Ratio 1 Journeyman /3 Mason Tender Cement
Finisher; concrete floater Smooths and finishes surfaces of poured concrete floors, walls, sidewalks, or curbs to specified textures, using hand tools or power tools, including floats, trowels, and screeds: Signals concrete deliverer to position truck to facilitate pouring concrete. Moves discharge chute of truck to direct concrete into forms. Spreads concrete into inaccessible sections of forms, using rake or shovel. Levels concrete to specified depth and workable consistency, using hand held screed and floats to bring water to surface and produce soft topping. Smooths, and shapes surfaces of freshly poured concrete, using straightedge and float or power screed. Finishes concrete surfaces, using power trowel, or wets and rubs concrete with abrasive stone to impart finish. Removes rough or defective spots from concrete surfaces, using power grinder or chisel and hammer, and patches holes with fresh concrete or epoxy compound. Molds expansion joints and edges, using edging tools, jointers, and straightedge. May sprinkle colored stone chips, powdered steel, or coloring powder on concrete to produce prescribed finish. May produce rough concrete surface, using broom. May mix cement, using hoe or concrete-mixing machine. May direct sub grade work, mixing of concrete, and setting of forms.

Drywall Finisher/Taper
Wallboard and plasterboard; sheetrock taper; taper and bedder; taper and floater. Seals joints

between plasterboard or other wallboards to prepare wall surface for painting or papering; Mixes sealing compound by hand or with portable electric mixer, and spreads compound over joints between boards, using trowel, broad knife, or spatula. Presses paper tape over joint to embed tape into compound and seal joint, or tapes joint, using mechanical applicator that spreads compound and embeds tape in one operation. Spreads and smooth's cementing material over tape, using trowel or floating machine to blend joint with wall surface. Sands rough spots after cement has dried. Fills cracks and holes in walls and ceiling with sealing compound. Installs metal molding at corners in lieu of sealant and tape. Usually works as member of crew. May apply texturing compound and primer to walls and ceiling preparatory to final finishing, using brushes, roller, or spray gun. May countersink nails or screws below surface of wall prior to applying sealing compound, using hammer or screwdriver.

Drywall Hanger
Dry-wall installer; gypsum dry-wall systems installer. Plans gypsum drywall installations, erects metal framing and furring channels for fastening drywall, and installs drywall to cover walls, ceilings, soffits, shafts, and movable partitions in residential, commercial, and industrial buildings: Reads blueprints and other specifications to determine method of installation, work procedures, and material, tool, and work aid requirements. Lays out reference lines and points for use in computing location and position of metal framing and furring channels and marks position for erecting metalwork, using chalk line. Measures, marks, and cuts metal runners, studs, and furring channels to specified size, using tape measure, straightedge and hand and portable power cutting tools. Secures metal framing to walls and furring channels to ceilings, using hand and portable power tools.
Measures and marks cutting lines on drywall, using square, tape measure, and marking devices. Scribes cutting lines on drywall, using straightedge and utility knife and breaks board along cut lines. Fits and fastens board into specified position on wall, using screws, hand tools, portable power tools, or adhesive. Cuts openings into board for electrical outlets, vents, or fixtures, using keyhole saw or other cutting tools. Measures, cuts, assembles, and installs metal framing and decorative trim for windows, doorways, and vents. Fits, aligns, and hangs doors and installs hardware, such as locks and kick plates (Includes Installing Metal Studs).

Electrician * Ratio 3 Journeymen /2 Apprentice
Plans layout, installs, and repairs wiring, electrical fixtures, apparatus, and control equipment: Plans new or modified installations to minimize waste of materials, provide access for future maintenance, and avoid unsightly, hazardous, and unreliable wiring, consistent with specifications and local electrical codes. Prepares sketches showing location of wiring and equipment, or follows diagrams or blueprints, ensuring that concealed wiring is installed before completion of future walls, ceilings, and flooring. Measures, cuts, bends, threads, assembles, and installs electrical conduit, using tools, such as hacksaw, pipe threader, and conduit bender. Pulls wiring through conduit. Splices wires by stripping insulation from terminal leads, using knife or pliers, twisting or soldering wires together, and applying tape or terminal caps. Connects wiring to lighting fixtures and power equipment, using hand tools. Installs control and distribution apparatus, such as switches, relays, and circuit-breaker panels, fastening in place with screws or bolts, using hand tools and power tools. Connects power cables to equipment, such as electric range or motor, and installs grounding leads. Tests continuity of circuit to ensure electrical compatibility and safety of components, using testing instruments, such as ohmmeter, battery and buzzer, and oscilloscope. Observes functioning of installed equipment or system to detect hazards and need for adjustments, relocation, or replacement (Including Pulling Wire and Low Voltage Wiring and Installation of Fire Alarms, Security Systems, Telephones, and Computers).

Elevator Mechanic * - Ratio 1 Journeyman /1 Apprentice
FOOTNOTES: a. - Employer contributes 8% of basic hourly rate for over 5 years' service and 6% of

basic hourly rate for 6 months to 5 years' service as Vacation Pay Credit. Paid Holidays: New Year's Day; Memorial Day; Independence Day Labor Day; Thanksgiving Day; Friday after Thanksgiving Day; Christmas Day.

Erector; elevator installer; elevator mechanic. Assembles and installs electric and hydraulic freight and passenger elevators, escalators, and dumbwaiters, determining layout and electrical connections from blueprints: Studies blueprints and lays out location of framework, counterbalance rails, motor pump, cylinder, and plunger foundations. Drills holes in concrete or structural steel members with portable electric drill. Secures anchor bolts or welds brackets to support rails and framework, and verifies alignment with plumb bob and level. Cuts prefabricated sections of framework, rails, and other elevator components to specified dimensions, using acetylene torch, power saw, and disk grinder. Installs cables, counterweights, pumps, motor foundations, escalator drives, guide rails, elevator cars, and control panels, using hand tools. Connects electrical wiring to control panels and electric motors. Installs safety and control devices. Positions electric motor and equipment on top of elevator shaft, using hoists and cable slings.

Formbuilder/Formsetter
Constructs built-in-place or prefabricated wooden forms, according to specifications, for molding concrete structures: Studies blueprints and diagrams to determine type and dimension of forms to be constructed. Saws lumber to blueprint dimensions, using handsaw or power saw, and nails lumber together to make form panels. Erects built-in-place forms or assembles and installs prefabricated forms on construction site according to blueprint specifications, using hand tools, plumb rule, and level. Inserts spreaders and tie rods between opposite faces of form to maintain specified dimensions. Anchors and braces forms to fixed objects, using nails, bolts, anchor rods, steel cables, planks, and timbers.

Glazier
Installs glass in windows, skylights, store fronts, and display cases, or on surfaces, such as building fronts, interior walls, ceilings, and tabletops: Marks outline or pattern on glass, and cuts glass, using glasscutter. Breaks off excess glass by hand or with notched tool. Fastens glass panes into wood sash with glazier's points, and spreads and smoothes putty around edge of panes with knife to seal joints. Installs mirrors or structural glass on building fronts, walls, ceilings, or tables, using mastic, screws, or decorative molding. Bolts metal hinges, handles, locks, and other hardware to prefabricated glass doors. Sets glass doors into frame and fits hinges. May install metal window and doorframes into which glass panels are to be fitted. May press plastic adhesive film to glass or spray glass with tinting solution to prevent light glare. May install stained glass windows.

Insulator (Batt and Foam)
Applies batt and form insulation to walls, ceilings and other surfaces according to manufacturers specifications and blue print instructions. May use sealants such as cement plaster or asphalt compound to seal insulation; may spread concrete over floor slabs to form wearing floor: brushes adhesives, cuts insulating materials to specified shape to cover surfaces; uses tape or other sealants to adhere insulation to surfaces. May use staple gun, towel, paintbrushes and caulking guns.

Ironworker (Reinforcing)
Positions and secures steel bars in concrete forms to reinforce concrete; places rods in forms, spacing and fastening together with wire and pliers. Cuts bars using hacksaw, bar cutters or acetylene torch. Bends steel rods with hand tools or rod bending machine; reinforces concrete with wire mesh; welds reinforcing bars together.

Ironworker (Structural)

Erector; ironworker; steel erector; structural-iron erector; structural-iron worker; structural steel erector. Performs any combination of following duties to raise, place, and unite girders, columns, and other structural-steel members to form completed structures or structure frameworks, working as member of crew: Sets up hoisting equipment for raising and placing structural-steel members. Fastens steel members to cable of hoist, using chain, cable, or rope. Signals worker operating hoisting equipment to lift and place steel member. Guides member, using tab line (rope) or rides on member to guide it into position. Pulls, pushes, or pries steel members into approximate position while member is supported by hoisting device. Forces members into final position, using turnbuckles, crowbars, jacks, and hand tools. Aligns rivet holes in member with corresponding holes in previously placed member by driving drift pins or handle of wrench through holes. Verifies vertical and horizontal alignment of members, using plumb bob and level.

Lather
Fastens wooden, metal, or rockboard lath to walls, ceilings, and partitions of buildings to provide supporting base for plaster, fireproofing, or acoustical material, using hand tools and portable power tools: Erects horizontal metal framework to which laths are fastened, using nails, bolts, and studgun. Drills holes in floor and ceiling, using portable electric tool, and drives ends of wooden or metal studs into holes to provide anchor for furring or rockboard lath. Wires horizontal strips to furring to stiffen framework. Cuts lath to fit openings and projections, using hand tools or portable power tools. Wires, nails, clips, or staples lath to framework, ceiling joists, and flat concrete surfaces. Bends metal lath to fit corners, or attaches preformed corner reinforcements. Wires plasterer's channels to overhead structural framework to provide support for plaster or acoustical ceiling tile.

Painter (Brush, Roller, and Spray)
Applies coats of paint, varnish, stain, enamel, or lacquer to decorate and protect interior or exterior surfaces, trimmings, and fixtures of buildings and other structures: Reads work order or receives instructions from supervisor or homeowner regarding painting. Smoothes surfaces, using sandpaper, brushes, or steel wool, and removes old paint from surfaces, using paint remover, scraper, wire brush, or blowtorch to prepare surfaces for painting. Fills nail holes, cracks, and joints with caulk, putty, plaster, or other filler, using caulking gun and putty knife. Selects premixed paints, or mixes required portions of pigment, oil, and thinning and drying substances to prepare paint that matches specified colors. Removes fixtures, such as pictures and electric switchcovers, from walls prior to painting, using screwdriver. Spreads dropcloths over floors and room furnishings, and covers surfaces, such as baseboards, doorframes, and windows with masking tape and paper to protect surfaces during painting. Paints surfaces, using brushes, spray gun, or paint rollers. Simulates wood grain, marble, brick, or tile effects. Applies paint with cloth, brush, sponge, or fingers to create special effects. Erects scaffolding or sets up ladders to perform tasks above ground level.

Pipe fitter * (HVAC Pipe Only) - Ratio 1Journeymen /1 Apprentice (See Schedule included)
Lays out, assembles, installs, and maintains pipe systems, pipe supports, and related hydraulic and pneumatic equipment for steam, hot water, heating, cooling, lubricating, sprinkling, and industrial production and processing systems, applying knowledge of system operation, and following blueprints: Selects type and size of pipe, and related materials and equipment, such as supports, hangers, and hydraulic cylinders, according to specifications. Inspects work site to determine presence of obstructions and to ascertain that holes cut for pipe will not cause structural weakness. Plans installation or repair to avoid obstructions and to avoid interfering with activities of other workers. Cuts pipe, using saws, pipe cutter, hammer and chisel, cutting torch, and pipe cutting machine. Threads pipe, using pipe threading machine. Bends pipe, using pipe bending tools and pipe bending machine. Assembles and installs variety of metal and nonmetal pipes, tubes, and fittings, including iron, steel, copper, and plastic. Connects pipes, using threaded, caulked, soldered, brazed, fused, or cemented joints, and hand tools. Secures pipes to structure with brackets, clamps,

and hangers, using hand tools and power tools. Installs and maintains hydraulic and pneumatic components of machines and equipment, such as pumps and cylinders, using hand tools. Installs and maintains refrigeration and air-conditioning systems, including compressors, pumps, meters, pneumatic and hydraulic controls, and piping, using hand tools and power tools, and following specifications and blueprints. Increases pressure in pipe system and observes connected pressure gauge to test system for leaks.

Pipe Fitter * (Excluding HVAC Pipe)
Lays out, assembles, installs, and maintains pipe systems, pipe supports, and related hydraulic and pneumatic equipment for steam, hot water, heating, cooling, lubricating, sprinkling, and industrial production and processing systems, applying knowledge of system operation, and following blueprints: Selects type and size of pipe, and related materials and equipment, such as supports, hangers, and hydraulic cylinders, according to specifications. Inspects work site to determine presence of obstructions and to ascertain that holes cut for pipe will not cause structural weakness. Plans installation or repair to avoid obstructions and to avoid interfering with activities of other workers. Cuts pipe, using saws, pipe cutter, hammer and chisel, cutting torch, and pipe cutting machine. Threads pipe, using pipe-threading machine. Bends pipe, using pipe bending tools and pipe bending machine. Assembles and installs variety of metal and nonmetal pipes, tubes, and fittings, including iron, steel, copper, and plastic. Connects pipes, using threaded, caulked, soldered, brazed, fused, or cemented joints, and hand tools. Secures pipes to structure with brackets, clamps, and hangers, using hand tools and power tools. Installs and maintains hydraulic and pneumatic components of machines and equipment, such as pumps and cylinders, using hand tools. Installs and maintains refrigeration and air-conditioning systems, including compressors, pumps, meters, pneumatic and hydraulic controls, and piping, using hand tools and power tools, and following specifications and blueprints. Increases pressure in pipe system and observes connected pressure gauge to test system for leaks. May weld pipe supports to structural steel members. May observe production machines in assigned area of manufacturing facility to detect machinery malfunctions. May operate machinery to verify repair. May modify programs of automated machinery, such as robots and conveyors, to change motion and speed of machine, using teach pendant, control panel, or keyboard and display screen of robot controller and programmable controller. May be designated Steam Fitter (construction) when installing piping systems that must withstand high pressure

Plasterer * See Plaster Tender - Ratio 1 Journeyman /3 Plaster Tenders
Applies coats of plaster to interior walls, ceilings, and partitions of buildings, to produce finished surface, according to blueprints, architect’s drawings, or oral instructions, using hand tools and portable power tools: Directs workers to mix plaster to desired consistency and to erect scaffolds. Spreads plaster over lath or masonry base, using trowel, and smoothes plaster with darby and float to attain uniform thickness. Applies scratch, brown, or finish coats of plaster to wood, metal, or board lath successively. Roughens undercoat with scratcher (wire or metal scraper) to provide bond for succeeding coats of plaster.

Plumber * (Excluding HVAC Pipe) - Ratio 3 Journeymen /2 Apprentice
Assembles, installs, and repairs pipes, fittings, and fixtures of heating, water, and drainage systems, according to specifications and plumbing codes: Studies building plans and working drawings to determine work aids required and sequence of installations. Inspects structure to ascertain obstructions to be avoided to prevent weakening of structure resulting from installation of pipe. Locates and marks position of pipe and pipe connections and passage holes for pipes in walls and floors, using ruler, spirit level, and plumb bob. Cuts openings in walls and floors to accommodate pipe and pipe fittings, using hand tools and power tools. Cuts and threads pipe, using pipe cutters, cutting torch, and pipe-threading machine. Bends pipe to required angle by use of pipe-bending machine or by placing pipe over block and bending it by hand. Assembles and installs valves, pipe

fittings, and pipes composed of metals, such as iron, steel, brass, and lead, and nonmetals, such as glass, vitrified clay, and plastic, using hand tools and power tools. Joins pipes by use of screws, bolts, fittings, solder, plastic solvent, and caulks joints. Fills pipe system with water or air and reads pressure gauges to determine whether system is leaking. Installs and repairs plumbing fixtures, such as sinks, commodes, bathtubs, water heaters, hot water tanks, garbage disposal units, dishwashers, and water softeners. Repairs and maintains plumbing by replacing washers in leaky faucets, mending burst pipes, and opening clogged drains.

Roofer
Covers roofs with roofing materials other than sheet metal, such as composition shingles or sheets, wood shingles, or asphalt and gravel, to waterproof roofs: Cuts roofing paper to size, using knife, and nails or staples it to roof in overlapping strips to form base for roofing materials. Installs gutters and downs spouts. Aligns roofing material with edge of roof, and overlaps successive layers, gauging distance of overlap with chalk line, gauge on shingling hatchet, or by lines on shingles. Fastens composition shingles or sheets to roof with asphalt, cement, or nails. Punches holes in slate, tile, terra cotta, or wooden shingles, using punch and hammer. Cuts strips of flashing and fits them into angles formed by walls, vents, and intersecting roof surfaces. When applying asphalt or tar and gravel to roof, mops or pours hot asphalt or tar onto roof base. Applies alternate layers of hot asphalt or tar and roofing paper until roof covering is as specified. Applies gravel or pebbles over top layer, using rake or stiff bristled broom.

Sheet metal worker * Ratio 2 Journeymen /1 Apprentice (Including Setting HVAC Duct & System Installs)
Fabricates, assembles, installs and repairs sheet metal products, including sheet metal roof (also see Roofer). Operates soldering and welding equipment to join together sheet metal parts. Seals seams and joints with sealant. Installs roof sheets, trims, flashing, gutters down spouts and other related items. Performs other related duties.

Sprinkler Fitter (Fire) * - Ratio 1 Journeyman /1 Apprentice
Lays out, assembles, installs, and maintains pipe systems, pipe supports, and related hydraulic and pneumatic equipment for steam, hot water, heating, cooling, lubricating, sprinkling, and industrial production and processing systems, applying knowledge of system operation, and following blueprints: Selects type and size of pipe, and related materials and equipment, such as supports, hangers, and hydraulic cylinders, according to specifications. Inspects work site to determine presence of obstructions and to ascertain that holes cut for pipe will not cause structural weakness. Plans installation or repair to avoid obstructions and to avoid interfering with activities of other workers. Cuts pipe, using saws, pipe cutter, hammer and chisel, cutting torch, and pipe cutting machine. Threads pipe, using pipe-threading machine. Bends pipe, using pipe bending tools and pipe bending machine. Assembles and installs variety of metal and nonmetal pipes, tubes, and fittings, including iron, steel, copper, and plastic. Connects pipes, using threaded, caulked, soldered, brazed, fused, or cemented joints, and hand tools. Secures pipes to structure with brackets, clamps, and hangers, using hand tools and power tools. Installs and maintains hydraulic and pneumatic components of machines and equipment, such as pumps and cylinders, using hand tools. Installs and maintains refrigeration and air-conditioning systems, including compressors, pumps, meters, pneumatic and hydraulic controls, and piping, using hand tools and power tools, and following specifications and blueprints. Increases pressure in pipe system and observes connected pressure gauge to test system for leaks. May weld pipe supports to structural steel members. May observe production machines in assigned area of manufacturing facility to detect machinery malfunctions. May operate machinery to verify repair. May modify programs of automated machinery, such as robots and conveyors, to change motion and speed of machine, using teach pendant, control panel, or keyboard and display screen of robot controller and programmable controller.

Tile Finisher
Supplies and mixes construction materials for TILE SETTER (construction) 861.381-054, applies grout, and cleans installed tile: Moves tiles, tile setting tools, and work devices from storage area to installation site manually or using wheelbarrow. Mixes mortar and grout according to standard formulas and request from TILE SETTER (construction), using bucket, water hose, spatula, and portable mixer. Supplies TILE SETTER (construction) with mortar, using wheelbarrow and shovel. Applies grout between joints of installed tile, using grouting trowel. Removes excess grout from tile joints with wet sponge and scrapes corners and crevices with trowel. Wipes surface of tile after grout has set to remove grout residue and polish tile, using nonabrasive materials. Cleans installation site, mixing and storage areas, and installation machines, tools, and equipment, using water and various cleaning tools. Stores tile setting materials, machines, tools, and equipment. May apply caulk, sealers, acid, steam, or related agents to caulk, seal, or clean installed tile, using various application devices and equipment. May modify mixing, grouting, grinding, and cleaning procedures according to type of installation or material used. May assist TILE SETTER (construction) to position and secure metal lath, wire mesh, or felt paper prior to installation of tile. May cut marked tiles to size, using power saw or tile cutter.

Tile Setter
Applies tile to walls, floors, ceilings, and promenade roof decks, following design specifications: Examines blueprints, measures and marks surfaces to be covered, and lays out work. Measures and cuts metal lath to size for walls and ceilings with tin snips. Tacks lath to wall and ceiling surfaces with staple gun or hammer. Spreads plaster base over lath with trowel and levels plaster to specified thickness, using screed. Spreads concrete on sub floor, with trowel and levels it with screed. Spreads mastic or other adhesive base on roof deck, using serrated spreader to form base for promenade tile. Cuts and shapes tile with tile cutters and biters. Positions tile and taps it with trowel handle to affix tile to plaster or adhesive base.

Truck Driver
Drives truck with capacity of more than 3 tons, to transport materials to and from specified destinations: Drives truck to destination, applying knowledge of commercial driving regulations and area roads. Prepares receipts for load picked up. Collects payment for goods delivered and for delivery charges. May maintain truck log, according to state and federal regulations. May maintain telephone or radio contact with supervisor to receive delivery instructions. May load and unload truck. May inspect truck equipment and supplies, such as tires, lights, brakes, gas, oil, and water. May perform emergency roadside repairs, such as changing tires, installing light bulbs, tire chains, and spark plugs. May position blocks and tie rope around items to secure cargo during transit.

Laborers

Common Laborer
Performs any combination of the following tasks in erecting, repairing and wrecking buildings; dig, spread and level dirt and gravel; lift carry and hold building materials, tools and supplies; clean tools, equipment, materials and work areas; mix, pour and spread concrete, asphalt, gravel and other materials; join, wrap and seal sections of pipe; routine non-machine tasks such as removing forms from set concrete, filling expansion joints with asphalt, and placing culverts in trench. May also signal construction equipment operators; measure distances from grade stakes, drive stakes and stretch lines; bolt, nail align and block up under forms; mix and finish poured concrete, erect scaffolding; spread paint or coating to seal surfaces; caulking compounds to seal surfaces; remove projections from concrete, and mount pipe hangers.

Mason Tender Brick

Mason Tender Cement

Pipe layer
Lay pipe for storm or sanitation sewers, drains, and water mains. Perform any combination of the following tasks: grade trenches or culverts, position pipe, or seal joints.

Plaster Tender
Tends machine that pumps plaster or stucco through spray gun for application to ceilings, walls, and partitions of buildings: Starts and stops machine on signals from PLASTERER (construction). Fills hopper of machine with plaster. Turns valves to regulate pump and compressor. Assists in erecting scaffolds.

Power Equipment Operator:

Asphalt Paver (operator)
Operator; bituminous-paving-machine operator; blacktop-paver operator; blacktop spreader; mechanical-spreader operator; paving-machine operator, asphalt or bituminous. Operates machine that spreads and levels hot-mix bituminous paving material on sub grade of highways and streets: Bolts extensions to screed to adjust width, using wrenches. Lights burners to heat screed. Starts engine and controls paving machine to push dump truck and maintain constant flow of asphalt into hopper. Observes distribution of paving material along screed and controls direction of screed to eliminate voids at curbs and joints. Turns valves to regulate temperature of asphalt flowing from hopper when asphalt begins to harden on screed.

Backhoe (operator)
Operates power-driven machine, equipped with movable shovel, to excavate or move coal, dirt, rock, sand, and other materials: Receives written or oral instructions from supervisor regarding material to move or excavate. Pushes levers and depresses pedals to move machine, to lower and push shovel into stockpiled material, to lower and dig shovel into surface of ground, and to lift, swing, and dump contents of shovel into truck, car, or onto conveyor, hopper, or stockpile. Observes markings on ground, hand signals, or grade stakes to remove material, when operating machine at excavation site.

Crane (operator)
Operates electric-, diesel-, gasoline-, or steam-powered guy-derrick or stiff-leg derrick (mast supported by fixed legs or tripod), to move products, equipment, or materials to and from quarries, storage areas, and processes, or to load and unload trucks or railroad cars: Pushes and pulls levers and depresses pedals to raise, lower, and rotate boom and to raise and lower load line in response to signals.

Forklift (operator)
Drives gasoline-, liquefied gas-, or electric-powered industrial truck equipped with lifting devices, such as forklift, boom, scoop, lift beam and swivel-hook, fork-grapple, clamps, elevating platform, or trailer hitch, to push, pull, lift, stack, tier, or move products, equipment, or materials in warehouse, storage yard, or factory: Moves levers and presses pedals to drive truck and control movement of lifting apparatus. Positions forks, lifting platform, or other lifting device under, over, or around loaded pallets, skids, boxes, products, or materials or hooks tow trucks to trailer hitch, and transports load to

designated area. Unloads and stacks material by raising and lowering lifting device.

Slab & Wall Saw (See Related Power Equipment Operator Above)
Use associated power equipment operators already defined.

Apprentices

Apprentices may be used in any of the crafts listed above where noted, if they are currently certified in a program recognized by the Bureau of Apprenticeship and Training, U.S. Department of Labor, providing the proper ratio between journeyman and apprentice is observed. Apprentice certification certificates must be supplied with the first weekly payroll upon which the apprentice's name appears.

Welder - Receive rate prescribed for craft performing operation to which welding is incidental.

Pipe fitters * Apprentice Schedule (Excluding HVAC Pipe)

Journeyman	Indentured Apprentice	Apprentice Applicant	Total
1	1	0	1 to 1
3	2	1	3 to 3
5	3	2	5 to 5
8	4	3	8 to 7
12	5	4	12 to 9
16	6	5	16 to 11
20	7	6	20 to 13
25	8	7	25 to 15
30	9	8	30 to 17
40	10	9	40 to 19
50	11	10	50 to 21

NOTE: Continue after 50 Journeyman — ONE (1) Indentured Apprentice and one (1) Apprentice Applicant for every ten (10) Journeyman

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*** When Apprentices are shown, Helpers cannot be utilized**

APPRENTICES (see definitions)

Registered Apprenticeship Ratios

For All Apprentices

Apprentice duties consist but are not limited to reading blue prints, lay out, fabrication, installation, and assembly. Other duties are the setting up and operation of fabrication machines, using hand tools, power tools, lifting/handling devices, sealing if necessary according to their particular craft. Apprentices also are trained in the preparation process of a job that include but not limited to staging, planning, distribution, and sectioning of materials. Apprentices may be used in any of the crafts listed where noted on the Prevailing Wage Rate Schedule, if they are currently certified in a program recognized by the Bureau of Apprenticeship and Training, U.S. Department of Labor, providing the proper ratio between journeyman and apprentice is observed. Apprentice certification certificates must be supplied with the first weekly payroll upon which the apprentice's name appears. Laborers cannot be utilized when Apprentices are shown

Asbestos Worker / Insulator

City of Houston allows the use of 1 Journeyman and 1 Apprentice, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 2th Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman.
1 Journeyman w/ 1 Apprentice
2 Journeymen w/ 2 Apprentices

Boilermakers

City of Houston allows the use of 5 Journeymen and 1 Apprentice, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 6th Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman.
1-5 Journeymen w/ 1 Apprentice
6-10 Journeymen w/ 2 Apprentices

Carpenter

City of Houston allows the use of 2 Journeymen and 1 Apprentice, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 4th Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman.
1-2 Journeymen w/ 1 Apprentice
3-4 Journeymen w/ 2 Apprentices
5-6 Journeymen w/ 3 Apprentices

Electrician

City of Houston allows the use of 3 Journeymen and 2 Apprentices, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 3rd Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman. All Journeymen and Apprentices must hold a current license from the State of Texas.

1 Journeyman w/ 1 Apprentice
2 Journeymen w/ 1 Apprentice
3 Journeymen w/ 2 Apprentices
4 Journeymen w/ 3 Apprentices
5 Journeymen w/ 3 Apprentices
6 Journeymen w/ 4 Apprentices
7 Journeymen w/ 4 Apprentices
8 Journeymen w/ 4 Apprentices
9 Journeymen w/ 4 Apprentices
10 Journeymen w/ 5 Apprentices

Plumbers

City of Houston allows the use of 3 Journeymen and 2 Apprentices, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 3rd Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman. All Journeymen and Apprentices must hold a current license from the State of Texas.

1 Journeyman w/ 1 Apprentice
2 Journeymen w/ 1 Apprentice
3 Journeymen w/ 2 Apprentices
4 Journeymen w/ 3 Apprentices
5 Journeymen w/ 3 Apprentices
6 Journeymen w/ 4 Apprentices
7 Journeymen w/ 4 Apprentices
8 Journeymen w/ 4 Apprentices
9 Journeymen w/ 4 Apprentices
10 Journeymen w/ 5 Apprentices

Sprinkler Fitter

City of Houston allows the use of 1 Journeyman and 1 Apprentice, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 2th Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman.

1 Journeyman w/ 1 Apprentice
2 Journeymen w/ 2 Apprentices
Sheetmetal Worker

City of Houston allows the use of 2 Journeymen and 1 Apprentice, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 4th Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman.

1-2 Journeymen w/ 1 Apprentice
3-4 Journeymen w/ 2 Apprentices
5-6 Journeymen w/ 3 Apprentices

Pipefitter

City of Houston allows the use of 1 Journeymen and 1 Apprentice, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 4th Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman.

1 Journeyman w/ 1 Apprentice
2 Journeymen w/ 1 Apprentice
3 Journeymen w/ 2 Apprentices
4 Journeymen w/ 3 Apprentices
5 Journeymen w/ 3 Apprentices
6 Journeymen w/ 4 Apprentices
7 Journeymen w/ 4 Apprentices
8 Journeymen w/ 4 Apprentices
9 Journeymen w/ 4 Apprentices
10 Journeymen w/ 5 Apprentices

Welders
Receive rate prescribed for craft performing operation is which welding is incidental

Pipefitters * Apprentice Schedule (Excluding HVAC Pipe)

NOTE: Continue after 50 Journeyman - ONE (1) Indentured Apprentice and one (1) Apprentice Applicant for every ten (10) Journeyman

Journeyman	Indentured Apprentice	Apprentice Applicant	Total
1	1	0	1 to 1
3	2	1	3to 3
5	3	2	5 to 5
8	4	3	8 to 7
12	5	4	12 to 9
16	6	5	16 to 11
20	7	6	20 to 13
25	8	7	25 to 15
30	9	8	30 to 17
40	10	9	40 to 19
50	11	10	50 to 21

When Apprentices are shown, Helpers cannot be utilized

If there are questions as to the classification of a worker, contact the Contract Compliance Officer in writing with a description of the work to be performed. After reviewing the Contract Compliance Officer will respond in writing with the classification and wage rate to be paid the worker in question.

EXHIBIT "B"

CERTIFICATE FROM CONTRACTOR APPOINTING OFFICER OR EMPLOYEE TO SUPERVISE PAYMENT OF EMPLOYEES

Project Name _____

_____

Project WBS#: _____ Date _____

Email Address: _____

(I) (We) hereby certify that (I am) (we are) the **Prime Contractor** for _____

_____
(specify type of job)

in connection with construction of the above-mentioned Project, and that (I) (we) have appointed _____, whose signature appears below, to supervise the payment of (my) (our) employees beginning _____, 20___; that he/she is in a position to have full knowledge of the facts set forth in the payroll documents and in the statement of compliance required by the Copeland Act and the City of Houston, which he/she is to execute with (my) (our) full authority and approval until such time as (I) (we) submit to the City of Houston a new certificate appointing some other person for the purposes hereinabove stated.

_____ Phone: _____
(Identifying Signature of Appointee)

Attest: _____
(Name of Firm or Corporation)

By: _____ By: _____
(Signature) (Signature)

_____ _____
(Title) (Title)

NOTE: This certificate must be executed by an authorized officer of a corporation or by a member of a partnership, and shall be executed prior to and be submitted with the first payroll. Should the appointee be changed, a new certificate must accompany the first payroll for which the new appointee executes a statement of compliance required by the Copeland Act and the City of Houston.

EXHIBIT "C"

CERTIFICATE FROM SUBCONTRACTOR APPOINTING OFFICER OR EMPLOYEE TO SUPERVISE PAYMENT OF EMPLOYEES

Project Name _____

_____

Project WBS#: _____ Date _____

Email Address: _____

(I) (We) hereby certify that (I am) (we are) the **Sub Contractor** for _____

_____
(specify type of job)

in connection with construction of the above-mentioned Project, and that (I) (we) have appointed _____, whose signature appears below, to supervise the payment of (my) (our) employees beginning _____, 20___; that he/she is in a position to have full knowledge of the facts set forth in the payroll documents and in the statement of compliance required by the Copeland Act and the City of Houston, which he/she is to execute with (my) (our) full authority and approval until such time as (I) (we) submit to the City of Houston a new certificate appointing some other person for the purposes hereinabove stated.

_____ Phone: _____
(Identifying Signature of Appointee)

Attest: _____
(Name of Firm or Corporation)

By: _____ By: _____
(Signature) (Signature)

_____ _____
(Title) (Title)

NOTE: This certificate must be executed by an authorized officer of a corporation or by a member of a partnership, and shall be executed prior to and be submitted with the first payroll. Should the appointee be changed, a new certificate must accompany the first payroll for which the new appointee executes a statement of compliance required by the Copeland Act and the City of Houston.

END OF DOCUMENT

Pay or Play Program
Operating Procedures

Background

The Pay or Play Program was established with Ordinance 2007-534 on July 1, 2007 and is governed by Executive Order 1-7. The Pay or Play Program (POP) creates a more level playing field and enhances fairness in the bid process between competing contractors that choose to offer health benefits to their workforce and those who do not. The program also recognizes and accounts for the fact that there are costs associated with providing health care for the uninsured citizens of Houston and Harris County area.

Administration:

- Vendors are required to begin complying with POP within 30 days of contract award by utilizing the designated system, *B2G Workforce Module*, at https://houston.mwdbe.com to complete/review POP activities.
- Vendors are required to utilize *JP Morgan Chase Pay Connexion* (*Pay Connexion*) portal that will accept POP payments electronically. B2G Workforce Module will provide a direct link to *Pay Connexion* where contractors may submit payment via Debit Card, Credit Card, Automated Clearing House (ACH) and/or Electronic Checks (e-checks). Contractors will be charged a convenience fee per transaction.
- Vendors who onboard new employees are allowed a 60-day waiting period upon each new employee's start date to begin participating in POP. After the 60-day period has lapsed, Vendor must include the employee in POP reporting.
- The Office of Business Opportunity (OBO) has citywide administrative oversight of the program, including audit responsibilities. Vendor's compliance with POP requirements will be directly managed by the City Department with whom Vendor has contracted (Contracting Department). Questions about POP should be referred to the Contracting Department's POP Liaison. A contact list for POP Liaisons is available at http://www.houstontx.gov/obo/popforms.html or by contacting the OBO POP Administrator at 832-393-0633 or Brianne.Maxwell@houstontx.gov.

Pre-bid/Pre-Proposal Forms:

- Vendors must complete and return the following forms before contract award by the Contracting Department:
  - *Acknowledgment Form* (POP-1)
  - *Certification of Compliance* (POP-2)
  - *Participating Subcontractors* Form (POP-3)

Prime/Subcontractor Waiver Request (Form POP-4):

- Completed by Contracting Department prior to City Council approval contract award, for contract(s) that may meet exemption criteria as stated in EO 1-7. Form POP-4 must be signed by Contracting Department and forwarded, along with supporting documentation, to OBO POP Administrator for final decision.
- A new Form POP-4 is not needed for contract amendments and/or extensions, as the POP requirements in the original contract continues to apply.
- Contractors that utilize self-employed, owner/operator individuals to complete services (e.g., Truck Drivers, Day Laborers, 10-99, etc.) are POP exempt.
- Vendors should not submit a Form POP-4 for contracts enumerated in section 4.2 of EO 1-7, as those contracts are not covered under POP.

Pay Option Reporting (Workforce Audit):

- Vendors will create a *Workforce Employee List* showcasing all active employees working on the City of Houston project. Vendors will complete a weekly workforce audit by the end of each month. Vendors must provide the Total Hours Worked and individual Hours Worked by each covered employee as part of the weekly workforce audit.
  - Total Hours Worked = Total Number of Hours Employee worked for Employer.
  - Hours Worked = Total Number of Hours Employee worked on COH project.

Invoice Submission:

- Invoices are created from monthly *Workforce Audits* reports. Payments are due to the contracting department 30 business days after receipt of invoice. Payments

may be made through the *Pay Connexion.* Prime Vendor is responsible to the City for compliance of covered employees of covered subcontractors.

- Vendors will "Pay" by contributing $1.00 per covered employee per regular hour for work performed under the contract with the City, not to exceed $40.00 per employee.
    - POP will not accept partial payments; invoices must be paid in full.

Play Option Reporting (Workforce Audit):

- Vendors will create a *Workforce Employee List* showcasing all active employees working on the City of Houston project.
- Vendors will complete a quarterly workforce audits by month end of October, January, April, and July by providing proof of insurance for all active and covered employees for previous three (3) months.
- Vendors will "Play" by providing health benefits to covered employees. Health benefits must meet or exceed the following standards:
    - The employer will contribute no less than 75% of the monthly premium toward the total premium cost covered employee per month.
    - The employee contribution, if any amount, will be no greater than 25% of the monthly premium cost.

Note: Proof of coverage (in the form of the most current Company Insurance invoice or individual employee insurance card) for POP covered employees that work on the City Project.

Employee Waiver Request (Form POP-8):

- Vendor may request employee POP program waiver by submitting a request on the City of Houston Pay or Play (POP) *Employee Waiver Request* (Form POP-8); if a covered employee has refused health coverage through their employee or if a covered employee has acquired health coverage on their own.
    - Vendor will attach approved Form POP-8 to respective employees' workforce profile in the designated system.

Self-Insured Contractor Request (Form POP-9):

- Vendor may request for Self-Insured Status if the employer is using their own money to cover their employees' claims.
- Vendors awarded Self-Insured Status will be PLAY participants and required to report once a year.

SECTION 01110
SUMMARY OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project description.

B. Work description.

C. City occupancy.

D. Contractor-salvaged products.

E. Separate contracts and work by City.

F. Extra copies of Contract Documents.

G. Permits, fees and notices.

1.02 THE PROJECT

The Project is the George Bush Intercontinental Airport in Houston, Texas.

1.03 GENERAL DESCRIPTION OF THE WORK

A. Construct the Work under a single general construction contract as follows:

B. Construct the Work in a single stage.

The Work is summarized as construction of interior renovations at IDO building as noted in the drawings. The space allocated for the building standards group is approximately 5,000 sq/ft and will include: reception area (adjacent to the main lobby), collaboration space, huddle room, storage space, IDF closet, coffee/break niche, copy/plot space, 3 private offices, 4 high wall cubicles, 30 low wall cubicles and 2 hoteling desks. The build-out will utilize existing building standards as selected in the current building design for lighting, HVAC, Telecom and Security.

General Information:

1. Scope of work requires the installer to access into the work area through the existing glazing by providing openings that meeting safety requirements.

2. It is the contractor's responsibility to coordinate noise level during the construction. Work lower than 50 dB level is allowed during work hours. Any construction above this dB level shall be completed after hours or coordinated with owner in 72 hours in advance.

3. Work needing utility shut-offs shall be completed after hours with 72 hours notification. Major shut-offs shall be done on Friday to allow time for repairs.

4. A lay-down area outside the IDO building will be identified next to the construction zone. It is the contractor's responsibility to provide closures that meet security requirements for the lay-down area and construction zone.

5. Existing doors to the construction zone will be temporarily boarded up to secure the office spaces. Any work to the doors will be conducted after the glazing is reinstalled. Glazing work will be performed by Southwest Glass to maintain its remaining warranty.

6. Any work that may impact ongoing operations to be coordinated in advance with HAS project team.

7. Firetrol will be required to be on site for any modifications to the HAS fire suppression systems.

8. The successful bidder will have access to any drawings that HAS might have on file.

C. Notice to Proceed
Following Contract Execution, the Contractor will be given an Administrative Notice to Proceed, which will include Mobilization, Operations Coordination, Approved Submittals, Request for Information (if any), Badging, Safety Training, and other requirements as needed to prepare for the Construction Work. Administrative NTP timeframe is estimated for an amount time of 90 days. Upon completion of pre-construction preparedness, HAS will issue a Construction Notice to Proceed.

D. The Work is summarized as construction of interior renovations at IDO building. Work that will be impacting current users of the building, such as installation of doors and HVAC work must be done at night between 11:00 p.m. and 5:00 a.m., as allowed by the owner.

1. Cut and patch existing construction designated or required to remain and to receive new construction, following Section 01731- Cutting and Patching, and Section 01761 – Protection of Existing Services.

E. Contract limit lines are shown diagrammatically on Drawings.

F. The construction budget for this construction project is $874,000.

1.04 CITY OCCUPANCY

The City intends to occupy the entire portion of the Project by _____TBD_____.

The City will occupy the premises and remain in operation during the entire period of construction.

A. Cooperate with the City to reduce conflict, and to facilitate the City's operations. Coordinate Contractor's activities with City Operations or Maintenance personnel through City Engineer.

B. Schedule Work to fit these requirements.

1.05 CONTRACTOR-SALVAGED PRODUCTS (CSP)

A. Products intended for salvage and return by the Contractor to City Engineer are scheduled in Part 2 of this Section and are shown in diagrammatic form or noted on Drawings.

B. Obtain, handle, store and protect CSP following Section 01731 - Cutting and Patching. Reinstall items designated for reuse following Section 01731.

C. Provide written receipt or transfer of title to City Engineer.

D. Assume CSP function properly, unless discovered to the contrary and notice given before removal. Correct damages or deficiencies occurring to CSP while in possession of Contractor, without change in Contract Sum or Time.

1.07 EXTRA COPIES OF CONTRACT DOCUMENTS

Use reproducible documents, furnished by City following Document 00700 Paragraph 2.2.2, to make extra copies of Contract Documents (diazo prints of Drawings and electrostatic copies of Project Manual) as required by Contractor for construction operations, and for Contractor's records following Sections 01726 - Base Facility Survey and 01770 - Contract Closeout. Follow Document 00700 Paragraph 1.3.

1.08 PERMITS, FEES AND NOTICES

Refer to Document 00700 Paragraph 3.14. Reimburse City for City's payment of fines levied against City or its employees because of Contractor's failure to obtain proper permits, pay proper fees, and make proper notifications. Reimbursement will be by Change Order, reducing the Contract Price as based upon the dollar amount of fines imposed.

PART 2 PRODUCTS

2.01 SCHEDULE OF CSP

A. Unless indicated otherwise, salvage and return to the City the following CSP existing within the contract limits:

1. [_Exterior Glazing_____]
2. [_Internal Wood Veneer Doors_____]
3. [_____]

B. Return excess CSP items following Section 01770 - Contract Closeout.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01145
CONTRACTOR'S USE OF PREMISES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rights-of-way and access to the Work.

B. Property and Base Facility outside contract limits.

C. General requirements for exterior work.

D. Work in AOA, including electrical lockout/tagout program.

E. Interior work.

F. Control of access into security areas.

1.02 SUBMITTALS

A. Show start dates and duration of closures and impediments on construction schedule following Section 01325 - Construction Schedules.

B. Prepare written requests, using Document 00931 - Request for Information, and submit requests at least 7 days before access is required, for following:

1. Roadway, street, driveway, curbside and building main entrance/exit closures or impediments. Do not close or impede emergency exits intended to remain.

2. Access to property outside contract limits, required to extend or connect work to utilities or environmental system controls in non-contract areas.

C. For work involving electrical energy or other hazardous energy sources, submit a Lockout/Tagout Program.

1.03 RIGHTS-OF-WAY AND ACCESS TO THE WORK

A. Confine access and operations and storage areas to contract limits and other areas provided by City, following Document 00700. Do not trespass on non-City-owned property or on airport occupants' spaces.

B. Airport operates "around the clock." In cases of conflicts with construction operations, airport operations take precedence. Airport roads, streets, drives, curbsides and sidewalks, and ticketing, baggage claim, security check points, concessions, restrooms, aircraft gates

and similar passenger-related areas are intended for year-round uninterrupted use and access by the public and airport operations. Maintain uninterrupted traffic movement.

1. Aircraft and emergency vehicles have right-of-way in AOA.

2. Private vehicles, public transportation and emergency vehicles have right-of-way on roads, streets, driveways and curbsides.

3. Passengers have right-of-way in public spaces. Occupants have right-of-way in other occupied areas.

C. Follow instructions of the City Engineer, Airport Manager and of ATCT. Follow FAA procedures.

D. FAA will review Contractor's submittals for compliance with FAA requirements. Attend meetings with FAA to assist the City Engineer in obtaining approvals.

E. Continued violations of or flagrant disregard for policies may be considered default, and individuals disregarding requirements may be determined as objectionable by the City Engineer, following provisions of Document 00700.

Do not close or impede rights-of-way without City Engineer approval.

F. City Engineer may approve temporary storage of products, in addition to areas shown on Drawings, in occupied areas and other on-airport areas if storage piles do not interfere with airport operations.

1. No permission will be granted for this type of storage in Terminal roadway areas.

1.04 PROPERTY AND BASE FACILITY OUTSIDE CONTRACT LIMITS

A. Do not alter condition of property or Base Facility outside contract limits.

B. Means, methods, techniques, sequences, or procedures which may result in damage to property outside of contract limits are not permitted.

C. Repair or replace damage to property outside contract limits to condition existing at start of the Work, or better.

1.05 GENERAL REQUIREMENTS FOR EXTERIOR WORK

A. Obtain permits and City Engineer's approval prior to impeding or closing roadways, streets, driveways, Terminal curbsides and parking areas.

B. Maintain emergency vehicle access to the Work and to fire hydrants, following Section 01505 - Temporary Facilities.

C. Do not obstruct drainage ditches or inlets. When obstruction is unavoidable due to requirements of the Work, provide grading and temporary drainage structures to maintain unimpeded flow.

D. Locate by Section 01726 - Base Facility Survey and protect by Section 01505 - Temporary Facilities lawn irrigation systems, communications or data systems which may exist. Repair or replace damaged systems to condition existing at start of Work, or better.

E. Public, Temporary, and Construction Roads and Ramps:

1. Construct and maintain temporary detours, ramps, and roads to provide for normal public traffic flow when use of public roads or streets is closed by necessities of the Work.

2. Provide mats or other means to prevent overloading or damage to existing roadways from tracked equipment or exceptionally large or heavy trucks or equipment.

3. Construct and maintain access roads and parking areas following Section 01505 - Temporary Facilities.

F. Excavation in Streets and Driveways:

1. Do not hinder or needlessly impede public travel on roadways, streets or driveways for more than two blocks at any one time, except as approved by City Engineer.

2. Obtain the City Traffic Management and Maintenance Department and City Engineer's approval when the Work requires closing of off-airport roadways, streets or driveways. Do not unnecessarily impede abutting property.

3. Remove surplus materials and debris and open each block for public use as work in that block is complete. Acceptance of any portion of the Work will not be based on return of street to public use.

4. Provide temporary crossings, or complete work in one continuous operation. Minimize duration of obstructions and impediments at drives or entrances.

G. Provide barricades and signs following Sections 01505 - Temporary Facilities and 01507 - Temporary Signs.

H. Traffic Control: Follow Section 01555 - Traffic Control and Regulation.

I. Surface Restoration:

1. Restore site to condition existing before construction, following Section 01731 - Cutting and Patching, to satisfaction of City Engineer.

1.07 GENERAL REQUIREMENTS FOR INTERIOR WORK

A. Obtain City Engineer's approval and permits prior to impeding or closing building entrances, corridors, and areas around passenger service functions (ticketing, baggage check and claim, security screening, waiting, aircraft enplaning and deplaning).

B. Maintain emergency access to the Work and to fire hose and extinguisher cabinets, following Section 01505 - Temporary Facilities.

C. Do not obstruct fire exits. When obstruction is unavoidable due to requirements of the Work, provide fire-retardant enclosures to maintain unimpeded flow, following Section 01505 - Temporary Facilities.

D. Locate by Section 01726 - Cutting and Patching and protect by Section 01505 - Temporary Facilities utility and communications or data systems which may exist. Repair or replace damaged systems to condition existing at start of Work, or better.

E. Provide temporary facilities and controls following Section 01505 - Temporary Facilities.

F. Provide signs following Section 01507 - Temporary Signs.

1.08 CONTROL OF SECURITY AREA ACCESS

A. Install barricades and enclosures to prevent uncontrolled access into security areas, following Section 01505 - Temporary Facilities. Provide locked access points. Provide duplicate keys to City Engineer.

B. Post one gatekeeper, employed by the Contractor, at each point of access through barricades or enclosures into security areas, during times when access points are not locked. Ensure persons entering are properly badged.

C. Provide signs following Section 01507 - Temporary Signs.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01210
CASH ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. City's allowances allocated to the items of work listed or as directed.

B. See Document 00700 - General Conditions, Paragraph 3.11 for costs included and excluded from cash allowance values listed in 1.02 below.

C. Follow Section 01255 - Modification Procedures for processing allowance expenditures. Cash Allowance sums remaining at Final Completion belong to the City, creditable by Change Order.

1.02 SCHEDULE OF CASH ALLOWANCES (TOTAL $5,000 VALUE)

A. Allowance Item 1 - Building Permit: For obtaining the Building Permit from City of Houston, $ 5,000.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01255
MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Signatories on behalf of City and Contractor.

B. Contractor's documentation.

C. Change Orders.

D. Requests for Proposal.

E. Work Change Directives.

F. Execution of Modifications.

G. Resolving Discrepancies.

H. Requests for Information or Clarification.

I. Correlation of Submittals.

1.02 SIGNATORIES

A. Submit at the Preconstruction Conference (Section 01312 - Coordination and Meetings) a letter indicating the name and address of Contractor's personnel authorized to execute Modifications, and with responsibility for informing others in Contractor's employ or Subcontractors of same.

1.03 REFERENCES

A. Blue Book: "Dataquest" Rental Rate Blue Book for Construction Equipment.

B. Rental Rate: The full unadjusted base rental rate for the applicable item of equipment.

1.04 CONTRACTOR'S DOCUMENTATION

A. Maintain detailed records of changes in the Work. Provide full information required for identification and evaluation of proposed changes, and to substantiate costs of changes in the Work.

B. Furnish sufficient data to allow City Engineer's evaluation of Contractor's responses to proposed changes.

C. Include with each proposal the following minimum information (as applicable to form of Contract Price):

1. Quantities of original Bid Schedule unit price work items (with additions, reductions, deletions, and substitutions).

2. When work items are not included in Document 00410 - Bid Tabulation Form, provide unit prices for the new items, with proper supporting information.

3. For Stipulated Price changes, furnish breakdown of labor, products, taxes, insurance, bonds, temporary facilities and controls as applicable, and overhead and profit.

4. Justification for change, if any, in Contract Time.

5. Additional data upon request.

D. Payment for rented equipment will be made to the Contractor by actual invoice cost for the duration of time required to complete additional work. If additional work comprises only a portion of the rental invoice where the equipment would otherwise be on the site, compute the hourly equipment rate by dividing the actual monthly invoice by 176. (One day equals 8 hours and one week equals 40 hours.) Operating costs shall not exceed the estimated operating costs given for the item of equipment in the Blue Book.

E. For changes in the Work performed on a time-and-materials basis using Contractor-owned equipment, compute rates with the Blue Book as follows:

1. Multiply the appropriate Rental Rate (the lowest cost combination of hourly, daily, weekly or monthly rates) by an adjustment factor of 70 percent plus the full rate shown for operating costs. Use 150 percent of the Rental Rate for double shifts (one extra shift per day) and 200 percent of the Rental Rate for more than two shifts per day. No other rate adjustments apply.

2. Standby Rates: 50 percent of the appropriate Rental Rate shown in the Blue Book. Operating costs are allowed.

1.05 CHANGE ORDERS

A. Changes to Contract Price or Time are made only by execution of a Change Order.

B. Stipulated Price Change Order: Stipulated Price Change Orders are based on an accepted Proposal/Contract Modification including the Contractor's lump sum price quotation.

C. Unit Price Change Order:

1. Where Unit Prices for the affected items of Work are included in Document 00410 - Bid Tabulation Form, Unit Price Change Orders are based on unit prices as originally bid, subject to requirements in Articles 7 and 9 of Document 00700 - General Conditions.

2. Where unit prices of Work are not pre-determined in Document 00410 - Bid Tabulation Form, Request for Proposal or Work Change Directive will state the unit prices to use.

D. Time-And-Material Change Order:

1. Provide an itemized account and supporting data after completion of change, within time limits indicated for claims in Document 00700 - General Conditions.

2. City Engineer will determine the change allowable in Contract Price and Contract Time following Document 00700 - General Conditions.

3. For changes in the Work performed on a time-and-material basis, furnish the following in addition to information specified in Paragraph 1.04.C:

a. Quantities and description of products and tools.

b. Taxes, insurance and bonds.

c. Overhead and profit, following Document 00700 - General Conditions Paragraphs 7.3.2.2.6 or Document 00800 - Supplementary Conditions.

d. Dates and times of work performance, and by whom.

e. Time records and certified copies of applicable payrolls.

f. Invoices and receipts for products, rented tools, and Subcontracts, similarly documented.

1.06 REQUEST FOR PROPOSAL

A. City Engineer may issue a Request for Proposal, including a detailed description of proposed changes, supported by revised Drawings and Specifications, if applicable.

Prepare and submit Contractor's response to the Request for Proposal within 7 days or as specified in the request.

B. This document does not authorize work to proceed.

C. Follow instructions on back of the Request for Proposal.

1.07 WORK CHANGE DIRECTIVE (WCD)

A. City Engineer may issue a WCD instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

B. City Engineer may issue minor changes in the Work, not involving an adjustment to Contract Price or Time by using a WCD.

C. The document will describe changes in the Work and will designate a method of determining change, if any, in Contract Price or Time. When properly executed, this document authorizes work to proceed. Follow instructions on back of the WCD.

D. Promptly execute changes in the Work following the directions from the Work Change Directive.

1.08 RESOLVING DISCREPANCIES

A. Complete Base Facility survey following Section 01726 - Base Facility Survey prior to preparation of submittal data and commencing main construction operations. Submit survey data of inaccessible concealed conditions as cutting and patching or demolition operations proceed.

B. Prepare and submit a Request for Information for each separate condition with a written statement of substantive discrepancies, including specific scope, location and discrepancy discovered.

C. Based upon the Contractor's knowledge of Base Facility conditions "as-found" and the requirements for the Work, propose graphic or written alternatives to Drawings and Specifications to correct discrepancies. Include as supplementary data to the Request for Information.

D. Modifications due to concealed conditions are allowed only for conditions which are accessible only through cutting or demolition operations.

1. No changes in the Contract Sum or Time are permitted for sight-exposed conditions or conditions visible by entry into access doors or panels and above lay-in or concealed spline acoustical ceilings, or by conditions described in Documents 00320 - Geotechnical Information or 00330 - Existing Conditions.

1.09 REQUEST FOR INFORMATION OR CLARIFICATION

A. The Request for Information or Clarification does not authorize work that changes the Contract Price or Time.

B. Request clarification of Contract Documents or other information by using the Request for Information or Clarification.

1. If additional work is required, then the requirement will be requested by the City Engineer's issuance of a Request for Information or Clarification; Request for Proposal; Work Change Directive.

2. This document does not authorize work to proceed.

C. Changes may be proposed by the Contractor only by submitting a Request for Information following Paragraph 1.08.

D. The City Engineer may issue minor changes in the Work, not involving an adjustment to Contract Price or Time using a Request for Information or Clarification and following Document 00700 - General Conditions.

E. Follow directions on back of the Request for Information or Clarification.

1.10 CORRELATION OF SUBMITTALS

A. For Stipulated Price Contracts, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Price, following Section 01290 - Payment Procedures.

B. For Unit Price Contracts, revise the next monthly estimate of work after acceptance of a Change Order to include new items not previously included and the appropriate unit rates.

C. Promptly revise progress schedules to reflect any change in Contract Time, revise schedules to adjust time for other items of work affected by the change and resubmit for review following Section 01325 - Construction Schedules.

D. Promptly record changes on record documents following Section 01770 - Contract Closeout.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01270
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for measurement and payment plus conditions for nonconformance assessment and nonpayment for rejected Products.

1.02 AUTHORITY

A. Measurement methods delineated in Specification Sections are intended to complement criteria of this Section. In event of conflict, requirements of the Specification Section shall govern.

B. Project Manager will take all measurements and compute quantities accordingly.

C. Assist by providing necessary equipment, workers, and survey personnel

D. Measurement and Payment paragraphs are included only in those Specification Sections of Division 01, where direct payment will be made. Include costs in the total bid price for those Specification Sections in Division 01 that do not contain Measurement and Payment paragraphs.

1.03 UNIT QUANTITIES SPECIFIED

A. Quantity and measurement estimates stated in the Agreement are for contract purposes only. Quantities and measurements supplied or placed in the Work and verified by Project Manager will determine payment as stated in Article 9 of Document 00700 – General Conditions.

B. When actual work requires greater or lesser quantities than those quantities indicated in Document 00410 – Bid Form, provide required quantities at Unit Prices contracted, except as otherwise stated in Article 9 of Document 00700 – General Conditions.

1.04 MEASUREMENT OF QUANTITIES

A. Measurement by Weight: Reinforcing Steel, rolled or formed steel or other metal shapes are measured by CRSI or AISC Manual of Steel Construction weights. Welded assemblies are measured by CRSI or AISC Manual of Steel Construction or scale weights.

B. Measurement by Volume:

1. Stockpiles: Measured by cubic dimension using mean length, width, and height or thickness.

2. Excavation and Embankment Materials: Measured by cubic dimension using average end area method.

C. Measurement by Area: Measured by square dimension using mean length and width or radius.

D. Linear Measurement: Measured by linear dimension, at item centerline or mean chord.

E. Stipulated Price Measurement: By unit designation in the Agreement.

F. Other: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of the Work.

G. Measurement by Each: Measured by each instance or item provided.

H. Measurement by Lump Sum: Measure includes all associated work.

1.05 PAYMENT

A. Payment includes full compensation for all required supervision, labor, Products, tools, equipment, plant, transportation, services, and incidentals; and erection, application or installation of an item of the Work; and Contractor's overhead and profit.

B. Total compensation for required Unit Price work shall be included in Unit Price bid in Document 00410 – Bid Form. Claims for payment as Unit Price work, but not specifically covered in the list of Unit Prices contained in Document 00410 – Bid Form, will not be accepted.

C. Interim payments for stored materials will be made only for materials to be incorporated under items covered in Unit Prices, unless disallowed in Document 00800 - Supplementary Conditions.

D. Progress payments will be based on Project Manager's observations and evaluations of quantities incorporated in the Work multiplied by Unit Price.

E. Final payment for work governed by Unit Prices will be made on the basis of actual measurements and quantities determined by Project Manager multiplied by the Unit Price for work which is incorporated in or made necessary by the Work.

1.06 NONCONFORMANCE ASSESSMENT

A. Remove and replace work, or portions of the Work, not conforming to the Contract documents.

B. When not practical to remove and replace work, City Engineer will direct one of the following remedies:

1. Nonconforming work will remain as is, but Unit Price will be adjusted lower at discretion of City Engineer.

2. Nonconforming work will be modified as authorized by City Engineer, and the Unit Price will be adjusted lower at the discretion of City Engineer, when modified work is deemed less suitable than specified

C. Specification sections may modify the above remedies or may identify a specific formula or percentage price reduction.

D. Authority of City Engineer to assess nonconforming work and identify payment adjustment is final.

1.07 NONPAYMENT FOR REJECTED PRODUCT

A. Payment will not be made for any of the following:

1. Products wasted or disposed of in an unacceptable manner.

2. Products determined as nonconforming before or after placement.

3. Products not completely unloaded from transporting vehicles.

4. Products placed beyond lines and levels of required work.

5. Products remaining on hand after completion of the Work, unless specified otherwise.

6. Loading, hauling, and disposing of rejected Products.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01290
PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Schedule of Values.

B. Billing forecast.

C. Value/ time log.

D. Expenditure of Cash Allowances.

E. Applications for Payment.

F. Payment for mobilization work.

G. Final payment.

1.02 DEFINITIONS

A. *Schedule of Values*: Itemized list, prepared by the Contractor, establishing the value of each part of the Work for a Stipulated Price contract, or for Major Stipulated Price items for a Unit Price contract. The Schedule of Values is the basis for preparing applications for payment. Quantities and unit prices may be included in the schedule when approved or required by City Engineer.

B. *Major Stipulated Price Item*: Item listed in Document 00410 - Bid Tabulation Form which qualifies as Major Unit Price Work following Document 00700 - General Conditions Paragraph 9.1.5.

1.03 SUBMITTALS

A. The Contractor must utilize, a web-based system run by the Houston Airport System, to submit Invoices. Before doing so, the Contractor must attend a brief mandatory training session, which will be conducted by a member of HAS. The Contractor must contact the designated HAS trainer prior to the start of construction to schedule a time for training. Access to will not be given to the Contractor's team until training is completed. All document collaboration will be done using a web-based system.

B. Submit electronic version in native format of preliminary Schedule of Values at the Preconstruction Conference (Section 01312 - Coordination and Meetings). Submit electronic copy in native format of final and updated Schedule of Values with each copy of Application for Payment.

C. Submit electronic version in native format of Billing Forecast and Value/Time Log at first Progress Meeting (Section 01312 - Coordination and Meetings). Obtain approval before making first application for payment. Coordinate this submittal with Master Schedule specified in Section 01325 - Construction Schedules.

D. Produce electronic document for Billing Forecast and Value/Time Log on 8 1/2 by 11-inch white bond paper.

1.04 SCHEDULE OF VALUES

A. Prepare Schedule of Values as follows:

1. Prior to the submission of the initial Application for Payment, Contractor shall obtain Project Manager approval for the format and content of the schedule of values for all invoices including the grouping of costs along the lines of specific equipment, asset or deliverable produced as a result of the work performed.

2. For Stipulated Price contracts, use the Table of Contents of the Project Manual as the outline for listing the value of work by Sections.

3. For Unit Price contracts, use Document 00410 as the outline. Include a proportional share of Contractor's overhead and profit in each Unit Price item so the sum of all items equals the Contract Price.

4. List mobilization, bonds, insurance, accepted Alternates and Cash Allowances as separate items.

B. Round off values for each item to the nearest $100.00, except for the value of one item of the Contractor's choice, if necessary, to make the total of all items in the Schedule of Values equal the Contract Price.

C. At direction of City Engineer revise the Schedule of Values and resubmit for items affected by Modifications, at least 10 days prior to submitting the next Application for Payment. List each Change Order as a separate item.

1.05 BILLING FORECAST

Prepare an electronic graphic or tabular Billing Forecast of estimated monthly applications for payment for the Work.

A. This information is not required in the monthly updates, unless significant changes in work require resubmittal of the schedule. Allocate the units indicated in the bid schedule or the schedule of values to Construction Schedule activities (weighted allocations are acceptable, where appropriate). Spread the dollar value associated with each allocated unit across the duration of the activity on a monthly basis. Indicate the total for each month and cumulative total.

B. Billing forecast is only for planning purposes of City Engineer. Monthly payments for actual work completed will be made by City Engineer following Document 00700 - General Conditions.

1.06 VALUE/ TIME LOG

Prepare an electronic Value/ Time Log as a slope chart, showing:

A. Original Contract Time/ Modified Contract Time: x coordinate, in weeks.

B. Original Contract Value/ Modified Contract Value: y coordinate, in thousands of dollars.

1.07 EXPENDITURE OF CASH ALLOWANCES

A. Verify with City Engineer that work and payment requested is covered by Cash Allowance.

B. Prepare electronic version of Document 00685 - Request for Information following Section 01726 - Base Facility Survey, include following minimum data to support Contractor's request for expenditure of Cash Allowances listed in Section 01210 - Cash Allowances, and process in a timely manner to allow detailed review by City Engineer:

1. Statement of fact indicating reason(s) expenditure is required. Include photographs or video following Section 01321 - Construction Photographs documenting existing conditions.

2. Quantity survey, made from on-site measurements, of quantity and type of work required to properly complete work.

3. Cost of work, including detailed proposals from trade(s) responsible. For work governed by unit prices, applying unit prices following this Section.

4. Trade(s) responsible for corrective work.

5. Change in Contract Time.

6. Administrative data, including contract name and number, and Contractor's name.

C. Do not commence affected work without written authorization.

D. Process approved expenditures following Section 01255 - Modification Procedures and Application for Payment process below.

1.08 APPLICATIONS FOR PAYMENT

A. Submit each Application for Payment following Document 00700 and as directed via SharePoint which utilizes an electronic version of the American Institute of Architects Document G702 including G703 continuation sheets.

1.09 PAYMENT FOR MOBILIZATION WORK

A. Measurement for mobilization is on a lump sum basis if included as a unit price in Document 00410.

B. Mobilization payments paid upon application by Contractor subject to:

1. Authorization for payment of 50 percent of the contract price for mobilization will be made upon receipt and approval by City Engineer of the following submittal items, as applicable:

a. Schedule of values.

b. Trench safety program.

c. Construction schedule.

d. Photographs.

e. Submit QC Program

C. Authorization for payment of the remaining 50 percent of the Contract Price for mobilization will be made upon completion of Work amounting to 5 percent of the Contract Price less the mobilization unit price.

D. Mobilization payments are subject to retainage amounts stipulated in the Document 00700.

1.10 FINAL PAYMENT

A. When Contractor considers the Work is complete, submit written certification that:

1. Work is fully inspected by the Contractor for compliance with Contract Documents.

2. Work follows the Contract Documents, and deficiencies noted on the Punch List are corrected.

3. Products are tested, demonstrated and operational.

4. Work is complete and ready for final inspection.

B. In addition to submittals required by Document 00700 and other Sections:

1. Furnish submittals required by governing authorities, such as Certificate of Occupancy and Certificates of Inspection.

2. Submit a final statement of accounting giving total adjusted Contract Price, previous payments, and sum remaining due (final Application for Payment).

C. When the Work is accepted, and final submittals are complete, a final Certificate for Payment will be issued.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01312
COORDINATION AND MEETINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General coordination is required throughout the documents and the Work. Refer to all of the Contract Documents and coordinate as required to maintain communications between Contractor, City and Designer; Subcontractors and Suppliers. Assist City with communications between Contractor and City's separate contractors.

B. Preconstruction conference.

C. Progress meetings.

C. Daily briefings.

1.02 SUBMITTALS

In addition to submittals related to meetings and described elsewhere in this Section, see following Sections for submittals prepared under those Sections, but submitted under this Section:

A. Section 01255 - Modification Procedures: Individual authorized to execute Modifications.

B. Section 01506 - Temporary Controls: "Airport Construction Control Plans", containing submittals prepared under Section 01506 and other Sections referenced therein.

1.03 RESPONSIBILITIES FOR MEETINGS

A. City Engineer may act directly or through designated representatives identified by name at the Preconstruction Conference, and will schedule, chair, prepare agenda, record and distribute minutes and provide facilities for conferences and meetings.

B. Contractor:

1. Present status information and submittal data for applicable items.

2. Record and distribute Contractor's corrections to meeting minutes.

3. Provide submittal data for attendees. Prepare, reproduce and issue Contractor's documents to support conferences and meetings. Issue typically as part of each

session unless more frequent publication is necessary. Issue one copy to each conference attendee, and to others as directed by City Engineer and as required by Contractor.

a. Transmit documents requiring urgent action by email or messenger.

b. Provide electronic and/or hard copies as required to properly document the project or project actions. The Contractor shall coordinate the submittal format with the City Engineer.

c. Initiate and provide facilities for Coordination Meetings as required in 1.04. H.1.

d. Costs for documentation are the Contractor's responsibility.

1.04 CONTRACTOR COORDINATION

A. Coordinate scheduling, submittals, and work of Sections to achieve efficient and orderly sequence of installation of interdependent construction elements.

B. Verify characteristics of products are compatible with existing or planned construction. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing products in service.

C. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. Conceal pipes, ducts, wiring and fasteners in finished areas, except as otherwise indicated. Coordinate locations of fixtures and outlets with finish elements. Locate work requiring accessibility to coordinate with existing access panels and doors.

E. Coordinate completion and clean up of work for Substantial Completion and for portions of the Work designated for partial occupancy.

F. Coordinate access to site and within the work area(s) for correction of nonconforming work. Minimize disruption of occupants' activities where work areas are occupied.

G. Do not proceed with affected work until discrepancies in contract requirements are resolved and unsatisfactory substrate and site conditions are corrected.

H. Coordination Drawings: Before materials are fabricated or Work begun, prepare coordination Drawings including plans, elevations, sections, and other details as required to clearly define relationships between sleeves, piping, ductwork, conduit, ceiling grid, lighting, fire sprinkler, HVAC equipment and other mechanical, plumbing and electrical equipment with other components of the building such as beams, columns, ceilings, and

walls.

1. Hold Coordination Meetings with trades providing the above Work, to coordinate Work of the trades for each floor and mechanical areas.

2. Prepare coordination Drawings to 1/4" = 1'-0" scale for general layout and 3/8" = 1' - 0" for plans and sections in congested areas such as equipment spaces.

3. Resolve conflicts between trades, prepare composite coordination Drawings and obtain signatures on original composite coordination Drawings.

4. When conflicts cannot be resolved, Contractor shall request clarification prior to proceeding with that portion of the Work affected by such conflicts or discrepancies. Prepare interference Drawings to scale and include plans, elevations, sections, and other details as required to clearly define the conflict between the various systems and other components of the building such as beams, columns, and walls, and to indicate the Contractor's proposed solution.

5. Submit Drawings for approval whenever job measurements and an analysis of the Drawings and Specifications by the Contractor indicate that the various systems cannot be installed without significant deviation from the intent of the Contract. When such an interference is encountered, cease Work in the general areas of the conflict until a solution to the question has been approved by the project Architect/Engineer.

6. Submit original composite coordination Drawings as part of record document submittals specified in Section 01770.

1.05 PRECONSTRUCTION CONFERENCE

A. Attendance Required: City Engineer’s representatives, Construction Manager (when so employed), Designer(s), Contractor, Contractor’s Superintendent, and major Subcontractors.

B. Submittals for review and discussion at this conference:

1. Draft Schedule of Values, following Section 01290 - Payment Procedures.

2. Bound draft of Airport Construction Plans, following Sections 01506 - Temporary Controls and 01555 - Traffic Control and Regulation.

3. Draft construction schedule(s), following Section 01325 - Construction Schedules.

4. Draft Submittal Schedule, following Sections 01325 - Construction Schedules and 01340 - Shop Drawings, Product Data and Samples.

C. Agenda:

1. Status of governing agency permits.

2. Procedures and processing of:

   a. Submittals (Section 01340 - Shop Drawings, Product Data and Samples).

   b. Permitted substitutions (Section 01630 - Product Options and Substitutions).

   c. Applications for payment (Section 01290 - Payment Procedures).

   d. Document 00685- Request for Information.

   e. Modifications Procedures (Section 01255 - Modification Procedures).

   f. Contract closeout (Section 01770 - Contract Closeout).

3. Scheduling of the Work and coordination with other contractors (Sections 01325 - Construction Schedules, 01326 - Construction Sequencing and this Section).

4. Agenda items for Site Mobilization Conference, if any, and Progress Meetings.

5. Procedures for Daily Briefings, when applicable.

6. Procedures for City's acceptance testing (Section 01455) and Contractor's testing (Section 01450 - Contractor's Quality Control).

7. Record documents procedures (Section 01770 - Contract Closeout).

8. Finalization of Contractor's field office and storage locations (Section 01505 - Temporary Facilities).

9. Use of premises by City and Contractor (Section 01145 - Use of Premises).

11. Review of temporary controls and traffic control (Sections 01506 - Temporary Controls and 01555 - Traffic Control and Regulation).

12. Construction controls provided by City.

13. Temporary utilities and environmental systems (Section 01505 - Temporary Facilities).

14. Housekeeping procedures (Section 01505 - Temporary Facilities).

1.06 PROGRESS MEETINGS

A. City Engineer will hold Progress Meetings weekly, or at other frequency determined by progress of the Work, at Department of Aviation office at

111 Standifer Street (at George Bush Intercontinental Airport/ Houston), Houston, Texas 77338 (281) 233-3000.

B. Attendance Required: Contractor's Superintendent, major Subcontractors' and Suppliers' superintendents, City Engineer representatives, and Designer(s), as appropriate to agenda topics for each meeting.

C. Submittals for review and discussion at this conference:

1. Project schedule (Section 01325 - Construction Schedules).

2. Submittal Log (Section 01340 - Shop Drawings, Product Data and Samples).

3. Log of Document 00685 - Request for Information.

D. Agenda:

1. Review minutes of previous meetings to note corrections and to conclude unfinished topics.

2. Review of: progress schedule; coordination issues if any; corrective measures if any to regain planned progress; planned progress during succeeding work period; off-site fabrication and product delivery schedules.

3. Field observations, problems, and decisions.

4. Identification of problems which impede planned progress and Contractor's proposals for resolution.

5. Review of submittals schedule and status of submittals.

6. Review of RFI status.

7. Review of Request for Proposal, Work Change Directive and Change Order status.

8. Closings and impediments (Section 01145 - Contractor's Use of Premises).

9. Maintenance of quality and work standards (Sections 01450 - Contractor's Quality Control and 01455 - City's Acceptance Testing).

10. Effect of proposed changes on progress schedule and coordination.

11. Other items affecting completion of the Work within contracted cost and time.

1.07 DAILY BRIEFINGS

A. In addition to Progress Meetings, hold briefings as frequently as required, at place designated by the City Engineer, to coordinate details of construction and airport operations. Discuss specific requirements, procedures and schedule changes, and closures and impediments.

B. When required, hold briefing before start of work each day, to confirm that required activities are properly allocated and unchanged.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01321

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Progress photographs to supplement Applications for Payment.

B. Detail photographs and video to supplement Request for Information.

1.02 MEASUREMENT AND PAYMENT

A. Cost of photographs is incidental to the Contract Price. No additional costs will be paid for other than administrative costs of extra copies and photographs resulting from additional station points.

B. Following work will be paid on a Unit Price basis:

1. Extra Prints: Per print.

   a. Extra prints provided direct from the photographer to parties authorized by the City Engineer up to date of Substantial Completion, priced at prevailing local commercial rates. Include photographer's costs and Contractor's administrative costs only.

   b. Extra prints provided direct from the photographer to the City Engineer up to 3 years after the date of Substantial Completion, priced at prevailing local commercial rates. Include photographer's costs but not Contractor's costs for this service.

2. Additional Station Points: Per stationpoint, for photographs made during same trips as Paragraph 2.01.

C. Emergencies: Per trip to site. Take additional photographs or video, as appropriate to conditions, within 24 hours of the City Engineer's request. This applies to professional photography required by conditions stated in Paragraph 8.2.1 in Document 00700 - General Conditions.

D. Following photography will be commissioned by Modification: Publicity photographs; special events at site; photographs taken at fabrication locations off-site.

1.03 SUBMITTALS

A. Station point Plan: One copy of the Site Plan, marked to show plan, altitude and cone-of-view of each stationpoint selected by the City Engineer or Designer. Submit at least 10 days prior to taking Preconstruction Photographs.

B. Preconstruction Photographs: Same as Paragraph B., except one-time only, and marked as such.

C. Progress Photographs: 3 prints (or digital copies) on approved media of each view. Submit 2 prints and 1 color aerial photograph of the project site (or digital copies) with each Application for Payment. Retain 1 print (or digital copy) by the Contractor at the work site and available at all times for reference. Retain photographic digital files, at the photographer's office, for 3 years after Substantial Completion.

D. Photographs and Video Supporting RFI: Identify following with RFI number and date of photographs:

1. Submit 1 copy of 3x5 inch prints on white card stock in clear plastic sleeves.

2. Submit video on CD’s or other approved media. Include video identification number, date of record, approximate location, and brief description of record.

E. Contract Closeout: Follow Section 01770, Contract Closeout to:

1. Return electronic copies of RFI photographs and video on CD’s or other approved media device, identified by Project name, Contractor, and date photographs were taken.

2. Return video on CD’s or other approved media device, identified with contents, by RFI number, and each CD or other approved media device numbered sequentially and with "Date From/ To" on each.

F. Aerial Progress Photographs: Submit 5 prints and 1 CD of 2 consistent oblique views with each Application for Payment. Retain 1 print by the contractor at the work site and available at all times for reference. The photos shall be large format oblique angles taken from a height and viewpoint to be selected by the City Engineer.

1.04 QUALITY ASSURANCE

A. Timely take and produce photographs from proper station points and provide proper image quality.

B. Cooperate with the photographer's work. Provide reasonable auxiliary services as requested, including access and use of temporary facilities including temporary lighting.

C. Qualifications of Photographer for General Progress Photographs: A firm or individual of established reputation regularly engaged as a professional building or scene photographer for not less than 3 years.

D. Qualifications of Photographer for RFI Photographs and Video: An employee of the Contractor knowledgeable in photography and videotaping technique, including proper use of video pan-zoom, close-ups, lighting, audio control, clear narrative, smooth transition between subjects, and steady camera support.

E. Qualifications of Aerial Photographer: A firm or individual of established reputation, regularly engaged in aerial photography with prior experience at IAH.

PART 2 PRODUCTS

2.01 MEDIA

A. Fixed-Film: 35mm color print film or color slide film, as determined by City Engineer; ASA 100 minimum, higher when required by lighting conditions.

B. Paper Prints:

1. For Progress Photographs: 8x10 inch matte-finish color, in clear plastic envelop with reinforced 3-ring binding.

2. For RFI Photographs: 3x5 inch minimum size, matte-finish color, contact-mounted on flexible white paper card stock in clear plastic envelop with reinforced 3-ring binding.

C. Video: Approved playable PC digital format; record at slowest speed or speed capable of freezing a clear image on "Pause"; date and time stamp as part of recording process. Use audio function for slate data below.

1. Provide color playback equipment at Contractor's site office, with minimum 13-inch (diagonal) screen size.

D. Bitmapped (Digital) Images: TIFF, JPG, PNG, GIF, JPEG, BMP, TGA, or TIFF format, maximum 1280x480 and minimum 480x480 pixels, digitally date and time stamped.

2.02 PRECONSTRUCTION, PROGRESS AND RFI PHOTOGRAPHS

A. Preconstruction Photographs: Prior to beginning on-site construction, take five sets of fixed-film photographs of the project area from approved stationpoints. Show condition of existing site area, and particular features as directed, within contract limits.

1. At exterior views, surrounding situs, showing streets, curbs, esplanades, landscaping, runway, taxiway and apron pavement.

2. At interior views, surrounding situs, showing floors, walls, ceilings and architectural signs.

3. Take pan-view photographs as required to encompass existing conditions.

B. Progress Photographs for Applications for Payment: Take 3 fixed-film photographs from each of 2 station-points (same station points each time to show a time-lapse sequence), coinciding with the cutoff date associated with each application for payment, and at Substantial Completion of each stage of the Work.

C. Photographs and Video for Request for Information: Take photographs and video as required to support Document 00685, Request for Information:

1. Details of existing conditions before construction begins.

2. Details of construction.

3. Details of damage or deficiencies in existing construction and work of separate contractors.

4. Take number of images as required to fully show conditions.

PART 3 EXECUTION

3.01 GENERAL

A. Do not record over previous video records.

B. Provide clear, sharp, vibration-less video data and clear audio without detrimental background noise.

END OF SECTION

SECTION 01325
CONSTRUCTION SCHEDULES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

C. City of Houston (City) Policies, Standards and Procedures, as applicable.

2.01 SECTION INCLUDES

A. Project Schedules and Progress Reporting

B. Construction Sequencing and Phasing

3.01 DEFINITIONS

A. Contractor: With respect to the Division 01 requirements, the entity contracted by the City to deliver the preconstruction and construction services defined in the Contract Documents.

B. Design Consultant - Person or firm and its authorized representatives, under contract with the City, to provide professional services during pre-construction and construction.

C. Project Scheduling Techniques

1. CPM: Critical Path Method

2. PDM: Precedence Diagramming Method

D. Section Definitions

1. **Activity:** A discrete element of Work or task performed during the course of the Project. Each schedule activity shall be clearly defined depicting duration, start and finish dates, logic links to predecessor and successor activities and supported by defined resources where applicable. The activities shall be detailed in such a way,

that they shall support the planning and measurement of physical percent complete for the purposes of Earned Value Management reporting.

2. **Baseline Schedule:** The schedule prepared by the Contractor and approved by the City which is the basis for representing the full scope of Work, the time scales and phasing for delivery, providing a means against which progress can be determined.

3. **Commissioning and Integration Testing Schedule:** Activities contained within the Project Schedule depicting startup, testing and commissioning phase of the Project, including activities associated with the transition to revenue service and required for achievement of Final Acceptance.

4. **Constraint:** Scheduling restriction imposed on start or finish of an activity. A constraint restricts the movement of an activity based on the type of constraint and the date used and may override the logic relationship also assigned to the activity.

5. **Construction Schedule:** Activities within the Project Schedule which depicts the construction activities performed or to be performed by the Contractor as a part of the Project.

6. **Contractor's Project Management Plan:** A formal document prepared by the Contractor and approved by the City which describes how the Project will be planned and progressed and delivered by the Contractor and the necessary reviews and acceptances by the City.

7. **Cost Breakdown Structure:** The breakdown structure the Contractor shall use to distribute contract costs in the various estimates, Schedule of Values and in alignment to the Work Breakdown Structure.

8. **Critical Path Method (CPM):** Scheduling technique utilizing activities, durations, and interrelationships/dependencies (logic), such that activities are interrelated with logic ties from the beginning of Project to Final Acceptance.

9. **Data Date:** Date when the status of schedule activities is determined for a Monthly Progress Schedule report. Any data prior to the Data Date is considered historical information and data after is the forecast of remaining work.

10. **Design Schedule:** Activities within the Project Schedule which includes the design activities of the Project. The Design Schedule shall demonstrate the interdependence between design activities and the Owner's requirements. The Design Schedule shall also demonstrate the relationships between design activities and the requirements to successfully deliver the activities within the Construction Schedule.

11. **Float:** The term "float" shall refer to "end float", also called "terminal float" End or terminal float is the period by which the finish of the longest path through a schedule

(the critical path) can be delayed, brought forward, or extended without affecting the completion date.

12. **Float Suppression:** Any technique that causes an activity to show less float, including but not limited to, as late as possible constraints and unnecessary lags.

13. **Fragnet:** A group of interrelated activities taken from or to be added to a Schedule that can stand on their own representing only a portion of a CPM schedule. For example, a Fragnet can be used to portray a scope of work being added to, or changed from, a Project Schedule.

14. **Key Plans:** Graphic representations on prints of Contract Documents of Contractor's planned breakdown of Project for scheduling purposes. Key plans shall clearly define boundaries of work for each designated segment, locations, and sub-locations. Alphanumeric codes on plans shall match code values for activity code designation in the Project Schedule.

15. **Lag:** Time that an activity follows or is offset from the start or finish of its predecessor.

16. **Materials Plan:** A plan for purchase, fabrication, delivery, storage and issuing of materials and products to the Project which must be integrated into the Project Schedule.

17. **Look-Ahead Schedule:** An element schedule prepared by the Contractor detailing the status of the work as of the Progress Date and Contractor’s plan for executing the remaining work before recalculation and/or re-sequencing.

18. **Longest Path:** The Longest Path is the Path through a Project network from start to finish where the total duration is longer than any other path. The Longest Path is determined by the string of activities, relationships that push the Project to its latest early finish dates.

19. **Monthly Progress Schedules:** The updates to the Project Schedules prepared by Contractor and submitted to the City on a monthly basis with the Application for Payment. There are two versions of Monthly Progress Schedules submitted; a Progress Only (PO) version and a Contractor Adjusted (CA) version.

20. **Preconstruction Schedule:** An element of the Project Schedule prepared by the Contractor which includes activities prior to approval to proceed with construction activities.

21. **Project Schedule:** A CPM Schedule prepared by the Contractor that includes all elements of the Scope of Work of the Contract. The Project Schedule clearly identifies all relationships that exist within the Scope of Work. The Project Schedule

communicates the sequencing of the multiple phases of work. The Project Schedule identifies interfaces, both internal and external to the Scope of Work of the Contract. The Project Schedule encompasses the Baseline Schedule, Look Ahead Schedules, Delivery Phase Schedules (Design, Procurement, Detailing, Fabrication, Shipment, Installation, Construction, Startup, Testing and Commissioning), updated or revised Baseline Schedules. The Project Schedule also includes Monthly Progress Schedules, Proposed Schedules, Schedule Fragnets, Recovery Schedules.

22. **Program Schedule:** When multiple Projects are logically linked into a Program, the Program Schedule is prepared by the City and incorporates all the interrelated projects by combining the individual Project Schedules. Project Schedules become element schedules of the Program Schedule.

23. **Proposed or Preliminary Schedule:** A schedule prepared by Contractor, prior to approval of the schedule by the City and subsequent incorporation into the Project Schedule. Also referred to as Draft or Initial Schedule.

24. **Recovery Schedule:** A schedule prepared by the Contractor and to be approved by the City which details the Contractor's plan for recovery of time lost on the Project and associated costs.

25. **Revised Baseline Schedule:** A revision to the Baseline Schedule that is necessitated to accurately reflect a significant change in scope or phasing of the scheduled Activities. The Baseline Schedule shall not be revised without prior approval by the City.

26. **Status Data Date:** The "as-of" date up to which all progress has been updated and reflected in the Status report. The Status Data Date is also the date from which a Look-ahead Schedule predicts future activities and progress.

27. **Submittal Schedule:** A register (list) of the Submittals to be made for materials, products, shop drawings, plans which is prepared by the Contractor and includes durations needed for submittal, reviews and processing. The dates and durations are to be coordinated with the associated activities within the Project Schedule.

28. **Delay Analysis:** Technique that demonstrates comparison of time impact for each schedule revision or proposed revision against the current Project Schedule. Methodology shall follow Association for the Advancement of Cost Engineering International (AACEI) Delay Analysis as applied in Construction (Recommended Practice No. 52R-06.) as a guideline or method submitted by the Contractor and approved by the PMT.

29. **Work Breakdown Structure (WBS):** A deliverable-oriented breakdown of a project into decreasingly smaller components, also described as a hierarchical decomposition of the project team's work into manageable sections.

30. **Working Day:** Day scheduled for active execution of Work in the Project Schedule Calendar in accordance with the Contract and as approved by the City.

4.01 SUMMARY

A. Acceptance of Schedule Requirements by Contractor

1. The Contractor accepts the responsibility to complete the project on time as called for in the contact.

B. Schedule Requirements

1. The Contractor is responsible for determining the sequence of activities, the time estimates for the detailed construction activities and the means, methods, techniques and procedures to be employed. The Project Schedule shall represent the Contractor's plan of how it will prosecute the Work in compliance with the Contract requirements. Contractor shall ensure that the Project Schedule is current and accurate and is properly and timely monitored, updated and revised as Project conditions may require and as required by the Contract Documents. Unless the context indicates otherwise, the term "schedule" used herein will be read to include updated schedules.

2. Schedules shall contain logic and necessary components to perform Critical Path Method (CPM) network analysis. Contractor's schedule shall also be able to illustrate Precedence Diagraming Method (PDM).

3. Contractor shall include in the Project schedule contractual milestones and all interface points with City, Design Consultant(s), Subcontractors, Suppliers, and other Contractors. These points shall be in the form of Start Milestones for deliverables due to the Contractor from others, and as Finish Milestones for deliverables that Contractor must supply to City, Design Consultant(s), Subcontractors, Suppliers and other Contractors. Finish milestones must be determinate by predecessor activity, not by constrain.

4. Schedule shall contain activities for preparation and approval of contractor's design and submittal deliverables. Procurement, fabrication and delivery of mayor materials and long lead items. Obtain permits and construction activities.

5. Contractor shall allocate duration uncertainty to the scheduled activities within the contract schedule to enable a Quantitative Schedule Risk Analysis (QSRA) to be performed by the Program Management Team. Duration uncertainty (minimum duration, maximum duration, most likely duration) according to the relevant risk exposure shall be captured by the contractor against the scheduled activities. The PMT must rely on the data being supplied by the Contractor and incorporated and updated in line with the monthly schedule update process.

6. Contractor shall utilize the most current version of Primavera P6 (15.1 or Later) for all schedules governed by these provisions.

7. The Contractor is responsible for assigning appropriate material, equipment and labor resource loading of the key quantities necessary to execute the activity. This will demonstrate realistic productivity rates as well as measure and report Key Performance Indicators (KPIs).

8. The City Engineer reserves the right to reject any schedule or report that fails to realistically or satisfactorily reflect completion of the Project scope of work or any agreed intermediate milestone. Failure of the Contractor to deliver satisfactory schedules or reports as required in the Contract Documents may result in actions by the City General Conditions.

9. The schedule shall show all activities in Work Days, with allowance for holidays or other periods when work is not permitted to be performed.

10. Detailed schedule requirements shall be contained within the City Policies, Standards and Procedures).

11. Contractor shall prepare schedules which assure that all work sequences are logical, and the network shows a coordinated plan for complete performance of the Work. Failure of the Contractor to include any element of work required for performance of the Contract in the network shall not excuse the Contractor from completing all Work within the Contract Time.

12. Contractor must have an approved workhour plan as noted in the approved Work Authorization Notification (WAN) prior to commencing work on the project site. Changes to the approved work-hours plan shall require 48-hour written notice and subsequent written approval by the City.

5.01 SUBMITTAL REQUIREMENTS

The Contractor must utilize the City's web-based application management system for submittals. The Project Manager will coordinate training and access to the web-based application management system. The submittal processes are further defined in Section 01330 Submittal Procedures and in the City Policies, Standards and Procedures, as applicable.

A. In addition to the PDF versions of the schedule required in this Section, submit one electronic copy of schedule in Primavera compressed format (.XER). Filename shall have a unique identifier and shall include a sequential number for each monthly update. PDF prints and reports shall be generated from same version of the Schedule that is provided in electronic form.

B. Submittal of Contractor Schedules

1. Submit Preconstruction Schedule for approval within 30 days of NTP for Preconstruction Services

2. Submit the initial proposed Project Schedule for approval as a Baseline Schedule within 30 days of NTP for Construction Services.

3. Submit Monthly Progress Schedule and Narrative no later than 12:00 noon (local time) on the Wednesday before the last Friday of the month. The Data Date for the Monthly Progress is 00:00 hours on the Saturday following the last Friday of the Month. The Monthly Progress Schedule is required for each Application for Payment. Contractor may request to meet with the City prior to the submittal of the Monthly Progress Schedule and Application for Payment to resolve issues prior to submittal.

4. The weekly 3 weeks Look-Ahead Schedule shall be submitted every Tuesday at 08:00 hours with the previous week's progress updated. The Status Date of the Look-Ahead Schedule shall be the previous Saturday at 00:00 hours, progressed weekly.

5. Submit Delay Analysis per the AACEI recommended practice 52R-06 as follows:

    a. Within ten work days after receipt of written change modification.

    b. Within ten work days after receipt of written notice by City.

    c. Within ten work days from beginning of delay caused by unforeseeable circumstances.

6. Submit Recovery Schedule following the event of a forecast delay. Contractor shall submit a Recovery Schedule within the 21 calendar days of Contractor receiving City's written request that is resource and cost justified indicating how the Contractor will recoup the impacted contract time.

7. Submit an As-Built Schedule within 30 work days after the City's Final Acceptance of the Work.

8. Submit a Submittal Log as a supplement documents for Monthly Progress Schedule, showing all submittals for products, materials, plans, and shop drawings, RFI's and administrative submittals required per the Technical Specifications including associated Specification Section numbers and headings.

    a. Include durations and dates for processing by Reviewers and/or other parties as required. Indicate submittals requiring special processing such as short-duration reviews.

    b. The Contractor shall coordinate packaging of individual submittals in a logical and organized fashion so that they may be reviewed in part or in whole with related

elements of work with the Reviewers.

c. Include durations and dates based on frequency of Contractor's submittals to City for items such as of administrative submittals such as Applications for Payment, Labor Reports, Safety Reports, MWBE Reports.

6.01 SCHEDULE CONTROL PROCEDURES AND QUALITY ASSURANCE

A. Control Procedures

1. Procedures for schedule control shall be included in the Contractor's Project Management Plan as part of the plan implementation and reporting requirements. Prior to submission of Monthly Progress Schedule contractor should call for scheduling workshop with Houston Airports to propose schedule changes to remove out of sequence logic and to present accurate critical path. Allowed changes are only for removing or adding logic links. Changes in original durations, resources etc. are not permitted. After approval of schedule changes contractor can proceed with Monthly Progress Schedule submission. All changes must be recorded in schedule change control log and submitted as supplementary document in Monthly progress report.

2. If any in-progress activity is delayed for any reason, that activity will be split to track the reason for the delay. A separate activity for the delay will be created and placed in between the split.

3. Procedures for preparing and monitoring the Project Schedule and other required reporting.,

4. Procedures for performing quality oversight of the schedule review/forecast.

5. Earned Valued Methodology Procedures shall be implemented for performance measurement using data from the schedule to provide an effective means of comparing Work scheduled/planned versus Work performed. Please see Section 0 Section 01 32 16, 1.3.D1.Provide, as a minimum, a continuous review of actual progress against the most recent Project Schedule. This is to assure that revised resource allocation and/or other corrective action can be considered and undertaken proactively and as early as possible.

B. Qualifications of Contractor's Scheduler

1. Contractor shall have within its employ or under separate Contract, throughout the execution of the Work under this Contract, such expertise in CPM scheduling and P6 software so as to insure its effective and efficient performance under this Specification. It shall be the responsibility of the Contractor to prepare input information for the Contract Schedule, monitor progress, provide input for updating

and revising logic diagrams when necessary and otherwise fulfilling its obligations hereunder. Contractor shall submit the qualifications of the CPM Specialist for acceptance by the City.

7.01 SCHEDULING PRINICIPLES AND REQUIREMENTS

A. General

1. Contractor shall prepare the Schedules identified in this Section during the performance of Contract. The Schedules shall:

   a. Be detailed, time-scaled, computer-generated schedules, using the Critical Path Method, that accurately depict activities representing each portion of the Work from the current Data Date through Final Acceptance.

   b. Be used for planning and coordinating the Work.

   c. Be the basis for reporting all the Work to be performed in fulfillment of the Contract Documents.

   d. Accurately depict the Contractor's current logical activity sequences and activity durations necessary to complete the Work in accordance with the requirements of the Contract Documents.

   e. Assist Contractor and City in preparation and evaluation of Contractor's monthly progress payments.

   f. Assist the City in evaluating progress (including payment) of the Work.

   g. Assist Contractor and City in monitoring progress of Work and evaluating proposed changes to the Contract and requests for additional contract time.

   h. Provide for optimum coordination by Contractor of its trades, Subcontractors, and Suppliers, and of its Work with the Work or services provided by any separate Contractors.

   i. Permit the timely prediction or detection of events or occurrences which may affect the timely prosecution of the Work.

   j. Provide a mechanism or tool for use by the City, and Contractor in determining and monitoring any actions of the Contractor which may be required in order to comply with the requirements of the Contract Documents relating to the completion of the various portions of the Work by the Contract Time specified in the Contract Documents.

2. Contractor shall include in the Contract schedule all interface points with City, Design

Consultant(s), Subcontractors, Suppliers, and other Contractors. These points shall be in the form of Start Milestones for deliverables due to the Contractor from others, and as Finish Milestones for deliverables which Contractor must supply to City, Design Consultant(s), Subcontractors, Suppliers and other Contractors. The PMT will assist in obtaining the relevant data from other parties when required.

3. Contractor shall provide to the City duration uncertainty and risk events for scheduled activities within the contract schedule to enable a Quantitative Schedule Risk Analysis (QSRA) to be performed by the City. Duration uncertainty (minimum duration, maximum duration, most likely duration) according to the relevant risk exposure shall be captured by the contractor against the scheduled activities.

4. Calendar

   a. Anticipated work and non-work periods shall be included for each activity.

   b. Agreed Holidays shall be included as non-work days assigned to the appropriate day as they occur.

   c. Anticipated Weather Lost Days

   d. As the basis for establishing a "Weather Calendar", use the National Oceanic and Atmosphere Administration's (NOAA) historical monthly averages for days with precipitation, using a nominal 30- year, greater than 2.5 mm 0.10-inch amount parameter, as indicated on the Station Report for the NOAA location closest to the project site. In addition, incorporate into the Weather Calendar, other non-workdays such as Saturdays, Sundays and Federal Holidays.

B. Activities

1. Contractor shall use and/or implement generally accepted recommended industry practices and the City Policies, Standards and Procedures, as applicable.

2. Schedule activities shall be sufficiently named or titled to include what is to be accomplished and identified by the applicable work areas. Activities shall be grouped to assist in the understanding of the activity sequence. Examples of the types of activities to include in each schedule are as follows:

   a. Design Activities: If and when Contractor has responsibility for the design as a part of the Contract, design activities shall be logically tied to the Construction Activities without constraints and Contractor shall develop an agreed design progress and performance measurement system based on design package deliverables and division of responsibilities. At a minimum, design work shall be divided to have an agreed number of deliverables per area/facility/system/subsystems and the governing jurisdictions. Actual design

packaging scheme shall be agreed upon with the City prior to implementation. When Contractor does not have responsibility for design as a part of the Contract the design activities shall be logically tied to the Construction Activities as start Milestones. Include Contractor's agreed design packaging scheme to support timely procurement of material, obtaining permits, and construction plan and include:

1) Agency review and approval cycles based on applicable Governmental Persons, Authority(s) Having Jurisdiction (AHJ) and other applicable Laws, Regulations, and Ordinances.

2) Activities for each design phase (Concept, Schematic (30%), Design Development (60%) and Issued for Permit and Issued for Construction (100%) documents.

3) Application for, and receipt, of required permits.

4) Contractor's submittal of design and construction documents for City review and approval.

5) Design review cycles and logical ties to subsequent fabrication, delivery, and construction activities.

6) Other design related deliverables.

b. Procurement Activities: Contractor’s procurement activities included in schedules shall be logically tied with no constraints and shall be resource and cost loaded. Examples of Procurement activities include, but are not limited to:

1) Bid and award cycles.

2) Shop Drawing development and approval.

3) Equipment and Materials submittal preparation and approval

4) Equipment and Materials, fabrication, factory acceptance testing, and delivery.

5) Purchased and Stored Material/Equipment.

6) Material/Equipment delivery requirements by the City.

c. City Activities: Activities of City and other third-party activities shall be clearly identified in the Project Schedule. These activities include, but are not limited to, the following and the precursor processes:

1) Right-of-Way property acquisition and site access.

2) Submittal reviews.

3) Inspections and tests as necessary.

4) Environmental permit approvals by regulators.

5) Notice to Proceed.

6) Delivery of City-furnished material/equipment.

d. Construction Activities: Construction activities shall be resource and cost loaded as described in this Section and shall include, but not be limited to:

1) Mobilization or demobilization.

2) Installation of temporary and permanent Work by trades, areas, and facilities as described in the Contract Documents.

3) Activities to describe the Work in sufficient detail identified according to the WBS.

4) Testing and inspections of installed work by technicians, inspectors or engineers as well as the outages.

5) Final clean-up.

6) Scheduled Substantial Completion.

e. Commissioning and Integration Testing Activities shall be resource and cost loaded and shall include, but not be limited to:

1) Start-up and Testing of equipment and systems.

2) Commissioning of building and related systems.

3) Scheduling of specified manufacturer's representatives.

4) Dynamic Testing Readiness.

5) Pre-Final inspection.

6) Final Acceptance inspection.

7) System Demonstration Performance Tests.

8) Training to be provided.

9) Administrative tasks and processes necessary to start, proceed with, accomplish, or finalize the Work.

C. Activity Durations:

1. Contractor shall maintain individual schedule activity durations of 20 work days or less.

2 Activities exceeding 20 work days in duration shall contain appropriate production projections so that entries can be maintained, and remaining durations adjusted according to physical progress.

3 Items such as Procurement, Fabrication, and Delivery activities may exceed 20 work days with the approval of City.

4. The Contractor is not permitted to modify (increase or decrease) an activity's original duration after it is approved by the City. During the monthly updating process, only the activity's remaining duration may be modified.

D. Summary Level Activities

1. Contractor may use Summary Level activities to represent the Work under the following conditions:

a. In the Preconstruction Schedule, those activities starting at least 180 days after the NTP or as otherwise agreed with the City.

b. In the Project Schedule and Monthly Progress Schedules, those activities starting at least 360 days after the NTP or as otherwise agreed with the City.
c. Summary Level activities should not exceed 90 work days without City approval and shall match the Work Breakdown Structure.

d. All Summary Level activities shall be detailed and supported by appropriate key resource information resource and cost loaded as agreed to in the Scheduling Conference.

e. Contractor shall replace Summary Level activities in the Preconstruction and Proposed Project Schedule with detailed activities through an updating process as the information becomes available and as the above-defined or agreed day limits roll forward.

2. Activity Relationships/Use of Constraints, Lags and Milestones

   a. Except for the Notice to Proceed and Project Completion milestone activities, no activities shall be open-ended, open-start or open finish. Each activity shall have predecessor and successor relationships to present sequence of work and movement of resources (hard and soft logic). Once an activity exists on an approved Project Schedule it may not be deleted, renamed, or renumbered, unless approved by City.

   b. Finish-to-Start relationships shall be the primary relationship used in all Project Schedules unless valid reasons are demonstrated for other logic relationships. Start-to-Start with lags shall be permitted provided the lag is updated and no gaps exist between contiguous activities due to the lag. Activities linked to successors only with Start-to-Start relationships shall not be permitted and must also include a Finish-to-Start or Finish-to-Finish relationship with one or more successors. Finish to Start relationship with lag shall not be permitted.

   c. Lags shall not be used when the creation of an activity will perform the same function (e.g., concrete cure time). Use of lag must be minimized and restricted to only those situations where it is not possible to properly define the start or finish of an activity by the use of a normal Finish-to-Start, Start-to-Start or Finish-to-Finish relationship. Duration of a lag shall not exceed the duration of the predecessor activity. Negative lags shall not be permitted. Contractor shall identify any lag proposed and provide an explanation for the purpose of the lag in the activity notebook and Narrative Report.

   d. Date/time constraints, other than those required by the Contract Documents, shall not be used unless jointly agreed to by City and Contractor. If Contractor seeks approval to include constraints in the schedule, Contractor shall identify any constraints proposed and provide an explanation for the purpose of the constraint in the activity notebook and Narrative Report.

   e. Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in the CPM scheduling software system. Actual Start and Actual Finish dates shall be included on the Monthly Progress Schedule and shall be consistent with other project reporting, such as daily reports, and the Contractor's monitoring and performance measuring system. In-progress activities will be updated by revising the activity's remaining duration according to actual measured or estimated work progression.

   f. Allowable activity dates are early start, late start, early finish, late finish, actual start, and actual finish. Use of activity dates such as "expected" are prohibited.

   g. Float Suppression techniques (i.e. as late as possible constraints) shall not be allowed. All Float shall be shown in the Project Schedule. Float shall be

monitored, accounted for, and maintained in accordance with this Section.

h. Activity constraints or use of activity durations, logic ties and sequences unapproved by the City shall not be used in any Project Schedule.

3. Resource Loading Project Schedule

a. The Activities within the construction schedule shall be resource loaded with key quantities and updated on a weekly basis to track the production of construction activities. The update of key quantities will be used to track Key Performance Indicators (KPIs) set forth by the PMT.

E. Software Settings

1. De-Link Remaining Duration and Percent Complete. Construction activity progress will be calculated using Remaining Duration and Physical Percent Complete.

2. Set Resource Data to “Two decimal places”.

3. All activity durations and Float values will be shown in days.

4. Schedule calculations and Out-of-Sequence progress (if applicable) shall be handled through Retained Logic, not Progress Override and not Actual Dates. Out- of-Sequence activities shall be updated to reflect actual project conditions.

5. Date format will be DDMMMYY (i.e., 01DEC15.)

6. Default activity type will be set to “Task Dependent”."

7. The Duration Type for each activity shall be set to "Fixed Duration and Units” before assigning any costs or resources to the activity.

F. Activity IDs

1. The naming and coding of activities will strictly be per the City policies, standards and procedures, as applicable. Activity IDs shall be provided for each Activity with up to 15 characters as detailed in the City Policies, Standards and Procedures, as applicable. The purpose of the structure for the Activity ID is for easier identification and for improved organization in all Project Schedules. Each part of the ID will also need to be included in the schedule as an activity code.

2. Activity IDs shall not be deleted and/or re-assigned. If during the course of the project, an activity is needed to be deleted, that Activity shall move to the inactive WBS titled “Deleted Activities” in order to avoid re-using of the same Activity IDs, should the need of adding new activities arise.

3. Activities to be deleted: Remove logic, relationships and Activity Codes.

G. Activity Names

1. Activity

a. Location - Verb Names shall be brief but shall convey the scope of work described. Non- Standard abbreviations shall be explained in the Narrative Report. Percentages shall not be used in activity descriptions (e.g., Pour West Footing (0 - 50%)) unless the City agrees with the use of percentage for a particular activity. Contractor shall submit samples of activity names for approval prior to establishing the schedule.

b. All activities shall have a unique activity name/description.

c. Activity names can only be modified to add detail describing an activity's scope, correct the spelling or grammar, or to improve for clarity, but cannot be revised to completely change the scope of the activity.

d. Each activity name should follow the following format:

(1) Noun.

(2) Station numbers, column numbers, or other description for the location, may be included at the end of the activity name if it will provide a better description of the activity.

e. Example values for Location include but are not limited to:

(1) Segment Number.

(2) Column Line Numbers.

(3) Stationing Value.

(4) Other Unique Identification schemes.

f. Examples of Verbs include, but are not limited to:

(1) Design.

(2) Install.

(3) Procure.

(4) Fabricate.

(5) Deliver.

(6) Erect.

(7) Describe the work being performed.

H. Work Breakdown Structure

1. Activities in Project Schedules shall be tied to the Work Breakdown Structure as provided in the City Policies, Standards and Procedures, as applicable.

I. Activity Codes

1. The purpose of the activity codes is to further sort and filter the schedule activities to enhance reporting capability. The activity codes required include both those that are already part of the Activity ID and those that are not.

2. Activities shall be coded as indicated in the City Policies, Standards and Procedures, as applicable.

J. Resource Loading

1. Resource loading shall be done on every construction activity, representing quantifiable work or materials of that Work Package.

2. Each resource-loaded activity shall have an estimate of the key quantities.

3. Failure to incorporate resource loading and establish planned productivity and/or production rates (defined as the planned quantity of work to be executed in a given time), may result in the Contractor's waiver of any right to compensation and time extension for loss of productivity. Submission of any such claim may be rejected for failure to establish baseline productivity by which any claimed loss would be measured.

4. Failure to incorporate resource loading and establish planned productivity may also result in the rejection of any schedule by the City Engineer.

K. Schedules as the Basis for Payment

1. The approved Project Schedule of Values shall be the basis for monitoring and calculating the Contractor’s progress during each update period and therefore the amount of each progress payment. Lack of an approved Project Schedule or Monthly Progress Schedule Update will result in the inability of the City to evaluate contract

progress for the purposes of payment. Failure of the Contractor to provide all information, as specified in this Section, will result in the disapproval of the Monthly Progress Schedule (City Engineer may decline to certify payment and may withhold request for payment in whole or in part as set forth in the General Conditions, Article 9, Subparagraph 9.7.3.).

2. Percent complete for activities in the Schedule of Values shall be based on proportion of the overall quantity of the physical work complete. Contractor and City to jointly assess and agree on actual values for easily discernible units of measure (square feet, each, linear feet) on a weekly basis.

L. Cash Flow Report

1. The Contractor shall generate Cash Flow Reports based on each submitted Project Progress Schedule. Report shall be grouped and formatted to be consistent with the approved schedule of values from the contract. Reports shall indicate a time-phased distribution of Schedule of Values. Alternate Cash Flow Reports, if requested by the PMT, shall be submitted for approval prior to submission of the first report.

2. The Cash Flow Report shall display in tabular and graphic format, projections of monthly values of anticipated cost. Each schedule of values line item is to be represented within the project. The Cash Flow Report should also contain the adjusted forecast of estimated costs to achieve completion of the project.

M. Use of Float

1. Float shall be monitored and accounted for. The Float in any schedule shall not be considered for the exclusive use of either the City or Contractor; rather it is for the benefit of the Project. As such, Float is considered an expiring resource available to both parties on a nondiscriminatory basis, so long as the parties act in good faith and work in the best interests of completing the Project on time.

N. Contractor and City Responsibilities for Schedules and Acceptance

1. Any schedule or schedule update rejected or otherwise marked by the City as requiring revision and resubmission shall be revised by the Contractor and resubmitted within 5 days of such revision or resubmission Notice by the Project Manager. Any schedule or schedule update that has not been approved or accepted is presumed lacking a reasonable degree of accuracy and will not be considered by the City to be reasonable, feasible, or accurate when used by Contractor as a basis for a Time Impact Analysis or other type of delay analysis or claim.

2. If Contractor fails to submit its initial construction schedule or monthly schedule updates, or any such schedule or updates are not acceptable to the City, the City Engineer or Director may take such action to decline certifying payment and may

withhold request for payment in whole or part) as set forth in Article 9 - General Conditions, §9.7.3 or any other remedy set forth in the Contract or at law of equity.

3. Contractor Responsibilities

   a. Contractor shall have the responsibility to develop and update the schedules according to all requirements described herein. All schedules shall accurately represent to the City the Contractor's plan for execution of Work. Contractor shall use the most current Project Schedule to execute the Work in compliance with Contract Documents.

   b. In developing and updating the Project Schedules, Contractor represents that it shall require its Subcontractors to actively participate in such development and updating processes. The Contractor represents that all schedules are consistent with Contractor-approved Subcontractor schedules with sufficient agreed details.

   c. Contractor is required to provide its Subcontractors' schedules and updates in native format upon request by City.

   d. Costs incurred by the Contractor in complying with the requirements of this Section or other scheduling obligations contained in the Contract Documents, including but not limited to Contractor's Scheduler, and preparation of all Project Schedules, creation of Recovery Schedules, and the preparation of Time Impact Analysis shall be included in the Contract Price, and shall not be the subject of requests to the City for contractual relief.

4. City's Responsibilities

   a. All Project Schedules shall be submitted to the City for review and approval, consistent with the specific requirements set forth herein. The City shall have the right to disapprove any schedule if the schedule fails to comply with the requirements herein, provided, that such disapproval is based on a reasonable determination by the City that such schedule contains deviations from the specifications. City shall have the right to waive what it considers to be, in its sole discretion, minor defects in a schedule. City recognizes its responsibility to act in a reasonable manner with respect to approvals and agrees that approvals shall not be unreasonably withheld (i.e. for matters that do not impact the effective functioning of the schedule.)

   b. Any approval by City of the schedules submitted by the Contractor to City shall mean that in the opinion of the City, Contractor has complied with the requirements of this Section. No such review shall release or relieve the Contractor from full responsibility for the accurate and complete performance of the Work, including the accuracy and completeness of the schedules, or any other duty, obligation or liability imposed on it by the Contract including, the responsibility

for completing the Work within the time set forth in the Contract. The review or approval will not constitute a representation by City that the Contractor will be able to proceed or complete the Work in accordance with the dates contained in submitted schedule.

c. In reviewing schedules submitted by designers, contractors, or others, the City will review the schedules to determine if the respective schedule appears "feasible and reasonable"; and, determine if the services or work could logically be accomplished in the time frames allotted in the schedule. Approving, accepting, or assenting to (hereafter referred to collectively as "approval" or "approving") a schedule only means that the City considers that the schedule appears "feasible and reasonable."

d. By approving a schedule, the City is not agreeing that the work or services will be accomplished according to and within times set forth in the schedule. Nor by approving a schedule does the City accept or bear some responsibility or liability if the work or services are not accomplished according to and within times set forth in the schedule or if factors upon which the schedule is based thereafter change during the execution of the works or services. Approval of any schedule showing completion beyond milestone dates and/or beyond contract completion times indicated in the contract shall not change any milestone or completion times in the contract and approval of a schedule is without any prejudice to the rights of the City.

O. Schedule Workshops and Review Meetings

1. A record of all Schedule Workshops and Schedule Review Meetings shall be made by the Contractor stating the place and time of the meeting, the names and identification of those present, and a description of the topics discussed, and the agreements reached. Meeting minutes for these meetings, subject to the City's review and approval, shall be prepared immediately after the meeting and issued within three days, with distribution to the City and all attendees.

2. Project Scheduling Workshops:

a. Proposed Schedule Workshop

b. Contractor shall meet with the City within 14 days after the Notice to Proceed for Preconstruction Services to conduct a Post-Award Kick-Off Meeting and Project Scheduling Workshop to review and coordinate schedule requirements including, but not limited to, the following:

(1) Review software limitations and content and format for reports.

(2) Verify availability of qualified personnel needed to develop and update

schedule.

(3) Discuss physical constraints to the project, including phasing, work stages, area separations, and interim milestones.

(4) Review delivery dates for City-furnished products.
(5) Review of Contractor and Subcontractor procurement cycles and their work plans.

(6) Review schedule for work of the City's separate contracts.

(7) Review submittal requirements and procedures.

(8) Review time required for review of submittals and re-submittals.

(9) Review requirements for tests and inspections by independent testing and inspecting Governmental Authority(s)

(10) Review time required for Project closeout and City startup procedures, including commissioning activities.

(11) Review and finalize list of construction activities to be included in schedule.

c. Baseline Schedule Workshop

(1) Contractor shall meet with the City within 30 days after the Notice to Proceed for Construction Services to conduct another Post Award Kick-Off Meeting and Project Scheduling Workshop. This Workshop shall involve scheduling personnel from Contractor and City with the objective of working together to establish procedures for the development of the Baseline Schedule, and to ensure that the City requirements are satisfied and to review and coordinate schedule requirements Contractor shall present the draft Baseline Schedule including a description of intended methodology and assumptions used to accomplish the Work. Presentation shall include:

(a) Contract scope.

(b) Submittals with City's review.

(c) Activity durations.

(d) Logic.

(e) Activity coding.

(f) Weather assumptions.

(g) Resource Loading

(h) Cost Loading and Resource Loading

(i) Performance and Progress measurement.

(j) Consequence of potential risks including:

(i) Long lead times (procurement/deliveries).

(ii) Labor and materials shortages.

(iii) Accidents.

(k) Environmental factors.

(l) Contractor's plan to mitigate any potential risks should they occur.

(m) Establish Key Performance Indicators (KPI's) for actual progress compared to projected progress.

(i) Workshops shall be conducted no more than every 14 calendar days, until the Baseline Schedule is accepted and approved by City.

P. Joint Monthly Progress Schedule Review Meetings

1. Joint Project Status and Monthly Progress Schedule Review Meetings will be held between the City and Contractor consistent with the Contractor's submission of a Monthly Progress Schedule. Contractor is responsible for gathering all supporting documentation, presenting the data for the applicable Monthly Progress Schedule and recording the meeting minutes. The primary purpose of these meetings shall be to review the Monthly Progress Schedule, the monthly Pay Application, and construction progress, including but not limited to:

a. Actual start and finish dates of work accomplished, or actual start date and physical percent complete. Identify activities started and completed during the previous period and enter the Actual Start and Actual Finish dates. It shall be understood that Actual Start is defined as the date that work begins on an activity with the intent to pursue the work represented by the activity to its substantial completion, and Actual Finish is defined as the date that the activity's work is complete.

b. The amount of the Work remaining for the next period as incorporated in the

schedule. Indicate activity progress and/or revise remaining duration (in workdays) to update each activity started, but not completed (remaining duration.) The remaining duration of an activity shall over-ride the calculated percent complete of an activity's duration when preparing the Monthly Progress Schedule.

c. Changes in the critical path(s) of the schedule.

d. Modifications that affect durations, sequencing or logic of activities for which the City, Governmental Authority(s) or other third parties are responsible.

e. The assessment of any delays to Longest Path(s).

f. Determination of delays, and, as applicable, adjustment of Force Majeure Reserve.

g. All other schedule changes as reflected in the accompanying narrative will be reviewed for relevance and effect on remaining Work.

h. Resource constraints, if any and proposed work-around sequences.

(i) Review proposed schedule changes, future Work and potential problems or impact.

(j) Review the Application for Payment to determine the accuracy of, in accordance with the Project Schedule, all progress achieved, the satisfaction all requirements relating to invoicing for Stored Materials, Time and Material (T&M) Change Orders, and whether it is otherwise complete and accurate.

Q. Modifications – Time Impact Analysis

1. Proposed modifications, including potential delays that are anticipated or experienced shall be submitted to City. Contractor has a duty to mitigate delays through modified sequences to minimize cost and time impact caused by the change or potential delay.

2. The Contractor shall prepare a Delay Analysis for each modification, potential delay, delay event, or Contractor request that may affect the Scheduled Substantial Completion Date. The Delay Analysis shall be developed and submitted in accordance with Contract Documents or as requested by City and shall conform to all scheduling principles described in this Section. Preparation of Time Impact Analyses is considered part of construction process and shall be performed at no additional cost to City.

3. Delay Analysis methodology shall follow the guidelines contained in the Association for the Advancement of Cost Engineering International (AACEI) Time Impact Analysis as Applied in Construction.

4. City will strive to approve or reject each Delay Analysis within ten Work Days after receipt of each Time Impact Analysis, unless subsequent negotiations are required, or multiple analyses are submitted at one time. Upon Approval, a copy of the Time Impact Analysis signed by City shall be returned to Contractor and incorporated into Schedule at next Monthly Progress Schedule update which will then become the current approved Schedule.

5. Delay Analysis shall meet requirements for submittal of Schedules including a Fragnet, with sufficient supporting documentation to enable City to make a determination of Contractor's request for a time extension.

6. Upon execution of a Change Order adjusting the Schedule Substantial Completion Date, the agreed upon event and impact shall be included in the next Monthly Progress Schedule if the parties agree to the extent of the impact. Changes in the schedule should be clearly identifiable by specific Activity IDs and activity coding and Work Breakdown Structure for changes as agreed upon with City. Inclusion of changed conditions shall conform to all scheduling principles noted in this Section. Changes included as an adjustment to the existing schedule activity durations are not allowed.

7. Once the Delay Analysis has been approved, the activities associated with that Time Impact Analysis should be added to the next Monthly Progress Schedule or Look-Ahead Schedule.

8. If the parties are unable to reach an agreement about how to forward-look the effect of the impact on the Monthly Progress Schedule's Critical Path(s), City may allow the Contractor to insert a Fragnet into the schedule on a preliminary basis following agreement of the proposed Fragnet activities. The duration of the Fragnet activities and/or the impact to the Scheduled Substantial Completion Date will be adjusted through the monthly update process as the actual duration of the delay becomes known.

R. Other Schedules

1. The Contractor may use other schedules and report in other formats to manage its work on a day-to-day basis, but these other schedules do not represent or replace the Project Schedules as specified in this Section.

8.01 PRE-CONSTRUCTION SCHEDULE

A. When Preconstruction Services are to be provided by the Contractor, upon receipt of the NTP for Preconstruction Services, Contractor shall prepare a Preconstruction Schedule which includes those activities prior to approval to proceed with construction activities.

B. The Preconstruction Schedule shall include the activities described in the plans developed during Preconstruction including design plans, subcontracting plans, procurement plan,

construction plans and development and negotiation of a Guaranteed Maximum Price (if applicable) at a summary level which can be replaced with detailed information as the Project Schedule is finalized and the construction is authorized.

8.02 PROJECT SCHEDULES

A. Proposed Project Schedule

1. Prepare an initial Proposed Project Schedule (Proposed Schedule) representing the Contractor's plan for the Work in accordance with the requirements of this Section. The Proposed Project Schedule will include the elements of the Preconstruction Schedule and be the initial draft of the Project Schedule. The Proposed Schedule will be the basis for Monthly Progress Schedules and monthly Pay Applications until the approval of the Baseline Schedule.

2. The Proposed Schedule shall be updated on a monthly basis until the approval of the Baseline Schedule after which the Baseline Schedule becomes the Project Schedule.

B. Baseline and Project Schedule

1. The Baseline Schedule is the Project Schedule at the point in time when the Contractor and City agree and approve the Proposed Schedule as the accepted basis for the Project. Requirements described in this subsection shall apply to the all Baseline Schedule submissions.

2. Baseline Schedule submitted by Contractor and approved by the City shall contain no progress for any activities and shall have a Data Date of the Notice to Proceed date.

3. Prepare a draft Baseline Schedule after the Baseline Schedule Workshop has been conducted.

4. Within 14 calendar days after the draft Baseline Schedule is accepted the Contractor shall provide its final Baseline Schedule for City's review and comments.

5. The final Baseline Schedule submission shall include the following:

   a. The approved final Baseline Schedule shall be version 00.

   b. One full-color time-scaled network document in PDF format organized by WBS. Print sizes shall be 11 inches by I7 inches standard sized sheets. Provide following information on the document:

      (i) Activity ID.

      (ii) Activity Description.

(iii) Original Duration.

(iv) Remaining Duration.

(v) Duration Percent Complete.

(vi) Early Start.

(vii) Early Finish.

(viii) Late Start.

(ix) Late Finish

(x) Total Float

(xi) Activities Gantt Chart

6. The Baseline Schedule narrative which shall address the following:

   a. Description of the Contractor's plan to perform the work through the entire contract performance period.

   b. Description of primary, secondary and tertiary Critical Paths.

   c. Explanation of calendars used, including days of the week, holidays, etc.

   d. Discuss calendar assignment to activities.

   e. Description of major pieces of equipment that will be used on the site.

   f. Discuss procurement of long lead items.

   g. A discussion of monthly cash flow planned costs, and cumulative expenditures.

   h. A general description of the means and methods proposed for the execution of the Work including, but not limited to:

      (1) Discussion of operating areas and the proposed sequences.

      (2) Description of the planned crews - sizes, equipment used, etc.

      (3) Number of shifts to perform the Work.

      (4) Significant activities that may inhibit the Work.

(5) A listing of all milestones.

7. Contractor shall represent that the final Baseline Schedule is an accurate representation of Contractor's plan for performing the entire Work and that Contractor intends to use such schedule to execute the Work in compliance with the Contract Documents. Once the final Baseline Schedule is accepted it shall be the initial Project Schedule and used as the baseline in the Monthly Progress Schedules.

C. Monthly Progress Schedules

1. Monthly Progress Schedules are Project Schedules with progress achieved indicated for each Activity.

2. Project Schedules shall be progressed (updated) on a monthly basis until Final Acceptance is accomplished. Progress of Schedule activities shall be a physical percent complete as agreed with the City.

3. The Contractor shall not reduce activity durations in an attempt to reduce negative float. If the Contractor intends to execute activities quicker than the original duration, this shall be mentioned in the float analysis.

4. Approved Changes shall be included in each Monthly Progress Schedule.

5. Contractor shall meet with City each month in a Joint Monthly Progress Schedule Meeting,

6. Contractor shall make two submittals (Progress Only and Contractor's Adjusted) of the Project Schedule each month:

   a. Shall incorporate the Contractor's Monthly Update (i.e. logic, durations, and calendar) made to the schedule including progress update information. This submission shall follow the scheduling principles described in this Section.

7. Each version of the Monthly Progress Schedule submitted by the Contractor shall require approval by City.

8. The Data Date for the Monthly Progress Schedule is 00:00 hours on Saturday following the last Friday of the Month. For each update of the Proposed and Baseline Schedules, the Version number shall increase by 1, and the previous schedule shall be archived to permit an audit trail.

   a. Designations for the Progress Only (PO) and the Contractor's Adjusted (CA) shall clearly define the submission.

   b. City will review and approve Monthly Progress Schedules based on remaining

durations provided for each activity.

c. Each Monthly Progress Schedule (PO and CA) shall contain activity progress measured through the Data Date and shall be submitted to the City for its review.

9. The City will review the Monthly Progress Schedule and provide comments at the Joint Monthly Progress Schedule Meeting to be held five working days after submission of the Monthly Progress Schedule.

10. Monthly Progress Schedule submissions shall be comprised of the following:

a. One full-color time-scaled network document in PDF format organized by WBS. Print sizes shall be 11 inches by I7 inches standard sized sheets.

Provide following information on the document:

(1) Activity ID.

(2) Activity Description.

(3) Original Duration.

(4) Remaining Duration.

(5) Duration Percent Complete.

(6) Early Start.

(7) Early Finish.

(8) Late Start.

(9) Late Finish.

(10) Total Float.

b. The Monthly Progress Schedule narrative shall address the following:

(1) Description of the Work completed by the Contractor in the past performance period and Contractor's plan to perform the work through the entire next performance period, including shift work.

(2) Description of primary, secondary, and tertiary Critical Paths.

(3) Description of problem areas and anticipated problem areas and an

explanation of corrective actions taken or planned to be taken.

(4) Current and anticipated delays including cause of delay, corrective actions taken, and impact of delay on other activities, milestones, and completion dates.

(5) Pending items (Minor Changes in the Work, Change Orders, Time Impact Analyses) and status thereof.

(6) A list of fully executed Changes issued by the Wednesday of the week before the last Friday of every reporting period.

(7) A description of any changes made to the schedule and reasons.

(8) A narrative to show revisions since previous submissions for changes in scope of work, sequencing and other identifiable changes.

(9) Progress made on critical activities indicated on CPM schedule.

(10) Status of critical project components (percent complete, amount of time ahead or behind schedule) and if delays have occurred provide an analysis of how they may be mitigated.

(11) Explanations for any lack of work on critical path activities planned to be performed during last month. Identify any changes to the critical path and the drivers for each change.

(12) List of critical activities scheduled to be performed next month.

(13) Status of major material and equipment procurement.

(14) Any delays encountered during the reporting period.

(15) Updated schedule duration uncertainty to coincide with the Project status and risk exposures.

D. Look-Ahead Schedules:

1. The Look-Ahead Schedule shall be the actual detailed work plan used by the Contractor in meeting the Contract schedule and milestones. The Look-Ahead Schedule shall be an element of the Contractor's Project Schedule.

2. The Look-Ahead Schedule shall be the basis of the weekly Progress Meetings.

3. The Look-Ahead Schedule shall display:

a. Past Week Activities

b. Current Week Activities

c. Three Week Look ahead Activities

4. Look-Ahead Schedules shall include as-built data, forecasted activity sequences, activity durations, through the Scheduled Substantial Completion Date and Final Acceptance, demonstrating the entire scope of Work.

5. In months coinciding with a Look-Ahead Schedule submission, PO Monthly Progress Schedule shall be based on the last approved Monthly Progress Schedule

6. Submission of Look-Ahead Schedules shall not replace the requirement for Contractor to prepare a Time Impact Analysis indicating delay to Scheduled Substantial Completion Date.

E. Commissioning and Integration Testing Schedule:

1. Testing and Commissioning is expected to be carried as a summary activity in the Baseline Schedule and Project Schedules until a draft Commissioning and Integration Testing Schedule shall be submitted not later than 90 days prior to the first testing / commissioning before the Scheduled Substantial Completion Date.

2. A final Commissioning and Integration Testing Schedule shall be submitted no later than 60 days prior to the first testing / commissioning activity before the Scheduled Substantial Completion Date and upon approval shall be incorporated into the Project Schedule with a Monthly Progress Schedule.

3. The Commissioning and Integration Testing Schedule shall display scheduled Work so that each activity is shown with duration of no more than 15 workdays.

F. Recovery Schedule

1. Should any of the following conditions exist, City may require the Contractor to prepare, at no extra cost to City, a plan of action and a Recovery Schedule as to how the Contractor plans to reorganize its work and resources to complete the Work by the Scheduled Substantial Completion Date and recover any lost time and/or delays that have been determined by the City to be caused by the Contractor:

a. Contractor’s monthly progress report indicates delays that are, as determined by City, of sufficient magnitude that the Contractor's ability to complete the Work by the Scheduled Substantial Completion Date is brought into question.

(1) If the Work is delayed on the Critical Path item for a period which exceeds

the greater of either a) thirty (-30) days in the aggregate, or b) that number of days in the aggregate equal to five percent of the days remaining until the approved Substantial Completion. For example, If the remaining duration during the period update is 300 Days, then five percent of the remaining 300 Days is 15 Days. The greater of (-30) days or (-15) days is (-15) days.

(2) Contractor 's performance and resource utilization are not as planned to result in unnecessary consumption of the float.
(3) Contractor desires to make changes in the logic (sequencing of Work) or the planned duration of future activities in the schedule to recover lost time.

b. Contractor shall submit a Recovery Schedule according to the requirements described in this Section. A Recovery Schedule, when required, shall be submitted to City for review and approval within 21 calendar days of Contractor receiving City's written request.

c. Changes included in Recovery Schedule shall be documented. Contractor shall submit to City an audit report that has been prepared using schedule comparison software (i.e. Claim Digger, Project Investigator, or other software approved by City.

d. If a recovery schedule is required hereunder, the City, at its sole discretion, may withhold the Contractor’s Fee for that period in the Payment Application until such time the Contractor has prepared, and the City has accepted such recovery schedule.

e. The Recovery Schedule submission shall include the following:

(1) Detailed narrative describing (with an explanation for the reason of) any revised sequences, durations, and resources.

(2) Anticipated effect of revision on the current Project Schedule and Scheduled Substantial Completion Date, including describing change in affected activities' Total Float value.

(3) Contractor shall furnish sufficient labor, resources and equipment to ensure the prosecution of the Work meets the current Scheduled Substantial Completion Date. If in the opinion of City, Contractor falls behind in the prosecution of the Work as indicated in the current Schedule, Contractor shall take such steps as may be necessary to improve its progress. City may require Contractor to increase the number of shifts, days of work, and/or the amount of plant and equipment, all without additional cost to City.

(4) If Contractor fails or refuses to implement such measures to bring the Work back to conformity within the Scheduled Substantial Completion Date, City

shall have the right to declare such failure or refusal a Contractor Event of Default under the Contract.

G. Revised Baseline Schedule

1. Either City or Contractor may request a Revised Baseline Schedule (Re-Baseline Schedule). The Monthly Progress Schedule to reflect actual progress shall not be considered as a Revised Baseline Schedule.
2. A Revised Baseline Schedule is considered necessary under the following conditions:

    a. Additions, deletions, or revisions to activities required by Contract modification.

    b. City determines there is reasonable doubt that milestones or the Scheduled Substantial Completion Date will be met. A Schedule Revision shall demonstrate how Contractor intends to reschedule remaining work by the Scheduled Substantial Completion Date. There shall not be additional cost to City, through re-sequencing and reallocating its forces to complete Work by Scheduled Substantial Completion Date.

3. Revised Baseline Schedule, when required, shall be submitted to City for review and approval within 21 days of Contractor receiving City's written request.

4. Revised Baseline Schedule shall conform to all requirements described in this Section for Project Schedules and shall include:

    a. An audit report that has been prepared using schedule comparison software (i.e. Claim Digger, Project Investigator, or other software approved by the City.)

    b. Detailed narrative explaining reason for revision.

    c. Anticipated effect of the Revised Baseline Schedule on the Scheduled Substantial Completion Date, including describing change in affected activities Total Float value.

    d. Appropriate Fragnet demonstrating the necessary changes.

H. As Built Schedule

1. Contractor shall prepare and submit an As-Built Schedule documenting actual start and actual finish dates for all activities and logic ties for all activities to show actual sequence in which Work was performed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01326
CONSTRUCTION SEQUENCING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work periods.

B. Mobilization and demobilization.

C. Construction sequence.

1.02 WORK PERIODS

A. No work is permitted at IAH during the following periods:

1. Beginning at 6:00 a.m. CST (0600 hours) on Tuesday prior to Thanksgiving Day and to 10:00 p.m. CST (2000 hours) the following Monday.

2. Beginning at 6:00 a.m. CST (0600 hours) one week prior to Christmas Day and to 11:59 p.m. CST (2359 hours) January 2 following.

3. Beginning at 6:00 a.m. CST (0600 hours) on Friday prior to Houston Area Spring Break, and to 11:59 p.m. CST (2359 hours) the following Monday. These dates maybe adjusted by HAS operations depending on scheduling of Spring Break for Houston Area School Districts.

No pavements shall be closed during these periods. The Contractor shall prepare any closed pavements to be opened during these periods, including, but not limited to, removal of all barricades and pavement closure devices, replacement of pavement markings. Coordinate requirements with HAS operations. This work shall be considered subsidiary to the cost of the project and shall not be measured or paid for separately.

B. For purposes of on-site construction operations for interior work, work may be accomplished in one or more of the following daily schedules (shifts) and as specified elsewhere herein:

1. “Day (D) Shift”: For work fully confined behind dust-resistant enclosures and where airborne or structure-borne noise is abatable by temporarily ceasing operations, work from 0000 hours through 2400 hours each day of the week, meaning a 24 hour shift is available whether or not all hours are used; however, deliver products and remove debris only during “N Shift.”

2. "Night (N) Shift": For work that cannot, due to dust or noise-producing operations, be done during "D Shift", work from 1900 hours through 0600 hours each day of the week (8-hour shift, one-hour lunch break), with the following restrictions on access:

    a. Move products into and remove debris only during "N shift" period.

    b. Complete work of the shift and entirely evacuate the work area by 0600 of the next day, including rubbish removal, leaving enclosures or barricades in place.

1.03 MOBILIZATION AND DEMOBILIZATION

A. Payment for mobilization is specified in Section 01290 - Payment Procedures.

B. General mobilization applicable to the Work, regardless of construction sequencing specified herein includes:

1. Construction and Submittal Schedule processing following Sections 01325 - Construction Schedules and 01340 - Shop Drawings, Product Data and Samples.

2. Obtain and pay for permits.

3. Submittal of other documents following Section 01312 - Coordination and Meetings.

4. Survey Base Building Following Section 01726- Base Facility Survey and process related Document 00685- Request for Information, including accessibility by cutting, following Section 01731- Cutting and Patching, into concealed areas.

5. Security badging following Section 01506 - Temporary Controls.

6. Approval of construction schedules following Section 01325 - Construction Schedules.

7. Product acquisition for other tasks; except products with short lead times may be acquired later as required to maintain schedule performance.

8. Acquisition of major construction equipment and set-up of on-site storage and office space.

9. Other activities necessary to maintain schedule performance.

10. Construction of exterior and interior barricades and enclosures following Section 01505 - Temporary Facilities.

C. Demobilization:

1. Processing of closeout documents, following Section 01770 - Contract Closeout, and activities not otherwise completed at the end of previous tasks.

1.04 CONSTRUCTION SEQUENCE

A. Prepare and process Contractor's construction schedule following Section 01325-Construction Schedules.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CONSTRUCTION SEQUENCE

A. Construct the Work in sequence as follows: One Sequence.

END OF SECTION

SECTION 01330
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittal procedures for:

1. Construction Schedules and Cash Flow Curve (billing forecast).
2. Shop Drawings, Product Data and Samples
3. Manufacturer's Certificates
4. Construction Photographs
5. Project Record Documents and monthly certification.
6. Design Mixes

1.02 SUBMITTAL PROCEDURES

A. Scheduling and Handling:

1. The Contractor must utilize Microsoft SharePoint, and/or a web-based system run by the Houston Airport System, to submit RFIs, Submittals and Invoices. Before doing so, the Contractor must attend a brief mandatory SharePoint training session, which will be conducted by a member of HAS. The Contractor must contact the designated HAS trainer prior to the start of construction to schedule a time for training. Access to SharePoint will not be given to the Contractor's team until training is completed. All document collaboration will be done using SharePoint.
2. Submit Shop Drawings, Data and Samples for related components as required by Specifications and Project Manager.
3. Schedule submittals well in advance of need for construction Products. Allow time for delivery of Products after submittal approval.
4. Develop submittal schedule that allows sufficient time for initial review, correction, resubmission and final review of all submittals. Allow a minimum of 30 days for initial review. Project Manager will review and return submittals to Contractor as expeditiously as possible, but time required for review will vary

depending on complexity and quantity of data submitted.

5. Project Manager's review of submittals covers only general conformity to Drawings, Specifications and dimensions that affect layout. Contractor is responsible for quantity determination. No quantities will be verified by Project Manager. Contractor is responsible for errors, omissions or deviations from Contract requirements; review of submittals does not relieve Contractor from the obligation to furnish required items in accordance with Drawings and Specifications.

6. Submit five copies of documents unless otherwise specified.

7. Revise and resubmit submittals as required. Identify all changes made since previous submittal.

8. Assume risk for fabricated Products delivered prior to approval. Do not incorporate Products into the Work, or include payment for Products in periodic progress payments, until approved by Project Manager.

B. Transmittal Form and Numbering:

1. Transmit each submittal to Project Manager with Transmittal letter which includes:

   a. Date and submittal number
   b. Project title and number
   c. Names of Contractor, Subcontractor, Supplier and manufacturer
   d. Identification of Product being supplied
   e. Location of where Product is to be installed
   f. Applicable Specification section number

2. Identify deviations from Contract documents clouding submittal drawings. Itemize and detail on separate 8-1/2 by 11-inch sheets entitled "DEVIATIONS FOR _____." When no deviations exist, submit a sheet stating no deviations exist.

3. Have design deviations signed and sealed by an appropriate design professional, registered in the State of Texas.

4. Sequentially number transmittal letters beginning with number one.

5. Use original number for resubmittals with an alphabetic suffix (i.e., 2A for the first resubmittal of submittal 2, or 15C for third resubmittal of submittal 15, etc.). Show only one type of work or Product on each submittal. Mixed submittals will

not be accepted.

C. Contractor's Stamp:

1. Apply Contractor's Stamp certifying that the items have been reviewed in detail by Contractor and that they comply with Contract requirements, except as noted by requested variances.

2. As a minimum, Contractor's Stamp shall include:

a. Contractor's name.

b. Job number.

c. Submittal number.

d. Certification statement Contractor has reviewed submittal and it is in compliance with the Contract.

e. Signature line for Contractor

D. Submittals will be returned with one of the following Responses:

1. "REVIEWED AS SUBMITTED" when no response and resubmittal is required.

2. "NO EXCEPTION" when sufficient information has supplied to determine that item described is accepted and that no resubmittal is required.

3. "MAKE CORRECTIONS AS NOTED WHEN EXCEPTIONS DO NOT REQUIRE FUTURE CHANGES" when sufficient information has been supplied to determine that item will be acceptable subject to changes, or exceptions, which will be clearly stated. When exceptions require additional changes, the changes must be submitted for approval. Resubmittal is not required when exceptions require no further changes.

4. "REVISE AND RESUBMIT" when submittal do not contain sufficient information, or when information provided does not meet Contract requirements. Additional data or details requested by Project Manager must be submitted to obtain approval.

1.03 MANUFACTURER'S CERTIFICATES

A. When required by Specification sections, submit manufacturers' certificate of compliance for review by Project Manager.

B. Place Contractor's Stamp on front of certification.

C. Submit supporting reference data, affidavits, and certifications as appropriate.

D. Product certificates may be recent or from previous test results, but must be acceptable to Project Manager.

1.04 DESIGN MIXES

A. When required by Specification sections, submit design mixes for review.

B. Place Contractor's Stamp, as specified in this section, on the front of each design mix.

C. Mark each mix to identify proportions, gradations, and additives for each class and type of mix submitted. Include applicable test results from samples for each mix. Perform tests and certifications within 12 months of the date of the submittal.

D. Maintain copies of approved mixes at mixing plant.

1.05 CHANGES TO CONTRACT

A. Changes to Contract may be initiated by completing a Request for Information form. Project Manager will provide a response to Contractor by completing the form and returning it to Contractor.

1. If Contractor agrees that the response will result in no increase in cost or time, a Minor Change in the Work will be issued by City Engineer.

2. If Contractor and Project Manager agree that an increase in time or cost is warranted, Project Manager will forward the Request for Proposal for negotiation of a Change Order.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01340
SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General procedural requirements for submittal data:

1. Shop drawings.
2. Product data.
3. Samples, including control samples.
4. Product certifications and compliance statements.
5. Submittal logging.

B. Submittal quantities specified in other Sections supersedes those specified herein.

C. Product interface control documents.

1.02 GENERAL PROCEDURES

A. Review submittal data and indicate results of review on documents submitted to Designer.

1. Obtain review and indicate results of Subcontractors' and applicable Separate Contractors' reviews before submittal to Designer.
2. Include on each shop drawing, sample or product data submittal the following minimum language, signed (by individuals authorized to make binding agreements on behalf of their respective firms) and dated on behalf of each responsible party:

> "The Subcontractor and the Contractor named below hereby certify this submittal has been checked prior to submission to Designer and conforms to the requirements of the Contract Documents for work represented hereby. This submittal does not deviate from requirements of the Contract Documents. It has been checked for: field conditions; correlation of dimensions and quantities; safety precautions; construction means, methods, techniques, schedules, sequences, procedures and fabrication processes; for errors and omissions in this submittal; and for coordination of the work of the trades.

_____ (Subcontractor Firm)
_____ (Authorized Signature)
_____ (Date)

This submittal has also been checked by the following Subcontractors and Separate Contractors for coordination of substrate/superstrate conditions and applicable product interfaces.
(List company names, place authorized signature and date for each.)

_____ (Contractor)
_____ (Authorized Signature)
_____ (Date)"

B. Transmit submittals under original transmittal to Designer, with a copy of the transmittal only to City Engineer. Number each submittal by specification number, for future reference.

1. Furnish number of copies specified herein or in other Sections, for Designer's and City Engineer's records, plus additional copies as the Contractor requires for construction operations and coordination of the Work.

2. Identify Project, Contractor, Subcontractor, Supplier, and generic name of component or system. Allow space on submittal data to accommodate required stamps by Contractor, applicable Subcontractors, applicable Separate Contractors, Designers, and other reviewers.

3. Indicate applicable Drawing detail and Section number.

4. For submittals using SI (metric) measure as the manufacturer's or fabricator's standard, include corresponding Imperial measure conversions. Follow requirements in Section 01610.

C. After Designer's review, revise and resubmit until resubmittal is no longer required; identify and log changes made to previous submittals.

D. Distribute copies of reviewed submittals to concerned parties, including Separate Contractors. Instruct recipients to promptly report inability to comply with requirements indicated therein.

E. Shop Drawings, Product Data and Samples: Follow Contractor's progress schedule for submittals related to work progress. Coordinate submittal of related items. Partial submittals will be returned unreviewed.

F. Transmit submittals far enough in advance to provide time required for reviews, for securing necessary approvals, for revisions and resubmittals. Allow 14 days after receipt for Designer's review, except where shorter processing time is approved due to extraordinary conditions.

G. Do not submit data where no submittal requirements occur. Unsolicited submittals will be returned unreviewed.

H. Incomplete, uncoordinated, inaccurate and illegible submittals, and submittals without evidence of review by Contractor, applicable Subcontractors and applicable Separate Contractors will be returned unreviewed.

I. Responsibility for costs of Designer's additional reviews resulting from improper submittal data remains with the Contractor, deductible from the Contract Sum or Time by Change Order.

1.03 SHOP DRAWINGS

A. Submit digital documents in PDF format. After Designer's review, reproduce and distribute copies required for the Contractor's use. The Designer will reproduce copies for Designer and City Engineer.

B. Sheet Size: 8-1/2 x 11 inches minimum; 36 x 24 inches maximum.

C. If CADD is used, prepare documents readable, writable and printable using IBM PC-compatible hardware and software, based on AutoCAD (13 or later versions) or software translated thereto. Provide AutoCAD data disks following Section 01770 - Contract Closeout.

D. Prepare shop drawings by qualified drafters, accurately and distinctly showing:

1. Field and erection dimensions clearly identified as such.

2. Arrangement and section views.

3. Relation to adjacent materials or structure including complete information for making connections between work under this Contract and work under other contracts.

4. Kinds of materials and finishes.

5. Parts list and descriptions.

6. Assembly drawings of equipment components and accessories showing their respective positions and relationships to the complete equipment package.

7. Where necessary for clarity, identify details by reference to drawing sheet and detail numbers, schedule or room numbers as shown on the Contract Drawings.

E. Drawing to scale, and accurately represent specific products furnished.

1.04 PRODUCT DATA/MANUFACTURERS' LITERATURE

A. Submit 4 original copies plus additional copies required for Contractor's use. Designer will retain four copies for distribution to City. Distribute remaining copies.

B. Mark each copy to clearly identify applicable products, models, options, and other data; supplement manufacturers' standard data to provide information unique to the Work.

C. When available, submit "SpecData" sheets.

D. Include manufacturers' installation instructions.

E. For products specified only by reference standard, give manufacturer's name, product name, model or catalog number, copy of referenced standard, and manufacturer's descriptive technical literature.

1.05 CONTRACTOR-PREPARED SAMPLES

A. Submit 4 original sets of samples plus additional copies required for Contractor's use. Designer will retain three copies for distribution to City. Distribute remaining copies.

B. Demonstrate functional and visual characteristics of products, complete with integral parts and attachment devices.

C. Submit a reasonable range of manufacturers' standard colors, textures, sheens, and patterns for selection where specific requirements are not specified, where deviations are proposed, and where the nature of the product may vary in color, vein or "grain," texture, sheen and other visible characteristics.

D. Sample characteristics are specified in individual Sections.

E. Size, unless otherwise specified:

1. Paint and Liquid Coated Products: 8-1/2 x 11 inches; tape edges of samples using gypsum board as the base or substrate.

2. Flat or Sheet Products: 8-1/2 x 11 inches.

3. Linear Products: 11 inches long.

4. Bulk Products: Copy of container label, only where label submittal is specified.

F. Full size or on-site samples or mock-ups may be used in the Work if approved.

1.06 CONTROL SAMPLES

A. Certain Base Facility construction establishes performance, product, workmanship, or aesthetic quality requirements for this contract.

B. Required control samples include:
1. Paint, film and other applied decorative coatings at sight-exposed surfaces in public spaces, regardless of substrate types; for matching compatibility, color, texture, sheen and other visual and performance characteristics of analogous new work.

C. Include control samples with submittal to which they apply.

D. For items transmittable by mail or hand, remove one representative sample, following Section 01312 - Coordination and Meetings, and nondestructively label as "Control Sample." Process following Paragraph 1.06.

E. Obtain control samples following Section 01731 - Cutting and Patching. The control sample will be returned to the Contractor.

F. For items impractical to remove or mail, temporarily and non-destructively tag each item in place and maintain until submittal processing is complete. Request submittal evaluation to occur on-site. Include request with submittal to which it applies.

1. Provide temporary facilities following Section 01505 - Temporary Facilities to provide access to and protection of control samples.

2. Handle, store and protect control samples following Section 01610- Basic Product Requirements.

G. Maintain control samples until applicable new work is completed or until directed.

1.07 PRODUCT INTERFACE CONTROL DOCUMENTS

A. Following requirements apply where specified in other Sections.

B. Prepare submittal data as required, to indicate proper interface between work of Subcontractors and Separate Contractors, for products of one Section or Contract required to be supported by or affixed or connected to products of another Section or Contract. Follow Section Paragraph 1.02 for review and processing requirements.

1. Fully describe mating surfaces between products.

2. Fully describe predecessor and successor staging and sequencing of product fabrications and installations.

C. Field corrections to mating surfaces are not permitted, unless field modification is specified in Sections.

1.08 CERTIFICATIONS AND COMPLIANCE STATEMENTS

A. Submit 4 original copies plus additional copies required for Contractor's use. Designer will retain three copies for distribution to City. Distribute remaining copies. Include original signature and applicable original seal(s) on each copy.

B. Certifications may be in the form of recent test results, research reports, reference data, or affidavits, as applicable to certifications required.

1.09 SUBMITTAL LOG

A. If approved, submittal log may be incorporated into submittal schedules following Section 01325 - Construction Schedules.

B. Coordinate shop drawings, samples, product data and certifications schedule in Section 01325 - Construction Schedules. Log submittals showing proposed submittal number and expected processing period for each.

C. Denote submittals requiring special attention, such as requested shorter review time due to extraordinary conditions. Indicate reasons for special attention.

D. Update and distribute following Sections 01312 - Coordination and Meetings and 01325 - Construction Schedules.

1.10 DESIGNER'S ACTIONS

A. Comments may be added by Designer to submittal data, to inform the Contractor of detected failure of submittal data to follow contract requirements and the design concept expressed therein.

B. Commencing work governed by submittal requirements without proper processing of required submittals is the risk of the Contractor.

1. Cost increases attributable thereto are the sole responsibility of the Contractor without increase in Contract Sum.

2. Time increases attributable thereto are the sole responsibility of the Contractor under provisions of Article 9.13 (Liquidated Damages) in Document 00700 - General Conditions.

C. Responsibility for Contractor's errors and omissions or construction of defective or deficient work remains with the Contractor and is not relieved by Designer's review.

D. Following is Designer's submittal review statement, which may be affixed to Contractor's submittal by stamp, label or separate sheet:

END OF DESIGNER'S SUBMITTAL REVIEW STATEMENT

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CONTROL SAMPLES

A. Reinstall control samples following Section 01731 - Cutting and Patching.

END OF SECTION

SECTION 01423
REFERENCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General quality assurance related to Reference Standards.

B. List of references.

C. List of definitions.

D. List of phrases.

1.02 QUALITY ASSURANCE

A. For work specified by association, trade, or Federal Standards, follow requirements of the standard, except when more rigid requirements are specified or are required by applicable codes or by Contract Documents.

B. Follow reference standard effective on the date stated in Document 00700 - General Conditions.

C. Submit Document 00685- Request for Information before proceeding if specified reference standards conflict with Contract Documents, or if no standards apply.

1.03 PARTIAL LIST OF REFERENCES

AA Aluminum Association
900 19th St. N.W.
Washington, DC 20006
Ph: 202-862-5100

AASHTO Amer. Assoc. of State Hwy. Officials
444 North Capitol Street, N.W. #249
Washington, DC 20001
Ph: 202-624-5800

ACI American Concrete Institute
P.O. Box 9094
Farmington Hills, MI 48333-9094
Ph: 248-848-3700

AGC Associated General Contractors of America
333 John Carlyle St., #200
Alexandria, VA 22314
Ph: 703-548-3118

ASME American Soc. of Mech. Engrs.
Three Park Ave.
New York, NY 10016-5902
Ph: 212-591-7733

AI Asphalt Institute
Research Park Dr.
P.O. Box 14052
Lexington, KY 40512-4052
Ph: 859-288-4960

AITC American Institute of Timber Construction
7012 S. Revere Pkwy, #140
Englewood, CO 80112
Ph: 303-792-9559

AISC American Institute of Steel Construction
1 E. Wacher Dr., #3100
Chicago, IL 60601-2001

Ph: 312-670-2400

AISI American Iron & Steel Institute
1101 17th Street, N.W., #1300
Washington, DC 20036
Ph: 202-452-7100

ANSI American Natl. Stds. Institute
25 W. 43rd St., 4 Floor
New York, NY 10036
Ph: 212-642-4900

APA The Engineered Wood Assoc.
7011 So. 19th,
Tacoma, WA 98466
Ph: 253-565-6600

API American Petroleum Institute
1220 L Street, N.W.
Washington, DC 20005-4070
Ph: 202-682-8000

AREA Amer. Railway Engrg. Assoc.
8201 Corporate Dr., #1125
Landover, MD 20785
Ph: 301-459-3200

ASTM American Soc. for Testing & Materials
100 Barr Harbor Dr.,
PO Box C700
West Conshohocken, PA 19428-2959
Ph: 610-832-9585

AWPA American Wood-Preservers' Association
PO Box 388
Selma, AL 36702-0388
Ph: 334-874-9800

AWS American Welding Society
550 N.W. LeJeune Rd.
Miami, FL 33126
Ph: 800-443-9353

AWWA Amer. Water Works Assoc.
6666 West Quincy Avenue
Denver, CO 80235
Ph: 303-794-7711

BICSI Bldg. Industry Consulting Svc. Intl.
8610 Hidden River Pkwy.
Tampa, FL 33637-1000
Ph: 800-242-7405

COH City of Houston
900 Bagby Street (Box 1562)
Houston, TX 77251-1562
Ph: 713-837-0311

CLFMI Chain Link Fence Mfgrs Inst.
10015 Old Columbia Rd., #B-215
Columbia, MD 21046
Ph: 301-596-2583

CRSI Conc. Reinforced Steel Institute
933 N. Plum Grove Road
Schaumburg, IL 60173-4758
Ph: 847-517-1200

EJMA Expansion Joint Manufacturers Assoc.
25 N. Broadway
Tarrytown, NY 10591
Ph: 914-332-0040

FS Federal Standardization Documents
Gen. Svcs. Admin. Specifictns. Unit (WFSIS)
7th and D Streets, S.W. #6039
Washington, DC 20407
Ph: 202-472-2205

HAS (City of) Houston Airport System
P.O. Box 60106 (16930 JFK Blvd., 77032)
Houston, TX 77205-0106
Ph: 281-233-3000

HOU William P. Hobby Airport (Airport Manager)
7800 Airport Blvd.
Houston, Texas 77061
Ph: 713-640-3000

IAH George Bush Intercontinental Airport Houston (Airport Manager)
2800 N. Terminal Road
Houston, TX 77032
Ph: 281-230-3100

ICEA Insulated Cable Engineer Association
P.O. Box 1568
Carrollton, GA 30112

IEEE Institute of Electrical and Electronics Engineers
445 Hoes Lane, or P.O. Box 1331
Piscataway, NJ 08854-1331
Ph: 732-981-0060

MIL Military Specifications (see "FS" for address)

NACE National Association of Corrosion Engineers
440 1st St. N.W.
Washington, DC 20001
Ph: 202-393-6226

NARTE National Association of Radio and Telecommunications Engineers, Inc.
167 Village Street
P.O. Box 678
Medway, MA 02053
Ph: 508-533-8333, 800-896-2783

NEMA National Electrical Manufacturers' Association
1300 North 17th Street, Suite 1847
Rosslyn, VA 22209

Ph: 703-841-3200

NFPA National Fire Protection Association
1 Batterymarch Park, P.O. Box 9101
Quincy, MA 02169-7471
Ph: 617-770-3000

OSHA Occupational Safety Health Administration
200 Constitution Avenue, NW
Washington, DC 20210
Ph: 866-487-2365

PCA Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077-1083
Ph: 847-966-6200

PCI Prestressed Concrete Institute
201 North Wacker Drive
Chicago, IL 60606
Ph: 312-786-0300

SDI Steel Deck Institute
P.O. Box 25
Fox River Grove, IL 60021
Ph: 847-458-4647

SSPC The Society for Protective Coatings
40 24th Street, 6th Floor
Pittsburgh, PA 15222-4656
Ph: 412-281-2331

TAC Texas Admin. Code,
Texas Water Development Board
Box 13231, Capitol Station
Austin, TX 78711-3231
Ph: 512-463-7926

UL Underwriters' Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062-2096
Ph: 877- 854-3577, 800-285-4476

UNI-BELL UNI-BELL Pipe Association
2655 Villa Creek Dr., Suite 155
Dallas, TX 75234
Ph: 972-243-3902

1.04 PARTIAL LIST OF DEFINITIONS

Airport: Area of land or water used or intended to be used for landing and takeoff of aircraft and includes buildings and facilities. Airports under control of City are certificated by FAA under FAR Part 139 and operate under specific safety requirements applicable to maintenance and construction activities.

Airport Manager: Individual delegated by Director of Department of Aviation, with absolute responsibility and authority for overall airport operation and compliance with FAR Part 139. Airport Manager shall communicate with Contractor through City Engineer except in case of emergency when City Engineer is not present. The Airport Manager may delegate responsibilities to other persons, such as airport electricians to coordinate lockouts/tag-outs.

Air Operations Area (AOA): Any area of Airport used or intended to be used for landing, takeoff, or surface maneuvering of aircraft, including paved or unpaved areas used or intended to be used for unobstructed movement of aircraft in addition to associated runway, taxiway, or apron. The AOA includes any adjacent areas (such as general aviation areas) that are not separated by adequate security systems, measures, or procedures.

Airport Security Officers: 1) Uniformed City of Houston Police (HPD) officers enforcing airport regulations and apprehension of unauthorized personnel in security areas; 2) Non-uniformed federal or local government personnel authorized to test for compliance with existing regulations.

Air Traffic Control Tower (ATCT): Person responsible for positive control of aircraft and vehicle traffic, including Contractor's, on and around runways, taxiways, and aprons.
Base Facility: Existing structure upon and within which the Work is constructed. "Existing construction" and "existing" mean the same as Base Facility.

1. By way of general description, Base Facility includes sidewalks and pavement; foundations; superstructure columns, beams and floors; exterior and interior walls, partitions and doors; mechanical and electrical systems; conveying systems; interior finish materials.

    a. Underground structures include sewer, water, gas, fuel and other piping, and manholes, chambers, electrical and signal conduits, ducts, tunnels, manholes and other means of access, foundations and below-ground extensions of surface structures and other existing subsurface Work located within or adjacent to the limits of the Work.

    b. Surface structures include existing buildings, tanks, masts and poles, navigational aids, walls, bridges, roads, dams, channels, open drainage, piping, wires, posts, signs, markers, curbs, walks, pavements and surfaces for wheeled vehicles (including aircraft), guard cables, fencing, lighting and similar constructs above the ground surface or visible without excavation, demolition or cutting.

DOT: Acronym for U.S. Department of Transportation.

Emergency Medical Service: Operational division of Houston Fire Department.

Emergency Vehicles: ARFF, HPD and EMS vehicles operating in emergency mode.

Federal Aviation Administration (FAA): Agency of U.S. Department of Transportation. FAA also means FAA's Administrator or Administrator's duly authorized representative.

Ground Support Equipment (GSE): Mobile and stationary vehicles and equipment for servicing aircraft.

Navigation Aids (NAVAIDS): Equipment used to locate aircraft and direct movement while airborne.

Public areas: Areas where no accessibility restrictions are imposed, generally including roadways, streets, parking lots and structures, and building interiors up to but not including baggage and passenger checkpoints at concourses.

Secured Area: Any portion of the airport where aircraft operators (and foreign air carriers that have a security program under part 1544 or 1546) enplane and deplane passengers, sort and load baggage, and any adjacent areas not separated by adequate security measures.
Security Areas, Security Identification Areas (SIDAs): 1.) AOA; 2) Secured Areas: Exterior or interior areas the access to which is controlled by authorized security personnel or by keyed or electronic locks, and which may have posted notice of restricted access.

Traffic Activity: In-the-air or on-the-ground aircraft and emergency vehicle activity that, determined by ATCT, Airport Manager or City Engineer because of safety reasons, prohibits the start, continuation or completion of construction operations.

Transportation Security Administration (TSA): Agency of U.S. Department of Transportation charged with implementing and enforcing federal airport security rules and regulations. TSA also means TSA's Undersecretary or the Undersecretary 's duly authorized representative(s).
TSR: an acronym for Transportation Security Regulation.

1.05 PARTIAL LIST OF PHRASES

A. Read "includes" and "including" as having the phrase "but not necessarily limited to" immediately following the words, if not otherwise written out.

B. "Required" means products, labor and services provided by the Contractor to properly complete the Work following the Contract Documents and the design concept expressed therein, such required work being determined and governed by field or shop conditions.

1.06 PARTIAL LIST OF ABBREVIATIONS AND ACRONYMS

A. Following abbreviations and acronyms may appear on Drawings and in other Sections:

1. CFP: City-furnished product(s).

2. CSP: Contractor-salvaged product(s).

3. NIC or N.I.C.: Not in contract.

4. NOTAM: Notice to Airman.

5. PDC: Department of Aviation Planning Design Construction Group.

6. RFI: Request for Information/Clarification.

7. RFP: Request for Proposal.

8. WCD: Work Change Directive.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01450
CONTRACTOR'S QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General requirements for Contractor's quality control services.

B. Contractor's responsibilities related to City's testing are specified in Section 01455 - City's Acceptance Testing.

1.02 GENERAL

A. Maintain source and on-site quality control over suppliers, manufacturers, products, services, site conditions, quality assurance programs, and workmanship, to provide work of required quality at no additional cost to the City.

B. Follow manufacturers' installation instructions, including each step-in sequence.

C. Request clarification from City Engineer before proceeding should manufacturers' instructions conflict with Contract Documents.

D. Follow specified standards as minimum requirements for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce the specified level of workmanship.

F. Observe, inspect, collect samples and test samples of the Work as it progresses and as required for compliance with Document 00700 - General Conditions Paragraph 3.2.

1. At Contractor's discretion, retain a testing laboratory to supplement manufacturers' own product testing programs, except do not retain the same testing laboratory retained by City under Section 01455 - City's Acceptance Testing.

2. Additional responsibilities of Contractor related to testing are specified in Section 01455 - City's Acceptance Testing.

1.03. CONTRACTOR'S QUALITY ASSURANCE PROGRAM (QAP)

A. Implement and maintain a QAP of inspection, sampling, testing, and observation and test results reporting for the Work, applicable to product source, fabrication, mixing, and through final installation, to provide proper work.

B. Submit required submittals and requests for information (RFIs) into the HAS's web-based application, Microsoft SharePoint. Access to the SharePoint portal and required training will be coordinated through the Project Manager. Submit Contractor's Quality Assurance Program (QAP), following Section 01340 - Shop Drawings, Product Data and Samples, with following minimum information:

1. Organization chart indicating Contractor's QAP personnel.

2. Inspection, Sampling and Testing Matrix/ Schedule: Overlaid with requirements of Section 01325 - Construction Schedules and Section 01455 - City's Acceptance Testing.

3. Sample QAP reporting forms.

4. Procedures for action to correct defective work.

5. Procedures to implement and manage the QAP.

6. Submit one copy of Contractor's written QAP Inspection, Test, and Daily Reports to City and one copy to ITL, on a daily basis, indicating:

   a. Project Name, Number, CIP Number.

   b. Date/time of inspection/sampling/test, and quantity of product involved.

   c. Product or installation batch, mill number, or production run number, and method used to assure statistically based random sampling following ASTM D3665.

   d. Environmental conditions where applicable to results.

   e. Name and signature of observer or tester, certifying as follows:

      "The above work was inspected/sampled and tested in the manner described, and the result(s) are hereby certified by the undersigned as complete and accurate."

   f. Product or installation inspected, by Section number, and location of inspection (such as product source, fabrication shop, or on site), and quantity of product tested.

g. Location in the Work, by Drawing/detail number, floor number, range/station number, or other specific identifier traceable to the Drawings.

h. Type of inspection or test (such as visual; non-destructive X-ray), and type of test by referenced standard test number.

i. Type of inspection, sample or test products used.

j. Performance standard required.

k. Factual evidence and results of inspections, measurements or tests stated as "pass" or "fail."

l. Factual evidence and record of observations and tests. Include nature and type of failure, and comments as applicable.

C. Contractor's QAP Personnel for Sitework:

1. Quality Control Manager: Sole responsibility for management, implementation and control of the QAP; an employee of Contractor and specialist in type of applicable construction. If not an officer of firm, this person shall report to an officer.

a. Duties and Responsibilities: Plan, organize, staff, direct and control the QC Program; supervise QCTs (below); collate and review detail reports of QC activities for accuracy and completeness before publication, and prepare factual summary reports. The QCM may work projects other than this project, except QCM shall be present at times of sampling, testing or observation, within 2 hours of notice.

b. Demonstrated experience in parking garage paving construction and quality assurance compliance equivalent in scope and complexity to work of this contract, plus one of the following minimums:

1) Registered civil engineer, with 1 year above experience.

2) Engineer-in-Training, with 2 years above experience.

3) Graduate Bachelor of Science degree in Civil Engineering, Civil Engineering Technology or Construction, with 3 years above experience.

4) National Institute for Certification in Engineering Technologies (NICET), Level III, certified Construction Materials Technician, Highway Materials

Technician, or Highway Construction Technician, with 4 years above experience.

5) NICET-certified Civil Engineering Technician, with 5 years above experience, and approved by the City Engineer.

2. Quality Control Technicians (QCT): Responsibility for processing this QC Program; report to the QCM.

a. Duties and Responsibilities: Inspect work, collect samples, take measurements, test work, collate test and measurement data, and prepare factual, accurate and complete reports. Use as many QCTs as required. QCTs may be Contractor's employees or personnel of a qualified ITL subcontracted to the Contractor, except do not use City's ITL to fulfill Contractor's testing requirements.

b. Demonstrated experience in same construction as QCM, and quality assurance compliance equivalent in scope and complexity to work of this contract, plus one of the following minimums:

1) Engineer or Engineering Technician, with 1 year above experience.

2) NICET Level II or higher certification as Construction Materials Technician, Highway Materials Technician, or Highway Construction Technician, , with 2 years above experience.

3. Equivalent certifications by authorities other than NICET may be substituted following Section 01630.

D. Contractor's QAP Personnel for Buildings:

1. Quality Control Manager: Sole responsibility for management, implementation and control of the QAP; an employee of the Contractor and specialist in type of applicable construction. If not an officer of firm, this person shall report to an officer.

a. Duties and Responsibilities: Plan, organize, staff, direct and control the QC Program; supervise QCT staff (below); collate and review detail reports of QC activities for accuracy and completeness before publication, and prepare factual summary reports. The QCM may work projects other than this project, except QCM shall be present at times of sampling, testing or observation, within 2 hours of notice.

b. Demonstrated experience in building Structural construction and quality assurance compliance equivalent in scope and complexity to work of this contract, plus one of the following minimums:

1) Registered structural engineer, with 1 year above experience.

2) Engineer-in-Training, with 2 years above experience.
3) Graduate Bachelor of Science degree in structural engineering, with 3 years above experience.

2. Quality Control Technicians (QCT): Responsibility for processing QAP; report to the QCM.

a. Duties and Responsibilities: Inspect work, collect samples, take measurements, test work, collate test and measurement data, and prepare factual, accurate and complete reports. Use as many QCTs as required. QCTs may be Contractor's employees or personnel of a qualified ITL subcontracted to the Contractor, except do not use City's ITL to fulfill Contractor's testing requirements.

b. Engineer or Engineering Technician, with minimum 1 year demonstrated experience in same construction as QCM, and quality assurance compliance equivalent in scope and complexity to work of this contract.

1.03 REFERENCES

A. Obtain copies of referenced standards and maintain at site when required by other Sections.

1.04 MANUFACTURER'S FIELD SERVICES

A. When specified in other Sections or when conditions are required to maintain schedule, cost or quality control, provide services of properly qualified manufacturer's or supplier's technical representative(s) to observe field conditions, conditions of substrates and installation, quality of workmanship, startup, testing, adjusting, balancing, demonstration and City-personnel training as required.

B. Within 14 days of observation, submit a written report to City Engineer, prepared by manufacturer's representative, documenting their observations, supplementary instructions and instructions at variance with manufacturer's written instructions, and, where applicable, recommendations for corrective action. Costs and time for corrective action is Contractor's responsibility, without increase in Contract Sum or Time.

1.05 SUBCONTRACTS

A. Coordinate work of subcontractors. Inform subcontractors of relation of their work to that of other subcontractors and Separate Contractors and direct scheduling of work to prevent conflicts or interferences.

B. Employ subcontractors with documented proof of proper completion of two projects during the past 3 years of work similar in scope, type and quality as that required for this contract.

1.06 EXAMINATION AND PREPARATORY WORK

A. Carefully examine substrates whether Base Facility or provided as part of the Work before commencing work applied to or accommodated by substrates. Proceed after unsatisfactory conditions are corrected, and after substrate work is properly prepared and complete.

B. Take field dimension and establish and maintain lines, dimensions, and benchmarks as required to control proper fabrication and installation of work.

C. Do not proceed with affected work until unsatisfactory site conditions and substrates are correct.

1. Make written notification of scope and type of corrections required of separate contracts.

D. Repair remaining substrates following Section 01731 - Cutting and Patching.

1.07 CONTRACTOR'S TESTING

A. Follow Document 00700 - General Conditions Paragraphs 3.9.2 and this Section 01450.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 INSPECTIONS BY BUILDING OFFICIALS AND OTHER AGENCIES

A. Immediately notify City Engineer of the date of inspections by governing authorities, in order for City Engineer to attend.

END OF SECTION

SECTION 01455
CITY'S ACCEPTANCE TESTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. City [has retained _____ as] [will retain an] Independent Testing Laboratory (ITL) for following services:

1. Collect product samples at source, site of fabrication, or project site as required by referenced test procedure, as specified herein or in other Sections.

2. Test product samples at source, site of fabrication, project site or in ITL's laboratory as required by referenced test procedure, as specified herein or in other Sections.

3. Inspect execution of work at source, site of fabrication, or project site, as applicable, as specified herein or in other Sections.

4. Record and distribute observations of work during inspections, indicating "pass" or "fail."

5. Record and distribute results of tests, indicating "pass" or "fail."

6. ITL does not have authority to:

   a. Release, revoke, alter, or enlarge requirements of Contract Documents.

   b. Approve or accept work.

   c. Assume duties of Contractor.

   d. Stop the Work or a part thereof.

1.02 CONTRACTOR'S RESPONSIBILITIES

A. Notify City Engineer, ITL and Designer minimum 24 hours prior to expected time for inspections or sample collections. Schedule ITL's, City Engineer's, and Designer's presence for timely inspections, observations, and sample collection without delay to the Work.

B. Provide access to the Work and cooperate with ITL for inspection and sample collection.

C. Furnish samples of manufactured products to ITL for inspection and testing.

D. Provide incidental labor, products, services and facilities for sample collection and for transportation and handling of samples to ITL's vehicle or to ITL's on-site test facility.

E. Reimburse City by Modification (Section 01255 - Modification Procedures) for costs of retesting previously "failed" work, including time expended by City's personnel related thereto.

F. Time delays and costs resulting from ill-timed QC work are the Contractor's responsibility, without increase in Contract Time or Price.

G. Follow Document 00700 - General Conditions Paragraph 3.2 and Section 01450-Contractor's Quality Control.

H. Perform work following requirements of Contract Documents.

I. Read reports of failed tests or measurements. Implement corrective actions to prevent defective work from proceeding farther.

J. Stop affected work when corrective action fails to bring work to required standards.

K. Remove defective work following Section 01731 and replace with proper work.

L. Inspect, sample and test Base Facility Section 01726, as required to determine and confirm acceptability of existing construction as substrate for new construction.

M. If Contractor employs a testing laboratory, follow ASTM D3740 and ASTM E329, plus other test standards specified in other Sections.

N. Provide QAP following Section 01450 - Contractor's Quality Control.

O. Keep one copy of ITL's reports at field office for duration of the Work.

P. Contractor shall not:

1. Employ for Contractor's quality assurance testing the same ITL employed by the City for this Project.

2. Retain possession of ITL's samples.

1.03 SUBMITTALS BY ITL

A. Submit 3 copies of following to City:

1. Written certification of compliance with following:

a. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

b. ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

2. Copy of latest inspection report by Materials Reference Laboratory/ National Bureau of Standards (NBS) or inspection traceable thereto, with statement of remedies of deficiencies.

3. Invoice for retesting previously "failed" work.

B. Submit 5 copies of following, 3 to City, 2 to Contractor. Immediately transmit "fail" reports by facsimile directly to City and to Contractor.

1. Project Name, Number, CIP Number.

2. Identify ITL, Contractor, Subcontractor or Supplier, Section number and name, generic and manufacturer's name of product, numerical sequence when more than one inspection, sample or test of the same product is made, date and time of each inspection, sample collection or test, and applicable Drawing detail number.

3. Date/time of inspection/sampling/test, and quantity of product involved.

4. Product or installation batch, mill number, or production run number, and method used to assure statistically based random sampling following ASTM D3665.

5. Environmental conditions where applicable to results.

6. Name and signature of observer or tester, certifying as follows:
"The above work was inspected/sampled and tested in the manner described, and the result(s) are hereby certified by the undersigned as complete and accurate."

7. Product or installation inspected, by Section number, and location of inspection (such as product source, fabrication shop, or on site), and quantity of product tested.

8. Location in the Work, by Drawing/detail number, floor number, range/station number, or other specific identifier traceable to the Drawings.

9. Type of inspection or test (such as visual; non-destructive X-ray), and type of test by ASTM or other reference standard test number.

10. Type of inspection, sample or test equipment used.

11. Performance standard required

12. Factual evidence and results of inspections, measurements or tests stated as "pass" or "fail."

13. Factual evidence and record of observations and tests. Include nature and type of failure, and comments as applicable. Furnish graphic or narrative data, or both, indicating nominal requirements and actual test values. Indicate type and numerical value of deviations from specified requirements.

14. For submittals using SI (metric) measure as the ITL's standard, include corresponding Imperial measure conversions. Follow Section 01610 - Basic Product Requirements.

C. Print and distribute copies of records.

D. Transmit reports within 7 days of observations, inspections or test completion, except where shorter processing time is required due to possibility of Contractor continuing installation of "failing" work.

E. For data in the form of drawings:

1. Submit one vellum sepia or electrostatic transparency (emulsion side "up") with one diazo print to City Engineer. Submit one diazo print to Contractor.

2. Sheet Size: 8-1/2 x 11 inches minimum; 44 x 34 inches maximum.

3. If CADD is used, prepare documents readable, writable and printable using IBM PC-compatible hardware and software, based on AutoCAD (11 or later versions) or software translated thereto. Provide copy of AutoCAD data disks to City Engineer

4. Prepare drawings by qualified drafters.

5. Draw to scale, and accurately represent products.

F. For statistical records in the form of spreadsheets or graphs:

1. Submit electrostatic prints.

2. Sheet Size: 8-1/2 x 11 inches minimum; 11 x 17 inches maximum.

3. Provide copy of data disks to City Engineer at completion of the Work.

PART 2 PRODUCTS

2.01 SAMPLING AND TEST EQUIPMENT

A. Provide and maintain in proper function sampling and test equipment of type and quantity

required, with calibration and accuracy traceable to NBS.

PART 3 EXECUTION

3.01 GENERAL PROCEDURES

A. Follow requirements of individual Sections.

B. Coordinate inspections, sampling and testing with construction progress and Contractor's schedule specified in Section 01325 - Construction Schedules.

C. At least once per shift inspect mixing, fabrication and installation of soil, cementitious and petroleum-based products for proper operation or tolerances. Confirm installers and tool operators are qualified, and tools are properly functioning.

D. Sample at frequencies following requirements of applicable Sections or as specified herein and test each sample.

E. Take quantity, linear, volume and bulk measurements as frequently as necessary to control mixing, fabrication and installation.

F. Properly calibrate test equipment and measuring tools before use.

G. Immediately report failed tests or measurements.

H. Test work for proper function and performance as specified herein and in other Sections.

I. Test and balance final HVAC system by AABC-certified contractor as part of the Work.

3.02 INSPECTION AND OBSERVATION

A. Inspect work by properly experienced personnel. Observe mixing, fabrication and installation procedures. Record observations.

B. Inspect at frequency indicated, using visual observation and measuring tools appropriate to the work. If not otherwise required in other Sections, inspect product source at the site of origin.

3.03 SAMPLING

A. Unless otherwise indicated in Sections or otherwise required by test standard, randomly collect 3 samples and maintain possession until observation and testing is complete and results documented.

B. Collect and handle samples following test standard.

C. Coordinate operations with Contractor.

3.04 TESTING

A. Test products *in situ* as approved by City Engineer or in laboratory where destructive tests are required, test to product failure. Note factual observations, test results, and measuring equipment setup, typed or legibly handwritten. For graph illustrations, use computerized database or spreadsheets.

B. Store and cure samples following test standards or as required to maintain samples in pristine condition until tested.

C. Test samples for conformance with requirements.

D. Follow test standards specified herein and in other Sections.

3.05 SCHEDULE OF INSPECTIONS, SAMPLES AND TESTS

A. Observe mixing, fabrication and installation, and inspect, collect samples and test, as indicated in applicable Sections.

END OF SECTION

SECTION 01505
TEMPORARY FACILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General temporary facilities:

1. Utilities and environmental systems.
2. Sanitary facilities.
3. Field office.
4. Storage sheds, buildings and lay-down areas.
5. General-purpose radios. ATCT radios are specified in Section 01640 - City-Furnished Products.
6. Fire protection.
7. Protection of the Work and property.
8. Interim cleaning.
9. Disposal of trash and debris.

B. Temporary facilities for exterior work:

1. Barricades.
2. Hazard lighting.
3. Access roads and parking.
4. Environmental controls.
5. Disposal of excavated material.
6. Control of erosion and water runoff.

C. Temporary facilities for interior work:

1. Barricades and enclosures, including those for accessways and exit ways.

2. Hazard lighting.

3. Environmental controls.

4. Existing electrical power, water, and HVAC are available at interior construction projects for Contractor's use at no charge by City Engineer.

D. Provide temporary product handling facilities and construction aids, such as scaffolds, staging, ladders and stairs, protective railings, hoists, chutes and other facilities, as required for construction operations and to protect persons, property and products. Follow governing agency requirements for scope, type and location if not otherwise specified.

E. Follow Section 01326 - Construction Sequencing for mobilization and demobilization requirements.

F. Temporary facilities specified herein are minimum standards. Provide additional facilities as required for proper execution of the Work and to meet responsibilities for protection of persons and property.

G. Properly install temporary facilities.

H. Maintain in proper operating condition until use is no longer required or as otherwise approved.

I. Modify and extend temporary facilities as required by Work progress.

J. Restore existing facilities used temporarily, to specified or original condition following Section 01731 - Cutting and Patching.

K. Provide weather protection and environmental controls as required to prevent damage to remaining Base Facility, the Work, and to other property.

M. Follow regulatory agency requirements for required temporary facilities not specified herein.

N. Where disposal of spoil and waste products, whether or not they are contaminated, is required under this or other Sections, make legal dispositions off site following governing authorities' requirements, unless on-site disposition is allowed under this or other Sections.

1.02 SUBMITTALS

A. Follow Section 01340 - Shop Drawings, Product Data and Samples.

B. Submit shop drawings and descriptive data showing:

1. Enclosure and barricade construction.

2. Enclosure and barricade layout if different from that shown on Drawings, including for each stage if applicable.

1.03 GENERAL REQUIREMENTS FOR UTILITIES AND ENVIRONMENTAL SYSTEMS

A. Make arrangements with utility service companies for temporary services.

B. Follow rules and regulations of utility service companies or authorities having jurisdiction.

C. Maintain utility service until Substantial Completion, including fuel, power, light, heat, and other utility services necessary for execution, completion, testing, and initial operation of the Work.

D. Follow Section 01312 - Coordination and Meetings for advance notifications and approvals of shutdowns of existing services and systems.

E. Water: Provide water for construction, at Contractor's sole cost and expense except as otherwise required below. Coordinate location and type of temporary water service with and obtain approval from City Engineer.

1. For water obtained direct from water mains or fire hydrants, obtain permit or license from proper authorities, and install temporary meter if applicable.

2. For water obtained downstream from Department of Aviation meter, City will provide water without cost for construction operations. Obtain approval of tap types, locations, and pipe routing. Provide valves and pipe as required.

3. For drinking water for personnel, provide potable water in proper dispensing containers, except public drinking fountains close to interior construction projects are available as long as use by Contractor does not impede airport operations or increase airport maintenance.

F. Electrical Power: Provide power for lighting, operation of Contractor’s plant or tools, or other uses by Contractor, at Contractor’s sole cost and expense, except as otherwise required below. Coordinate location and type of temporary power service with and obtain approval from City Engineer.

1. For power obtained direct from electric mains, obtain permit or license from proper authorities, and install temporary meter if applicable.

2. For power obtained downstream from Department of Aviation meter, City will provide power, without cost for construction operations, however, this shall be solely at the discretion of the City Engineer. Tap existing electrical panels and circuits at locations and ampacities approved by City Engineer. Obtain approval of tap types, locations, and conduit/wire routing. Provide switches as required.

3. Provide temporary power service or generators to power construction operations and to power existing facilities during main service shutdowns, and at locations where proper commercial power is not available.

G. Lighting: Provide lighting in construction areas, or other areas used by Contractor, at Contractor's sole cost and expense, except as otherwise required below. Coordinate location and type of temporary light fixtures with and obtain approval from City Engineer.

1. Provide explosion-resistant fixtures in areas where fuel is stored, handled or dispensed.

2. Minimum Lighting Level: 5-foot candles for open areas; 10-foot candles for exitways. Provide minimum of one 300W lamp per 20 square feet of work area.

H. Heat and Ventilation: Provide temporary heat and ventilation as required for protection or completion of the Work and to control dust, odors and other environmental contaminants. Provide safe working conditions. Maintain enclosed work areas, including interior work areas, at minimum of 50 degrees F.

1.04 SANITARY FACILITIES

A. Provide one portable self-contained chemical toilet/urinal for each 25 workers for exterior construction projects or construction areas not close to existing public restrooms. Place at reasonably secluded locations conveniently accessible to workers. Follow regulations of State and local departments of health.
1. Public restrooms close to interior construction projects are available as long as use by Contractor does not impede airport operations or increase airport maintenance.

B. Enforce use of sanitary facilities.

C. Supply and service temporary sanitary units at least twice per week. Legally dispose of waste off-site.

1.05 CONTRACTOR'S FIELD OFFICE

A. Furnish and maintain portable building(s) for Contractor's field office, located on-site as shown on Drawings or in a place approved by City Engineer. Include furnishings and equipment as required by Contractor for proper construction operations and with following minimums when used by City Engineer or Designer:

1. Structurally sound foundation and superstructure.

2. Completely weathertight with insulated roof and walls.

3. Exterior finish acceptable to City Engineer.

4. Slip-resistant entry ramp sloped 1:12 maximum, with handrail platform (5x5 feet) with mud scraper at door. Supplemental and railings and slip-resistant stairs as required. Follow requirements of Americans with Disabilities Act.

5. Interior finishes acceptable to City Engineer.

6. Screened windows sufficient for light, view, and ventilation.

7. Minimum Parking: 2 all weather hard surfaced parking spaces, all-weather paving, for use by City Engineer and Designer, connected to office by walkway.

B. Maintenance for Field Office:

1. Continuous maintenance of office, accessways, and services; clean not less than once per week;

2. Provide soap, paper towels, cleansers, janitorial service and appurtenances;

3. Immediately repair damage, leaks or defective service.

1.06 STORAGE SHED, BUILDINGS AND LAY-DOWN AREAS

A. Store products neatly and orderly onsite, arranged to allow inspection, identification and inventory, at locations approved by City Engineer.

B. When lack of or ill-timed environmental control systems could damage products, store in bonded off-site facilities approved by manufacturer, supplier or fabricator.

C. Provide suitable and substantial storage sheds, rooms, covers, or other facilities, for storage of material subject to contamination or damage from other construction operations. Provide environmental control to maintain products within manufacturers' required limits, when required. Storage of materials not susceptible to weather damage may be on blocks off the ground.

D. Do not overload Base Facility structure. Provide temporary shoring or bracing as required to prevent damage to structures.

1.07. GENERAL-PURPOSE RADIOS

B. Provide proper FCC licenses for operators.

1.08 FIRE PROTECTION

A. Follow fire protection and prevention requirements specified herein and those established by Federal, State, or local governmental agencies.

B. Follow applicable provisions of NFPA Standard No. 241, Safeguarding Building Construction and Demolition Operations.

C. Provide portable fire extinguishers, rated not less than 2A or 5B following NFPA Standard No. 10, Portable Fire Extinguishers, for field office and for every 3000 square feet of floor area of facilities under construction, located within 50 feet maximum from any point in the protection area.

D. Prohibit smoking in hazardous areas. Post suitable warning signs in areas which are continuously or intermittently hazardous.

E. Use metal safety containers for storage and handling of flammable and combustible liquids.

F. Do not store flammable or combustible products inside occupied buildings or near stairways or exits.

G. Maintain clear exits from all points in the Work.

1.09 PROTECTION OF THE WORK AND PROPERTY

A. Take precautions, provide programs, and take actions necessary to protect the Work and public and private property from damage.

B. Prevent damage to existing public and private utilities and systems during construction. Utilities are shown on Drawings at approximate locations, but this information is not warranted as complete or accurate. Give City Engineer at least 48 hours notice before commencing work in the area, for locating the utilities during construction, and for making adjustments or relocation of the utilities when they conflict the Work.

1. Utilize the Utility Coordinating Committee One Call System, telephone number, (713) 223-4567, called 48 hours in advance. The toll-free telephone number is 1-800-245-4545, Texas One Call System.

2. Follow Section 01726 - Base Facility Survey, to determine existing utilities and systems.

3. Follow Section 01761 - Protection of Existing Services, to make coordination efforts for each existing Service that requires protection.

C. Provide safe barricades and guard rails around openings, for scaffolding, for temporary stairs and ramps, around excavations, accessways, and hazardous areas.

D. Obtain written consent from proper parties, before entering or occupying with workers, tools, or products on privately-owned land, except on easements required by the Contract Documents.

E. Assume full responsibility for preservation of public and private property on or adjacent to the site. If direct or indirect damage is done by or on account of any act, omission, neglect, or misconduct in execution of the Work by Contractor, restore by Contractor, at no cost or time increase, to a condition equivalent to or better than that existing before the damage was done.

F. Where work is performed on or adjacent to roadways, rights-of-way, or public places, provide barricades, fences, lights, warning signs, and danger signals sufficient to prevent vehicles from being driven on or into Work under construction.

1. Paint barricades to be visible from sunset to sunrise

2. Install at least one flashing hazard light at each barricade section.

3. Furnish watchmen in sufficient numbers to protect the Work.

4. Other measures for protection of persons or property and protection of the Work.

G. Protect existing trees, shrubs, and plants on or adjacent to the site against unnecessary cutting, breaking or skinning of branches, bark, or roots.

1. Do not store products or park vehicles within drip lines.

2. Install temporary fences or barricades in areas subject to damage from traffic.

3. Water trees and plants to maintain their health during construction operations.

4. Cover exposed roots with burlap and keep continuously wet. Cover exposed roots with earth as soon as possible. Protect root systems from physical damage and damage by erosion, flooding, run-off, or noxious materials contamination.

5. Repair branches or trunks if damaged, prune branches immediately and protect the cut or damaged areas with emulsified asphalt compounded specifically for horticultural use in a manner approved by City Engineer.

6. Remove and replace damaged trees and plants that die or suffer permanent injury. Replace with product of equivalent size and in good health.

7. Coordinate this work with Division 2 requirements for clearing and landscaping.

H. Protection of Existing Structures:

1. Fully sustain and support in place and protect from direct or indirect injury underground and surface structures located within or adjacent to the limits of the Work.

   a. Before proceeding with sustaining and supporting work on property of others, satisfy City Engineer that the owner of the property approves the methods and procedures proposed.

2. Do not move or in any way change the property of public utilities or private service corporations without prior written consent of a responsible official of that service or public utility. Representatives of these utilities reserve the right to enter within the limits of the Work for the purpose of maintaining their properties, or of making changes or repairs to their property considered necessary by performance of the Work.

   a. Notify the owners and/or operators of utilities and pipelines of the nature of construction operations proposed and the date or dates on which those operations will be performed. When construction operations are required in the immediate vicinity of existing structures, pipelines, or utilities, give minimum 5 working days advance notice. Probe and securely flag locations of underground utilities prior to beginning excavation.

3. Assume all risks attending presence or proximity of existing construction within or adjacent to the limits to the Work including but not limited to damage and expense for direct or indirect injury caused by the Work to existing construction. Immediately repair damage caused, following Section 01731.

I. Protect installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed.

1. Control traffic to prevent damage to products and surfaces.

2. Provide coverings to protect products from damage. Cover projections, wall corners, jambs, sills, and off-site of openings in areas used for traffic and for passage of product in subsequent work.

1.10 ACCESS ROADS AND PARKING

A. Follow Section 01575 - Stabilized Construction Exit for construction exits.

B. Provide temporary stable construction roads, walks, and parking areas of a load bearing capacity required during construction connecting to public thoroughfares and for use of emergency vehicles. Design and maintain temporary roads and parking areas for full use in all weather conditions.

1. Locate temporary roads and parking areas as approved by City Engineer.

2. Prevent interference with traffic, City and airport operations on existing roads. Indemnify and save harmless the City from expense caused by Contractor's operations over these roads.

3. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking. If not shown on the Drawings, locate as directed by City Engineer.

4. Minimize use of construction traffic on existing on-site streets and driveways. For tracked vehicles, use street plugs. Do not load paving beyond design capacity.

5. Do not allow heavy vehicles or construction equipment in existing parking areas.

6. Construction personnel may use designated areas of existing parking facilities.

7. Remove temporary roads, walks and parking areas prior to final acceptance. Return to its original condition, unless otherwise required by the Contract Documents.

C. Public, Temporary, and Construction Roads and Ramps:

1. Public Roads: Follow laws and regulations of governing authorities when using public roads. If Contractor's work requires public roads be temporarily impeded or closed, obtain approvals from governing authorities and pay for permits before starting work. Coordinate activities with City Engineer following Section 01312 - Coordination and Meetings.

2. On-Site Roads: Prepare temporary roads, construction roads, ramps, and areas on the site to be accessible for trucking and equipment.

3. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage. Extend and relocate as approved by City Engineer as Work progress requires, provide detours as necessary for unimpeded traffic flow. Maintain 12-foot width access road with turning space between and around combustible materials. Provide and maintain access for fire trucks to fire hydrants free of obstructions.

   a. Do not use limestone for paving.

4. Obtain approval of special requirements covering handling exceptionally large or heavy trucks, cranes, or other heavy equipment. Provide mats or other means, so roadways are not overloaded or otherwise damaged.

D. Submit access road and parking locations to City Engineer for approval.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide products for temporary construction using equivalent type as required for permanent construction, except "construction grade" quality may be used (such as for wood framing, enclosures and barricades, and construction locks).

B. Where materials for use in this Section are not specified or detailed, propose products in writing and obtain approval from City Engineer before commencing work.

2.02 TEMPORARY EXTERIOR ENCLOSURES AND BARRICADES

A. Repair damaged existing barricades following Paragraph B. Reuse existing to maximum practical extent. Match new work to existing sightlines, profiles, and color,]

B. Provide temporary fencing as required to enclose exterior storage/staging and demolition areas, during on-site operations, chain link fence at remote areas (away from Terminal buildings), and chain link fence with plywood overlay at on-site areas (adjacent to or near Terminal buildings and AOA).

1. Chain Link: Minimum 6-foot high commercial quality galvanized fabric, galvanized steel or minimum 4 x 4 treated wood posts at 8 feet on center maximum, gate frames as required, with barbed wire at top if required by Contractor. For natural earth areas, provided minimum 8-inch diameter by 3-foot deep hole for posts. Fill annular space with pea gravel or crushed stone. For paved areas, provide welded base plate on each post and attach to paving with drill-in or powder actuated fasteners of size

and quantity required to resist imposed loads. Provide corner bracing and struts as required to maintain erect fencing and taut fabric. Provide gate locks of Contractor's choice. Provide one set of keys to City Engineer.

2. Plywood Overlay: Exterior grade, minimum 3/4 inch-thick, 8-feet-high. Tie plywood with wire to public side of chain link fence and gates. Paint exterior (public) face with flat latex-based paint to match "Nevamar Pepperdust" plastic laminate.

C. Barricades in Safety Areas of Taxiways and Aprons at AOA: Preservative-treated wood construction, maximum 3 feet high sawhorse legs at both ends of one 8-inch-high top rail, with 45 degree-angled white and orange hashmarks, on 4 by 4-inch wood posts and struts bolted to 12 by 12-inch continuous timber base. Install hazard lights at maximum 6 feet centers and at each end and corners of the barricade. Sandbag wood frame to prevent overturning by jet blast or prop wash.

2.03 TEMPORARY INTERIOR ENCLOSURES AND BARRICADES

A. Provide temporary partitions and ceilings or reuse existing partitions as required to separate work areas during on-site finishing operations, to prevent penetration of dust, odors, gases and moisture into occupied areas and to prevent damage to remaining Base Facility and to Contractor's work. Remove new and existing barricades upon completion of work or as directed by City.

B. Rigid Barricades and Enclosures: Provide wood or metal framing and gypsum board or plywood sheet materials with closed joints; flame spread rating of 25 or less following ASTM E84.

1. Paint faces exposed to public areas to match "Nevamar Pepperdust" plastic laminate, as required by City Engineer.

2. Sandbag or foam-tape floor track to existing terrazzo or tile flooring. Do not fasten to existing finished walls or ceiling tiles.

C. Membrane Enclosures: Provide same framing as above. Cover with minimum 12 mil black plastic sheet, with taped joints and edges. Seal punctures as they occur.

D. Perimeter Tape: Manufactured plastic tape, with printed "Construction Area" or equivalent message. Fasten to saw horses, "trees" or equivalent moveable posts. Repair breaks as they occur. Install around areas where quick changeability of barrier limits is required.

2.04 HAZARD LIGHTS

A. Provide battery-powered flashing yellow lights on barricades and enclosures around perimeter of exterior areas adjacent to AOA, roadways, and parking aisles or spaces. Install on posts set in striped barrels and anchored with sand, or attach to fencing, as applicable and as ground space permits where barricades or enclosures do not occur.

2.05 TEMPORARY UTILITY AND ENVIRONMENTAL SYSTEMS WORK

A. Furnish temporary HVAC, plumbing and electrical products as required to provide continued Base Facility operation, including systems by-pass dampers, ductwork, valves, pipe and fittings, conduit, wiring, junction boxes, and other items.

B. Coordinate these products with products of Sections 01731 - Cutting and Patching and Divisions 2, 15 and 16.

PART 3 EXECUTION

3.01 CONTRACTOR'S FIELD OFFICE

A. Install field office ready for occupancy, 10 days after date fixed in Notice to Proceed.

3.02 ENCLOSURE AND BARRICADE, SIGN, AND HAZARD LIGHT INSTALLATION

A. Fill and grade site for temporary structures to provide drainage away from buildings. Follow Section 01506- Temporary Controls and 01572 - Erosion and Sedimentation Control for erosion and sedimentation control.

B. Follow Section 01507 - Temporary Signs.

C. Install and maintain enclosures and barricades, passageways, signs and lights at locations shown on Drawings, or as directed by City Engineer, or as required to safely divert unauthorized parties away from or around construction operations.

1. Maintain minimum 3-foot candles of illumination at exitways, including those remaining adjacent to permanent barricades.

2. Reinforce barricades at AOA as required to withstand jet blast loads.

3.03 TEMPORARY UTILITY AND ENVIRONMENTAL SYSTEMS

A. Install temporary HVAC, plumbing and electrical products as required to maintain adequate environmental conditions to facilitate progress of Work, to meet specified minimum conditions for installation of materials, to protect materials and finishes from damage due to temperature or humidity beyond specified or otherwise required ranges, and to maintain proper Base Facility systems operation outside contract limits.

B. Provide ventilation of enclosed areas for proper curing of installed products, to disperse or control humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases inside or outside of enclosures.

3.06 REMOVAL OF TEMPORARY FACILITIES

A. Maintain temporary facilities until Substantial Completion inspection, or when use is no longer required, or as directed by City Engineer.

B. Clean and repair damage caused by installation or use of temporary facilities.

C. Restore existing facilities used during construction to specified or original condition following Section 01731 - Cutting and Patching.

3.07 DISPOSAL OF DEBRIS , EXCESS PRODUCTS AND EXCAVATED MATERIAL

A. Legally dispose of waste and excess products off site. Do not burn or bury on site.

1. Prepare and file with Texas Department of Health (TDH) "TDH Demolition/ Renovation Notification" related to compliance with National Emissions Standards for Hazardous Air Pollutants. Obtain form from TDH, 10500 Forum Place Drive, Suite 300, Houston, TX 77036-8599, (713) 414-6125, or (800) 572-5548.

B. Place excavation material and salvageable products on site at locations and to profiles shown on Drawings or as directed by City Engineer.

1. Load, haul, and deposit excavated material.

2. Base, surface, and bedding material: Load shell, gravel, bituminous, or other base and surfacing material into City of Houston trucks.

3. Pipe culvert: Load culverts designated for salvage into City of Houston trucks.

4. Other salvageable materials: Follow individual Sections.

5. Coordinate loading of salvageable material on City's trucks with City Engineer.

C. Do not dispose of debris in sewers. Repair sewer lines to proper function within contract limits as a result of permitted use.

D. Remove and legally dispose of excess and other products not designated for salvage.

3.08 INTERIM CLEANING

A. Temporarily store debris in areas concealed from public, occupants' and AOA view. Prevent migration of debris and dust following Section 01506 - Temporary Controls.

B. Clean-up dirt and debris in vicinity of construction entrances each day. Clean up debris, scrap materials, and other disposable items before completion of each day's work. Keep streets, driveways, and sidewalks clean of dirt, debris and scrap materials.

1. Failure to maintain clean site is the basis for City Engineer take action following Section 2.5 in Document 00700 - General Conditions.

C. Remove debris daily unless otherwise approved by City Engineer. Remove only between 2000 and 0600 hours for interior projects.

D. Prevent hazardous conditions due to product or debris storage in work areas and storage areas.

E. Keep streets used for entering or leaving the job area free of excavated material, debris, and foreign material, including carryout dust and mud, resulting from construction operations. Follow Section 01575 - Stabilized Construction Exit for vehicle wash areas. Follow City of Houston Ordinance No. 5705, Construction or Demolishing Privileges.

F. As frequently as necessary, sweep and damp mop floors of spaces in public spaces adjoining access points through barricades or enclosures.

END OF SECTION

SECTION 01506
AIRPORT TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dust control.

B. Noise control.

C. Pest and rodent control.

D. Pollution and environmental control.

E. Security controls, security plan and procedures. Work in AOA or the airport's secured area is not intended as part of this Contract; however, TSA may be involved in reviews of Contractor's construction plans to verify no TSA requirements or restrictions apply.

F. Safety requirements and safety plan.

G. Emergency procedures.

1.02 REFERENCES

A. U.S. Department of Transportation Federal Aviation Administration Advisory Circular AC 150/5370-2C.

1.03 SUBMITTALS

A. Make following submittals in 3-ring "D" binders, with clear spine and cover pockets and label "Airport Construction Control Plans" on white card-stock inserts. Prepare submittals as work of this and other Sections but submit following Section 01312 - Coordination and Meetings.

B. Preliminary "Airport Construction Control Plans": Submit, under provisions of Section 01325, 3 copies in draft form of the following, with section dividers labeled as and containing:

1. Construction Traffic Control Plan prepared under Section 01555 - Traffic Control and Regulation.

2. Emergency Response Plan Listing Safety Officers (Paragraph 1.09) with names, positions, office and home telephone numbers, and pager and portable telephone numbers.

3. Safety Plan, including Trench Safety Plan prepared under Section 01561 - Trench Safety System.

4. Security Plan.

5. Dust Control Plan.

6. Ground Water and Surface Water Control Plan prepared under Section 01578 - Control of Ground and Surface Water.

7. Revise as required and submit 5 final copies, in same form as preliminary copies under Section 01312 - Coordination and Meetings.

C. Pesticides and Poisons: Submit following Section 01340 - Shop Drawings, Product Data and Samples. Include Material Safety Data Sheets and manufacturers' recommendations for use and application. Include copy of applicator's certification from manufacturer.

1.04 DUST CONTROL

A. Prevent uncontrolled dust creation and movement. Prevent airborne particulates from reaching receiving streams or storm water conveyance systems, building interiors and AOA.

B. Use spray-on adhesives or plastic covers on exposed soil piles.

C. Follow Section 01505 - Temporary Facilities for interior enclosures.

D. Implement dust control methods immediately whenever dust migration is observed.

1.05 NOISE CONTROL

A. Provide vehicles and tools with noise suppressors and use methods and products that minimize noise to the greatest degree practicable. Follow OSHA standards and City Ordinances regarding noise. Do not create noise levels which interfere with the Work, with work by City, with airport operations, or which create a nuisance in surrounding areas.

B. Do not use impact-type or powder-actuated-type tools adjacent to occupied office-type areas.

1.06 PEST AND RODENT CONTROL

A. Provide pest and rodent control as required to prevent infestation of construction or storage areas using legal chemicals applied by a licensed applicator.

B. Provide methods and products with no adverse effect on the Work or adjoining properties.

C. Use and store chemicals following manufacturers' recommendations and with local, state, and federal regulations. Avoid overuse of pesticides that produce contaminated runoff. Prevent spillage. Do not wash pesticide containers in or near flowing streams or storm water conveyance systems, or inside buildings.

1.07 POLLUTION AND ENVIRONMENTAL CONTROL

A. Prevent contamination of soil, water or atmosphere by discharge of noxious substances from construction operations.

B. Contain spillage and remove contaminated soils or liquids. Excavate and dispose of contaminated earth off-site and replace with suitable compacted fill and topsoil.

C. Prevent harmful substances from entering public waters. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.

D. Provide systems for control of atmospheric pollutants. Prevent toxic concentrations of chemicals. Prevent harmful dispersal of pollutants into the atmosphere.

E. Use equipment during construction following Federal, State, and local laws and regulations.

F. Follow statutes, regulations, and ordinances governing prevention of environmental pollution and preservation of natural resources, including but not limited to the National Environmental Policy Act of 1969, PL 91-190, Executive Order 11514.

G. Undeveloped areas on the airport site have considerable natural value. Do not cause unnecessary excavation or filling of terrain, unauthorized destruction of vegetation, air or stream pollution, nor harassment or destruction of wildlife.

H. Follow environmental requirements. Limit disturbed areas to boundaries established by the Contract Documents. Do not pollute on-site streams, sewers, wells, or other water sources.

1.08 SECURITY CONTROLS, PLAN AND PROCEDURES

A. Protect products and property from loss, theft, damage, and vandalism. Protect City property and other private property from injury or loss in connection with the Work.

B. Employ watchmen as needed to provide required security and prevent unauthorized entry.

C. Repair damage or replace property vandalized.

D. If existing fencing or barriers are breached or removed for purposes of construction, provide an appropriate (as determined by the airport manager or designee) number of guards and/or maintain temporary security fencing equivalent to existing and approved by City Engineer.

E. Maintain security program through construction until City's acceptance and occupancy precludes need for Contractor's security program.

F. Provide chain link fence Terminal area staging areas, following Section 01505 - Temporary Facilities.

G. Airport Security Requirements:

1. Airport Manager and TSA monitor effectiveness of airport security by attempting to gain unauthorized entry into security areas. When TSA gains unchallenged access to security areas, City and/or the responsible individual may be fined. When unauthorized entry into security areas is made through contract limits or other areas under the Contractor's control:

   a. Reimburse the City, without increase in contract price, the amount of imposed fines levied against the City, accomplished by Change Order following Section 01255 - Modification Procedures.

   b. Cease work in breached areas until proper security measures are in place, without change in contract price or time.

2. Immediately notify HPD of discovered presence of unbadged or unknown persons, vehicles or animals in security areas. Dial (IAH) (281) 231-3100.

3. Obtain permitted AOA gate and other security area access locations from Airport Manager. Assign personnel to control passage through entry points not staffed by airport personnel.

4. Badges:

   a. After contract award and before preparation of the Safety Plan (Paragraph 1.09D) and construction schedule (Section 01325), obtain permitted security badges.

   b. Security identification badges are required for access into AOA/Secured areas. Badges are valid for one year or for the period of the contract, whichever is shorter.

   c. TSA TSR Part 1542.209 applies to personnel engaged in work of this contract occurring within the AOA or secured area, and reads in part as follows:

"…each airport operator must ensure that no individual is granted unescorted access authority unless the individual has undergone a fingerprint-based criminal history records check (CHRC) that does not disclose that he or she has a disqualifying criminal offense."

d. Obtain from City Engineer and fill out one security badge application package (application form and all associated paperwork) per person (including subcontractors' personnel) needing unescorted access in security areas.

e. Contact the airport ID badging office to arrange for collection and submittal of fingerprints. Prepare and maintain a file for each applicant, including a copy of the completed application. Keep in Contractor's main office until expiration of the warranty period.

(1) Short-term or temporary personnel are permitted in security areas but only under constant escort by a properly badged escort, who shall have no duty other than to escort short-term or temporary personnel.

(2) Badged and escorted personnel are limited to access to and from work areas and shall remain in the work area.

(3) Personnel under constant escort shall be continuously observed by and in the immediate company of badged personnel.

(4) City Engineer may limit the number of badged personnel and personnel under constant escort.

f. Submit completed applications to City Engineer for further review.

g. Attend required security training sessions.

h. Pick up completed badges and pay badging fees (as of November 2019, $55.00 per badge for a 1-year period--verify fee and duration with Airport Manager).

5. Do not leave fence breaks unattended. Restore fence or erect equivalent secure temporary fencing before departing the work area.

6. Provide proper identification on Contractor’s vehicles permitted in AOA.

1.09 SAFETY REQUIREMENTS

A. Contractor and not City, City Engineer or Designer is solely and without qualification responsible for observation and compliance with safety regulations without reliance or superintendence of or direction by City, City Engineer or Designer.

B. Safety measures, including but not limited to safety of personnel, provision of first-aid equipment, installation, operation and removal of temporary ventilation and safety

equipment, in the Contract Documents are a subsidiary obligation of Contractor compensated through various payment items.

C. Follow Document 00700 - General Conditions Paragraph 10.1 and this Section for safety plan and procedures.

D. Prepare a written detailed Safety Plan for the Work describing:

1. Specific methods used to maintain airport safety procedures, based on requirements of the Contract Documents, airport procedures, FAA/TSA requirements and Contractor's own safety and security program.

2. Contractor's emergency procedures in event of following minimum set of circumstances: airport's-, tenants'- or Contractor's on-site property damage; accidents; fire emergency; medical emergency; Airport Manager's intervention in construction operations; detainment or arrest of unauthorized Contractor's employees and subcontractors in Security areas; discovery of hazardous materials.

3. Provisions for temporary removal of security fencing (including culvert and drain-way grates). Include proposed actions to prevent entry of people or animals into security areas when security fence is breached. Do not breach fencing without approval.

4. Requirements for closing safety areas.

5. Submit draft Safety Plan at the Preconstruction Conference, following Section 01312 - Coordination and Meetings.

E. City Engineer will review the safety program with FAA and ATCT for compliance with applicable regulations. If the plan fails to demonstrate compliance, modify it until approval is obtained.

F. Contractor's Safety Officers: Refer to Section 01550 - Public Safety & Contractor Safety Staffing, Paragraph 1.05, Contractor’s Safety Staffing Requirements.

G. Submit final Safety Plan at the first Progress Meeting following Section 01312 - Coordination and Meetings.

1. Include in the safety plan Contractor's response to trench safety requirements following Section 01561 - Trench Safety System.

H. Follow applicable Federal, State and local safety codes and statutes and with proper construction practice. Establish and maintain procedures for safety of work, personnel and products involved in the Work.

I. Follow Texas Occupational Safety Act (Art. 5182a, V.C.S.) and promulgations of Secretary of Labor under Section 107 of Contract Work Hours and Standards Act, published in 29 CFR Part 1926 and adopted by Secretary of Labor as occupational safety

and health standards under the Williams-Steiger Occupational Safety and Health Act of 1970. Follow other legislation enacted for safety and health of Contractor employees. These safety and health standards apply to Contractor, Subcontractors and Suppliers and their respective employees.

J. Immediately notify City Engineer of investigation or inspection by Federal Safety and Health inspectors of the Work or place of work on the job site, and after such investigation or inspection inform City Engineer of results. Submit 1 copy of accident reports to City Engineer within 10 days of date of inspection.

K. Protect areas occupied by workmen by the best available devices for detection of lethal and combustible gases. Frequently test devices to assure their functional capability. Monitor liquids and gases infiltrating into work areas for visual or odor evidences of contamination. Take immediate appropriate steps to seal off entry of contaminants into to the Work.

L. Maintain coordination with City's Police and Fire Departments during the Work.

1.10 EMERGENCY PROCEDURES

A. If an emergency situation occurs, including involvement in or witness to aircraft or motor vehicle emergencies and emergencies involving other parties or property regardless of fault, or a violation of requirements of this Section, or a violation of FAA/TSA regulations, take one or more of the following minimum actions as appropriate to the situation.

B. Immediately report to City Engineer accident or damage to pavement, buildings, utilities, and vehicles involving or caused by Contractor, Subcontractors, Suppliers, personnel, equipment or others.

C. In general:

1. Immediately notify HFD or HPD (public areas) as appropriate and applicable to location of emergency.

2. Notify City Engineer by telephone or in person.

3. Stop work in the area. Secure site as required to prevent further damage to property and persons.

4. Evacuate non-essential personnel from the scene. Keep involved personnel and witnesses on-site until otherwise directed by City Engineer or security officers.

5. Impound involved vehicles in "as-is condition" until otherwise directed.

6. Do not resume work in the area until released by City Engineer.

D. For discovery of actual or suspected hazardous material contamination, proceed with Paragraph B above while simultaneously initiating Contractor's own hazardous material response program.

E. Follow City Engineer's instructions for emergencies affecting the Work but occurring outside the Contract Limits. Certain situations may require the Work or work to be temporarily stopped under provisions of Document 00700 - General Conditions.

1. Maintain a log documenting cost and time impact of the stop-work order.

2. Submit data to the City Engineer in form as instructed at that time.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01507
TEMPORARY SIGNS

PART 1- GENERAL

1.01 SECTION INCLUDES

A. Temporary signs at construction access points.

B. Maintenance.

C. Removal.

D. Project and Contractor identity signs are not permitted.

1.02 QUALITY ASSURANCE

A. Design signs and supporting sign structure to remain in place and withstand 50 miles-per-hour wind velocity.

B. Sign Manufacturer/Maker/Painter: Experienced professional sign company.

C. Finishes, Painting: Withstand weathering, fading, and chipping for duration of construction.

D. Appearance: Fresh, new-looking, legible and neat look during the entire period during which required.

1.03 SUBMITTALS

A. Follow Section 01340 - Shop Drawings, Product Data and Samples.

B. Submit shop drawings including:

1. Signboards and Copy: Show to-scale size, dimensions, content, layout, font style and size, and colors.

2. Location of each sign.

PART 2 PRODUCTS

2.01 TEMPORARY SIGNS FOR ACCESS POINTS

A. Posts for Exterior Signs: New 4x4 inch moisture-resistant-treated wood or 2-1/2-inch diameter by 12-foot long galvanized steel.

1. Paint white

2. Fabricate to length required for 3-foot direct-bury plus aboveground length required for proper height of signboard mounting.

3. Furnish number of posts as required for proper support of signboard

B. Signboards:

1. For Exterior Signs: 3/4-inch-thick exterior grade medium density overlay (MDO) plywood, or 3/16-inch sheet aluminum. Paint background white.

a. Contractor's Option: Use colored vinyl film in lieu of paint for aluminum.

2. For Interior Signs: 3/4-inch-thick fire-retardant treated medium density overlay plywood, or colored plastic laminate cladding both faces and with painted edges, or 1/8-inch sheet aluminum. Paint background black.

a. Contractor's Option: Use colored vinyl film in lieu of paint for aluminum.

C. Color Coating for Signboards and Hashmarks: Flat ultraviolet inhibited acrylic polyurethane or matte vinyl, all visible surfaces.

D. Copy and Borders: Flat color (color as scheduled) vinyl die-cut, Helvetica Medium typeface, size as shown or scheduled.

E. Rough Hardware: [For wood, galvanized steel or brass for fasteners and other hardware] [For aluminum, cadmium-plated steel or stainless steel].

F. Skid-mounted Signs: Allowed only when approved by the City Engineer. Approval does not release Contractor from responsibility of maintaining temporary signs on site and does not make City responsible for security of temporary signs.

2.03 SIGN FABRICATION

A. Fabricate signboards and install copy in the shop.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install temporary signs at construction area access points, including within security areas and AOA, at following location:

1. As scheduled below.

2. Where shown on Drawings.

3. Where required by City Engineer.

B. Install signs fully visible, legible, level and plumb.

C. Install 22" x 28" poster sized sign at IDO office lobby on an easel. HAS will provide artwork for the sign. Contractor to provide printer's proof before final printing.

D. Project and Contractor identity signs are not permitted.

3.02 MAINTENANCE

A. Maintain signs and supports and markings clean. Repair deterioration and damage.

B. Relocate signs as work progresses at each site at no additional cost to the City.

3.03 REMOVAL

A. Remove temporary sign work when control is no longer needed or as directed by City Engineer.

3.04 MESSAGE SCHEDULE

A. Construction Entrance Warning Sign: One-foot square signboard, white copy and border on black background. Surface-mount at north doors of the construction area; at 50 feet on center unless otherwise required by governing agencies. This sign shall include the following:

NO ENTRANCE (4 inch)

CONSTRUCTION AREA (4 inch)

(45-degree hash marks, full width) (2 inch)

Hard Hat Required (2 inch)

Security Badge Required (2 inch)

Emergency Phone# (2 inch)

B. Emergency Egress Sign: One-foot square signboard, white copy and border, with directional arrow, on black background. Surface-mount on fences, barricades or enclosures, or freestanding, spaced 50 feet on center along path of egress, unless otherwise required by governing agencies.

EXIT (4 inch)

(Arrow direction as appropriate to egress path) (6 inch)

END OF SECTION

SECTION 01550

PUBLIC SAFETY & CONTRACTOR'S SAFETY STAFFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Public Safety and Convenience

B. General Requirements

C. Street Markers and Traffic Control Signs

D. Contractor's Safety Staffing Requirements

1.02 RELATED SECTIONS

A. Section 00700 - General Conditions

B. Section 01555 – Traffic Control & Regulations

C. Section 01561 – Trench Safety System

1.03 PUBLIC SAFETY AND CONVENIENCE

A. The Work in this Project is to be performed [edit wording for scope of work and coord. w/other const. Projects going on in the immediate area]. The Contractor shall furnish and maintain appropriate barricades and signage required to maintain a safe work environment for the HAS employees, the public and construction staff working at the project site.

B. Contractor shall plan and execute his operations in a manner that will cause a minimum interference with other construction projects.

C. Signs, barricades and warning devices informing public of construction features will be placed and maintained by Contractor, who shall be solely responsible for their maintenance.

D. Contractor shall perform the necessary cleanup and finishing immediately after all or a portion of the Work is completed.

E. All fire hydrants and water control valves shall be kept free from obstruction and available for use at all times.

1.04 GENERAL REQUIREMENTS

A. The Contractor shall observe the rules and regulations of the State of Texas and agencies of the U.S. Government which prohibit the pollution of any lake, stream, river, or wetland by dumping of any refuse, rubbish, dredge material, or debris therein.

B. The Contractor is specifically cautioned that disposal of materials into any water of the State must conform to the requirements of the Texas Natural Resource Conservation Commission (TNRCC), and any applicable permit from the US Army Corps of Engineers.

C. Waste material must be disposed of at sites approved by the Owner's Representative and permitted by the City.

1.05 CONTRACTOR'S SAFETY STAFFING REQUIREMENTS

A. Refer to Section 00700 – General Conditions, Article 10 – Safety Precautions

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF DOCUMENT

SECTION 01555

TRAFFIC CONTROL AND REGULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Signs, signals, lights and control devices.

B. Flagmen.

C. Construction parking control.

D. Designated haul routes.

E. Construction Traffic Control Plan.

F. See also Section 01145 - Use of Premises.

1.02 DEFINITIONS

A. See Section 01312 - Coordination and Meetings for definition of terms related to Aircraft Operations Area (AOA).

B. Flagman: A person who has successfully fulfilled the "Certified Flagman" requirements set forth by the Texas Department of Transportation. Flagman certification may be achieved either through the Texas Department of Transportation, Texas Engineering Extension Services (TEEX), the City of Houston's E.B Cape Training Center, or by a trained and certified flagman instructor, employed by the Contractor. The certified flagman must carry proof of certification while performing flagman duties. The certified flagman will be required to wear a distinctive, bright colored vest and be equipped with appropriate flagging and communication devices. He/she must be fluent in English (speaking, reading, writing), with Spanish an advantageous, but not required, primary or secondary language.

C. Peace Officer: A licensed police officer actively employed in a full-time capacity as a peace officer, working on average, minimum 32 paid hours per week, at a rate not less than the prevailing minimum rate following the Federal Wage and Hour Act, and entitled to full benefits as a peace officer, and who receives compensation for private employment as an individual employee or independent contractor. Private employment may be either in employee-employer relationship or on an individual contractual basis. He/she must be fluent in English (speaking, reading, writing) with Spanish an advantageous, but not required, primary or secondary language.

D. Uniformed Flagman: A peace officer trained in traffic control and familiar with George Bush Intercontinental Airport roadway traffic patterns and airport operation procedures. A uniformed flagman may not be a reserve peace officer.

1.03 SUBMITTALS

A. For Contractor-proposed changes to Traffic Control and Regulation shown on Drawings, permitted only in order to reduce construction time and cost through re-sequencing the Work, prepare plan drawings and supplement with product literature, narrative description, and construction schedule.

1.04 MEASUREMENT AND PAYMENT

A. Traffic Control and Regulation, excluding Flagmen: Measurement is on a lump sum basis, including submittal of Contractor-proposed changes. Payment will be made based on schedule of values and percent of work complete.

B. Flagmen: Measurement is on a lump sum basis as required for the Work. Payment will be made based on schedule of values and percent of work complete.

C. Follow Section 01290 - Payment Procedures.

1.05 CONSTRUCTION TRAFFIC CONTROL PLAN AND PROCEDURES

A. Develop a written and graphic detailed Construction Traffic Control plan describing:

1. Rerouting of public roadway and AOA roadway traffic (outside safety areas) showing route, duration, and methods for change over from one route to the other and return to normal.

2. Product Deliveries: Location, space required and duration for temporary off-loading along public roadways or curbsides and along AOA roadways and around buildings adjacent to aprons, and route through occupied building interiors.

3. Barricade locations and duration of installation. Submit barricade construction details following Section 01505 - Temporary Facilities.

4. Maintain, update and obtain approval for changes.

PART 2 PRODUCTS

2.01 SIGNS, SIGNALS, AND DEVICES

A. Furnish traffic cones, drums, barricades and traffic intersection lights, including control devices in AOA, following TMUTCD.

2.02 FLAGMEN AND OTHER PERSONNEL

A. Provide certified flagmen in number, at assigned, locations, and for durations as required to regulate even flow of vehicular and pedestrian traffic affected by construction activities.

B. Employ other personnel, i.e. uniformed peace officers, to take the additional steps required to protect the Work and public, or when specifically requested by Airport Operations personnel through the City Engineer to assist flagmen in the regulating of airport roadway traffic. The uniformed peace officer will coordinate with City Engineer, contractor, and/or Airport Operations personnel, as appropriate, prior to beginning shift.

C. Use of flagmen or peace officers does not reduce responsibility for damage for which the contractor would otherwise be liable.

PART 3 EXECUTION

3.01 GENERAL

A. Install traffic control devices, including flagmen, at approaches to site and on site, at crossroads, detours, parking areas, at AOA, at construction entrances, and elsewhere as required to direct construction and affected public traffic, aircraft and GSE, or where directed by City Engineer and/or Airport operations personnel.

B. As directed by appropriate authority, e.g., City Engineer, employ additional uniformed peace officers to supplement the flagmen when performing a total terminal area road closure, detour, or overnight activity that affects existing traffic patterns. The uniformed peace officer will coordinate with City Engineer, contractor, and/or Airport Operations personnel, as appropriate, prior to beginning shift.

C. Install and operate traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor’s control, and areas affected by Contractor’s operations.

D. Install warning lights on traffic control devices for use during hours of low visibility to delineate traffic lanes and to guide traffic. Do not use flares or flame pots.

E. Relocate traffic controls as Work progresses, to maintain effective traffic control.

3.02 HAUL ROUTES

A. Confine construction traffic to designated haul routes.

B. Regulate construction traffic along haul routes. Minimize interference with public traffic.

C. Follow Texas State Highway and Public Transportation load limits of roadways.

3.03 PUBLIC ROADS AND TERMINAL AREA OADS

A. Abide by laws and regulations of governing authorities when using roads.

B. Maintain road lane use as follows, unless otherwise permitted by Airport Manager or Airport Operations personnel, as coordinated through City Engineer.

1. All Terminal area road lanes available from 0500 to 2200 hours; minimum two lanes in each direction at all times.

2. All on-airport road lanes (outside Terminal area) available from 0500 to 0900 hours, and from 0600 to 1900 hours; minimum two lanes in each direction at all times.

C. Maintain access at driveways. Do not block any vehicle or pedestrian traffic area without obtaining prior approval from the Houston Airport. Any unusual or otherwise unforeseen activity will require forty-eight (48) hours of notification to the City Engineer as well as Airport Operations personnel. Traffic control meetings are held weekly, on Thursdays, at 2:00 pm at a location to be identified during the pre-construction conference. Contractor shall attend these meetings to coordinate all roadway traffic impacts. Contractor must present detailed traffic control/coordination plan, including drawings, written narrative, etc., with dates, times, and durations of proposed activities. This plan must be presented a minimum of three weeks prior to intended activity.

D. Maintain roads on airport property clean at all times. Broom or wash as required. At Terminal area roads, follow behind haul vehicles and immediately clean up roads and debris and foreign material resulting from construction operations is deposited.

E. Follow City of Houston Ordinance 5705, Construction or Demolishing Privileges

3.04 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and airport operations.

B. Prevent construction personnel's vehicles in revenue-producing facilities. Maintain vehicular access to and through construction parking areas.

C. Do not park on or adjacent to roadways or curbsides.

D. Comply with all security directives with regard to parking in the Terminal area

3.05 REMAINING EXISTING CONTROL AND REGULATION DEVICES

A. Leave existing control and regulation devices in place and properly operating and visible during construction, unless indicated for removal or otherwise permitted.

B. Repair damage resulting from construction operations.

3.06 REMOVAL OF EXISTING CONTROL AND REGULATION DEVICES

A. Contact City of Houston Signal Shop Dispatcher at (713) 803-3004 before removing or deactivating existing control and regulation devices.

B. Remove designated or permitted existing control and regulation devices following Section 01731.

C. Unless otherwise indicated or directed, remove existing lane striping and reflective buttons in conflict with temporary control and regulation devices. Install matching temporary lane striping and reflective buttons, maintain during construction, remove after construction is complete, and install permanent matching lane striping and reflective buttons.

3.07 BRIDGING TRENCHES AND EXCAVATIONS IN ROADS

A. Follow Section 01505 - Temporary Facilities.

3.08 REMOVAL OF TEMPORARY CONTROL AND REGULATION

A. Remove controls and regulation when no longer required. Repair damage caused by installation.

B. Remove post settings to a depth of 2-feet.

END OF SECTION

SECTION 01576
WASTE MATERIAL DISPOSAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disposal of waste material and salvageable material.

1.02 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit copy of approved "Development Permit", as defined in Chapter 19 of Floodplain Ordinance (City Ordinance Number 81-914 and Number 85- 1705), prior to disposal of excess material in areas designated as being in "100-year Standard Flood Hazard Area" within the City and areas designated as being in “500-year Standard Flood Hazard Area”. Contact the City of Houston Floodplain Management Office at the Houston Permitting Center (1002 Washington Avenue, 3rd Floor), at (832) 394-8854 for floodplain information.

C. Obtain and submit disposal permits for proposed disposal sites, if required by local ordinances.

D. Submit copy of written permission from property owner, with description of property, prior to disposal of excess material adjacent to Project. Submit written and signed release from property owner upon completion of disposal work.

E. Describe waste materials expected to be stored on-site and a description of controls to reduce Pollutants from these materials, including storage practices to minimize exposure of materials to storm water; and spill prevention and response measures in the Project's Storm Water Pollution Prevention Plan (SWPPP). Refer to Section 01410 - TPDES Requirements.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SALVAGEABLE MATERIAL

A. Excavated Material: When indicated on Drawings, load, haul, and deposit excavated material at location or locations shown on Drawings outside limits of Project.

B. Base, Surface, and Bedding Material: Load shell, gravel, bituminous, or other base and surfacing material designated for salvage into City trucks.

C. Pipe Culvert: Load culverts designated for salvage into City trucks.

D. Other Salvageable Materials: Conform to requirements of individual Specification Sections.

E. Coordinate loading of salvageable material on City trucks with Project Manager.

3.02 EXCESS MATERIAL

A. Remove and legally dispose of vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage from job site.

B. Excess soil may be deposited on private property adjacent to Project when written permission is obtained from property owner. See Paragraph 1.02 D above.

C. Verify floodplain status of any proposed disposal site. Do not dispose of excavated materials in area designated as within 100-year and 500-year Standard Flood Hazard Areas unless "Development Permit" has been obtained. Remove excess material placed in "100-year and 500-year Standard Flood Hazard Areas" within the City without "Development Permit", at no additional cost to the City.

D. Remove waste materials from site daily, in order to maintain site in neat and orderly condition.

END OF SECTION

SECTION 01610
BASIC PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for transportation, delivery, handling, and storage of Products.

1.02 PRODUCTS

A. Products: Defined in Document 00700 – General Conditions. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components designated for reuse.

B. For material and equipment specifically indicated or specified to be reused in the work:

1. Use special care in removal, handling, storage and reinstallation, to assure proper function in completed work.

2. Arrange for transportation, storage and handling of products which require off-site storage, restoration or renovation. Include cost in unit price for related items.

C. When contract documents require that installation of work comply with manufacturer's printed Instructions, obtain and distribute copies of such instructions to parties involved in installation, including two copies to Project Manager. Maintain one set of complete instructions at job site during installation until completion.

D. Provide Products from the fewest number of manufacturers as practical, in order to simplify spare parts inventory and to allow for maximum interchangeability of components. For multiple components of the same size, type or application, use the same make and model of component throughout the Work.

1.03 TRANSPORTATION

A. Make arrangements for transportation, delivery, and handling of Products required for timely completion of the Work.

B. Transport and handle Products in accordance with manufacturer's instructions.

C. Consign and address shipping documents to proper party giving name of the Project and its complete street address. Shipments shall be delivered to Contractor.

1.04 DELIVERY

A. Arrange deliveries of Products to accommodate short-term site completion schedules and in ample time to facilitate inspection prior to Installation. Avoid deliveries that cause lengthy storage or overburden of limit storage space.

B. Coordinate deliveries to avoid conflict with the Work and conditions at the site and to accommodate the following:

1. Work of other contractors or the City.

2. Limitations of storage space.

3. Availability of equipment and personnel for handling Products.

4. The City's use of premises.

C. Have Products delivered to the site in manufacturer's original, unopened, labeled containers.

D. Immediately upon delivery, inspect shipment to assure:

1. Product complies with requirements of the Contract.

2. Quantities are correct.

3. Containers and packages are intact; labels are legible.

4. Products are properly protected and undamaged.

1.05 PRODUCT HANDLING

A. Coordinate off-loading of Products delivered to the site. If necessary, during construction, move and relocate stored Products at no additional cost to the City.

B. Provide equipment and personnel necessary to handle Products, including those provided by the City, by methods to prevent damage to Products or packaging.

C. Provide additional protection during handling as necessary to prevent breaking, scraping, marring, or otherwise damaging Products or surrounding areas.

D. Handle Products by methods to prevent over-bending or overstressing.

E. Lift heavy components only at designated lifting points.

F. Handle Products by methods to prevent over-bending or overstressing.

G. Do not drop, roll, or skid Products off delivery vehicles. Hand-carry or use Suitable materials handling equipment.

1.06 STORAGE OF PRODUCTS

A. Store and protect Products in accordance with manufacturer's recommendations and requirements of these Specifications.

B. Make necessary provisions for safe storage of Products. Place Products so as to prevent damage to any part of the Work or existing facilities and to maintain free access at all times to all parts of the Work and to utility service company installations in the vicinity of the Work. Keep Products neatly and compactly stored in locations that will cause minimum inconvenience to other contractors, public travel, adjoining owners, tenants, and occupants. Arrange storage in a manner so as to provide easy access for inspection.

C. Restrict storage to areas available on the site for storage of Products as shown on Drawings or approved by Project Manager.

D. Provide off-site storage and protection when on-site storage is not adequate. Provide addresses of, and access to, off-site storage locations for inspection by Project Manager.

E. Do not use lawns, grass plots, or other private property for storage purposes without written permission of owner or other person in possession or control of premises.

F. Protect stored Products against loss or damage.

G. Store in manufacturers' unopened containers.

H. Neatly, safely, and compactly stack Products delivered and stored along the line of the Work to avoid inconvenience and damage to property owners and general public and maintain at least 3 feet clearance around fire hydrants. Keep public, private driveways and street crossings open.

I. Repair or replace damaged lawns, sidewalks, streets or other improvements to satisfaction of Project Manager. Total length that Products may be distributed along route of construction at one time is 1000 linear feet, unless otherwise approved in writing by Project Manager.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01630
PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedure for requesting substitution of products in lieu of those specified. These requirements supplement Paragraph 3.10 of Documents 00700 - General Conditions and 00800- Supplementary Conditions.

B. After submittal period expires, requests for substitutions will be considered only when a specified product becomes unavailable because of conditions beyond Contractor's control.

1.02 DEFINITIONS

A. Process: Any proprietary method for installing products that results in an integral, functioning part of the Work. For this Section, the word "product" includes "process."

1.03 SUBMITTALS

A. Submit 5 copies of each separate product substitution request, within time period stated in Document 00700 - General Conditions, including:

1. Full submittal data for specified products, following Section 01340- Shop Drawings, Product Data and Samples.

2. Full data substantiating compliance of proposed substitutions with Contract Documents and substantiating equivalency with specified products:

   a. Product identification, including manufacturer's name and address.

   b. Manufacturer's literature with precise product description, and directly applicable performance and test data and reference standards.

   c. Samples, as applicable.

   d. Name and address of projects on which proposed product was used in similar or equivalent conditions within the last 3 years, and date of installation.

   e. Name, address and telephone number of owners, designer, and installing contractor.

f. For process substitutions, detailed description of proposed method and drawings illustrating methods.

B. Detailed reason(s) for substitution, and tangible benefits accruing to City.

C. Itemized comparison of proposed substitutions with specified products and full description of deviations.

D. Fully describe all effects of substitutions on the Work and on separate contracts and work by City. Include full cost data comparing proposed substitution with specified products and amount of change in Contract Sum. Indicate changes in construction schedule (Section 01325 - Construction Schedules).

E. Substitutions are not permitted when:

1. They are not processed following Document 00700 - General Conditions and this Section.

2. Acceptance will require revision of Contract Documents or will change the design concept.

3. Delay in construction will occur.

4. No provisions for substitutions are stated in the Contract Documents.

F. Burden of proof of merit of proposed substitution remains solely with Contractor.

1.02 CONTRACTOR'S OPTIONS

A. Options, stated as "Contractor's option(s)" in Contract Documents, are intended to benefit the Work through reduced cost, decreased construction time, or better performance within designated range of criteria.

B. Volunteer options are not permitted.

C. Notify in writing City Engineer of options chosen.

1.03 QUALITY ASSURANCE

A. To the maximum extent possible, provide products of the same type or function from a single manufacturer, make, or source. Where more than one choice is available, select the product which is compatible with other products already selected, specified, or which is in use by City.

1.04 DESIGNER'S ACTIONS

A. Decision to accept or deny proposed substitute products, or selection of one product instead of another, is solely the responsibility of Designer; such decisions and selections are final.

1.05 COSTS FOR REVIEW OF SUBSTITUTIONS

A. Pay costs related to Designer's review and examination of proposed substitutions. Assume liability for obtaining acceptance of substitutions.

B. Reimburse City for actual evaluation costs of Designer's(s') if proposed substitute does not meet requirements of Contract Documents, or acceptance of proposed substitute requires changes to the Work.

C. Reimburse City for associated design costs, including redesign, additional submittal reviews, investigations, Designer's fees and revision of Contract Documents required because of the requested substitution. Design costs are the full price for additional work performed, paid at the rates established by Designer's contract with City for Design and Contract Documents phase of the Project.

D. Pay for laboratory testing required to obtain information upon which equivalency can be determined.

E. If Designer determines that proposed substitutions are not equivalent to specified products, furnish one of the specified products without delay in time or additional cost to City.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01731
CUTTING AND PATCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Obtain CSP and control samples.

B. Repair remaining Base Facility.

C. Connect work to Base Facility.

D. Remove construction required to enable required alteration or addition to Base Facility.

E. Uncover work for inspection or reinspection of covered work by authorities having jurisdiction.

F. Connect work not done in proper sequence.

G. Make connections or alterations to Base Facility or to work.

H. Provide openings, channels, chases and flues as required.

I Demolition is specified in Division 2.

1.02 REFERENCES

A. National Terrazzo and Mosaic Association, Inc. (NTMA).

1.03 SUBMITTALS

A. Submit Document 00931 - Request for Information, with supporting data, in advance of cutting or patching not shown on the Drawings or which affects:

1. Contract Sum or Time.

2. Visual quality of remaining sight-exposed surfaces exposed after work is complete and for which no work is required other than to gain access.

3 Warrantability, value, integrity, serviceability, or life expectancy of any component of the Base Facility and the Work.

4. Integrity or serviceability of weather-exposed, moisture-resistant, or fire-resistant components or systems.

5. Work outside indicated contract limits.

B. Include in each request:

1. Identification of the Project.

2. Description of affected Work.

3. The necessity for cutting and patching.

4. Effect on Base Facility construction, on the Work, or on work of separate contractors and work by City.

5. Description of proposed work:

a. Scope of cutting and patching.

b. Contractor, Subcontractor or trades executing work.

c. Products proposed.

d. Extent and type of refinishing.

e. Schedule of operations.

6. Alternatives to cutting and patching, if any.

7. Written permission of separate contractors or installers of work by City whose work will be affected, countersigned by City Engineer.

C. Should Base Facility conditions require change of products, follow Section 01630 - Product Options and Substitutions.

D. Submit product data and samples following Section 01340 - Shop Drawings, Product Data and Samples.

1. Submit manufacturer's technical literature for each patch material and fully describe compatibility with each substrate.

2. Submit samples of paint colors and sheen on gypsum board with taped edges.

3. Submit 2-foot square samples of drywall and plaster finish texture.

E. Submit written notice to City Engineer designating time work will be uncovered for observation. Do not cut until authorized by City Engineer, except when documentable emergency conditions require immediate cutting.

F. Should conditions of work or schedule indicate change of products or methods, submit Document 00931 - Request for Information stating conditions indicating change, recommendations for alternative products or methods and submittals. Follow Section 01630 - Product Options and Substitutions.

1.04 QUALITY ASSURANCE

A. Cut and patch by persons qualified to perform work.

B. Remove minimum construction necessary. Return surfaces to appearance of new work and match Base Facility.

1. Cut finish surfaces such as masonry, tile, plaster or metals in a straight line at a natural line or plane of division from abutting work.

C. Make patch work visually undetectable at 5-feet for exposed and semi-exposed interior work, and at 10-feet for exposed and semi-exposed exterior work under Base Facility lighting conditions.

D. Presence of a damaged or defective product, finish or type of construction requires patching, extending or matching be performed as necessary to make work complete and consistent to standards of quality identical to Base Facility.

E. Promptly notify City Engineer by Document 00931 - Request for Information of discoveries of construction, such as furnishings and articles having possible historic or private value to City.

1. Protect discovery until disposition.

2. Legally dispose of items not removed by City.

1.05 INSPECTION, HANDLING, STORAGE AND PROTECTION OF CSP AND CONTROL SAMPLES

A. Follow Section 01610 - Basic Product Requirements and following minimum standards.

B. After removal CSP and control samples, inspect and tag each item. Prepare a written inventory.

1. Describe damage or deficiencies discovered. Process claims and obtain replacement products.

2. Inspect and inventory in presence of City Engineer if necessary.

C. Store CSP following Section 01610 - Basic Product Requirements until delivery to City. Package CSP in weatherproof containers, labeled with inventory on outside of containers.

D. Load, transport, off-load and provide other incidental labor required to place CSP inside City's facility. Notify City Engineer at least 7 days before delivery is scheduled.

E. Provide CSP manufacturer's labor if required to properly handle, store and protect products.

F. Obtain written receipt or transfer of title from City Engineer.

1.06 SCHEDULING AND SEQUENCING

A. Provide specific time and date information to City Engineer 72 hours in advance of proposed Work involving temporary shutdown of utilities and environmental systems.

B. Notify City Engineer at least 7 days before starting work in areas or conditions affecting data, communications, security and paging systems. Do not cut or patch such systems without approval of City Engineer.

C. Submit a detailed schedule of proposed connections, including shutdowns and tie-ins. Include in the submittal the proposed time and date as well as the anticipated duration of the Work. Submit the detailed schedule coordinated with the construction schedule.

PART 2 PRODUCTS

2.01 MATERIALS

A. Based on the Designer's knowledge of available "as-builts" of the Base Facility, and observation of sight-exposed construction, patching materials required include:
1. Paint: Follow Section 099123.

2. Gypsum Drywall: Follow Section 092900.

B. Where there is no specification for a required patch product, provide same products and types of construction as analogous Base Facility construction.

1. Contract Documents do not define products or standards of quality present in the Base Facility unless indicated otherwise in Document 00330 - Existing Conditions.

2. Determine products required following Section 01726 - Base Facility Survey. Determine required workmanship by using equivalent Base Facility products as control samples.

PART 3 EXECUTION

3.01 GENERAL PERFORMANCE

A. Patch, repair and refinish Base Facility items intended or designated to remain, to match analogous Base Facility conditions for each product, with proper transition between new work and Base Facility.

B. Remove and replace defective or deficient new work and work not following Contract Documents.

C. Remove samples of Base Facility and work for Contractor's surveillance testing and for tests in Section 01455 - City's Acceptance Testing.

D. Repair damage to Base Facility resulting from work under this contract.

E. Perform activities to avoid interference with facility operations and work of other contractors, following Document 00700 - General Conditions and Sections 01145 - Use of Premises, 01312 - Coordination and Meetings, 01505 - Temporary Facilities and 01506 - Temporary Controls.

F. Restore Base Facility to a state equivalent to or better than that before cutting and patching. Restore new work to standards of these Specifications.

G. Support, anchor, attach, match, trim and seal materials to work of other contractors. Unless otherwise specified, provide sleeves, inserts, and hangers, required for the execution of the Work.

H. Provide shoring, bracing and support as required to maintain structural integrity and protect adjacent work from damage during cutting and patching. Before cutting beams or other structural members, anchors, lintels or other supports, request written instructions from City Engineer. Follow such instructions, as applicable.

I. Cut and patch as recommended by manufacturers of patch products, and where possible by manufacturer of affected Base Facility products.

J. Fit and adjust products to provide finished installation complying with specified products, functions, tolerances and finishes.

K. Restore Base Facility damaged as a result of the Work. Install work following Contract Documents, Base Facility documents, trade standards, or governing agencies, as applicable.

1. Follow Section 01726 - Base Facility Survey to document Base Facility damage Base Facility prior to commencing work.

L. Refinish entire exposed and semi-exposed surfaces.

1. For continuous surfaces, refinish to nearest change in plane. Remove and reinstall remaining signs, hardware and similar interferences.

2. For an assembly, refinish entire unit.

M. Where cutting and patching fails to match Base Facility work, provide complete replacement work.

3.02 TEMPORARY FACILITIES AND PROTECTION

A. Follow Section 01505 - Temporary Facilities.

3.03 INSPECTION AND COORDINATION

A. Inspect Base Facility following Section 01726 - Base Facility Survey, and if required provide Contractor's testing following Section 01450 - Contractor's Quality Control, for Base Facility conditions subject to this Section.

B. Report by Document 00931 - Request for Information Questionable Base Facility conditions that affect the Work.

C. Obtain written authorizations before beginning utility or environmental systems work affecting Base Facility outside the contract limits.

D. Coordinate work with demolition work specified in Division 2.

3.04 REMAINING FLOORS, WALLS, CEILINGS AND DOORWAYS

A. Where only partitions are removed, patch remaining floors, walls and ceilings, with substrate and finish materials to match Base Facility.

1. Where removal of partitions results in adjacent spaces becoming one, rework floors and remaining walls and ceilings to provide smooth planes without breaks, steps or bulkheads.

2. Where extreme change of plane occurs, obtain direction by Document 00931 - Request for Information.

B. Trim and refinish Base Facility doors as necessary to clear plane of new floors.

3.05 DAMAGED SURFACES

A. Replace or patch any portion surfaces of the Work and Base Facility found damaged, lifted, discolored, or showing other imperfections resulting from work, with matching sound material and finish.

1. Provide proper support of substrate before patching.

2. Refinish patched portions of painted or coated surfaces scheduled for new finish, to produce uniform color and texture over entire surface.

a. Tape, float, sand and apply two coats of latex paint to repaired Base Facility drywall, plaster, doors and doorframes.

3. Exceptions: Fully patch remaining Base Facility surfaces exposed and semi-exposed to public view to match all visual characteristics of Base Facility.

3.06 TRANSITION FROM BASE FACILITY TO NEW CONSTRUCTION

A. Where new work abuts or finishes against Base Facility work, make smooth and workmanlike transition. Match patched work adjacent to Base Facility work for all visual characteristics.

1. Where smooth transition is not possible, terminate Base Facility surface neatly along a straight line at a natural line or plane of division, and provide edge trim appropriate to substrate and finish.

2. Exceptions: Fully patch remaining Base Facility surfaces exposed and semi-exposed to public view to match all visual characteristics of Base Facility.

3.07 SITE UTILITY AND BUILDING ENVIRONMENTAL SYSTEMS

A. Perform work needed to complete connections and tie-ins to Base Facility. Keep Base Facility in continuous operation unless otherwise specifically permitted or approved by City Engineer.

B. Base Facility electrical and mechanical systems and site utilities are intended to be functioning properly prior to start of the Work. Follow Section 01505 to confirm proper function.

1. Notify City Engineer by Document 00931 - Request for Information of non-operating systems prior to commencing affected work in each area.

2. Do not proceed with work affecting improperly functioning utilities or systems until corrective work is complete.

C. Make required cuts, plugs and terminations. Tag remaining lines with contents names and direction of flow, whether or not flow is active, using weather-resistant tags and permanent markers.

D. Plumbing Systems and HVAC Systems:

1. Provide temporary or permanent by-passes, test plugs and stop valves in plumbing waste and supply lines, and in HVAC system piping as individual fixtures and equipment are removed. Do not bypass wastewater or sludge into waterways. Provide temporary pumping facilities to handle wastewater if necessary. Provide temporary power supply and piping to facilitate construction where necessary.

a. Scope, type and locations of temporary plugs and valves are at the Contractor's option, as approved, based on Base Facility conditions encountered.

b. Unless otherwise required, install permanent plugs and valves as follows:

1) For risers tapped into remaining lateral lines cut and plug risers as close as practical to laterals.

2) For laterals, cut and plug approximately one foot from surface of Base Facility demising walls intended to remain.

3) For risers extending through floors in unoccupied areas, cut and plug approximately one foot above top surface of Base Facility floor.

4) For risers extending through floors in occupied areas and which cannot be fully removed following Paragraph 1) above, cut and plug flush with surface of Base Facility floor.

E. Electrical Power Systems:

1. Provide temporary or permanent bypasses and terminations of electrical systems. Do no work on Base Facility data, communications, security or paging systems following Paragraph 1.05.B above.

a. Scope, type and location of terminations are at the Contractor's option, as approved, determined by Base Facility conditions encountered.

b. Unless otherwise required, terminate electrical lines as follows:

1) For circuits tapped into remaining laterals intended to remain and which occur above Base Facility ceiling planes, terminate circuits in approximately sized junction boxes as close as practical to the lateral. Attach boxes to building structure, install wire nuts on unconnected wires, and permanently label outside of box with panel/circuit number and voltage.

2) For abandoned circuits, remove wire, conduit, boxes, breakers and related components back to the respective panel boxes or terminal boards, and provide a blank plate in the breaker slot, and identify plate as "SPARE CIRCUIT/ (CAPACITY) AMP" minimum.

c. Unless otherwise required by demolition work, and where Base Facility ceilings are indicated for removal, leave paging and security system components in place, using at least two hanger wires per device.

2. Provide permanent support for risers and laterals intended to remain.

3. Fit ductwork, conduit and pipes water-tight, air-tight and fire-stopped at penetrations through walls, floors and ceiling, whether or not Base Facility penetrations are constructed as water-, air- or fire-tight.

a. If not otherwise shown on Drawings, provide properly sized fire dampers for remaining Base Facility ducts which penetrate fire-rated construction, and which do not already have fire dampers.

4. Temporarily or permanently seal penetrations of removed laterals and risers through floors and full-height walls with firestopping, following demolition requirements, as work progresses.

5. Provide minimum 20-gauge galvanized sheet metal plate with self-tapping screws at openings in ductwork. Seal joints as required to prevent air intake or exhaust.

7. Remove site utility lines without disturbing underlying soil or sub-base.

F. Insofar as possible, test work under operating conditions before final tie-ins are made to connect equipment to the Base Facility. Test remaining utilities and service in presence of City Engineer before covering up. Repair defects and deficiencies.

3.09 SALVAGING CONTROL SAMPLES AND CSP

A. Remove Base Facility designated as CSP and control samples using methods and procedures specified herein.

1. Control samples located outside contract limits are intended to remain in place.

2. Remove control samples of sufficient size and proper quantity to establish standards for comparison.

B. Inspect, handle, store, and protect control samples and CSP following this Section. Package CSP in impact- and moisture-resistant containers.

C. Where applicable, reinstall control samples following this Section.

3.12 GYPSUM DRYWALL SYSTEMS

A. Follow Section 092900.

B. Fasten new framing to Base Facility with powder-actuated or drill-in fasteners at conditions subject to shear and compression loads, with drill- in fasteners at conditions subject to tension loads, and with drywall screws firmly secured to Base Facility metal framing.

3.14 PAINT

A. Prepare and prime substrates following manufacturer's recommendations.

B. Apply paint with equipment as required to achieve match with Base Facility. Apply at rates recommended by manufacturer.

C. Follow Section 099123.

3.17 INTERIM CLEANING

A. Clean occupied areas daily. Immediately remove spillage, overspray, dust and debris in occupied areas and at points of access into contract limits. Sweep and wet mop floors as required, using safety cones and tape barricades as required cleaning operations.

B. Make surfaces ready for work of successive trades.

C. At completion of work in each area, provide final cleaning following Section 01770 - Contract Closeout.

END OF SECTION

SECTION 01740
SITE RESTORATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Restoration of site affected by the Work in public or private property, including pavement, esplanades, sidewalks, driveways, fences, lawns and landscaping.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for restoration of Project site disturbed by utility construction operations is on a linear foot basis. Measurement will be as provided for corresponding utility in each Specification section. No separate payment made for branch pipe, valves, and other associated work for utilities. Measurement for restoration with multiple utilities within the same right-of-way will be on a linear foot basis for only one utility.

2. No separate payment made for facility or roadway projects. Include cost in the surface improvements associated with the facility or roadway construction.

3. Payment includes required site restoration within the right-of-way or easement regardless of size or type of pipe, method of construction, paved or unpaved areas or thickness and width of pavement.

4. No separate payment made for site restoration for service connections under this Section. Include cost in appropriate utility Section.

5. Refer to Section 01270 – Measurement and Payment for Unit Price procedures.

B. Stipulated Price (Lump Sum) Contracts. If Contract is Stipulated Price Contract, include payment for work under this Section in total Stipulated Price.

1.03 DEFINITIONS

A. Phase: Locations identified on the plans and listed in Section 01110 – Summary of Work and Section 01326 – Construction Sequencing.

B. Site Restoration: Replacement or reconstruction of site Improvements located in rights-of-way, easements, public property, and private property affected or altered by the Work.

C. Site Improvement: Includes pavement curbs and gutters, esplanades, sidewalks, driveways, fences, lawns, irrigation systems, landscaping, and other improvements in existence at the Project site before commencement of construction operations.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 – Submittal Procedures.

B. Schedule of testing, service connections, abandonment, backfill, and site restoration.

C. Sample of notices to residents outlining their responsibility for maintenance of site improvements adjacent to the Project that are not disturbed by construction operations.

1.05 SCHEDULING

A. Schedule testing, service connections, abandonment, backfill and site restoration immediately following completion of pipe laying work or paving within each block or line segment.

B. Phased Construction:

1. Commencement of subsequent Phase(s) will follow scheduling of site restoration of prior Phase. Limit work to a maximum of two (2) Phases of the project.

C. Construction of Project(s) with no Phases listed in Section 01110 – Summary of Work:

1. Complete site restoration prior to disturbing over 50% of total project linear feet or 2,000 linear feet, whichever is greater, of right-of-way or easement.

2. Limit work to a maximum of 50% of total project linear feet or 2, 000 linear feet, whichever is greater, of right-of-way or easement. Commence work in additional right-of-way or easement after completion of site restoration.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pavement, Sidewalks, and Driveways: Materials specified in Section 02951 – Pavement Repair and Resurfacing.

B. Seeding and Sodding: Sod specified in Section 02922 – Sodding and Seed specified in Section 02921 – Hydro-Mulch Seeding.

C. Trees, Shrubs and Planting: Conform to requirement in Section 01562 – Tree and Plant Protection.

PART 3 EXECUTION

3.01 PREPATORY WORK

A. Provide cleanup and restoration crews to work closely behind pipe laying and roadway construction crews, and where necessary, during testing, service restoration, abandonment, backfill and surface restoration.

B. Water Lines: Unless otherwise approved by Project Manager, comply with the following:

1. Once Project Manager approves work within a Phase, immediately begin preparatory work for disinfection effort.

2. No later than three (3) days after completing disinfection preparatory work, submit to City appropriate request for disinfection.

3. If City fails to perform initial disinfection of lines in accordance with Section 02514 – Disinfection of Water Lines, within seven (7) days from submission of appropriate request, and if approved by Project Manager, pipe laying operations may continue beyond approved limits until the City responds.

4. Immediately after transfer of services, begin abandonment of old water lines and site restoration.

C. Wastewater Lines:

1. Once Project Manager approves work within a Line Segment, immediately begin preparatory work for testing effort.

2. No later than three (3) days after completing preparatory work for testing, initiate testing work.

3. Immediately after transfer of service connections, begin abandonment of old wastewater lines, and site restorations.

D. Street Construction and Paving Projects:

1. Once Project Manager approves work within a Line Segment or Block, immediately begin preparatory work for testing effort.

2. No later than three (3) days after completing preparatory work for testing, initiate testing work.

3. Immediately after testing, begin site restoration.

E. Street Construction and Paving Projects:

1. Once Project Manager approves work within a Block, immediately begin preparatory work for sidewalk construction, sodding and hydro-mulching and tree planting.

2. No later than seven (7) days after completing preparatory work, initiate construction.

3.02 CLEANING

A. Remove debris and trash to maintain a clean and orderly site in accordance with requirements of General Conditions and Section 01576 Waste Material Disposal.

3.03 LANDSCAPING AND FENCES

A. Seeding and Sodding.

1. Remove construction debris and level area with bank sand so that new grass surface matches level of existing grass and maintains preconstruction drainage patterns. Level and fill minor ruts or depressions caused by construction operations with bank sand, where grass is still viable.

2. Restore previously existing turfed areas with sod and fertilize in accordance with Section 02922 Sodding. Sod to match existing turf.

3. Restore unpaved areas not requiring sodding with hydro-mulch seeding conforming to Section 02921 – Hydro-Mulch Seeding.

B. Trees, Shrubbery and Plants.

1. Remove and replant trees, shrubs, and plants in accordance with Section 01562 – Tree and Plant Protection.

C. Fence Replacement.

1. Replace removed or damaged fencing to equal or better condition than existed prior to construction, including concrete footing and mow strips. Provide new wood posts, top and bottom railings and panels. Metal fencing material, not damaged by the Work, may be reused.

2. Remove and dispose of damaged or substandard material.

3.04 MAINTENANCE

A. Maintain shrubs, plantings and seeded or sodded areas.

B. Replace shrubs, plantings and seeded or sodded areas that fail to become established.

C. Refer to Section 01562 – Tree and Plant Protection, Section 02921 – Hydro-Mulch Seeding, and Section 02922 – Sodding for Maintenance Requirements.

END OF SECTION

SECTION 01761
PROTECTION OF EXISTING SERVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements to protect existing services and minimize impact of interruptions.

1.02 DEFINITIONS:

A. Service is defined to include utilities (natural gas, water, or power); lighting and emergency lighting; data and telecommunications; closed-circuit video, control and monitoring circuits, and air conditioning, heating, and ventilating. Service types include:

1. Power.
2. Lighting, and emergency lighting.
3. Paging.
4. Telephone.
5. Video.
6. Data and computer networks.
7. Water.
8. Natural gas.
9. Heating, ventilating, and air conditioning

B. Data and Telecom Service is defined to include:

1. Wiring and cable used for the transmission of data, voice, or video information.

2. Wiring for low voltage monitoring and control of various types of devices.

C. Service interruption is defined to include any temporary or permanent inability to provide the service as contracted or as intended and includes interference with or disruption to source, distribution, or terminal items of a service system.

D. Response time is defined to be the time elapsed between the time that a Service Interruption becomes known to the Contractor and the time that a person is at the site of the interruption

or, if the site of the interruption is not immediately known, at the job site to diagnose and locate the service interruption.

1.03 PERFORMANCE REQUIREMENTS

A. Contractor is required to protect and maintain existing services to those operating areas of the Airport.

1. Where services are affected by construction activities and interruption of service is required to complete the Work, schedule service interruption to minimize impact.

2. Where services cannot be interrupted, provide alternate services or circuits as required to maintain affected services. Design and implement service "cut-over" so that services are maintained without interruption.

B. Train employees and subcontractors to ensure that accidental service interruptions are promptly recognized, and appropriate responses can be initiated.

C. Maintain personnel, equipment, and parts at hand or on call to provide the response times indicated.

D. Interruptions to Existing Service are classified as follows:

1. Security Service Interruption:

a. Any service interruption of power, lighting, or data and telecom service that affects and compromises one of the following:

(1) FAA Security

(2) Airline Security

(3) Airport Security

(4) Other government entity charged with enforcing security at the Airport (Houston Police Department, FBI, Secret Service, etc.).

b. Security Services must be active at all times.

2. Life Safety Service Interruption:

a. Any service interruption of power, lighting, or data and telecom service affecting or compromising one or more of the following life safety systems.

(1) Fire/smoke alarms.

(2) Emergency lighting.

(3) Elevator operations in "Fire" mode.

(4) Emergency intercom systems.

b. Life Safety Services must be active at all times.

3. Business Service Interruption:

a. `Any service interruption of utility service (power, lighting, natural gas, data and telecom, etc.) that affects and compromises the ability of a profit-seeking entity to earn revenue, including:

(1) Airline: Includes FIDS network, reservation/confirmation systems, paging systems.

(2) Tenants Other Than Airlines: Point of sale systems, reservation/confirmation systems, utilities for storing, cooking, or maintaining food for sale to the public.

b. Business Services must be active at all times in the areas of the Airport served by Airlines or other tenants during hours of their operation.

4. Comfort / Convenience Service Interruption :

a. Any service interruption of power, lighting, or data and telecom services affecting or compromising the comfort or convenience of those using the Airport (passengers, visitors, employees, concessionaires, etc.) including:

(1) Lighting.

(2) Air Conditioning.

(3) Heating.

(4) Public telephones.

(5) Elevators.

b. Minimize Comfort/Convenience Service Interruptions except in construction areas.

1.04 SUBMITTALS

A. Schedule of service interruptions.
B. Emergency Response Plan.

1.05 QUALITY ASSURANCE

A. Develop emergency response plan for each class of service interruption indicated. Notify other contractors responsible for services and obtain contact information. Where possible, obtain written instructions for emergency repairs from the contractor responsible for each service. Where required, arrange for contractor personnel to be available to meet required response times.

1.06 COORDINATION AND SEQUENCING

A. Schedule and execute construction activities to prevent service interruption or, where service interruption is required to complete the Work, minimize service interruption.

1.07 SCHEDULING

A. Follow Section 01325.

B. Develop a schedule of required service interruptions. Coordinate with the schedules required by Section 01325 and revise as required by the City or project conditions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CONTRACTOR RESPONSIBILITIES:

A. Follow Section 01726.

B. Scheduled Service Interruptions: Notify the City Engineer in writing not less than 7 days in advance of a scheduled service interruption. In notifying of the Scheduled Service Interruptions, click on the weblink ***- https://bit.ly/3lLFtyv [(HAS Work Area Notification (WAN) Form]*** and review the checklist. At the bottom of the checklist, check the box confirming attendance of the Contractor Safety Requirement meeting, and Contractor and all Subcontractors understands and will comply with all Houston Airport System (HAS) and OSHA requirements.

C. Complete a Work Area Notification form by clicking on the weblink ***https://bit.ly/3lLFtyv [(HAS Work Area Notification (WAN) Form]***for any/all service interruptions and/or; for,

D. Unscheduled Service Interruptions to Data and Telecom Service:

1. *Immediately notify IAH 24-Hour Emergency Dispatch Service at (281) 230-3024 [HOU 24-Hour Emergency Dispatch Service at (713) 641-4000; EFD Dispatch Service during 0800-1700, M-F, call 713-847-4234, (after hours call: 713-847-4200]. Do not attempt to repair these lines. Include the following information:*

a. Location.

b. Area(s) affected.

c. Type and classification of service (if known).

d. Entities affected (if known).

2. In addition to the notification requirements above, immediately notify the City Engineer of interruption.

E. Unscheduled Service Interruptions to Service Other Than Data and Telecom Service:

1. When executing Work in an area known to have existing services, maintain on-site or on-call capability to initiate repairs to unscheduled service interruptions within the response times required.

2. Immediately notify the City Engineer of interruption.

a. Location.

b. Area(s) affected.

c. Type and classification of service (if known).

d. Entities affected (if known).

3. Response Times to Interruptions to Existing Service:

a. Security Service Interruption: 15 minutes.

b. Life Safety Service Interruption: 15 minutes.

c. Business Service Interruption:

(1) Service Interruptions to Airlines: 15 minutes.

(2) Service Interruptions to Tenants other than Airlines: 1 hour.

d. Comfort/Convenience Service Interruption: 1 hour.

END OF SECTION

WORK AREA NOTIFICATION

I.A.H PDC
HOUSTON, TEXAS 77032

TO: Plan & Review / IAH	CONTRACTOR:
ATT: James Beehner & Scott Hill	
OFFICE NUMBER: 281-230-8909 & 281-230-8999	DATE:
FAX NUMBER: 281-230-8781	PROJECT NUMBER:
E-MAIL: jamesbeehner@cityofhouston.net scott.hill@cityofhouston.net	Onsite contact / phone #'s:

FROM:	
OFFICE NUMBER:	
MOBIL NUMBER:	
FAX NUMBER:	

LOCATION	Description	DATE OF REQUEST	TIME OF REQUEST	COMMENTS
		Starting Date:	Ending Date:	
		Starting Time:	Ending Time:	
Impacts to Area :				

Plan & Review Response:

SECTION 01770
CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittal of Operation and Maintenance (O & M) manual, lien releases, record documents, badges, and keys.

B. O & M manual format and contents.

C. Final cleaning. Interim cleaning is specified in Section 01505.

D. Systems demonstrations and personnel training.

E. Notification of Substantial Completion.

F. Contractor's punch list.

G. Record of the Work.

H. Forwarding of Contractor-Salvaged products (CSP), and extra products.

1.02 SUBMITTALS

A. Two weeks before Substantial Completion inspection, submit 2 sets of Preliminary O & M manual (Paragraph 1.03), 1 copy to Designer and 1 copy direct to City Engineer.

B. Subsequent to Preliminary O & M manual submittal and precedent to final Certificate for Payment, submit the following:

1. The Contractor shall submit Preliminary O&M Manuals to the City for review and acceptance a minimum of 60 calendar days prior to starting the commissioning process.

2. Release or Waiver of Liens and consents of sureties following Documents 00700-General Conditions and 00800 - Supplementary Conditions.

3. BIM As-Built and BIM Record Documents

a. Provide the final coordinated trade construction as-built and/or fabrication models in native format, to the City at regular intervals at the end of the Construction Phase that will have incorporated all addenda, approved Change Orders, and the

modifications and deliver the final record model to the City as part of the project close-out documents.

b. The format of the delivered documents shall consist of:

1) PDF files of drawings and specifications.

2) HAS approved AutoCAD version of drawings.

3) Native formats of the BIM model including HAS approved Revit version.

4) HAS approved version of Navisworks files and Civi3D

5) All information, drawings and manuals should conform with HAS approved BIM standards and BPxP.

4. File organization, File directory structure, Sheet Borders, titles, method of delivery and other specifications should be in conform to HAS CAD/GIS Data Standards and HAS BIM Standards, available in www.fly2houston.com/tip.

5. Security identification badges.

6. Construction and other master keys.

1.03 O&M MANUAL CONTENTS AND FORMAT

A. Provide O & M Manual with full information to allow matching products under future contracts to products under this contract, and to allow City to operate, maintain and repair (for user-serviceable aspects) products, including trade names, model or type numbers, colors dimensions, and other physical characteristics.

B. Electronic Format:

1. Submit in searchable PDF to reflect 8.5" x 11" inch page and margins shall be formatted for double-sided print out or copy. Large format shall be pre-approved by the City.2. Sections within the O & M Manual shall also be formatted to reflect dividers if a printout copy is desired.3. Cover of the O& M Manual shall be titled "OPERATION AND MAINTENANCE MANUAL, title of project and subject matter and "Number _ of _ if multiple volumes are developed. Include the City's Project Number and AIP/CIP Number.

C. Contents:

1. Table of Contents for each volume, naming each Part.

2. Part 1: Directory with name, address, and telephone number of Designer, Contractor, and Subcontractors and Suppliers for each Project Manual Section.

3. Part 2: Operation and maintenance instructions, arranged by Project Manual Section number where practical, and where not, by system. Include:

    a. For finish materials, maintenance instructions prepared by manufacturers, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

    b. Utility, door and window hardware, HVAC, plumbing and electrical products, prepared by product manufacturer, including:

        1) Product design criteria, functions, normal operating characteristics, and limiting conditions.

        2) Assembly, installation, alignment, adjustment, checking instructions, and troubleshooting guide.

        3) Operating instructions for start-up, normal operation, regulation and control, normal shutdown, and emergency shutdown.

        4) Lubrication and detailed maintenance instructions; detailed drawings giving location of each maintainable part and lubrication point and detailed instructions on disassembly and reassembly of products.

        5) Spare parts list for operating products, prepared by manufacturers, including detailed drawings giving location of each maintainable part; describe predicted life of parts subject to wear, lists of spares recommended for user-service inventory, and nearest source of in-stock spares.

        6) Outline, cross-section, and assembly drawings; engineering data; wiring diagrams.

        7) Test data and performance curves.

4. Part 3: Project documents and certificates, including:

    a. Shop drawings, product data, and where practical, samples.

    b. Air and water balance reports.

    c. Certificates of occupancy or use.

    d. Product certifications and mix designs.

e. Material Safety Data Sheets.

5. Part 4: Copy (not original) of each warranty form containing language of final warranty.

6. Part 5: Meeting notes from systems demonstrations.

7. Revise content and arrangement of preliminary Manual until approval by City Engineer.

1.04 FINAL CLEANING

A. Execute final cleaning prior to Substantial Completion [of each Stage].

B. Clean surfaces exposed to view; remove temporary labels and protective coverings, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to sanitary condition. Clean permanent filters and install new replaceable filters at equipment. Clean HVAC diffusers.

C. Remove and legally dispose of waste and surplus products and rubbish, including from roofs, gutters, downspouts, drainage systems, pavements, lawn and landscaped areas, and elsewhere from site.

D. Sweep streets and parking areas, rake lawn and landscaped areas.

E. Wash roofs, opaque building walls and sidewalks.

F. Remove temporary facilities and controls.

G. Leave premises in spotless condition, requiring no further cleaning of construction by City.

H. Adjust products to proper operating condition.

I. Correct defective function of products.

1.05 SYSTEMS DEMONSTRATIONS AND PERSONNEL TRAINING

A. Demonstrate proper operation and maintenance of each product to City’s maintenance personnel precedent to Substantial Completion inspection.

1. Operate HVAC, plumbing, and electrical systems 7 continuous days precedent to personnel training.

B. Precedent to submittal of O & M Manual, train City's maintenance personnel in proper operation, adjustment, and maintenance of products and systems, using the preliminary O

& M Manual as the basis of instruction. Continue training until City's personnel demonstrate proper knowledge and skills.

C. Take minutes of meetings, including sign-in sheet, and record subjects covered in each session. Bind minutes in O&M Manual.

1.06 NOTIFICATION OF SUBSTANTIAL COMPLETION

A. When Contractor considers the Work (or a designated portion or stage thereof identified in Section 01326 - Construction Sequencing) substantially complete, submit written notice and Punchlist (Paragraph 1.04) to City Engineer.

1. Do not claim Substantial Completion until authorities having jurisdiction issue certificates of occupancy or use and related inspections affirming compliance.

2. Attach copy of each certificate to Substantial Completion form.

B. Within a reasonable time after receipt of certificates, an inspection will be made by City Engineer and Designer to determine status of completion.

C. Should the Work be determined by City Engineer as not substantially complete as a result of any Substantial Completion inspection, Contractor will be notified in writing.

1. Remedy deficiencies.

2. Send written notice of Substantial Completion as above.

3. City Engineer and Designer will reinspect the Work.

4. Pay costs of Designer’s second and subsequent Substantial Completion inspections, by Change Order.

D. When the Work is determined as substantially complete, the Certificate of Substantial Completion will be executed.

1.07 CONTRACTOR'S PUNCHLIST

A. Prior to and in connection with Substantial Completion procedures, prepare a written Punchlist on a [room-by-room] [area-by-area] basis [for each stage] and as follows:

1. Designer will provide one reproducible copy of then-current floor plans. These drawings are the basis of Contractor’s Punchlist.

2. Inspect the Work and mark applicable comments on the floor plans. Prepare written notes as required to supplement notes made on drawings.

3. Continue completion of the Work including Punchlist items, marking off completed items.

4. Forward 3 diazo prints of the annotated Drawings to City Engineer accompanied by notification that Substantial Completion Inspection is ready.

B. Schedule Punchlist Inspection and other closeout inspections through City Engineer.

C. Punchlist inspection will be attended by the following as a minimum:

1. Contractor, Contractor's Superintendent, and applicable Subcontractors' superintendents. Attend with Punchlist drawing.

2. City Engineer.

3. Designer.

4. Others of City Engineer's choice.

D. Substantial Completion inspection will be made during one or more mutually agreed times to inspect the Work, to review and amend Contractor's Punchlist. If the work is substantially complete, Document 00645 - Certificate of Substantial Completion will be executed.

1. Amendments to the Contractor's Punchlist will be made on the reproducible.

2. Within 5 days of execution of Document 00645, provide 4 copies of the amended Punch List and original Document 00645 to City Engineer.

E. Expeditiously correct work.

F. Process each reinspection as above and in Paragraph 1.04.

G. Punchlist items and corrections required after execution of Document 00650 - Certificate of Final Completion will be processed as warranty work following Document 00700 - General Conditions, Paragraph 3.12.

1.08 RECORD OF THE WORK

A. Following requirements expand Paragraph 3.16 of Documents 00700 - General Conditions and 00800 - Supplementary Conditions.

B. Record information concurrently with construction progress. Do not conceal work until required information is recorded.

C. Keep in a secure location in the [field office (Section 01505- Temporary Facilities) at the site] [Contractor's office] and timely record the Work as actually built as the Work progresses.

1. Contractor shall maintain one full size set of Construction Documents and one set of the Project Manual(s) in the Contractor's Field office. In addition, the Contractor shall maintain one record set of submittal data, video and photographic data, and other record data as required by to support and supplement record changes made on Drawings and the Project Manual(s).

2. Legibly note variations from Contract Documents on Drawings, Project Manual and submittal data, whichever most clearly shows the change.

3. Clearly mark each document in red ink "RECORD OF THE WORK. Use only for recording field deviations and actual constructed conditions and arrangements."

D. Keep documents current and make available for inspection by City Engineer.

E. Show following minimum information, as applicable to type of work, marked in fine-point red ink:

1. Measured depths of foundation elements in relation to finish first floor datum.

2. Measured horizontal locations and elevations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Elevations of underground utilities referenced to City's benchmark utilized for project.

4. Measured locations of internal utilities, environmental systems and appurtenances concealed in construction, referenced to visible and accessible features of construction.

5. Field changes of dimension and detail.

6. Changes made by RFI (Document 00931).

7. Changes made by Modifications.

8. Details not on original Contract Documents.

9. References to related shop drawings, product data, samples, RFIs and Modifications.

F. Upon completion of the Work, collect diazo prints of marked-up Drawings, one single-sided copy of marked-up Project Manual, one set of shop drawings (including diskettes of CADD files prepared as part of the Contract, such as data required by Section 01340- Shop Drawings, Product Data and Samples), one original set of product data (Section 01340), one set of RFIs, one set of Modifications, one set of originals of video tapes and one copy of photographs (Section 01321 - Construction Photographs), and other required documents.

1. Clearly mark each document, immediately adjacent to the "RECORD OF THE WORK" mark, in red ink thus:

   "CERTIFIED AS THE CORRECT AND COMPLETE RECORD OF WORK PERFORMED.
   _____ (Contractor Firm Name)
   _____ (Authorized Signature)
   _____ (Date)

G. Transmit all records to City Engineer.

H. Transmit reproducible copies of Drawings (see Section 01110 - Summary of Work) to City Engineer.

I. Submit proper record of the Work, in addition to other requirements in the Contract Documents, precedent to City Engineer's authorization for release of final payment.

1.09 FORWARDING CSP AND EXTRA PRODUCTS

A. Before submitting final application for payment, forward remaining proper CSP (Section 01110 - Summary of Work), extra products, including spare parts (specified in other Sections) to location designated by City Engineer.

B. Furnish pallets and containers as required for proper product storage.

C. Unload products from Contractor's vehicles. Place pallets, containers and products as directed by City Engineer.

D. Obtain written transfer of title or receipt.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01785
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Maintenance and submittal of record documents and Samples.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Maintain one record copy of documents at the site in accordance with Document 00700 - General Conditions,

B. Store record documents and Samples in field office, if a field office is required by the Contract, or in a secure location. Provide files, racks, and secure storage for record documents and Samples.

C. Label each document "PROJECT RECORD" in neat, large, printed letters.

D. Maintain record documents in a clean, dry, and legible condition. Do not use record documents for construction purposes. Do not use permit drawings to record Modifications to the Work.

E. Keep record documents and Samples available for inspection by Project Manager.

F. Bring record documents to progress review meetings for viewing by Project Manager and, if applicable, Design Consultant.

1.03 RECORDING

A. Record information legibly with red ink pen on a set of blueline opaque drawings, concurrently with construction progress. Maintain an instrument on site at all times for measuring elevations accurately. Do not conceal work until required information is recorded

B. Contract Drawings and Shop Drawings: Mark each item to record completed Modifications, or when minor deviations exist, the actual construction including:

1. Measured depths of elements of foundation in relation to finish first floor datum.

2. Measured horizontal locations and elevations of Underground Facilities and appurtenances, referenced to permanent surface improvements.

3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

4. Dimensions and details of field changes.

5. Changes made by Modifications.

6. Details not on original Drawings.

7. References to related Shop Drawings and Modifications.

C. Survey all joints of water mains at the time of construction. Record on Drawings, water main invert elevation, elevation top of manway, and centerline horizontal location relative to baseline.

D. For large diameter water mains, mark specifications and addenda to record:

1. Manufacturer, trade name, catalog number and Supplier of each Product actually installed.

2. Changes made by Modification or field order.

3. Other matters not originally specified.

E. Annotate Shop Drawings to record changes made after review.

1.04 SUBMITTALS

A. At closeout of the Contract, deliver Project record documents to Project Manager.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

1.2 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 PREINSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Engineering Survey: Submit engineering survey of condition of building as required

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of selective demolition activities with starting and ending dates for each activity.

D. Pre-demolition photographs or video.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.5 CLOSEOUT SUBMITTALS

A. Inventory of items that have been removed and salvaged.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. Furniture and Materials currently stored in the work area.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

G. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

B. Glazing – Removal and re-installation of exterior Glazing shall be by Southwest Glass to maintain existing glazing warranty.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Perform a survey of the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

C. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
6. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 064116

PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

B. Related Requirements:

1. Section 123623.13 "Plastic-Laminate-Clad Countertops."

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
5. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.

D. Samples for Initial Selection: For each type of exposed finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Certificates: For the following:

1. Thermoset decorative panels.
2. High-pressure decorative laminate.
3. Adhesives.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Manufacturer of products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate

measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

B. Architectural Woodwork Standards Grade: Custom.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

1. Formica Corporation.
2. Wilsonart LLC.
3. Pionite; a Panolam Industries International, Inc. brand.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Vertical Surfaces: Grade VGS.
3. Edges: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
4. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Materials for Semi-exposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.

a. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.

2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermoset decorative panels.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated on the drawings.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
2. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural**.**

1. Grass America Inc.
2. Accuride International
3. Knape & Vogt Manufacturing Company

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 110 degrees of opening, self-closing.

C. Back-Mounted Pulls: BHMA A156.9, B02011.

D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

E. Shelf Rests: BHMA A156.9, B04013;two-pin plastic with shelf hold-down clip.

F. Drawer Slides: BHMA A156.9.

1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.

G. Door and Drawer Silencers: BHMA A156.16, L03011.

H. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

I. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate:. Adhesives shall be of a formula and type recommended by AWI. Adhesives shall be selected for their ability to provide a durable, permanent bond and shall take into consideration such factors as materials to be bonded, expansion and contraction, bond strength, fire rating, and moisture resistance. Adhesives shall meet local regulations regarding VOC emissions and off-gassing.

1. Adhesive for Bonding Edges: Adhesive specified above for faces.

2.5 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semi-exposed surfaces.

END OF SECTION 064116

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Mildew-resistant joint sealants.
4. Latex joint sealants.
5. Joints in or between fire-resistance-rated constructions.

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.4 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
1. When joint substrates are wet.
2. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
3. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.5 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. GE Construction Sealants; Momentive Performance Materials Inc.
2. Pecora Corporation.
3. The Dow Chemical Company.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. GE Construction Sealants; Momentive Performance Materials Inc.
2. Pecora Corporation.
3. Sika Corporation; Joint Sealants.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. GE Construction Sealants; Momentive Performance Materials Inc.
2. Pecora Corporation.
3. The Dow Chemical Company.

2.5 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Pecora Corporation.
2. Tremco Incorporated.
3. Sherwin-Williams Company (The)

2.6 FIRESTOPPING MATERIALS

A. Fire-rated Silicone: Single-component, non-staining, low modulus architectural silicone sealant, nontraffic use, ASTM C920, Type S, Grade NS, Class 25, Use G, A, M and O.

2.7 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Alcot Plastics Ltd.
2. Construction Foam Products; a division of Nomaco, Inc.
3. Master Builders Solutions.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
3. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT .
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081216

ALUMINUM FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior aluminum frames for doors installed in gypsum board partitions.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, fire-resistance rating, and finishes.

B. Shop Drawings: For aluminum frames:

1. Include elevations, sections, and installation details for each wall-opening condition.
2. Include details for each frame type, including dimensioned profiles and metal thicknesses.
3. Include locations of reinforcements and preparations for hardware.
4. Include details of anchorages, joints, field splices, connections, and accessories.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard sizes.

D. Samples for Initial Selection: For each type of exposed finish.

1. Include Samples of seals, gaskets, and accessories involving color selection.

E. Samples for Verification: For each type of the following products:

1. Framing Member and Finish: 12 inches long. Include trim.

F. Product Schedule: For aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum frames to include in maintenance manuals.

1.4 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. RACO Interior Products, Inc.
2. Versatrac Frames; a division of American Door Products Inc.
3. Alpha Aluminum Products, Inc.

B. Source Limitations: Obtain aluminum frames from single source from single manufacturer.

1.5 PERFORMANCE REQUIREMENTS

A. Fire-Rated Frames: Frames for fire-rated door assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1.6 COMPONENTS

A. Aluminum Framing: ASTM B221 , with alloy and temper required to suit structural and finish requirements, and not less than 0.062 inch thick.

B. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.

C. Glazing Frames: Extruded aluminum, for glass thickness as indicated on the drawings. Retain "Door Tracks" Paragraph below if door tracks such as for sliding doors are exposed.

D. Door Tracks: Extruded aluminum where exposed, sized to enclose sliding-door hardware, and in finish matching frame and trim finish.

E. Trim: Extruded aluminum, not less than 0.062 inch thick; removable, snap-in glazing stops and door stops, without exposed fasteners.

F. Doors: As specified in Section 081416 "Flush Wood Doors."

G. Frame and Trim Finish: Color-anodized aluminum.

1. Color: Black.

1.7 ACCESSORIES

A. Fasteners: Aluminum, nonmagnetic, stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.

B. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals in black color.

C. Glazing Gaskets: Manufacturer's standard extruded or molded rubber or plastic, to accommodate glazing thickness indicated; in black.

D. Glass: As specified in Section 081216 “Interior Aluminum Doors, Door Frames, and Storefront Framing.”

E. Door Hardware: As specified in Section 087100 "Door Hardware."

1.8 FABRICATION

A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted and mitered connections.

B. Fabricate components to allow secure installation without exposed fasteners.

1.9 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.10 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that wall thickness does not exceed standard tolerances allowed by throat size of indicated aluminum frame.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 INSTALLATION

A. Install aluminum frames plumb, rigid, properly aligned, and securely fastened in place; according to manufacturer's written instructions.

1. At fire-protection-rated openings, install fire-rated frames according to NFPA 80.

B. Install frame components in the longest possible lengths with no piece less than 48 inches ; components 96 inches or shorter shall be one piece.

1. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
2. Secure clips to extruded main-frame components and not to snap-in or trim members.
3. Do not leave screws or other fasteners exposed to view when installation is complete.

C. Glass: Install glass according to Section 081216 “Interior Aluminum Doors, Door Frames, and Storefront Framing.” and aluminum-frame manufacturer's written instructions.

2.3 ADJUSTING

A. Inspect installation, correct misalignments, and tighten loose connections.

B. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended in writing by frame manufacturer and according to AAMA 609 & 610.

C. Touch Up: Repair marred frame surfaces to blend inconspicuously with adjacent unrepaired surface so touchup is not visible from a distance of 48 inches as viewed by Architect. Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

END OF SECTION 081216

SECTION 081216

INTERIOR ALUMINUM DOORS, DOOR FRAMES, AND STOREFRONT FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum officefront framing system for interior use.
2. Aluminum and glass doors for interior use.

B. Related Requirements:

1. Section 087100 “Door Hardware” for officefront systems sliding door hardware.
2. Section 088113”Decorative Glass Glazing” for glazing panels for all-glass system.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for all-glass system.

B. Shop Drawings: For all-glass officefront systems.

1. Include plans, elevations, and sections.
2. Include details of fittings and glazing.
3. Door hardware locations, mounting heights, and installation requirements.

C. Samples for Initial Selection: For each type of exposed finish indicated.

D. Samples for Verification: For each type of exposed finish indicated, prepared on Samples of size indicated below.

1. Metal Finishes: 6-inch- long sections of rail fittings, accessory fittings, and other items.
2. Glass: 6 inches square, showing exposed-edge finish.
3. Door Hardware: For exposed door hardware of each type, in specified finish, full size.

E. Fabrication Sample: Continuous rail fitting at bottom and top, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery.
2. Anchorage.
3. Glazing with butt glazing.

F. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

G. Delegated-Design Submittal: For all-glass officefront systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For all-glass officefront systems, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For all-glass officefront systems to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Provide aluminum frames, aluminum and glass doors, and accessories produced by a single manufacturer for each type of product indicated.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver frames and doors in cartons to provide protection during transit and storage at project site.

B. Inspect frames and doors upon delivery for damage.
1. Repair minor damage to pre-finished products by means as recommended by manufacturer

2. Replace frames and doors that cannot be satisfactorily repaired.

C. Store frames and doors at project site under cover and as near as possible to final installation location. Do not use covering material that will cause discoloration of aluminum finish.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not begin installation of frames or doors until area of work has been completely enclosed and interior is protected from the elements.

B. Maintain temperature and humidity in areas of installation within reasonable limits, as close as possible to final occupancy. If necessary, provide temperature control and ventilation to maintain required environmental conditions.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of all-glass officefront systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   b. Failure of operating components.

B. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design all-glass entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of all-glass entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. RACO Interiors
2. Special-Lite, Inc.
3. Versatrac Interior Aluminum Frames

2.3 METAL COMPONENTS

A. Fitting Configuration:
   1. Manual-Sliding, All-Glass Officefront Entrance Doors: . Medium stile, Sliding Doors, complete with standard construction stiles and rails. Factory glazed with 1/4" clear tempered glass, black or grey EPDM glazing gaskets.
   2. All-Glass Officefront Systems: Continuous rail fitting at top and bottom.

B. Patch Fittings: Aluminum.

C. Rail Fittings:

   1. Material: Match patch-fitting metal and finish.
   2. Height:

      a. Top Rail: As indicated
      b. Bottom Rail: As indicated.

   3. Profile: As indicated.
   4. End Caps: Manufacturer's standard precision-fit end caps for rail fittings.

D. Accessory Fittings: As necessary for complete system.

E. Anchors and Fastenings: Manufacturer's standard type, compatible with materials being secured. All clips and fasteners concealed.

F. Materials:

   1. Aluminum: ASTM B 221 , with strength and durability characteristics of not less than Alloy 6063-T5.

      a. Color: Match building standards finishes.

2.4 GLASS

A. Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), tested for surface and edge compression per ASTM C 1048 and for impact strength per 16 CFR 1201 for Category II materials.

   1. Class 1: Clear monolithic.

      a. Thickness: 3/8 inch and 5/8 inch as indicated on the drawings.
      b. Locations: As indicated.

   2. Exposed Edges: Machine ground and flat polished.
   3. Butt Edges: Flat ground.

2.5 BUTT-GLAZING SEALANTS

A. Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses NT, G, and A.

2.6 FABRICATION

A. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.

1. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of door or lite.

B. Factory assemble components and factory install hardware and fittings to greatest extent possible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install all-glass systems and associated components according to manufacturer's written instructions.

B. Set units level, plumb, and true to line, with uniform joints.

C. Maintain uniform clearances between adjacent components.

D. Lubricate hardware and other moving parts according to manufacturer's written instructions.

E. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.

3.3 ADJUSTING AND CLEANING

A. Adjust all-glass officefront doors and hardware to produce smooth.

B. Remove excess sealant and glazing compounds and dirt from surfaces.

END OF SECTION 081216

SECTION 081416

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core flush wood doors with plastic-laminate-faces.
2. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware.
3. Dimensions and locations of blocking for hardware attachment.
4. Dimensions and locations of mortises and holes for hardware.
5. Clearances and undercuts.

C. Samples for Initial Selection: For plastic-laminate door faces.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions. Store products in manufacturer's unopened packaging until ready for installation.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252.

2.3 SOLID-CORE FLUSH WOOD DOORS WITH PLASTIC-LAMINATE FACES

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

   1. VT Industries Inc.
   2. Oshkosh Door Company.
   3. ABS-American Building Supply, Inc.

B. Interior Doors:

   1. Performance Grade: WDMA I.S. 1A Heavy Duty.
   2. Architectural Woodwork Standards.
   3. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
   4. Colors, Patterns, and Finishes: As indicated.
   5. Exposed Vertical and Top Edges: Plastic laminate that matches faces, applied before faces.
      a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.

      b. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

         1) Screw-Holding Capability: 475 lbf in accordance with WDMA T.M. 10.

   6. Core for Non-Fire-Rated Doors: ANSI A208.1, Grade LD-1particleboard.

a. Blocking: Provide wood blocking in particleboard-core doors as follows:

1) 5-inch top-rail blocking, in doors indicated to have closers.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware." Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

B. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

a. Secure with countersunk, concealed fasteners and blind nailing.

3. Install fire-rated doors and frames in accordance with NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
   1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 087100

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:

a. Swinging doors.
b. Sliding doors.

2. Electrified door hardware.

B. Related Requirements:

1. Section 081216 "Aluminum Frames" for door silencers provided as part of aluminum frames.

1.2 COORDINATION

A. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

B. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.
2. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.

C. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

    a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
    d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
    e. Fastenings and other installation information.
    f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
    g. Mounting locations for door hardware.
    h. List of related door devices specified in other Sections for each door and frame.

D. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC)

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
a. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

C. Accessibility Requirements: For door hardware on doors in an accessible route, comply with 2012 Texas Accessibility Standards.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf .
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

2.3 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.

2.4 HINGES

A. Hinges: BHMA A156.1.

1. Stanley Commercial Hardware; a division of Stanley Security Solutions.
2. Hager Companies.
3. Allegion plc.

2.5 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Mortise Locks: Minimum 3/4-inch latchbolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Description: As indicated in the hardware sets.

2. Levers: Forged or Cast.
3. Escutcheons (Roses): Wrought.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

F. Mortise Locks: BHMA A156.13; Operational Grade 1,Security Grade 2; stamped steel case with steel or brass parts; Series 1000.

1. Stanley Commercial Hardware; a division of Stanley Security Solutions.
2. Best Access Systems; Stanley Security Solutions, Inc.
3. Allegion plc.

2.6 ELECTROMECHANICAL LOCKS

A. Electromechanical Locks: BHMA A156.25; Grade 2; motor or solenoid driven; with strike that suits frame.

1. Stanley Commercial Hardware; a division of Stanley Security Solutions.
2. Best Access Systems; Stanley Security Solutions, Inc.
3. Allegion plc.

4. Type: Mortise latchbolt.

2.7 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices to match building standard.

1. Stanley Commercial Hardware; a division of Stanley Security Solutions.
2. Best Access Systems; Stanley Security Solutions, Inc.
3. Allegion plc.

B. Standard Lock Cylinders: BHMA A156.5; Grade 2 permanent cores; face finished to match lockset.

1. Core Type: Interchangeable and Removable.

C. High-Security Lock Cylinders: BHMA A156.30; Grade 2 permanent cores that are removable; face finished to match lockset.

1. Type: E, electrical.

D. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.8 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

1. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.

a. Provide three cylinder change keys and five each of master and grand master keys.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2.9 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Stanley Commercial Hardware; a division of Stanley Security Solutions.
2. Dorma USA, Inc
3. Allegion plc.

2.10 SLIDING DOOR HARDWARE

A. Sliding Door Hardware: BHMA A156.14; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories indicated.

1. Dormakaba Group.
2. Stanley Commercial Hardware; a division of Stanley Security Solutions.
3. Hettich America L.P.

2.11 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- thick brassor bronze; with manufacturer's standard machine or self-tapping screw fasteners.

1. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

2. Trimco.
3. Hager Companies.

2.12 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

    a. Wood or Machine Screws: For the following:

        1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors.
        2) Strike plates to frames.
        3) Closers to doors and frames.

    b. Steel Through Bolts: For the following unless door blocking is provided:
        1) Closers to doors and frames.

2.13 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations

in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30

inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying schedule.

E. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

3.8 DOOR HARDWARE SCHEDULE

SET #1

Doors: 501, 509A

4	Hinges	FBB179 4 1/2 X 4 1/2 NRP	ID	ST
1	Electro-mech Lock	45HW-7DEU14M PATD CPK RQE	622	BE
1	Door Closer	QDC111	693	ST
1	Kick Plate	K0050 10” X 2” LDW B4E CSK	622	TR
1	Wall Bumper	1211 / 1270CVSV As Required	622	TR
1	Door Position Switch	DPS By Owner’s Security Vendor		
1	Power Supply	Power Supply By Owner’s Security Vendor		
1	Card Reader	Card Reader By Owner’s Security Vendor		
1	Power Transfer	EPT-12C		PR
1	Wire Harness	WH-192P		ST
1	Wire Harness	WH-44		ST

NOTE: Operational Description: Doors normally closed and locked. Presentation of authorized credential unlocks door to allow ingress than relocks. Loss of power results in locked door (fail secure).

SET #2 - Storage

Doors: 511

4	Hinges	FBB179 4 1/2 X 4 1/2 NRP	ID	ST
1	Lockset	45H-7D14M PATD CPK	622	BE
1	Door Closer	QDC111	693	ST
1	Kick Plate	K0050 10” X 2” LDW B4E CSK	622	TR
1	Wall Bumper	1211 / 1270CVSV As Required	622	TR

SET #3 – Offices

Doors: 506, 507, 508

1	Sliding Barn Door Lock	9100BDL-3 x 5” x 7200P	622	AC
1	Mortise Cylinder	1E-74 PATD CPK	622	BE
1	Sliding Door Hardware	MUTO Comfort 1P XL 150 SC WD W 399-Black		DM

SET #4 – Collaboration Room / Huddle Room

Doors: 502, 505

1	Barn Door Lock - Passage	9100BDL-0 x 5” x 7200P	622	AC
1	Sliding Door Hardware	MUTO Comfort 1P XL 150 SC WD W 399-Black		DM

END OF SECTION 087100

SECTION 08 87 00

DECORATIVE FILM OVERLAY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Decorative film overlay installed on face of interior glazing.

B. Related Requirements:
1. Section 081216 “Interior Aluminum Doors, Door Frames, and Storefront Framing” for glass to receive glazing film.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product; include application instructions and use requirements.

B. Samples for Initial Selection: For translucent glazing film, submit 3 inch by 4 inch samples of full range of manufacturer’s colors for Architect selection.

C. Samples for Verification Purposes: For each type glazing film, submit 8 inch by 10 inch sample mounted on specified glazing.

D. Maintenance and Cleaning Instructions: List cleaning solutions recommended by the manufacturer and describe proper cleaning procedures.

1.3 QUALITY ASSURANCE

A. Applicator: Firm with not less than 5 years successful experience applying specified film to glass in commercial applications.

1.4 SEQUENCING

A. Apply decorative film overlay after office front system and glazing installation are complete and just before Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. 3M Company
2. Avery Dennison Graphics.
3. Decorative Films, LLC
4. Eastman Chemical Company.
5. FDC Graphic Films.
6. Huper Optik.

2.2 DECORATIVE FILM OVERLAY PRODUCTS

A. Decorative Film Overlay: Translucent, dimensionally stable, cast PVC film, 2-mil- minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing. Provide pattern selected by Architect from manufacturer's full range of patterns.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine all-glass officefront system, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Minimum required face or edge clearances.
3. Effective sealing between joints of all-glass officefront system.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Apply decorative film overlay squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, in pattern as selected by the Architect to the front face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.

3.3 FIELD QUALITY CONTROL

A. Comply with "Visual Inspection Standard" published by IWFA.

3.4 CLEANING AND PROTECTION

A. Protect installed decorative film overlay from damage in accordance with manufacturer's written instructions until Substantial Completion. Replace decorative film overlay damaged by construction activities so that repaired installation cannot be distinguished from undamaged installation.

B. Immediately prior to Substantial Completion, clean decorative film overlay in accordance with the manufacturer's written instructions.

END OF SECTION 088700

SECTION 092216

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. Horizontal Deflection: For composite wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft. .

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.

B. Studs and Tracks: ASTM C645.

1. Steel Studs and Tracks:
   a. Minimum Base-Steel Thickness: 0.0179 inch with 0.0329 inch minimum thickness supporting wall hung items such as cabinetwork, equipment and fixtures.

b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide the following:

1. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inchdeep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Steel Thickness: 0.0329 inch .

2.3 SUSPENSION SYSTEMS

A. Furring Channels (Furring Members):

1. Steel Studs and Tracks: ASTM C645.

a. Minimum Base-Steel Thickness: 0.0179 inch.
b. Depth: 3-5/8.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.4 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Furring Channels (Furring Members): 24 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900

GYPSUM BOARD

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

C. Samples for Initial Selection: For each type of trim accessory indicated.

D. Samples for Verification: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.3 QUALITY ASSURANCE

A. Mockups: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

    a. Cornerbead.
    b. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge

trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Type X: Where required for fire-resistance-rated assembly.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    a. Stagger abutting end joints not less than one framing member in alternate courses
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

2. Level 5: At panel surfaces that will be exposed to view unless otherwise indicated.

a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 095000

WOOD PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes

1. Solid Wood and Wood veneer ceiling panels.
2. Exposed grid suspension system.
3. Wire hangers, fasteners, main runners, wall angle moldings and accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For components with factory-applied color and other decorative finishes.

C. Samples for Verification: Minimum 3-1/2 inch or 5-1/2 inch samples of specified panel; 8 inch long samples of exposed wall molding and suspension system, including main runner.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Linear pattern.
2. Joint pattern.
3. Ceiling suspension members.
4. Method of attaching hangers to building structure.
5. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
6. Ceiling perimeter and penetrations through ceiling; trim and moldings.
7. Minimum Drawing Scale: 1/4 inch = 1.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Ceiling Units: Furnish quantity of full-size units equal to 5.0 percent of amount installed.
2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

1.6 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide ceiling panel units and grid components by a single manufacturer..

B. Woodworking Standards: Manufacturer must comply with specified provisions of Architectural Woodworking Institute quality standards.

C. Woodworks Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

D. Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, wet work i.e. gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store the wood veneer ceiling panels in a dry interior location in their cartons prior to installation to avoid damage. Store the ceiling panel cartons in a flat, horizontal position. Do not remove the protectors between the panels until installation.

B. Do not store in unconditioned spaces with humidity greater than 55 percent or lower than 25 percent relative humidity and temperatures lower than 50 degrees F or greater than 86 degrees F. Do not expose the wood veneer ceiling panels to extreme temperatures, for example, close to a heating source or near a window with direct sunlight.

C. Handle ceiling units carefully to avoid chipped edges or damage to units in any way.

1.8 PROJECT CONDITIONS

A. Prior to installation, the wood veneer ceiling materials are required to reach room temperature and have stabilized moisture content for a minimum of 72 hours.

B. Do not install the wood veneer panels in spaces where the temperature or humidity conditions vary greatly from the temperatures and conditions that will be normal in the occupied space.

C. As interior finish products, the wood veneer panels are designed for installation in temperature conditions between 50 degrees F and 86 degrees F, in spaces where the building is enclosed and HVAC systems are functioning and will be in continuous operation. Relative humidity should not fall below 25 percent or exceed 55 percent.

1.9 WARRANTY

A. Wood Veneer Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:

1. Ceiling Panels: Defects in materials or factory workmanship
2. Grid System: Rusting and manufacturing defects

B. Warranty Period:

1. Wood veneer panels: One (1) year from date of installation
2. Grid: One (1) year from date of installation

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: As follows, tested by HPVA (Hardwood Plywood and Veneer Association) under the test standard ASTM E-84 tunnel test and complying with ASTM E 1264 for Class A products.

1. Flame-Spread Index: Comply with ASTM E1264 for Class A materials, 25 or less.
2. Smoke-Developed Index: 50 or less.

2.2 WOOD VENEER CEILING UNITS

A. Basis of Design: Design is based on WOODWORKS Linear Solid Wood Panels, Item # 8117W1 as manufactured by Armstrong World Industries. Subject to compliance with the following properties:

1. Surface Texture: Smooth
2. Composition: Wood
3. Species/Finish: As indicated on the drawings.
4. Size: As indicated on the drawings.
5. Reveal: Square 15/16 in
6. Profile: 15/16 in
7. Edge Banding and Trim: To match face veneer
8. Dimensional Stability: Standard

2.3 METAL SUSPENSION SYSTEMS

A. Metal Suspension Systems Standard: Provide ceiling manufacturer's standard metal suspension systems of types and finishes indicated that comply with applicable ASTM C635/C635M requirements.

B. Suspension Systems: Provide systems complete with carriers, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.

C. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated.

D. Wire Hangers, Braces, and Ties: Provide wire complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C635/C635M, Table 1, Direct Hung is less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 15/16-inch- wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Factory finished with matte black baked finish.

G. Edge Moldings and Trim: Provide exposed members as indicated or required to comply with seismic requirements of authorities having jurisdiction, to conceal edges of penetrations through ceiling, to conceal ends of pans and carriers, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching linear metal pans or extruded plastic unless otherwise indicated.

2.4 ACCESSORIES

A. Access Panels: For access at locations indicated, provide door hinge assembly, retainer clip, and retainer bar, assembled with ceiling panels and carrier sections into access doors of required size, permitting upward or downward opening.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which wood panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of linear metal ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of wood panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and on Coordination Drawings.

3.3 INSTALLATION

A. Comply with ASTM C636/C636M and seismic requirement indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate to which hangers are attached and for type of hanger involved.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Install edge moldings and trim of type indicated at perimeter of wood panel ceiling area and where necessary to conceal edges and ends of wood panels.

1. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system carriers so they are aligned and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

3.4 CLEANING

A. Clean exposed surfaces of ceilings panels, including trim, edge moldings, and suspension members after removing strippable, temporary protective covering if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 095000

SECTION 095113

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Initial Selection: For components with factory-applied finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: Set of 6-inch- square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Method of attaching hangers to building structure.
3. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
4. Items penetrating finished ceiling and ceiling-mounted items including the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Sprinklers.
    e. Perimeter moldings.
5. Minimum Drawing Scale: 1/4 inch = 1 foot.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 ACOUSTICAL PANELS APC-1

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. Armstrong Ceiling & Wall Solutions.
2. USG Corporation.
3. Certainteed; SAINT-GOBAIN.

B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide panels as follows:

1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted with factory-applied latex paint.
2. Pattern: E (lightly textured).

D. Color: White .

E. Light Reflectance (LR): Not less than ASTM E 1477; 0.88.

F. Ceiling Attenuation Class (CAC): Not less than ASTM C 1414; 40.

G. Noise Reduction Coefficient (NRC): Not less than): ASTM C 423; 0.60.

H. Edge/Joint Detail: Beveled Tegular.

I. Thickness: 3/4 inch.

J. Modular Size: 24 by 24 inches Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.3 METAL SUSPENSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. Armstrong Ceiling & Wall Solutions.
2. USG Corporation.
3. Certainteed; SAINT-GOBAIN.

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.

C. Narrow-Face, Uncapped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; to produce structural members with 9/16-inch-wide faces.

1. Structural Classification: Heavy-duty system.
2. Face Design: With 1/4-inch- wide, slotted, box-shaped flange.
3. Face Finish: Painted white.
4. Reveal Finish: Painted to match flange color.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 12 gauge diameter wire.

C. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

2.5 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.

B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.

1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.6 ACOUSTICAL SEALANT

A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E90.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
3. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
4. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
6. Do not attach hangers to steel deck tabs.

7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet , non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoset-rubber base.
2. Rubber molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

E. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials**,** from the same product run**,** that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F .

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F , in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F .

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. Roppe Corporation; Roppe Holding Company.
2. Flexco; Roppe Holding Company.
3. Johnsonite; a Tarkett company.

B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location:

a. Style A, Straight: Provide in areas with carpet.

C. Thickness: 0.125 inch .

D. Height: As indicated on Drawings.

E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: As indicated on the drawings.

2.2 RUBBER MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. Roppe Corporation; Roppe Holding Company.
2. Flexco; Roppe Holding Company.
3. Johnsonite; a Tarkett company.

B. Description: Rubber reducer strip for resilient floor covering.

C. Profile and Dimensions: As recommended by manufacturer.

D. Colors and Patterns: Match rubber base.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Preformed Corners: Install preformed corners before installing straight pieces.

G. Job-Formed Corners:

1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luxury vinyl floor tile.
2. Vinyl composition floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Shop Drawings: For each type of resilient floor tile.
2. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
3. Show details of special patterns.

B. Samples: Full-size units of each color, texture, and pattern of floor tile required.

C. Samples for Initial Selection: For each type of floor tile indicated.

D. Samples for Verification: Full-size units of each color and pattern of floor tile required.

E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials**,** from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F . Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg in spaces to receive floor tile during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F .

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURY VINYL FLOOR TILE

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. Shaw Contract Group; a Berkshire Hathaway company.

2. Armstrong Flooring, Inc.
3. Mannington Mills, Inc.

B. Tile Standard: ASTM F1700.

1. Class: Class III, Printed Film Vinyl Tile.
2. Type: B, Embossed Surface.

C. Thickness0.157 inch.

D. Size: 7 by 48 inches.

E. Colors and Patterns: As indicated on the drawings.

2.3 VINYL COMPOSITION FLOOR TILE

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. Armstrong Flooring, Inc.
2. Johnsonite; a Tarkett company.
3. American Biltrite.

B. Tile Standard: ASTM F1066, Class 2, through pattern.

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch.

E. Size: 12 by 12 inches .

F. Colors and Patterns: To match existing building standard color and pattern.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum **75** percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply coat(s) as recommended by the manufacturer.

E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096813

TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modular carpet tile.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

D. Samples for Initial Selection: For each type of carpet tile.

1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.

E. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

F. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. .

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI's "CRI Carpet Installation Standard."

1.8 FIELD CONDITIONS

A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent edge raveling, snags, and runs.
b. Dimensional instability.
c. Excess static discharge.
d. Loss of tuft-bind strength.
e. Loss of face fiber.
f. Delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. Shaw Contract Group; a Berkshire Hathaway company.
2. J&J Invision; J&J Industries, Inc.
3. Mannington Mills, Inc.

B. Color and Pattern: As indicated on the drawings.

C. Fiber Content: 100 percent solution dyed nylon.

D. Primary Backing/Backcoating: Manufacturer's standard composite materials.

E. Secondary Backing: Manufacturer's standard material.

F. Size: 24 by 24 inches .

G. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer's standard treatment.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum **75** percent relative humidity level measurement.
c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns indicated on Drawings.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings ,and thresholds. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 097200

WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl wall covering.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement seams and termination points.

C. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36-inch- long in size.

1. Wall-Covering Sample: From same production run to be used for the Work, with specified paint applied.

D. Samples for Initial Selection: For each type of wall covering.

E. Samples for Verification: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36-inch- long in size.

1. Wall-Covering Sample: From same production run to be used for the Work, with specified paint applied.

F. Product Schedule: For wall coverings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each wall covering, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Covering Materials: For each type, color, texture, and finish, full width by length to equal to **5** percent of amount installed.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 50 or less.

2.2 VINYL WALL COVERING

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. Maharam.
2. Versa; LSI Wallcovering.

3. Eykon Design Resource.

B. Total Weight: 20 oz/ly, excluding coatings.

C. Width: 54 inches .

D. Backing: Nonwoven fabric.

1. Fiber Content: Polyester cellulose.

E. Repeat: per manufacturers product specifications.

F. Colors, Textures, and Patterns: As indicated on the drawings.

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining**,** strippable adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.

B. Primer/Sealer: Mildew resistant as recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

C. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
1. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
2. Painted Surfaces: Treat areas susceptible to pigment bleeding.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.

E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 WALL-COVERING INSTALLATION

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

D. Install wall covering without lifted or curling edges and without visible shrinkage.

E. Match pattern as recommended by manufacturer.

F. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

G. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

SECTION 099123

INTERIOR PAINTING

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

1. Gypsum board.

1.2 DEFINITIONS

A. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

B. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal**.** of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. .
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F .

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F .

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. Sherwin-Williams Company (The)

2. Benjamin Moore & Co.
3. PPG Paints

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: As indicated on the drawings.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
4. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Pipe hangers and supports.

2. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.
b. Metal conduit.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. High-Performance Architectural Latex System MPI 5.3M:

    a. Prime Coat: Primer, galvanized, water-based, MPI #134.
    b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
    c. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

B. Gypsum Board Substrates:

1. High-Performance Architectural Latex System MPI INT 9.2B:

    a. Prime Coat: Primer sealer, latex, interior, MPI #50.
    b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
    c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), MPI #139.

END OF SECTION 099123

SECTION 101100

VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass markerboards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

B. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work.

C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:

1. Samples of facings for each visual display panel type, indicating color and texture.

D. Samples for Verification: For each type of visual display unit indicated.

1. Visual Display Panel: Not less than 8-1/2 by 11 inches , with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.

E. Product Schedule: For visual display units.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For manufacturer's special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display units to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 GLASS MARKERBOARDS

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. Clarus Glassboards, LLC.
2. Claridge Products and Equipment, Inc.
3. Krystal Glass Writing Boards, Inc.

B. Glass Markerboards: Fabricated of 6-mm tempered safety writing glass with magnetic finish. Non-staining writing surface and compatible with any marker, even permanent.

1. Edge Treatment: Smooth polished edge with eased corners.
2. Surface: Glossy.
3. Color: White.

C. Mounting: Round, stainless steel standoffs, holding glass approximately 1 inch from wall surface; mounted through holes in markerboard.

D. Size: 48 by 96 inches.

2.2 MATERIALS

A. Clear Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 CLEANING AND PROTECTION

A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas per manufacturer’s written instructions.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 101423 - PANEL SIGNAGE

1.1 SUMMARY

A. Section Includes interior identification signage in matching and accordance with existing building signage

1. Panel signs.

2. Cubicle Signs

B. Related Requirements:
1. Section 265213 "Emergency and Exit Lighting" for illuminated, self-luminous, and photoluminescent exit sign units.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements including raised characters and Braille, and layout for each sign at least half size.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

B. Accessibility Standard: Comply with applicable provisions in the TDLR “2012 Texas Accessibility Standards” (TAS)

2.2 PANEL SIGNS

A. Panel Sign – Reference Drawing A1/A-802: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.

2.3 PANEL-SIGN MATERIALS

A. Acrylic Sheet: ASTM D4802, Type UVF (UV filtering).

B. Photopolymer plate: ASTM D635

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:

1. Use concealed fasteners, anchors and/or adhesives as indicated on documents.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

C. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Accessible Signage: Install in locations on walls as indicated on Drawings and according to the accessibility standard

C. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

D. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 101423

SECTION 102600

WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Corner guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.

1. Include Samples of accent strips and accessories to verify color selection.

D. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long. Include example top caps.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.

1.5 WARRANTY

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with applicable provisions in the 2012 Texas Accessibility Standards.
1.

2.3 CORNER GUARDS

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. Fry Reglet Corporation.
2. Construction Specialties, Inc.
3. IPC Door and Wall Protection Systems, InPro Corporation.

B. SurfaceFlush-Mounted, Metal Corner Guards <Insert drawing designation>: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.

1. Material: Extruded aluminum, minimum 0.0625 inch thick, with clear anodic finish.
2. Wing Size: Nominal 1-1/2 by 1-1/2 inches.
3. Mounting: Per Manufacturer's written instructions.

2.4 MATERIALS

A. Aluminum Materials: Extruded aluminum alloy 6063 T5 thickness as indicated.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view. Aluminum or Type 302 or 304 stainless steel.

2.5 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Mounting holes: Provide factory-drilled mounting holes.

2.6 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Anodized finish: Architectural 200R1 medium etch (AA-M32c10A21), clear color. Standard finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

3.4 PROTECTION

A. Protect accessories from damage until date of Substantial Completion. Replace accessories which become damaged.

END OF SECTION 102600

SECTION 104416

FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Manufacturers: Subject to compliance with requirements, provide product approved by the Architect manufactured by one of the following:

1. Potter Roemer LLC; a Division of Morris Group International
2. Larsens Manufacturing Company.
3. Activar Construction Products Group, Inc. - JL Industries.

B. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.

1. Source Limitations: Obtain fire extinguishers and accessories, from single source from single manufacturer.
2. Valves: Nickel-plated, polished-brass body.
3. Handles and Levers: Stainless steel.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

C. Multipurpose Dry-Chemical Type in Steel Container : UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 123623.13

PLASTIC-LAMINATE-CLAD COUNTERTOPS

1.1 SUMMARY

A. Section includes plastic-laminate-clad countertops.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plastic-laminate-clad countertops.

1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
2. Show locations and sizes of cutouts and holes for items installed in plastic-laminate-clad countertops.
3. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: Plastic laminates in each type, color, pattern, and surface finish required in manufacturer's standard size.

D. Samples for Initial Selection: For plastic laminates.

E. Samples for Verification: As follows:

1. Plastic Laminates: For each type, color, pattern, and surface finish required, 8 by 10 inches in size.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Fabricator.

B. Product Certificates: For the following:

1. High-pressure decorative laminate.
2. Adhesives.

C. Quality Standard Compliance Certificates: AWI Quality Certification Program.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Shop Certification: AWI's Quality Certification Program accredited participant.

B. Installer Qualifications: Fabricator of products.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.

B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.

1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that countertops comply with requirements of grades specified.

B. Grade: Custom.

C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.

1. Formica Corporation.
2. Wilsonart LLC.
3. Pionite; a Panolam Industries International, Inc. brand.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated on the drawings.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: Particleboard or MDF.

G. Core Material at Sinks: MDF made with exterior glue.

H. Core Thickness: 3/4 inch.

1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

2.2 MISCELLANEOUS MATERIALS

A. Adhesive for Bonding Plastic Laminate: As selected by fabricator to comply with requirements.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.3 FABRICATION

A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of cutouts by saturating with varnish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.2 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches . Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
2. Secure backsplashes to walls with adhesive.
3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces.

C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 123623.13

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Sprinklers.
3. Hanging.

1.2 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 300 psig.

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, attachment details, and all other information required by NFPA 13.
2. Include hydraulic calculations with flow test data less than 1 year old.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling Grid
2. Items penetrating finished ceiling include the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. HVAC Duct work

B. Qualification Data: For qualified Installer

C. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Field Test Reports:

1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
2. Fire-hydrant flow test report.

F. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems. Base calculations on results of fire-hydrant flow test, preparation of working plans, calculations, and field test reports.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.8 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.

Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

2. Sprinkler system design shall be approved by authorities having jurisdiction.

a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.

3. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft.
   c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft.

   Note – Remote area reduction for quick response sprinklers is allowed per NFPA 13

4. Maximum Protection Area per Sprinkler: According to UL listing.
5. Maximum Protection Area per Sprinkler:
   a. Light Hazard: 225 sq. ft.
   b. Ordinary Hazard: 130 sq. ft.

B. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7

2.2 STEEL PIPE AND FITTINGS

A. Schedule 40, Black Steel Pipe: ASTM A53/A53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 10, Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

C. Black Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.

D. Uncoated Steel Couplings: ASTM A865/A865M, threaded.

E. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

F. Malleable- or Ductile-Iron Unions: UL 860.

G. Grooved-Joint, Steel-Pipe Appurtenances:
1. Pressure Rating: 175-psig minimum.
2. Uncoated Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:
1. Standard: UL 213.
2. Pressure Rating: 175-psig minimum
3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
4. Type: Mechanical-tee and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Adjustable Drop Nipples:
1. Standard: UL 1474.
2. Pressure Rating: 175-psig minimum
3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
4. Size: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

2.4 SPRINKLERS

A. Listed in UL's "Fire Protection Equipment Directory"

B. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element:
1. Nonresidential Applications: UL 199
2. Characteristics: Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
3. Characteristics: Discharge Coefficient K of 8.0, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes: White Concealed

E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: white finish, one piece, flat.

2.5 Hanging

A. All fire sprinkler pipe shall be hung with UL approved Materials per NFPA 13 and manufacturers listing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations

B. Report test results promptly and in writing

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping where required. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

F. Fill sprinkler system piping with water.

G. Install sleeves for piping penetrations of walls, ceilings, and floors.

H. Install sleeve seals for piping penetrations of concrete walls and slabs.

I. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

E. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

F. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

3.4 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.

7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.7 PIPING SCHEDULE

A. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller shall be one the following:

1. Schedule 40 black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Schedule 40 black-steel pipe with roll grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

B. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger, shall the following:
1. Schedule 10 or schedule 40, black-steel pipe with roll grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.8 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms with Suspended Ceilings: Concealed sprinklers

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.

END OF SECTION 211313

SECTION 211316 – PRE-ACTION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinkler specialty pipe fittings.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Pre-Action sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For preaction sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For preaction sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. Compressed air piping.
3. HVAC hydronic piping.
4. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.

B. Qualification Data: For qualified Installer

C. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Fire-hydrant flow test report.

E. Field Test Reports:

1. Fire-hydrant flow test report.
2. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For preaction sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

A. Double-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of a fire-detection system, located in same area as sprinklers, and simultaneous activation of low pressure switch due to loss of air pressure activates special hazard panel, energizing a normally closed solenoid which opens deluge valve, permitting water to flow into sprinkler piping. Water will then discharge from opened sprinklers.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.

C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

D. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design preaction sprinkler systems.

E. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: **10** percent, including losses through water-service piping, valves, and backflow preventers.

2. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1950-sq. ft

3. Maximum Protection Area per Sprinkler: According to UL listing.
4. Maximum Protection Area per Sprinkler:
   a. Electrical Equipment Rooms: **130 sq. ft**

5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
   a. Ordinary-Hazard Occupancies: **250 gpm**

F. shall withstand the effects of earthquake motions determined according to NFPA 13 and **ASCE/SEI 7**

2.3 STEEL PIPE AND FITTINGS

A. Standard-Weight, Black-Steel Pipe: ASTM A 53/A 53M, **Type E** Pipe ends may be factory or field formed to match joining method.

B. Malleable- or Ductile-Iron Unions: UL 860.

C. Cast-Iron Flanges: ASME B16.1, Class 125.

D. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.
   b. Shurjoint Piping Products USA Inc.
   c. <**Insert manufacturer's name**>.

E. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International.
   b. Corcoran Piping System Co.
   c. National Fittings, Inc.
   d. Shurjoint Piping Products USA Inc.
   e. Smith-Cooper International.
   f. Tyco Fire Products LP.
   g. Victaulic Company.

2. Pressure Rating: **175-psig**
3. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.4 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Preaction Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Globe Fire Sprinkler Corporation.
b. Reliable Automatic Sprinkler Co., Inc. (The).
c. Tyco Fire Products LP.
d. Venus Fire Protection Ltd.
e. Victaulic Company.
f. Viking Corporation.

2. Standard: UL 260.
3. Design: Differential-pressure type.
4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
5. Air-Pressure Maintenance Device:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Globe Fire Sprinkler Corporation.
2) Reliable Automatic Sprinkler Co., Inc. (The).
3) Tyco Fire Products LP.
4) Venus Fire Protection Ltd.
5) Victaulic Company.
6) Viking Corporation.

6. Standard: UL 260.
7. Type: Automatic device to maintain minimum air pressure in piping.
8. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig range, and **175-psig** outlet pressure.
9. Air Compressor:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Gast Manufacturing Inc.
        2) General Air Products, Inc.
        3) Viking Corporation.

    b. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
    c. Motor Horsepower: Fractional.
    d. Power: 120-V ac, 60 Hz, single phase.

10. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
11. Motor Horsepower: Fractional.
12. Power: 120-V ac, 60 Hz, single phase.
13. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

G. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Reliable Automatic Sprinkler Co., Inc. (The).
    b. Tyco Fire Products LP.

2. Standard: UL 1726.
3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4
6. End Connections: Threaded.

2.5 SPRINKLER PIPING SPECIALTIES

A. General Requirements for Preaction System Fittings: **UL listed** for preaction service.

B. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anvil International.

b. National Fittings, Inc.
c. Shurjoint Piping Products USA Inc.
d. Tyco Fire Products LP.
e. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: **175-psig**
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

C. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AGF Manufacturing Inc.
b. Reliable Automatic Sprinkler Co., Inc. (The).
c. Tyco Fire Products LP.
d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: **175-psig**
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

D. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elkhart Brass Mfg. Co., Inc.
b. Fire-End & Croker Corporation.
c. Potter Roemer LLC.

2. Standard: UL 199.
3. Pressure Rating: 175-psig minimum.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

E. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AGF Manufacturing Inc.
    b. Triple R Specialty.
    c. Tyco Fire Products LP.
    d. Victaulic Company.
    e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: **175-psig**
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

F. Low Supervisory Air Pressure Test Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Potter Electric Signal Company, LLC; Bleeder valve model BVL or a comparable product by one of the following:

    a. Reliable Automatic Sprinkler Co., Inc. (The).
    b. Tyco Fire Products LP.
    c. Viking Corporation.

2. Valve Body Material: Bronze.
3. Maximum Pressure Rating: 300 psig
4. End Connections: NPS 1/2
5. Exhaust Orifice Size: 0.125 inches

G. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Aegis Technologies, Inc.
    b. CECA, LLC.
    c. Corcoran Piping System Co.
    d. Merit Manufacturing.

2. Standard: UL 1474.
3. Pressure Rating: **250-psig**
4. Body Material: Steel pipe with EPDM O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

2.6 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc. (The).
3. Tyco Fire Products LP.
4. Venus Fire Protection Ltd.
5. Victaulic Company.
6. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig

D. Pressure Rating for Automatic Sprinklers: 175-psig

E. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: **UL 199**
2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

F. Sprinkler Finishes: White concealed plate

G. Special Coatings: NA

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: **Plastic, white finish, one piece, flat**

I. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Reliable Automatic Sprinkler Co., Inc. (The).
b. Tyco Fire Products LP.
c. Victaulic Company.
d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.7 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Pressure Switches – Water Flow Alarm Detection:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Potter Electric Signal Company, LLC; PS10-2 or a comparable product by one of the following:

   a. Potter Electric Signal Company, LLC.
   b. Barksdale, Inc.
   c. Detroit Switch, Inc.
   d. Tyco Fire Products LP.
   e. United Electric Controls Co.
   f. Viking Corporation.

2. Standard: UL 346.
3. Type: Electrically supervised, pressure activated, water-flow switch.
4. Components: Two single-pole, double-throw switches.
5. Design Operation: Rising pressure to 6 psi (41 kPa), plus or minus 2 psi (13.8 kPa), signals water flow.
6. Conduit Openings: Two.
7. Electrical Rating: 10 A at 125/250 V ac, 2 A at 30 V dc.
8. Adjustability: Each switch is independently adjustable.
9. Wire Separation: Pressure switch shall provide for separation of wiring to each switch connection to allow for low and high voltage connections to comply with NFPA 70 Article 760 requirements.

C. Pressure Switches – Low/High Air Pressure Supervisory:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Potter Electric Signal Company, LLC; PS15-2, PS25-2, or PS40-2, depending on supervisory air pressure, or a comparable product by one of the following:

   a. Potter Electric Signal Company, LLC.
   b. Barksdale, Inc.
   c. Detroit Switch, Inc.
   d. Tyco Fire Products LP.
   e. Viking Corporation.

2. Standard: UL 346.
3. Type: Electrically supervised pressure supervisory switch.
4. Components: Two single-pole, double-throw switches.
5. Design Operation: Detects increase and/or decrease from normal supervisory air pressure.
6. Conduit Openings: Two.
7. Electrical Rating: 10 A at 125/250 V ac, 2 A at 30 V dc.
8. Adjustability: Each switch is independently adjustable.
9. Wire Separation: Pressure switch shall provide for separation of wiring to each switch connection to allow for low and high voltage connections to comply with NFPA 70 Article 760 requirements.

D. Valve Supervisory Switches:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Potter Electric Signal Company, LLC; OSYSU-2 for use on outside screw and yoke valves,

PCVS-2 for use on post indicator valves and butterfly valves without factory internal supervisory switches, RBVS for use on quarter-turn lever operated ball valves, or a comparable product by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Kennedy Valve Company; a division of McWane, Inc.

2. General Requirements for Valve Supervisory Switches:

a. Standard: UL 346.
b. Type: Electrically supervised.
c. Design: Signals that operating wheel/lever of controlled valve has turned two revolutions or moved 1/5 from the fully open position.
d. Wire Terminal Designations: Indicates normal switch position when the switch is properly installed on the valve and the valve is fully open.

3. Requirements for OS&Y Valve Supervisory Switches:

a. Components: One or two Single-Pole, Double-Throw switches.
b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
c. Visual Switch Indication: Indicates device is properly installed and OS&Y valve is fully open.
d. Mounting Hardware: Knurled mounting bracket grips the valve yoke and prevents movement of switch assembly on OS&Y valve.
e. Trip Rod Length: Adjustable.

4. Requirements for PIV and Butterfly Valve Supervisory Switches:

a. Components: Two Single-Pole, Double-Throw switches.
b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
c. Mounting Hardware: Removable nipple.
d. Trip Rod Length: Adjustable.

5. Requirements for Ball Valve Supervisory Switch:

a. Components: One Single-Pole, Double-Throw switch.
b. NEMA Rating: NEMA 4 enclosure suitable for mounting in any position indoors or outdoors.
c. Mounting Hardware: Suitable for mounting directly to pipe, ball valves or backflow preventers sized from NPS 1/2 to NPS 2 (DN 15 to DN 50).

2.8 MANUAL CONTROL STATIONS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve.

B. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.9 CONTROL PANELS

A. Description: Single-area, two-area, or single-area cross-zoned type control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves.

1. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" when used with thermal detectors and Class A detector circuit wiring.
2. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

C. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 (DN 15) pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

D. Panels Components:

1. Power supply.
2. Battery charger.
3. Standby batteries.
4. Field-wiring terminal strip.
5. Electrically supervised solenoid valves and polarized fire-alarm bell.
6. Lamp test facility.
7. Single-pole, double-throw auxiliary alarm contacts.
8. Rectifier.

2.10 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AGF Manufacturing Inc.
2. AMETEK, Inc.
3. Ashcroft Inc.
4. Brecco Corporation.
5. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: **0- to 250-psig**

E. Label: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gage: Include"AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valves to drain piping between fire department connections and check valves. Drain to floor drain or to outside building.

K. Connect compressed-air supply to preaction sprinkler piping.

L. Connect air compressor to the following piping and wiring:

1. Pressure gages and controls.
2. Electrical power system.
3. Fire-alarm devices, including low-pressure alarm.

M. Install alarm devices in piping systems.

N. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

O. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

P. Drain preaction sprinkler piping.

Q. Pressurize and check preaction sprinkler system piping and **air-pressure maintenance devices**

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

K. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

L. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.

M. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install **preaction** valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

a. Install air compressor and compressed-air-supply piping.
b. Install air-pressure maintenance device with shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with **14- to 60-psig** adjustable range; and **175-psig** maximum inlet pressure.
c. Install compressed-air-supply piping from building's compressed-air piping system.

3.5 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of **narrow dimension of** acoustical ceiling panels.

B. Install sprinklers with water supply from heated space. Do not install pendent or sidewall sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.6 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.9 DEMONSTRATION

A. **Train** Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.10 PIPING SCHEDULE

A. Standard-pressure, preaction sprinkler system, shall bethe following:

1. Schedule 40 Black-steel pipe with threaded or roll grooved ends; galvanized, gray-iron threaded or Grooved fittings; and threaded or grooved joints.

3.11 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms with Suspended Ceilings: **concealed sprinklers**

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

END OF SECTION 211316

SECTION 220500

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Except as modified in this section, General Conditions, Supplementary Conditions, applicable provisions of Division 1, General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 22.

B. Each section included in Division 22 is incomplete without the provisions stated herein.

1.2 PRODUCTS SUPPLIED BUT NOT INSTALLED UNER THIS SECTION

A. Access Doors

1.3 RELATED SECTIONS

A. Section 01 33 29 – Submittal Procedures for Plumbing.

B. Section 01 78 23.12 – Operations and Maintenance Data for Plumbing.

C. Section 22 05 53 – Identification of Plumbing Piping and Equipment.

D. Section 22 05 93 – Plumbing System Testing.

1.4 REFERENCES

A. ASME B31.1 – Power Piping.

B. ASME BPVC, Section IX – Boiler and Pressure Vessels Code – Section IX – Welding and Brazing Qualifications.

C. ASTM D 698 – Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. Ft. (600kN-m/cu. M)).

D. ASTM D 2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

E. ASTM E 814 – Fire Tests of Through-Penetration Fire Stops.

F. IEEE C2 - National Electrical Safety Code.

G. UL 1479 – Fire Tests of Through-Penetration Firestops.

1.5 DEFINITIONS

A. Provide: Where the word "provide" is used, the word shall be understood to mean "the Contractor shall furnish and install", the equipment, tests, inspections, etc. referenced.

B. Concealed: Where the word "concealed" is used in conjunction with piping, ductwork, equipment, and the like, the word shall be understood to mean hidden from sight as in chases, furred spaces, within walls, or above suspended ceilings.

C. Exposed: Where the word "exposed" is used in conjunction with piping, ductwork, equipment, and the like, the word shall be understood to mean open to view, as in mechanical equipment rooms, and outside the building.

D. Interior: Where the word "interior" is used in conjunction with piping, ductwork, equipment, and the like, the word shall be understood to mean inside the building envelope.

E. Exterior: Where the word "exterior" is used in conjunction with piping, ductwork, equipment, and the like, the word shall be understood to mean outside the building envelope. "Exterior exposed" shall refer to piping, ductwork, equipment, and the like, that is outside the building envelope and exposed to the weather. "Exterior covered" shall refer to piping, ductwork, equipment, and the like, that is outside the building envelope and is in some way covered or protected from the weather but not necessarily from extremes of heat and cold.

F. Related Work: The sections referenced under RELATED SECTIONS shall be understood to include provisions, which directly affect the work being specified in the section where RELATED SECTIONS occurs.

1.6 SUBMITTALS

****

A. Access Doors: Furnish product data and shop drawings. Indicate detailed dimensions.

B. The contractor shall prepare shop drawings and product data for the fire suppression project plumbing systems. The plumbing system submittal shall include, as a minimum, the following:

1. Product Data: Submit manufacturer's data for the components (valves, piping, fittings, etc.) utilized in the system with all applicable data marked or non-applicable data marked out to clearly indicate the products to be used on the project and that they are in compliance with the Contract Documents. The components shall be submitted in separate packages by specification section with a copy of the applicable specification section included indicating compliance or exception to the specification (including all related sections). A coversheet shall be included with a written description of the proposed exceptions referenced to the applicable paragraph in the specification section.
2. Shop Drawings: Shop drawings drawn to scale (minimum scale of ¼" =1'-0" for floor plans and ½"=1'-0" for equipment room plans) indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals as well as

installation, layout, weights, piping sizes, valves, mounting and support details, piping connections, etc.

C. Refer to Section 01 33 29, "Submittal Procedures for Plumbing" for additional submittal requirements.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and tag numbering in a copy of the project "Revit" model.

B. Operation and Maintenance Data: Refer to Section 01 78 23.12, "Operations and Maintenance Manuals for Plumbing" for preparation requirements.

1.8 REGULATORY REQUIREMENTS

A. Perform work in accordance with the editions, revisions, amendments, or supplements of applicable statutes, ordinances, codes, or regulations of Federal, State, and Local Authorities having jurisdiction in effect on the date bids are received.

B. Where approval standards have been established by OSHA, UL, ASME, ASTM, AGA, AMCA, ANSI, ASHRAE, ARI, NFPA, State Fire Insurance Regulatory Body, and FM, follow these standards whether or not indicated on the Drawings and Specifications. Include cost of work required to comply with requirements of these authorities in the original proposal. Comply with IEEE C2 where applicable.

C. Requirements in reference specifications and standards are minimum requirements for equipment, material, and work. In instances where capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet scheduled or specified capacities.

D. Resolve code interpretations discovered in Contract Documents with Architect / Engineer (A/E) prior to Contract award. After Contract award, make corrections or additions necessary for compliance with applicable codes.

E. Arrange with local and state authorities and utility companies for permits, fees, and service connections for temporary and permanent water, sanitary sewer, storm and industrial waste services, verifying locations and arrangement, and pay charges including inspections.

1.9 CONTRACT DRAWINGS

A. Drawings are generally diagrammatic and are intended to encompass a system that will not interfere with the structural and architectural design of the building. Coordinate work to avoid interferences between piping, equipment, architectural, and structural work.

B. Coordinate with architectural features, trim and millwork details, and install equipment in cabinets or other special areas as directed by A/E.

C. Horsepower ratings on motors are based on scheduled equipment and design conditions. Actual field condition or substitutions from scheduled equipment may require different

horsepower. If larger motor sizes are required, coordinate electrical service to ensure proper wire sizes and devices.

D. Provide valves, stopcocks, drain cocks, strainers, and connections where shown on Drawings and where required for controlling the various pieces of equipment. Install valves where branches take off from mains for domestic water, hot water, chilled water, compressed air and natural gas.

E. Drawings are based on equipment specified. Make adjustments, modifications, or changes required, due to use of other equipment.

F. All Drawings within the Contract Documents, regardless of discipline, shall be used together to construct a complete and useable project in accordance with the design intent. Do not break up the drawings into the separate disciplines (i.e. Mechanical, Electrical, Plumbing, etc.) as Drawings are not trade specific. It is the Contractor's responsibility to perform the work. Any division of work with trade subcontractors is the contractors' responsibility unless such division is specifically indicated in the Contract Specifications. Do not assume that all work for a particular trade is contained under a single discipline as many installations require cross discipline interactions. For example, the contractor may need to have an electrical subcontractor install motor starters indicated on the control drawings that may not necessarily be shown on the electrical drawings. No allowances will be made for lack of coordination between trades in any phase of the project from bidding to closeout.

G. Where conflicts exist between the Contract Drawings and the Specifications, the Specifications shall govern unless otherwise directed by the Engineer.

1.10 PROJECT/SITE CONDITIONS

A. Site Visitation: Visit the site of the proposed construction to become thoroughly familiar with details of work and working conditions, verify dimensions in the field, and advise A/E of discrepancies before performing Work.

B. Keep all areas affected by work clear of trash and debris and keep all roads into and around project site clear.

C. Contractor is responsible for ensuring installed equipment can be transported and placed in the areas indicated. Contractor shall provide for removal of walls, doors, other equipment, etc. as needed to accommodate equipment transport and placement. Any items removed or relocated shall be reinstalled or revised to accommodate the new equipment installation.

1.11 MATERIALS AND WORKMANSHIP

A. Provide new materials and equipment of a manufacturer regularly engaged in the production and manufacture of specified materials and equipment. Where UL or other agency has established standards for materials, provide materials, which are listed and labeled accordingly. The commercially standard items of equipment and the specific names mentioned herein are intended to identify standards of quality and performance necessary for the proper functioning of the work.

B. Work shall be performed by workmen skilled in the trade required for the work. Install materials and equipment to present a neat appearance when completed in accordance with the approved recommendations of the manufacturer and in accordance with Contract Documents.

C. Provide labor, materials, apparatus, and appliances essential to the complete functioning of the systems described or indicated herein, or which may be reasonably implied as essential whether mentioned in the Contract Documents or not.

D. Make written request to A/E for supplementary instructions in cases of doubt as to Work intended or in the event of need for explanation thereof.

E. Performance and material requirements scheduled or specified are minimum standards acceptable. The right to judge the quality of equipment that deviates from the Contract Documents remains solely with A/E.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Follow the manufacturer's directions completely in the delivery, storage, and handling of equipment and materials.

B. Store equipment in a clean, dry place protected from other construction. While stored maintain factory wrapping or tightly cover and protect equipment against dirt, water, construction debris, chemical, physical or weather damage, traffic and theft.

C. Adequately brace and package equipment to prevent breakage and distortion while in transit.

1.13 WELDING AND WELDER'S CERTIFICATION

A. Weld piping and above grade steel tanks in accordance with qualified procedures using performance qualified welders and welding operators. Qualified procedures and welders in accordance with ASME Section IX.

B. Welding procedures qualified by others and welders and welding operators qualified by another employer may be accepted as permitted by ANSI B31.1.

C. Furnish A/E with a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

D. Apply welders or welding operators' assigned symbols near each weld they make as permanent record.

E. Notify the A/E a minimum of twenty-four (24) hours in advance of tests, and perform the tests at the work site if practicable.

1.14 PAINTING

A. Refer to architectural painting section for methods and materials.

B. Properly prepare surfaces to receive paint. Prime prepared surfaces and finish with two (2) coats of exterior oil base paint. Verify primer and paint is rated for application.

C. Repair damage to factory painted finishes.

D. Remove splattered and incidental paint from mechanical equipment.

E. Refer to Section 22 05 53 for specific requirements for plumbing systems.

1.15 PILOT INSTALLATION

A. Provide a pilot installation of items of equipment, which are concealed and require service, such as terminal units, fan coil units, and hot water coils.

B. Have pilot installation approved by A/E before further installation work is performed for the particular items of equipment.

1.16 NOISE AND VIBRATION

A. Provide the entire operating system and its component items of equipment free of objectionable vibration or noises. Refer to ASHRAE handbook for recommended Room Criteria (RC), unless otherwise noted.

B. Statically and dynamically balance rotating equipment, and mount or fasten so that no equipment vibration will be transmitted to the building.

C. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts, or other parts of work, rectify such conditions at no additional compensation to the Owner.

1.17 PROTECTIVE GUARDS

A. Provide protective guard for belts, pulleys, gears, couplings, projecting set screws, keys, and other rotating parts, which are located so a person might come in close proximity with.

B. Construct protective guard around angle iron frame, securely bolted to apparatus; comply with safety requirements.

C. Install guard to completely enclose drives and pulleys, and not interfere with lubrication of equipment. Provide a minimum two inch (2”) diameter opening in fan belt guards housing for tachometer.

1.18 OPERATING INSTRUCTIONS

A. Provide services of authorized representatives of manufacturer to ensure that the equipment is installed according to the manufacturer's recommendations, is operating properly, and to instruct Owner's operating personnel during start-up and operating tests of complete mechanical systems.

B. Prove operation of equipment to A/E.

C. Notify A/E a minimum of seven (7) days prior to beginning equipment start-up.

D. Certify in writing that these services have been performed.

E. Perform tests as specified in Section 22 05 93.

1.19 PROJECT RECORD DOCUMENTS

A. Maintain a set of Contract Documents at the job site for the purpose of recording final size, location, and interrelation of work under this Division. Mark this set of drawings as the job progresses to indicate "AS-BUILT" location of everything installed on the project, including, but not limited to, concealed piping, valves, and ductwork.

B. Contractor to record all as-built conditions by use of AUTOCAD 2000 or later. After as-built conditions have been recorded, provide reproducible “Record Drawings” for delivery to Owner.

C. Clearly and accurately delineate the work by dimensions on the record drawings as installed, with equipment locations identified by at least two (2) perpendicular dimensions to permanent structures.

D. Final reproducible record drawings shall be marked "AS-BUILT," and signed and dated by Contractor. Contractor shall certify drawings are complete and reflect actual conditions. In addition, provide final AUTOCAD record drawing files to Owner on compact disc, clearly labeled with written index attached.

1.20 FINAL REVIEW

A. Obtain necessary Certificates of Occupancy from local authorities.

B. Submit final approved operation and maintenance manuals including approved submittals, test reports, and "AS-BUILT" drawings prior to requesting final payment.

C. Delivery of operation and maintenance manuals is a condition of final acceptance. Review to Section 01 78 23.12 for additional information.

1.21 GUARANTEE

A. Guarantee materials, parts, and labor for Work for one (1) year (unless specified for a longer period elsewhere in the Contract Documents) from the date of final acceptance by the owner. During that period, make good faults or imperfections that may arise due to defects or omissions in materials or workmanship with no additional compensation and as directed by A/E.

B. Certain items of equipment, such as small sealed refrigeration units, are covered by the manufacturer's warranty of longer durations. Refer to individual Sections for additional requirements and extended coverage.

1.22 CLEANUP

A. Provide ongoing site cleanup during course of work to maintain clean working environment. Do not allow trash and debris to accumulate at site.

B. Final Cleanup: Place plumbing systems in complete working order, clean and polish fixtures, equipment, and materials thoroughly returning to "as new" condition prior to request for final review. Remove excess material and debris. Clean out lines and fittings and adjust valves. Mop clean areas. Thoroughly clean outside of piping and equipment before grilles are installed.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

A. Provide access doors in walls, floors, and ceilings to permit access to equipment and piping requiring service or adjustment to include:
1. Valves.
2. Manual balance dampers and automatic control dampers.
3. Fire dampers, smoke dampers and smoke/fire dampers.
4. Air terminal units.
5. Duct mounted filters and coils.
6. Plumbing drainage cleanouts.
7. Kitchen hood exhaust ductwork, in accordance with NFPA requirements.
8. Other mechanical equipment indicated in mechanical equipment schedules requiring maintenance, adjustment, or operation.

B. Provide hinged access doors and frames as follows:
1. Drywall Construction:
   a. Provide with concealed spring hinges and flush screwdriver operated cam locks in sufficient number of the size of the panel. Factory prime paint surfaces not galvanized.
   b. Product: Milcor, "Style DW".
   c. Fire Rated: Milcor, "Style CFRAD".
2. Visible Masonry and Ceramic Tile: Milcor, "Style M/MS".
3. Gypsum and Cement Plaster: Milcor, "Style K".
4. Acoustic Plaster:
   a. Reinforce panel as required to prevent sagging. Provide continuous steel piano type hinge for the length of the panel, and sleeved and grommeted screwdriver operated cam locks in sufficient number for the size of the panel. Factory prime paint surfaces not galvanized.
   b. Product: Milcor, "Style AP".
5. Acoustic Tile: Milcor, "Style AT".

C. Provide continuous concealed hinges and cam locks.

D. Provide UL listed 1-1/2 hour Label "B" access doors with automatic self-closing latching mechanism where required.

E. Provide removable ceiling access tile section immediately adjacent to each mechanical or electrical device located in the ceiling plenum above removable tile ceiling.

F. Coordinate approval and location of access doors with A/E.

PART 3 - EXECUTION

3.1 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in location of equipment and material. Do not provide equipment or material, which is not suitable in this respect.

B. Make changes in equipment location of up to three feet (3'), to allow for field conditions prior to actual installation, and as directed by the A/E.

C. Conceal piping and ductwork in finished areas, except in mechanical rooms, and where noted otherwise on the drawings. Route pipes and ducts through the building without interfering with other contractors' equipment or construction.

D. Provide maximum possible clear height underneath piping and ductwork.

E. Install equipment requiring service so that it is easily accessible.

F. Compare the equipment sizes with the space allotted for installation before installation and make written notice of possible conflict. Disassemble large equipment to permit installation through normal room openings when required. Should written notice not be made in a timely manner, make adjustments and modifications necessary without additional compensation.

G. Timely place equipment too large to fit through finished openings and stairways.

3.2 SITE OBSTRUCTIONS

A. Drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed as to accuracy of location or completeness of information.

B. Verify with A/E, utility companies, municipalities, and other interested parties that available information has been provided before cutting or trenching operations are begun. Verify locations given.

C. Should obstruction be encountered, alter routing of new work, whether or not shown on Drawings. Reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

D. Assume total responsibility for and repair damage to existing utilities caused by construction, whether or not such existing facilities are shown. Repair the lines, if damaged.

3.3 CUTTING AND PATCHING

A. Submit written request to A/E in advance of cutting or alterations.

B. Execute cutting and demolition by methods that prevent damage to other work and provide proper surfaces to receive installation of repairs.

C. Restore work which has been cut or removed; install new products complying with specified products, functions, tolerances, and finishes specified.

D. Escutcheon Plates: Heavy chrome-plated or nickel-plated escutcheon plates for penetrations of finished surface equal to a B&C No. 10 escutcheon plate with concealed hinges.

E. Fit work airtight to pipes, sleeves, ducts, and other penetrations through surfaces. For fire-rated penetrations, provide assemblies in accordance with UL 1479 and ASTM E 814 utilizing products and materials equal to rating of surfaces penetrated.

3.4 EXCAVATION

A. Trenching:

1. Perform all excavating of every description and of whatever substance encountered to depths indicated or specified. Pile materials suitable for backfilling a sufficient distance from banks of trenches to prevent slides or cave-ins. Comply with OSHA requirements for excavation, trenching and shoring. Pile excavated material suitable for backfilling on one side only of trenches in such a manner as to permit ready access to and use of existing fire hydrants, valves, manholes and other utilities system apparatus and a sufficient distance from banks of trenches to prevent slides or cave-ins. Keep surface drainage of adjoining areas unobstructed. Discard all excavated materials deemed not required or unsatisfactory for backfill. Remove water by pumping or other approved methods, and discharge at a safe distance from the excavation.

2. Provide trenches of necessary width for proper installation of piping and materials that comply with latest publication of OSHA 2226, "Excavating and Trenching Operations" be not less than twelve inches (12”) wide. Coordinate trench excavation with pipe installation to avoid open trenches for prolonged periods. Accurately grade bottoms of trenches to provide uniform bearing and support for each section of pipe on undisturbed soil or new, compacted bedding material (as specified hereinafter) at every point along its entire length.

3. When excavating for manholes and similar structures, provide a minimum twelve inches (12”) between outer surfaces the structure and the embankment or shoring. Remove unstable soil that is incapable of supporting the structure in the bottom of the excavation to the depth necessary to obtain design bearing.

4. Material to be excavated is "unclassified." No adjustment in the contract price will be made due to the presence or the absence of rock, shale, masonry, or other materials.

5. Protect existing utility lines that are to be retained where their locations are indicated or the locations of which are made known prior to excavating and trenching. Protect utility lines constructed during the excavating and trenching operations from damage during excavating, trenching and backfilling; if damaged, repair lines as directed by the utility company, Owner, and A/E. Issue

notices when utility lines that are to be removed within the area of operations in ample time for the necessary measures to be taken to prevent interruption of the service.

6. Provide trenches for the underground utilities indicated on the Contract Documents of a depth that will provide sufficient cover over the installed utilities but not less than the following minimum amount of cover from existing grade or from indicated finish grades, whichever is deeper:

   a. One foot (1') minimum cover for sanitary sewer piping, storm drainage piping, industrial waste piping, and acid waste piping not installed under pavement. Under pavement, provide a minimum of two feet (2') of cover for sanitary sewer piping, storm drainage piping, industrial waste piping, and acid waste piping.

   b. Two feet (2') minimum cover for chilled water piping, heating hot water piping, steam piping, condensate piping, domestic water piping, and fire piping.

   c. Depth of cover is measured from top of the outermost surface (e.g. insulation jacket) of the piping system.

B. Backfilling:

1. Prior to installation of the utilities, provide a setting bed of sand in the trench at a minimum depth of six inches (6") that is compacted by mechanical means to ninety-five percent (95%) of the maximum soil density as determined by ASTM D 698.

2. All piping, fittings, joints, jacket integrity, etc. shall be fully tested and approved prior to any backfilling of the trench.

3. For trenches that cross under streets, driveways, building slabs, or other pavements, backfill utility line trench with sand backfill material in six inch (6") layers up to within twelve inches (12") from the finished grade (less the pavement thickness) but not less the minimum cover listed hereinbefore. Moisten each layer and compact to ninety-five percent (95%) of the maximum soil density as determined by ASTM D 698. Accomplish backfilling in such a manner as to permit the rolling and compaction of the filled trench with the adjoining material to provide the required bearing value so that paving of the area can proceed immediately after backfilling is complete. For all other trenches, backfill with sand to provide a minimum of twelve inches (12") of sand cover over the utilities.

4. Backfill remainder of trenches with satisfactory materials consisting of earth, loam, sandy clay, sand, and gravel, or soft shale that is free from large clods of earth and/or stones over one and one-half inch (1-1/2") in diameter. Backfill material shall be deposited in maximum nine inch (9") high layers (loose depth) while taking care not to damage utility lines. Each layer of backfill materials in the trench shall be compact by mechanical means to the soil density specified hereinbefore.

5. The contractor shall open any trenches and/or excavation pits found to be improperly backfilled or where settlement occurs. The effected trenches and/or excavation shall be opened to the depth required to obtain the specified compaction. The contractor shall then backfill and compact the excavation as

specified hereinbefore with the surface restored to the required grade and compaction.

3.5 SERVICE

A. Inspect, clean, and service strainers and air filters immediately prior to final acceptance of project. Replace disposable type air filters.
B. Provide lubrication for operation of equipment until final acceptance of the equipment by A/E.
C. Protect bearings during installation and thoroughly grease steel shafts to prevent corrosion.
D. Provide extended lubrication lines for parts requiring lubrication that are concealed or inaccessible.

END OF SECTION 220500

SECTION 220719

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Thermal insulation for plumbing piping systems including jackets and accessories.

1.2 REFERENCES

A. City of Houston Commercial Energy Conservation Code.

B. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM C165 – Test Method for Measuring Compressive Properties of Thermal Insulation.

D. ASTM C168 – Terminology Relating to Thermal Insulating Materials.

E. ASTM C195 – Specification for Mineral Fiber Thermal Insulating Cement.

F. ASTM C335 – Test Method for Heat Transfer Properties of Horizontal Pipe Insulation.

G. ASTM C411 – Test Method for Hot-Surface Performance of High Temperature Thermal Insulation.

H. ASTM C461 – Test Methods for Mastics and Coatings Used With Thermal Insulation.

I. ASTM C518 – Standard Test Method for Steady0State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

J. ASTM C533 – Specification for Calcium Silicate Block and Pipe Thermal Insulation.

K. ASTM C534 – Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

L. ASTM C547 – Specification for Mineral Fiber Pipe Insulation.

M. ASTM C585 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

N. ASTM C591 – Specification for Un-faced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

O. ASTM C795 – Specification for Thermal Insulation for Use in Contact With Austenitic Stainless Steel.

P. ASTM C921 – Jackets for Thermal Insulation.

Q. ASTM C1104 – Test Method for Measuring Water Vapor Sorption of Fibrous Thermal Insulation Materials.

R. ASTM C1126 – Specification for Faced or Un-faced Rigid Cellular Phenolic Thermal Insulation.

S. ASTM C1136 –Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

T. ASTM C1338 – Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

U. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

V. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

A. Manufacturer's product data to include the following:
1. Application Company Qualifications.
2. Product descriptions.
3. Provide a table indicating piping system, insulation type, density, and thickness for each type of piping system in the project.
4. Manufacturer's installation instructions.

B. Submit product data for:
1. Pipe insulation.
2. Pipe insulation jackets.
3. Adhesives.
4. Sealants.
5. General materials.

C. Refer to section 01 33 29 for shop drawing and submittal preparation and submission requirements.

1.4 CLOSEOUT SUBMITTAL

A. Submit Operation and Maintenance Manuals for the project in accordance with section 01 78 23.12.

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1.5 QUALITY ASSURANCE

A. Application Company Qualifications: The installing company must be in the business of insulation installation for the previous consecutive five year period. The installing company must also be regularly engaged in installing the specific specified insulation material types on projects of equal or greater magnitude and scope as this project for the previous consecutive five-year period.

B. Application Personnel Qualifications: The installing company must provide qualified installation personnel on this project jobsite directly employed by them who are skilled and proficient at installing the specific specified insulation material types.

C. All materials (to include, but not be limited to, insulation, jackets, facings, coatings, mastics, adhesives, sealants, etc.) installed inside the building must have a certified and tested composite flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Armacell (Type P4)

B. Certainteed Corporation (Type P2).

C. ITW (Type P5).

D. Johns Manville Corporation (Type P2 / Type P3).

E. K-Flex (Type P2)

F. Knauf (Type P2).

G. Kingspan Corporation (Type P1 / Type P5).

H. Owens-Corning (Type P2).

I. Pittsburgh Corning (Type P6).

J. Resolco (Type P1).

2.2 PIPING INSULATION MATERIALS

A. Type P1: Rigid Phenolic Kingspan Corporation, Koolphen K", ", Resolco Insul-Phen").
   1. Specification Compliance: ASTM C1126, Type 3, ASTM C795.
   2. 'K' Value: 0.13 BTU x in. / (hr. x ft^2 x ˚F) at 75 ˚F (ASTM C518).
   3. Maximum Service Temperature: 225 degrees-F.
   4. Factory Vapor Retarder Jacket: ASJ (All-Service Jacket) facing (ASTM C1136 – Type 1).

B. Type P2: Mineral Fiber ("Fiberglass").
1. Specification Compliance: ASTM C547, Type 1.
2. 'K' Value: 0.23 BTU x in. / (hr. x ft^2 x ˚F) at 75 ˚F (ASTM C335).
3. Maximum Service Temperature: 800 degrees-F.
4. Factory Vapor Retarder Jacket: ASJ (All-Service Jacket) facing (ASTM C1136 – Type 1).

C. Type P3: Hydrous Calcium Silicate.
1. Specification Compliance: ASTM C533, Type 1
2. 'K' Value: 0.41 BTU x in. / (hr. x ft^2 x ˚F) at 200 ˚F (ASTM C518).
3. Maximum Service Temperature: 1200 degrees-F.
4. Factory Vapor Retarder Jacket: None.

D. Type P4: Flexible Elastomeric (Armacell "Armaflex®", K-Flex USA "K-Flex® LS")
1. Specification Compliance: ASTM C534, Type 1
2. 'K' Value: 0.27 BTU x in. / (hr. x ft^2 x ˚F) at 75 ˚F (ASTM C518).
3. Maximum Service Temperature: 220 Degrees-F.
4. Factory Vapor Retarder Jacket: None.

E. Type P5: Polyisocyanurate (ITW "Trymer", Kingspan "Nilflam").
1. Specification Compliance: ASTM C591, Type 1
2. 'K' Value: 0.16 BTU x in. / (hr. x ft^2 x ˚F) at 75 ˚F (ASTM C177).
3. Maximum Service Temperature: 300 Degrees-F
4. Factory Vapor Retarder Jacket: ASJ (All-Service Jacket) facing (ASTM C1136 – Type 1).
5. Note: Does not meet Smoke Developed requirement of less than 50 when tested in accordance with ASTM E84. Use for outdoor systems only.

F. Type P6: Cellular Glass (Pittsburg Corning "Foamglas").
1. Specification Compliance: ASTM C552.
2. 'K' Value: 0.29 BTU x in. / (hr. x ft^2 x ˚F) at 75 ˚F (ASTM C177).
3. Maximum Service Temperature: 900 Degrees-F.
4. Factory Vapor Retarder Jacket: ASJ (All-Service Jacket) facing (ASTM C1136 – Type 1).
5. Water Vapor Permeability: 0.00 perm-in. (ASTM E96).

2.3 INSULATION ACCESSORIES

A. Pipe Support Inserts:
1. Block Insert: Type P1, Rigid Phenolic inserts with a minimum density of five pounds per cubic foot (5.0 lbs. /cu. ft.).
2. Support Shield: Minimum sixteen (16) gauge galvanized steel metal support shield with an inside diameter equal to the outside diameter of the pipe and insulation that covers the bottom 180 degrees of the bottom of the piping and insulation.

B. Jackets:
1. Factory vapor retarder jacket as specified above.

2. PVC Jackets: One piece, pre-molded type, to meet flame spread and smoke developed rating of 25/50 in accordance with ASTM E 84. Sealed with PVC cement.
3. Canvas Jackets: UL listed treated cotton fabric, six (6) ounces per square yard.
4. Metal Jackets: [ASTM B 209 Aluminum; 0.020 inch thick; smooth finish][Type 304 stainless steel; 0.010 inch thick; smooth finish] with factory applied moisture barrier.
5. Metal Jacket Bands: Three-eighths inch (3/8") wide; [0.015 inch thick aluminum][0.010 inch thick stainless steel] to match jacket.

C. Adhesives:
1. Adhesives shall conform to ASTM C916 and ASTM E84.
2. Lagging Adhesive: Suitable for bonding fibrous glass cloth to faced and un-faced insulation or for bonding fibrous glass insulation to metal surfaces. Provide products suitable for type of insulation being used.
3. Contact Adhesive: Neoprene based, rubber based, or elastomeric type. Adhesive shall not adversely affect, at any time, the insulation to which it is applied. Adhesive shall not emit any odors or toxic chemicals after drying. Solvent dispersing mediums shall not contain benzene or carbon tetrachloride.
4. Provide products suitable for type of insulation being used.

D. Vapor Retarder Mastic Coating:
1. Water-based, flexible, high solids vapor barrier finish.
2. Appropriately selected for indoor or outdoor application.
3. Color: White.
4. Vapor Permeance: 0.013 perms at 43 mils dry, as determined according to procedure B of ASTM E96.
5. Suitable for service temperature of pipe.

E. Joint Sealant/Vapor Stop:
1. Butyl polymer type, styrene-butadiene rubber type or butyl type.
2. Maximum vapor transmission of 0.02 perms.
3. Combustibility: Negligible.

F. Cements:
1. Mineral fiber insulation cement shall conform to ASTM C195.
2. Finishing Cement: ASTM C449 mineral fiber hydraulic setting thermal insulating and finishing cement.

G. Fibrous Reinforcing Glass Cloth and Glass Tape:
1. Mesh Size: 20x20.
2. Tape Size: Four inch (4") wide rolls.
3. Class 3 tape shall be 4.5 ounces per square yard.

H. Caulking: ASTM C920, Type S, Grade NS, Class 25, Use A.

I. Insulation Bands: Three-quarters inch (3/4") wide, minimum twenty-six (26) gauge [stainless steel][aluminum].

PART 3 - EXECUTION

3.1 PREPARATION

A. Thoroughly clean all surfaces to be insulated as required to remove all oil, grease, loose scale, rust, and foreign matter.

B. Piping must be completely dry at the time of application. The installation of piping insulation associated with an operating chilled water system is strictly prohibited.

C. PROVIDE PRIMER COAT ON ALL PIPING, TO INCLUDE FIELD WELDS AND OVER FACTORY APPLIED PAINT/COATING. Refer to Mechanical identification Section of the Specifications. Primer paint shall be approved by the insulation manufacturer for installation contact with their insulation type. Painting must be completed and approved by the Engineer prior to installation of insulation.

D. Install insulation material only after all performance tests on piping have been completed and approved by the Engineer.

3.2 INSTALLATION

A. Any materials found by the Architect/Engineer (A/E) to be improperly installed or not installed in total compliance with the specific installation instructions and methods (written or implied) of the material manufacturer, must be removed by the installing company. The preparation instructions must be followed prior to the re-installation of the insulation material using the correct installation instructions and methods of the material manufacturer.

B. The insulation shall be installed only after the piping testing has been successfully completed and the heat tracing is installed, tested and found to be properly installed and operating, if piping is indicated to be heat traced.

C. Install materials in complete and total compliance with the specific manufacturer's installation instructions and the following instructions. The piping systems to be insulated shall be fully insulated with all insulation materials tightly butted with no gaps or air space.

D. Wherever possible, the insulation shall have a factory applied flexible, ASJ vapor retarder as specified above. Where it is necessary to field apply the vapor retarder, insulation without an ASJ jacket shall be secured with a fiber-reinforced strapping tape, and apply a vapor retarder mastic and fabric system.

E. Apply three inch (3”) wide matching butt strips to all circumferential joints with a fifty percent (50%) overlap. For pipes greater than twelve inch (12”) diameter, apply strips on twelve inch (12”) centers.

F. Continue vapor barrier through wall and floor penetrations.

G. In exposed piping, locate insulation and cover seams in least visible locations.

H. Insulate fittings, valves, flanges and strainers to the same thickness as the pipe. Allow space for flange and valve bolt removal without disturbing the pipe insulation. Provide vapor retarder mastic end caps on valve/fitting and pipe interface where insulation "steps up" to a different level.

I. Fittings, valves, and strainers shall be insulated with two (2) piece (split along the length of fitting) factory fabricated preformed insulation matching pipe insulation. Where formed pieces are unavailable or impractical, fabricate with mitered segments (minimum four (4) equal segments) in accordance with ASTM C450 utilizing insulation equal to the insulation applied to the adjoining piping. Insulation "diapers" are not acceptable (NO EXCEPTIONS).

J. On flexible connections, expansion joints, and unions, bevel and seal ends of insulation and apply a continuous seal a minimum of four inches (4") along the piping.

K. On insulated domestic water piping conveying fluids between 100 degrees F and 140 degrees F, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation at such locations. Apply a continuous seal a minimum of four inches (4") along the piping.

L. Provide an insert of same thickness and contour as adjoining insulation, between support shield and piping, and under the finish jacket, to prevent insulation from sagging at support points. Provide inserts and shields as detailed on the Drawings. Insulating insert material shall be high-density phenolic foam insulation as described hereinbefore with a minimum density of five pounds per cubic foot (5.0 lbs./cubic feet) that is a minimum of six inches (6") longer that the metal pipe shield. It shall be suitable for the planned temperature range. Factory fabricated inserts with integral galvanized pipe saddles are recommended. Adhere pipe support shield to insulation with adhesive.

M. Neatly finish and seal all insulation at supports, protrusions and interruptions. Insulation shall extend a minimum of three (3) times the insulation thickness along the protrusion. Maintain vapor barrier with finish coat.

N. All terminations shall be sealed with a vapor retarder mastic and fabric system. Mastic shall extend onto the pipe and vapor retarder.

O. Insulate tubing from trap primers and trap primer manifolds to floor drains per the insulation specified for domestic cold water piping.

P. All gauge cocks, temperature/pressure taps, thermometer wells, etc. shall be fully insulated with closed cell flexible insulation with all joints sealed vapor tight. Insulation shall be applied tightly to the device piping with no gaps.

Q. On all cold water piping (lower than ambient) where piping is interrupted by fittings, flanges, valves, or hangers, and at intervals not exceeding twenty-one feet (21') on continuous runs, an insulation isolation seal shall be formed between the vapor barrier jacket and the bare pipe by liberal applications of Foster 30-35 flexible vapor barrier joint sealant to the ends of the pipe insulation. This seal requirement is in addition to regular joint vapor seal specified hereinbefore. The seal location shall be identified by an orange color three -quarters inch (¾") wide press-tite tape around the circumference of the

insulation on field insulated piping. The Engineer shall select at least four (4) locations in the insulation that the completed seal procedure will be reviewed. Inspected seal area shall be resealed after review.

R. All piping exposed to outside shall have metal jackets applied over the insulation with the joints on the bottom of the piping.

S. If grooved piping is utilized, the insulation contractor shall provide factory, pre-molded insulation fittings specifically constructed to tightly fit over coupling, fittings, etc. Insulation diapers or other methods of insulating the fittings are not acceptable.

3.3 Apply insulation according to the insulation application and thickness schedule below.

Pipe Insulation Material Application and Thickness Schedule				
Piping Application	**Insulation Type****	**Insulation Density (lbs. per cu. ft.)**	**Nominal Pipe Size (in.)**	**Insulation Thickness (in.)**
Indoor – Concealed **Jacket: Factory ASJ**				
Cold Condensate	P1	2.2	All Sizes	3/4
Domestic Cold Water	P2	3.0	1-1/2 and Smaller	1-1/2
			2 through 4	2
			6 and Larger	2
Domestic Hot Water	P2	3.0	1-1/2 and Smaller	1-1/2
			2 through 4	2
			6 and Larger	2
Roof/Overflow Drains and Cold Condensate Drains*	P2	3.0	2 through 4	1
			6 and Larger	1

Pipe Insulation Material Application and Thickness Schedule				
Piping Application	**Insulation Type****	**Insulation Density (lbs. per cu. ft.)**	**Nominal Pipe Size (in.)**	**Insulation Thickness (in.)**
Indoor – Exposed **1- Finished Space: Factory ASJ – Painted according to Architect's Instructions** **2- Exposed in Mechanical Room or Unfinished Space:** **a) 6'-0" AFF or higher: Factory ASJ** **b) Below 6'-0" AFF: Factory ASJ with Canvas and Finishing Cement, or PVC, or Metal Outer Jacket** **3- Central Plant/Machinery Room** **a) 6'-0" AFF or higher: Factory ASJ** **b) Below 6'-0" AFF: Factory ASJ with Canvas and Finishing Cement, or Metal Outer Jacket**				
Cold Condensate	P1	2.2	All Sizes	1
Domestic Cold Water	P1	2.2	1-1/2 and Smaller	1
			2 through 4	1
			5 and Larger	1
Domestic Hot Water	P1	2.2	1-1/2 and Smaller	1
			2 through 4	1
			6 and Larger	1
Roof/Overflow Drains and Cold Condensate Drains*	P1	2.2	2 – 4	1
			6 and Larger	1
Outdoor and Unconditioned Indoor **Jacket: Factory ASJ Jacket with Metal Outer Jacket.**				
Domestic Cold Water	P1	2.2	4 and Smaller	1
			6 and Larger	1
Domestic Hot Water	P1	2.2	4 and Smaller	1
			5" and Larger	1

* Includes underside of all roof/overflow drain bodies and related horizontal roof drain lines up to and three feet (3') past the first turn down elbow, and all floor drain bodies and related horizontal sanitary drain lines over to the vertical riser above occupied areas which receive cold condensate drainage or refrigerated drinking fountain drainage.

** Where multiple insulation types are listed for a service, any of those listed may be used for that service. Where multiple thicknesses are listed – they correspond to the position of the insulation type before and after the "/" symbol.

END OF SECTION 220719

SECTION 221116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Domestic water piping, including valves and fittings.

B. Miscellaneous apparatus attached to plumbing piping systems.

1.2 REFERENCES

A. ASME A112.26.1M - Water Hammer Arresters.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

D. ASSE 1011 - Hose Connection Vacuum Breakers.

E. ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.

F. ASSE 1019 - Wall Hydrants, Frost-Proof Automatic Draining Anti-Backflow Types.

G. ASTM A 47 - Ferritic Malleable Iron Castings.

H. ASTM A 53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

I. ASTM A 234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

J. ASTM B 32 - Solder Metal.

K. ASTM B 88 - Seamless Copper Water Tube.

L. ASTM B 306 - Copper Drainage Tube (DWV).

M. AWS A5.8 - Brazing Filler Metal.

N. AWWA C111 - Rubber Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings.

O. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

P. AWWA C606 - Grooved and Shouldered Joints.

Q. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

R. PDI WH-201 - Water Hammer Arresters.

1.3 SUBMITTALS

A. Include data on pipe materials, pipe fittings, and special fabricated items.

B. Include component sizes, rough-in requirements, service sizes and finishes for specialties.

C. Refer to Section 01 33 29 for additional shop drawing and submittal preparation and submission requirements.

1.4 CLOSEOUT SUBMITTALS

A. Submit Operation and Maintenance (O&M) Manuals for the project in accordance with Section 01 78 23.12.

1.5 QUALITY ASSURANCE

A. For each product specified, provide components by same manufacturer throughout project.
B. All piping, valves, fittings, and accessories utilized in domestic water system shall be "lead-free" construction and certified as such.

PART 2 - PRODUCTS

2.1 WATER PIPING

A. Below Grade Beyond Five Feet (5') of Building:
   1. Cast Iron Piping: AWWA C151.
      a. Fittings: Ductile or gray iron, standard thickness.
      b. Joints: AWWA C111, rubber gasket with 3/4-inch diameter rods.
   2. Copper Tubing: ASTM B 88, Type K, hard drawn.
      a. Fittings: ASME B16.18 cast bronze or ASME B16.22 wrought copper or bronze.
      b. Joints: AWS A5.8 BCuP silver braze (lead free).

B. Below Grade Within Five Feet (5') of Building:
   1. Pipe Two Inches (2") and Smaller; Copper Tubing: ASTM B 88, Type K, annealed.
      a. Fittings: None.
      b. Joints: AWS A5.8 BCuP silver braze (lead free).
   2. Pipe Over Two Inches (2"); Copper Tubing: ASTM B 88, Type K, hard drawn.
      a. Fittings: ASME B16.18, cast bronze or ASME B16.22, wrought copper and bronze.
      b. Joints: AWS A5.8 BCuP silver braze (lead free).

C. Above Grade:

1. Pipe Two and one-half Inches (2-1/2") and Smaller; Copper Tubing: ASTM B 88, Type L, hard drawn.
   a. Fittings: ASME B16.18, cast bronze, or ASME B16.22 wrought copper and bronze.
   b. Joints: ASTM B 32, solder, Grade 95TA (lead free).
2. Pipe Over Two and one-half Inches (2-1/2"):
   a. Galvanized Steel Pipe: Seamless ASTM A 53, Schedule 40.
      1) Fittings: Cast iron.
      2) Joints: Grooved mechanical couplings.
   b. Copper Tubing: ASTM B 88, Type K, hard drawn.
      1) Fittings: ASME B16.18, cast bronze or ASME B16.22, wrought copper and bronze.
      2) Joints: AWS A5.8 BCuP silver braze (lead free).

2.2 UNIONS, FLANGES AND COUPLINGS

A. Pipe Two Inches (2") and Smaller:
   1. Ferrous Piping: 150 pounds per square inch gage malleable iron threaded unions.
   2. Copper Tubing: 150 pounds per square inch gage bronze unions with soldered joints.

B. Pipe Over Two Inches (2"):
   1. Ferrous Piping: 150 pounds per square inch gage forged steel slip-on flanges; 1/16-inch thick preformed neoprene gaskets.
   2. Copper Tubing: 150 pounds per square inch gage weld neck bronze flanges; 1/16-inch thick preformed neoprene gaskets.

C. Grooved and Shouldered Pipe End Couplings:
   1. Housing: ASTM A 47, malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction and expansion; steel bolts, nuts and washers; galvanized for galvanized pipe.
   2. Sealing gasket: "C" shape composition sealing gasket.

D. Dielectric Unions:
   1. Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.3 STRAINERS

A. Y-Pattern Strainers:
   1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
   2. Body:
      a. Bronze body with threaded connections for piping two inch (2") and smaller.
      b. Cast iron body with flanged connections and interior lining complying with AWWA C550 or a FDA-approved epoxy coating for piping two and one-half inch (2-1/2") and larger.
   3. Screen: Stainless steel with round perforations, unless otherwise indicated, with perforation sizes as follows:
      a. Piping two inch (2") and smaller: 0.033 inch.
      b. Piping two and one-half inch (2-1/2") up to four inch (4"): 0.045 inch.
      c. Piping six inch (6") and larger: 0.10 inch.
   4. Drain: Factory-installed, hose-end drain valve with cap.

2.4 VALVES (Refer to Section 22 05 23 for valve specifications)

2.5 BACKFLOW PREVENTERS (Refer to Section 22 11 19 for Backflow Preventers specifications)

2.6 ESCUTCHEONS

A. Provide escutcheons at finished surfaces where bare or insulated piping exposed to view passes through floors, walls or ceilings, except in boiler, utility or equipment rooms. Fasten securely to pipe or pipe covering.
B. Refer to Section 22 05 18 for additional requirements.

2.7 PIPE DRAINS

A. Provide three-quarter inch (3/4") drain connection in the low points of the piping with a gate valve or full port ball valve ahead of hose end adapter and cap. Disconnection of supply piping at fixture will be acceptable.

2.8 WATER HAMMER ARRESTERS (Refer to Section 22 11 19 for Water Hammer Arrestor specifications)

2.9 HOSE BIBBS / HYDRANTS (Refer to Section 22 11 19 for Hose Bibb / Hydrants specifications)

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Coordinate forming of floor construction to receive drains to required invert elevations.

3.2 INSTALLATION

A. Install non-conducting, dielectric connections wherever jointing dissimilar materials with valves to isolate the branch piping from the main piping to allow service of the dielectric union.

B. Route piping in orderly manner and maintain gradient.

C. Install piping to conserve building space and not interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Provide clearance for installation of insulation and access to valves.

G. Provide access where valves and fittings are not exposed.

H. Establish elevations of buried piping outside the building to be below "frost line," but not less than eighteen inches (18”).

I. Where pipe support members are welded to structural building framing, each weld shall be scraped and brushed clean to allow for the proper application of one (1) coat of zinc rich primer to the welds.

J. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.

K. Excavate and backfill in accordance with the mechanical general provisions.

L. Install hub and plain end pipe with hub end upstream.

M. Refer to Section 22 05 23 for valve installation requirements.

N. The use of grooved mechanical couplings and fasteners in exposed locations in mechanical equipment rooms are only acceptable they comply with the requirements specified hereinbefore and for insulated systems, the contractor certifies their compliance with the insulation installation requirements for grooved piping systems in Section 22 07 19.

O. Install unions downstream of valves and at equipment or apparatus connections.

P. Install brass male threaded adapters each side of valves in copper pipe system. Sweat solder adapters to pipe.

Q. Slope water piping and arrange to drain at all low points. Provide a valved drain connection with hose end adapter and cap.

R. Install piping parallel with or at right angles to walls unless otherwise shown on drawings.

S. Conceal piping above ceiling, in walls or chases, etc., unless otherwise noted on the drawings.

T. Bending of rigid piping is not permitted, only elbows shall be utilized for a change in direction.

U. All elbows shall be long radius, non-reducing type. The use of reducing fittings, tees, elbows, etc. are not acceptable.

V. Use concentric reducers for changes piping sizes indicated on the drawings. Eccentric reducers shall only be used in locations where they are specifically shown or specified as well as on the suction of pumps as detailed.

W. Temporarily plug or cap open ends of pipe at the end of each work day.

X. Install specialties in accordance with manufacturer's instructions to permit intended performance.

Y. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

Z. Encase exterior cleanouts in concrete flush with grade.

AA. Install water hammer arresters complete with accessible isolation valve.

BB. Install water hammer arresters on hot and cold water lines at the end of each battery of plumbing fixtures and at each plumbing fixture which is located remote from a battery of fixtures, unless noted otherwise on Drawings.

CC. Provide trap primers in cold water lines for traps as shown on Drawings. Tap trap primers off the top of the domestic water supply line.

3.3 SERVICE CONNECTIONS

A. Provide new water service complete with backflow preventer, water meter with by-pass valves and pressure reducing valve, as indicated.

3.4 PIPE TESTING AND CLEANING

A. Refer to Section 22 05 93 for pipe cleaning and testing requirements.

END OF SECTION 221116

SECTION 221316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sanitary drainage and vent piping systems and domestic water piping, including valves and fittings.

B. Miscellaneous apparatus attached to plumbing piping systems.

1.2 REFERENCES

A. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DMV.

B. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

C. ASTM A 47 - Ferritic Malleable Iron Castings.

D. ASTM A 53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

E. ASTM A 74 - Cast Iron Soil Pipe and Fittings.

F. ASTM A 234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

G. ASTM B 32 - Solder Metal.

H. ASTM B 306 - Copper Drainage Tube (DWV).

I. ASTM C 425 - Compression Joints for Vitrified Clay Pipe and Fittings.

J. ASTM C 564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

K. ASTM C 700 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.

L. ASTM D 2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

M. ASTM D 3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings (4 inches to 15 inches).

N. ASTM F 477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

O. ASTM F 679 - Standard Specifications for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings (18 inches to 27 inches).

P. AWS A5.8 - Brazing Filler Metal.

Q. AWWA C606 - Grooved and Shouldered Joints.

R. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

S. CISPI 310 - Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

T. MSS SP-110 - Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

A. Include data on pipe materials, pipe fittings, and special fabricated items.

B. Include component sizes, rough-in requirements, service sizes and finishes for specialties.

C. Refer to Section 01 33 29 for shop drawing and submittal preparation and submission requirements.

1.4 CLOSEOUT SUBMITTALS

A. Submit Operation and Maintenance (O&M) Manuals for the project in accordance with Section 01 78 23.12.

1.5 QUALITY ASSURANCE

A. For each product specified, provide components by same manufacturer throughout project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Drains:
1. Jay R. Smith.
2. Josam.
3. Tyler/Wade.
4. Zurn.
5. Mifab.

B. Cleanouts:
1. Jay R. Smith.
2. Josam.
3. Tyler/Wade.
4. Zurn.
5. Mifab.

C. Trap Primers:
1. Jay R. Smith.
2. Precision Plumbing Products.
3. Watts.

2.2 SANITARY SEWER AND VENT PIPING

A. Below Grade Beyond Five Feet (5') of Building:
1. Cast Iron Piping and Fittings: Hub and spigot ASTM A 74, service weight with ASTM C 564, neoprene elastomeric compression gasket type joints.
2. Vitrified Clay Piping and Fittings: Hub and plain end ASTM C 700, extra strength with ASTM C 425, neoprene elastomeric compression gasket joints.
3. At the contractor's option and if allowable by the owner and local authority having jurisdiction, may utilize the following:
a. PVC Piping and Fittings: Hub and plain end ASTM D 3034 or ASTM F 679, Type SDR 35.
b. Joints: ASTM F 477, elastomeric compression gasket type joints.
4. All joining systems shall be an approved product of the piping system manufacturer.

B. Below Grade Within Five Feet (5') of Building:
1. Cast Iron Piping and Fittings: Hub and Spigot ASTM A 74, service weight with CISPI 301 or ASTM C 564 neoprene elastomeric compression gasket type joints.
2. Cast Iron Pipe and Fittings: Hubless CISPI 301, service weight with ASTM C 564, neoprene elastomeric coupling with stainless steel clamp and shield assembly.
3. At the contractor's option and if allowable by the owner and local authority having jurisdiction, may utilize the following:
a. PVC Piping and Fittings: Hub and plain end ASTM D 3034 or ASTM F 679, Type SDR 35.
b. Joints: ASTM F 477, elastomeric compression gasket type joints.
4. All joining systems shall be the product of the piping system manufacturer.

C. Above Grade:
1. Cast Iron Piping and Fittings: Hub and spigot ASTM A 74, service weight with ASTM C 564, neoprene elastomeric compression gasket type joints.
2. Cast Iron Piping and Fittings: Hubless CISPI 301, service weight with CISPI 310 neoprene elastomeric coupling stainless steel clamp-and-shield assembly.
3. Copper Tubing and Fittings: ASTM B 306, Type DWV with ASME B16.23 cast bronze or ASME B16.29 wrought copper fittings and ASTM B 32, grade 50B solder joints.

2.3 SANITARY PRESSURIZED PIPING (FROM SEWAGE EJECTOR)

A. Below Grade:
1. Piping: Ductile iron, AWWA C151.
2. Fittings: Ductile or gray iron, standard thickness with flanged or grooved ends.
3. Joints: AWWA C111, rubber gasket with three-quarters inch (3/4") diameter rods or mechanical grooved couplings with a synthetic rubber gasket for AWWA pipe, AWWA C606.

B. Above Grade
1. Piping: Galvanized steel ASTM A 53, Schedule 40.
2. Fittings: ASME B16.3, galvanized malleable iron, ASTM A 234 forged steel welding type or pre-grooved cast iron fittings.
3. Joints: Threaded joints for piping up to two inch (2") in size. For piping larger than two inch (2") in size, welded joints or "zero-flex" mechanical joint coupling for grooved piping.

2.4 DRAINS
A. Refer to the Contract Drawings for the specified and scheduled floor drains and floor sinks.

2.5 CLEANOUTS

A. Refer to the Contract Drawings for the specified and scheduled cleanouts.

2.6 ESCUTCHEONS

A. Provide escutcheons at finished surfaces where bare or insulated piping exposed to view passes through floors, walls or ceilings, except in boiler, utility or equipment rooms. Fasten securely to pipe or pipe covering.

B. Refer to Section 22 05 18 for additional requirements.

2.7 TRAP PRIMERS

A. Refer to Section 22 11 19 for trap primer Specifications.

B. For up to two (2) floor drains provide a trap primer equal to a Precision Plumbing Products Model P-2.

C. For three (3) to eight (8) floor drains provide a trap primer equal to a Precision Plumbing Products Model P-1.

D. Provide trap primer distribution unit for more than one drain trap.

2.8 TRAP SEAL PROTECTION

A. Provide flexible trap seal assembly in all drains with P-trap connected to the sanitary system to prevent entrance of sewer gas emissions.

B. Material: Smooth, soft, flexible, elastomeric PVC material molded into the shape of a "duck bill" over a curled closure at the bottom.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Coordinate forming of floor construction to receive drains to required invert elevations.

3.2 INSTALLATION

A. Route piping in orderly manner and maintain gradient.
B. All drains and cleanouts mounted in traffic areas shall have heavy duty, traffic rated grates and bodies.

C. Install piping to conserve building space and not interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Establish elevations of buried piping outside the building to be below "frost line," but not less than eighteen (18) inches.

G. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

H. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.

I. Establish invert elevations, slopes for drainage to one-eighth inch (1/8") per foot (nominally 1 percent) minimum, except the main building sewer line shall slope at one-sixteenth inch (1/16") per foot (1/2 percent), as shown on Drawings. Maintain gradients.

J. Excavate and backfill in accordance with the requirements of Section 22 05 00.

K. Install hub and plain end pipe with hub end upstream.

L. Install piping parallel with or at right angles to walls unless otherwise shown on drawings.

M. Conceal piping above ceiling, in walls or chases, etc., unless otherwise noted on the drawings.

N. Bending of rigid piping is not permitted, only elbows shall be utilized for a change in direction.

O. Temporarily plug or cap open ends of pipe at the end of each work day.

P. Install specialties in accordance with manufacturer's instructions to permit intended performance.

Q. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

R. Encase exterior cleanouts in concrete flush with grade.

S. All horizontal waste stack offsets and elbows (3" and larger) shall be restrained and supported at each joint in the offset piping as well as each joint on both sides elbows using four bolt (two bolts on each side of the clamp) riser clamps and threaded rods across each joint routed between the bolts on each side. At the contractor's option on "no-hub" piping systems, the "Holdrite" restraint system (Series 117) may be substituted for the pipe clamps and all-thread rods for elbow restraints.

T. Provide trap seal protection or trap primer protection to all drains four inch (4") and smaller as indicated on the Contract Documents.

U. Provide trap primer protection to all drains larger than four inch (4").

V. All waste piping and the associated drain body for drains receiving cold condensate shall be fully insulated from the drain body to the vertical waste riser. The insulation and its installation shall comply with Section 22 07 19.

W. The installation of thermoplastic piping for sewer and other gravity flow systems underground shall comply with the requirements of ASTM Standard D2321 and as detail on the drawings.

3.3 SERVICE CONNECTIONS

A. Connect to sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

3.4 PIPE TESTING AND CLEANING

A. Refer to Section 22 05 93 for pipe cleaning and testing requirements.

END OF SECTION 221316

SECTION 224000

COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to Section 22 05 00 for additional requirements.

1.2 SECTION INCLUDES

A. Water closets, urinals, lavatories, sinks, electric water coolers, mop sinks, service sinks, showers, emergency showers, emergency eyewash, and emergency shower/eyewash combination.

1.3 SUBMITTALS

A. Include fixtures, sizes, utility sizes, trim and finishes.

B. Refer to Section 01 33 29 for additional shop drawing and submittal preparation and submission requirements.

1.4 CLOSEOUT SUBMITTALS

A. Submit Operation and Maintenance (O&M) manuals in accordance with Section 01 78 23.12.

1.5 QUALITY ASSURANCE

A. Fixtures: By same manufacturer for each type product specified throughout unless noted otherwise.

B. Trim: By same manufacturer for each product specified throughout unless noted otherwise.

C. All water closets shall be tested in accordance with the MaP Standard to produce a MaP performance score of no less than 800 when combined with the selected flush valves.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver and store fixtures in shipping containers with labelling in place.

B. Handle fixtures with care to insure against breakage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fixtures:

1. Toto.
2. American Standard.
3. Kohler.

B. Fixture Trim:

1. Toto.
2. Chicago.
3. Speakman.
4. T&S.
5. Zurn Industries.

C. Flush Valves:

1. Toto.

D. Water Closet Seats:

1. Church.
2. Kohler.
3. Olsonite.

E. Fixture Carriers:

1. Jay R. Smith.
2. Josam.
3. Tyler/Wade.
4. Zurn Industries.

F. Electric Water Coolers:

1. Halsey Taylor.
2. Haws.
3. Elkay.

G. Mop Sinks:

1. Crane Plumbing, LLC (American Standard Brands)
2. Florestone Products, Inc.
3. Stern-Williams Co., Inc.

H. Emergency Eyewash, Showers, and combination Eyewash/Showers:

1. Bradley.
2. Haws.
3. Speakman.

2.2 Refer to construction documents plumbing fixtures schedule for fixture types and specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Review millwork shop drawings. Confirm location with architectural drawings and size of fixtures and openings before rough-in and installation.

B. Verify adjacent construction is ready to receive rough-in work of this Section.

3.2 INSTALLATION

A. Install each fixture with trap, unless noted otherwise on the drawings, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall carriers and bolts.

E. Seal fixtures to wall and floor surfaces with sealant as specified in Division 7 - Waterproofing; color to match fixture.

F. Mount fixtures to the following heights above finished floor:

1. Water Closet:
   a. Standard: Fifteen inches (15") to top of bowl rim.
   b. Handicapped: Seventeen inches (17") to nineteen inches (19") to top of seat.
2. Urinal:
   a. Standard: Twenty-four inches (24") to top of bowl rim.
   b. Handicapped: Seventeen inches (17") to top of bowl rim.
3. Lavatory Wall-Hung:
   a. Standard: Thirty-one inches (31") to top of bowl rim.
   b. Handicapped: Thirty-four inches (34") to top of bowl rim.
4. Electric Water Cooler:
   a. Standard: Forty inches (40") to top of basin rim.
   b. Handicapped: Thirty-six inches (36") to spout.
5. Water Closet Flush Valves:
   a. Eleven inches (11") minimum above bowl rim.
   b. Orient away from adjacent wall at handicapped water closets.

3.3 ADJUSTING AND CLEANING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

B. At completion, clean plumbing fixtures and equipment.

C. Solidly attach water closet carrier feet to floor with all screws, as recommended by manufacturer.

END OF SECTION 224000

SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Except as modified in this section, General Conditions, Supplementary Conditions, applicable provisions of Division 01, General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 23.

B. Each section included in Division 23 is incomplete without the provisions stated herein.

1.2 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

A. Access Doors

1.3 RELATED SECTIONS

A. Section 01 33 30 – Submittal Procedures for HVAC.

B. Section 01 78 23.13 – Operations and Maintenance Data for HVAC.

C. Section 21 05 53 – Identification of HVAC Piping and Equipment.

D. Section 21 05 93 – Testing, Adjusting and Balancing for HVAC.

1.4 REFERENCES

A. ASME B31.1 – Power Piping.

B. ASME BPVC, Section IX – Boiler and Pressure Vessels Code – Section IX – Welding and Brazing Qualifications.

C. ASTM D 698 – Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. Ft. (600kN-m/cu. M)).

D. ASTM E 814 – Fire Tests of Through-Penetration Fire Stops.

E. IEEE C2 - National Electrical Safety Code.

F. UL 1479 – Fire Tests of Through-Penetration Firestops.

1.5 DEFINITIONS

A. Provide: Where the word “provide” is used, the word shall be understood to mean “the Contractor shall furnish and install”, the equipment, tests, inspections, etc. referenced.

B. Concealed: Where the word "concealed" is used in conjunction with piping, ductwork, equipment, and the like, the word shall be understood to mean hidden from sight as in chases, furred spaces, within walls, or above suspended ceilings.

C. Exposed: Where the word "exposed" is used in conjunction with piping, ductwork, equipment, and the like, the word shall be understood to mean open to view, as in mechanical equipment rooms, and outside the building.

D. Interior: Where the word "interior" is used in conjunction with piping, ductwork, equipment, and the like, the word shall be understood to mean inside the building envelope.

E. Exterior: Where the word "exterior" is used in conjunction with piping, ductwork, equipment, and the like, the word shall be understood to mean outside the building envelope. "Exterior exposed" shall refer to piping, ductwork, equipment, and the like, that is outside the building envelope and exposed to the weather. "Exterior covered" shall refer to piping, ductwork, equipment, and the like, that is outside the building envelope and is in some way covered or protected from the weather but not necessarily from extremes of heat and cold.

1.6 SUBMITTALS

****

A. Access Doors: Furnish product data and shop drawings. Indicate detailed dimensions.
B. The contractor shall prepare shop drawings and product data for the project HVAC systems.

C. Refer to Section 01 33 30, "Submittal Procedures for HVAC" for additional submittal requirements.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and tag numbering in a copy of the project "Revit" model.

B. Operation and Maintenance Data: Refer to Section 01 78 23.13, "Operations and Maintenance Manuals for HVAC" for preparation requirements.

1.8 REGULATORY REQUIREMENTS

A. Perform work in accordance with the editions, revisions, amendments, or supplements of applicable statutes, ordinances, codes, or regulations of Federal, State, and Local Authorities having jurisdiction in effect on the date bids are received.

B. Where approval standards have been established by OSHA, UL, ASME, ASTM, AGA, AMCA, ANSI, ASHRAE, ARI, NFPA, State Fire Insurance Regulatory Body, and FM, follow these standards whether or not indicated on the Drawings and Specifications. Include cost of work required to comply with requirements of these authorities in the original proposal. Comply with IEEE C2 where applicable.

C. Requirements in reference specifications and standards are minimum for equipment, material, and work. In instances where capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet scheduled or specified capacities.

D. Resolve code interpretations discovered in Contract Documents with Architect / Engineer (A/E) prior to Contract award. After Contract award, make corrections or additions necessary for compliance with applicable codes.

E. Arrange with local and state authorities and utility companies for permits, fees, and service connections for temporary and permanent water, sanitary sewer, storm and industrial waste services, verifying locations and arrangement, and pay charges including inspections.

1.9 CONTRACT DRAWINGS

A. Drawings are generally diagrammatic and are intended to encompass a system that will not interfere with the structural and architectural design of the building. Coordinate work to avoid interferences between piping, equipment, architectural, and structural work.

B. Coordinate with architectural features, trim and millwork details, and install equipment in cabinets or other special areas as directed by A/E.

C. Horsepower ratings on motors are based on scheduled equipment and design conditions. Actual field condition or substitutions from scheduled equipment may require different horsepower. If larger motor sizes are required, coordinate electrical service to ensure proper wire sizes and devices.

D. Provide valves, stopcocks, drain cocks, strainers, and connections where shown on Drawings and where required for controlling the various pieces of equipment. Install valves where branches take off from mains for domestic water, hot water, chilled water, compressed air and natural gas.

E. Drawings are based on equipment specified. Make adjustments, modifications, or changes required, due to use of other equipment.

F. All Drawings within the Contract Documents, regardless of discipline, shall be used together to construct a complete and useable project in accordance with the design intent. Do not break up the drawings into the separate disciplines (i.e. Mechanical, Electrical, Plumbing, etc.) as Drawings are not trade specific. It is the Contractor's responsibility to perform the work. Any division of work with trade subcontractors is the contractors' responsibility unless such division is specifically indicated in the Contract Specifications. Do not assume that all work for a particular trade is contained under a single discipline as many installations require cross discipline interactions. For example, the contractor may need to have an electrical subcontractor install motor starters indicated on the control drawings that may not necessarily be shown on the electrical drawings. No allowances will be made for lack of coordination between trades in any phase of the project from bidding to closeout.

G. Where conflicts exist between the Contract Drawings and the Specifications, the Specifications shall govern unless otherwise directed by the Engineer.

1.10 PROJECT/SITE CONDITIONS

A. Site Visitation: Visit the site of the proposed construction to become thoroughly familiar with details of work and working conditions, verify dimensions in the field, and advise A/E of discrepancies before performing Work.

B. Keep all areas affected by work clear of trash and debris and keep all roads into and around project site clear.

C. Contractor is responsible for ensuring installed equipment can be transported and placed in the areas indicated. Contractor shall provide for removal of walls, doors, other equipment, etc. as needed to accommodate equipment transport and placement. Any items removed or relocated shall be reinstall/re-built.

1.11 MATERIALS AND WORKMANSHIP

A. Provide new materials and equipment of a manufacturer regularly engaged in the production and manufacture of specified materials and equipment. Where UL or other agency has established standards for materials, provide materials, which are listed and labeled accordingly. The commercially standard items of equipment and the specific names mentioned herein are intended to identify standards of quality and performance necessary for the proper functioning of the work.

B. Work shall be performed by workmen skilled in the trade required for the work. Install materials and equipment to present a neat appearance when completed in accordance with the approved recommendations of the manufacturer and in accordance with Contract Documents.

C. Provide labor, materials, apparatus, and appliances essential to the complete functioning of the systems described or indicated herein, or which may be reasonably implied as essential whether mentioned in the Contract Documents or not.

D. Make written request to ARCHITECT / ENGINEER for supplementary instructions in cases of doubt as to Work intended or in the event of need for explanation thereof.

E. Performance and material requirements scheduled or specified are minimum standards acceptable. The right to judge the quality of equipment that deviates from the Contract Documents remains solely with ARCHITECT / ENGINEER.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Follow the manufacturer's directions completely in the delivery, storage, and handling of equipment and materials.

B. Store equipment in a clean, dry place protected from other construction. While stored maintain factory wrapping or tightly cover and protect equipment against dirt, water, construction debris, chemical, physical or weather damage, traffic and theft.

C. Adequately brace and package equipment to prevent breakage and distortion while in transit.

1.13 WELDING AND WELDER'S CERTIFICATION

A. Weld piping and above grade steel tanks in accordance with qualified procedures using performance qualified welders and welding operators. Qualified procedures and welders in accordance with ASME Section IX.

B. Welding procedures qualified by others and welders and welding operators qualified by another employer may be accepted as permitted by ANSI B31.1.

C. Furnish A/E with a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

D. Apply welders or welding operators' assigned symbols near each weld they make as permanent record.

E. Notify the A/E a minimum of twenty-four (24) hours in advance of tests, and perform the tests at the work site, if practicable.

1.14 PAINTING

A. Refer to architectural painting section for methods and materials.

B. Properly prepare surfaces to receive paint. Prime prepared surfaces and finish with two (2) coats of exterior oil base paint. Verify primer and paint are rated for application.

C. Repair damage to factory painted finishes.

D. Remove splattered and incidental paint from mechanical equipment.

E. Refer Section 21 05 53 for specific requirements for HVAC systems.

1.15 PILOT INSTALLATION

A. Provide a pilot installation of items of equipment, which are concealed and require service, such as terminal units, fan coil units, and hot water coils.

B. Have pilot installation approved by A/E before further installation work is performed for the particular items of equipment.

1.16 NOISE AND VIBRATION

A. Provide the entire operating system and its component items of equipment free of objectionable vibration or noises. Refer to ASHRAE handbook for recommended Room Criteria (RC), unless otherwise noted.

B. Statically and dynamically balance rotating equipment, and mount or fasten so that no equipment vibration will be transmitted to the building.

C. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts, or other parts of work, rectify such conditions at no additional compensation to the Owner.

1.17 PROTECTIVE GUARDS

A. Provide protective guard for belts, pulleys, gears, couplings, projecting set screws, keys, and other rotating parts, which are located so a person might come in close proximity with.

B. Construct protective guard around angle iron frame, securely bolted to apparatus; comply with safety requirements.

C. Install guard to completely enclose drives and pulleys, and not interfere with lubrication of equipment. Provide minimum two inch (2”) diameter opening in fan belt guards housing for tachometer.

1.18 OPERATING INSTRUCTIONS

A. Provide services of authorized representatives of manufacturer to ensure that the equipment is installed according to the manufacturer's recommendations, is operating properly, and to instruct Owner's operating personnel during start-up and operating tests of complete mechanical systems.

B. Prove operation of equipment to A/E.

C. Notify A/E a minimum of seven (7) days prior to beginning equipment start-up.

D. Certify in writing that these services have been performed.

E. Perform tests as specified in Testing and TAB Sections.

1.19 PROJECT RECORD DOCUMENTS

A. Maintain a set of Contract Documents at the job site for the purpose of recording final size, location, and interrelation of work under this Division. Mark this set of drawings as the job progresses to indicate "AS-BUILT" location of everything installed on the project, including, but not limited to, concealed piping, valves, and ductwork.

B. Contractor to record all as-built conditions by use of AUTOCAD 2000 or later. After as-built conditions have been recorded, provide reproducible “Record Drawings” for delivery to Owner.

C. Clearly and accurately delineate the work by dimensions on the record drawings as installed, with equipment locations identified by at least two (2) perpendicular dimensions to permanent structures.

D. Final reproducible record drawings shall be marked "AS-BUILT," and signed and dated by Contractor. Contractor shall certify drawings are complete and reflect actual conditions. In addition, provide final AUTOCAD record drawing files to Owner on compact disc, clearly labeled with written index attached.

1.20 FINAL REVIEW

A. Obtain necessary Certificates of Occupancy from local authorities.

B. Submit final approved operation and maintenance manuals including approved submittals, test reports, and "AS-BUILT" drawings prior to requesting final payment.

C. Delivery of operation and maintenance manuals is a condition of final acceptance. Refer to Section 01 78 23.13 for additional information.

1.21 WARRANTY

A. Warrant all materials, parts, and labor for work for a period of one (1) year from the date of final acceptance of the owner. During that period, make good faults or imperfections that may arise due to defects or omissions in materials or workmanship with no additional compensation and as directed by ARCHITECT / ENGINEER.

B. Certain items of equipment, such as small sealed refrigeration units, are covered by the manufacturer's warranty of longer durations. Refer to individual Sections for additional requirements and extended coverage.

1.22 CLEANUP

A. Provide ongoing site cleanup during course of work to maintain clean working environment. Do not allow trash and debris to accumulate at site.

B. Final Cleanup: Place mechanical systems in complete working order, clean and polish fixtures, equipment, and materials thoroughly returning to “as new” condition prior to request for final review. Remove excess material and debris. Clean out lines and fittings and adjust valves. Mop clean areas. Thoroughly clean outside and inside of ductwork before grilles are installed.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

A. Provide access doors in walls, floors, and ceilings to permit access to equipment and piping requiring service or adjustment to include:
1. Valves.
2. Manual balance dampers and automatic control dampers.
3. Fire dampers, smoke dampers and smoke/fire dampers.
4. Air terminal units.
5. Duct mounted filters and coils.
6. Plumbing drainage cleanouts.
7. Kitchen hood exhaust ductwork, in accordance with NFPA requirements.
8. Other mechanical equipment indicated in mechanical equipment schedules requiring maintenance, adjustment, or operation.

B. Provide hinged access doors and frames as follows:

1. Drywall Construction:
   a. Provide with concealed spring hinges and flush screwdriver operated cam locks in sufficient number of the size of the panel. Factory prime paint surfaces not galvanized.
   b. Product: Milcor, “Style DW”.
   c. Fire Rated: Milcor, “Style CFRAD”.
2. Visible Masonry and Ceramic Tile: Milcor, “Style M/MS”.
3. Gypsum and Cement Plaster: Milcor, “Style K”.
4. Acoustic Plaster:
   a. Reinforce panel as required to prevent sagging. Provide continuous steel piano type hinge for the length of the panel, and sleeved and grommeted screwdriver operated cam locks in sufficient number for the size of the panel. Factory prime paint surfaces not galvanized.
   b. Product: Milcor, “Style AP”.
5. Acoustic Tile: Milcor, “Style AT”.

C. Provide continuous concealed hinges and cam locks.

D. Provide UL listed 1-1/2 hour Label "B" access doors with automatic self-closing latching mechanism where required.

E. Provide removable ceiling access tile section immediately adjacent to each mechanical or electrical device located in the ceiling plenum above removable tile ceiling.

F. Coordinate approval and location of access doors with A/E.

PART 3 - EXECUTION

3.1 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in location of equipment and material. Do not provide equipment or material, which is not suitable in this respect.

B. Make changes in equipment location of up to three feet (3’), to allow for field conditions prior to actual installation, and as directed by the A/E.

C. Conceal piping and ductwork in finished areas, except in mechanical rooms, and where noted otherwise on the drawings. Route pipes and ducts through the building without interfering with other contractors’ equipment or construction.

D. Provide maximum possible clear height underneath piping and ductwork.

E. Install equipment requiring service so that it is easily accessible.

F. Compare the equipment sizes with the space allotted for installation before installation and make written notice of possible conflict. Disassemble large equipment to permit installation through normal room openings when required. Should written notice not be made in a timely manner, make adjustments and modifications necessary without additional compensation.

G. Timely place equipment too large to fit through finished openings and stairways.

3.2 SITE OBSTRUCTIONS

A. Drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed as to accuracy of location or completeness of information.

B. Verify with ARCHITECT / ENGINEER, utility companies, municipalities, and other interested parties that available information has been provided before cutting or trenching operations are begun. Verify locations given.

C. Should obstruction be encountered, alter routing of new work, whether or not shown on Drawings. Reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

D. Assume total responsibility for and repair damage to existing utilities caused by construction, whether or not such existing facilities are shown. Repair the lines, if damaged.

3.3 CUTTING AND PATCHING

A. Submit written request to A/E in advance of cutting or alterations.

B. Execute cutting and demolition by methods that prevent damage to other work and provide proper surfaces to receive installation of repairs.

C. Restore work which has been cut or removed; install new products complying with specified products, functions, tolerances, and finishes specified.

D. Escutcheon Plates: Heavy chrome-plated or nickel-plated escutcheon plates for penetrations of finished surface equal to a B&C No. 10 escutcheon plate with concealed hinges.

E. Fit work airtight to pipes, sleeves, ducts, and other penetrations through surfaces. For fire-rated penetrations, provide assemblies in accordance with UL 1479 and ASTM E 814 utilizing products and materials equal to rating of surfaces penetrated.

3.4 EXCAVATION

A. Trenching:

1. Perform all excavating of every description and of whatever substance encountered to depths indicated or specified. Pile materials suitable for backfilling a sufficient distance from banks of trenches to prevent slides or cave-ins. Comply with OSHA requirements for excavation, trenching and shoring. Pile excavated material suitable for backfilling on one side only of trenches in such a manner as to permit ready access to and use of existing fire hydrants, valves, manholes and other utilities system apparatus and a sufficient distance from banks of trenches to prevent slides or cave-ins. Keep surface

drainage of adjoining areas unobstructed. Discard all excavated materials deemed not required or unsatisfactory for backfill. Remove water by pumping or other approved methods, and discharge at a safe distance from the excavation.

2. Provide trenches of necessary width for proper installation of piping and materials that comply with latest publication of OSHA 2226, "Excavating and Trenching Operations" be not less than twelve inches (12”) wide. Coordinate trench excavation with pipe installation to avoid open trenches for prolonged periods. Accurately grade bottoms of trenches to provide uniform bearing and support for each section of pipe on undisturbed soil or new, compacted bedding material (as specified hereinafter) at every point along its entire length.

3. When excavating for manholes and similar structures, provide a minimum twelve inches (12”) between outer surfaces the structure and the embankment or shoring. Remove unstable soil that is incapable of supporting the structure in the bottom of the excavation to the depth necessary to obtain design bearing.

4. Material to be excavated is "unclassified." No adjustment in the contract price will be made due to the presence or the absence of rock, shale, masonry, or other materials.

5. Protect existing utility lines that are to be retained where their locations are indicated or the locations of which are made known prior to excavating and trenching. Protect utility lines constructed during the excavating and trenching operations from damage during excavating, trenching and backfilling; if damaged, repair lines as directed by the utility company, Owner, and A/E. Issue notices when utility lines that are to be removed within the area of operations in ample time for the necessary measures to be taken to prevent interruption of the service.

6. Provide trenches for the underground utilities indicated on the Contract Documents of a depth that will provide sufficient cover over the installed utilities but not less than the following minimum amount of cover from existing grade or from indicated finish grades, whichever is deeper:

   a. One foot (1’) minimum cover for sanitary sewer piping, storm drainage piping, industrial waste piping, and acid waste piping not installed under pavement. Under pavement, provide a minimum of two feet (2’) of cover for sanitary sewer piping, storm drainage piping, industrial waste piping, and acid waste piping.

   b. Two feet (2’) minimum cover for chilled water piping, heating hot water piping, steam piping, condensate piping, domestic water piping, and fire piping.

   c. Depth of cover is measured from top of the outermost surface (e.g. insulation jacket) of the piping system.

B. Backfilling:

1. Prior to installation of the utilities, provide a setting bed of sand in the trench at a minimum depth of six inches (6”) that is compacted by mechanical means to ninety-five percent (95%) of the maximum soil density as determined by ASTM D 698.

2. All piping, fittings, joints, jacket integrity, etc. shall be fully tested and approved prior to any backfilling of the trench.

3. For trenches that cross under streets, driveways, building slabs, or other pavements, backfill utility line trench with sand backfill material in six inch (6") layers up to within twelve inches (12") from the finished grade (less the pavement thickness) but not less the minimum cover listed hereinbefore. Moisten each layer and compact to ninety-five percent (95%) of the maximum soil density as determined by ASTM D 698. Accomplish backfilling in such a manner as to permit the rolling and compaction of the filled trench with the adjoining material to provide the required bearing value so that paving of the area can proceed immediately after backfilling is complete. For all other trenches, backfill with sand to provide a minimum of twelve inches (12") of sand cover over the utilities.

4. Backfill remainder of trenches with satisfactory materials consisting of earth, loam, sandy clay, sand, and gravel, or soft shale that is free from large clods of earth and/or stones over one and one-half inch (1-1/2") in diameter. Backfill material shall be deposited in maximum nine inch (9") high layers (loose depth) while taking care not to damage utility lines. Each layer of backfill materials in the trench shall be compact by mechanical means to the soil density specified hereinbefore.

5. The contractor shall open any trenches and/or excavation pits found to be improperly backfilled or where settlement occurs. The effected trenches and/or excavation shall be opened to the depth required to obtain the specified compaction. The contractor shall then backfill and compact the excavation as specified hereinbefore with the surface restored to the required grade and compaction.

3.5 SERVICE

A. Inspect, clean, and service strainers and air filters immediately prior to final acceptance of project. Replace disposable type air filters.

B. Provide lubrication for operation of equipment until final acceptance of the equipment by A/E. Protect bearings during installation and thoroughly grease steel shafts to prevent corrosion. Provide extended lubrication lines for parts requiring lubrication that are concealed or inaccessible.

C. Provide complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to ensure completely balanced conditions, check the charge and modify it for proper operation as required.

END OF SECTION 230500

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Supports, anchors and sleeves applicable to mechanical, plumbing, and fire protection systems, including:
   1. Pipe hangers, supports, and associated devices.
   2. Equipment bases and supports.
   3. Pipe sleeves and seals.
   4. Flashing and sealing equipment and pipe stacks.
   5. Finishes.

1.2 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Provide hanger and support inserts and sleeves and coordinate placement into concrete formwork.

1.3 REFERENCES

A. ANSI/MSS-69 – Pipe Hangers and Supports – Selection and Application.

B. ASME B31.1 – Power Piping.

C. ASTM A 123/A 123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. ASTM A 153/A 153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E. MSS-SP58 – Pipe Hangers and Supports – Materials, Design, and Manufacture.

1.4 SUBMITTALS

A. Submit product data on all hanger and support devices. Product shall include materials, finishes, load ratings, application, and dimensional information.
B. Refer to section 01 33 30 for shop drawing and submittal preparation and submission requirements.

1.5 CLOSEOUT SUBMITTALS

A. Submit Operation and Maintenance Manuals for the project in accordance with section 01 78 23.13.

1.6 QUALITY ASSURANCE

A. Hangers and supports shall be designed and manufactured in conformance with MSS-SP58.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Pipe Hangers
   1. Anvil International (Grinnell).
   2. Cooper B-Line.
   3. PHD.
   4. Superstrut.
   5. Tolco.

B. Metal Framing Support Channels
   1. Cooper B-Line.
   2. Powerstrut (Tyco)
   3. Superstrut.
   4. Tolco.
   5. Unistrut (Tyco).

C. Roof Supports
   1. Portable Pipe Hangers

D. Sleeves and Sealants
   1. PSI Thunderline/Link-Seal.
   2. Rectorseal.
   3. Specified Technologies.
   4. 3M.

2.2 PIPE HANGERS

A. Single Pipe Hangers
   1. Unless noted otherwise, all hangers shall be galvanized carbon steel. Rollers shall be cast iron. Rollers shall be sized for the outside diameter of the pipe/insulation/shield assembly.
   2. Uninsulated pipe 2-inches and smaller:
      a. Adjustable steel swivel ring (band type) hanger.
      b. Adjustable steel swivel J-hanger.
      c. Adjustable steel clevis hanger.
   3. Uninsulated pipe 2-1/2 inches and larger:
      a. Adjustable steel clevis hanger.
      b. Pipe roll with sockets.
      c. Adjustable steel yoke pipe roll.
   4. Insulated hot or steam pipe 2-inches and smaller:
      a. Adjustable steel clevis hanger with galvanized sheet metal shield.
   5. Insulated hot pipe 2-1/2 inches and larger:
      a. Adjustable steel yoke pipe roll with pipe covering protection saddle.
      b. Pipe roll with sockets with pipe covering protection saddle.
   6. Insulated cold pipe 5-inches and smaller:
      a. Adjustable steel clevis hanger with galvanized sheet metal shield.
   7. Insulated cold pipe 6-inches and larger:
      a. Pipe roll with sockets with pipe covering protection saddle.

b. Adjustable steel yoke pipe roll with pipe covering protection saddle.

B. Multiple or Trapeze Hangers

1. Unless noted otherwise, all multiple or trapeze hangers shall be 12-gauge hot-dipped galvanized steel channel with welded spacers. Nuts shall be zinc-plated steel. Structural I-beams may be used in lieu of channel.

a. Trapeze shall be sized to handle the expected load. Trapeze shall be sized to handle the expected load however not less than 1-5/8 inch x 1-5/8 inch.

2. Uninsulated pipes not subject to axial movement shall be mounted to trapeze hangers with two pipe straps or universal pipe clamps bolted to channel. Neoprene isolators shall be used between pipe and clamp.

3. For insulated pipes and pipes subject to axial movement a strut mounted cast-iron roller support shall be provided. Provide pipe protection shield on insulated lines.

4. Rollers shall be sized for the outside diameter of the pipe/insulation/shield assembly.

C. Wall Supports

1. Unless noted otherwise, all wall supports shall be galvanized steel sized to support the pipe and weight intended. Rollers shall be cast iron. Rollers shall be sized for the outside diameter of the pipe/insulation/shield assembly.
2. Piping four inch (4”) and smaller:
   a. Galvanized steel hook.
   b. Galvanized steel J-hanger.
   a. Provide shield for insulated pipe.
3. Uninsulated or cold piping four inch (4”) through eight inch (8”):
   a. Welded strut bracket with pipe straps.
   b. Provide shield for insulated pipe.
4. Insulated hot piping four inch (4”) through eight inch (8”):
   a. Welded steel bracket with adjustable steel yoke pipe roll.
   b. Provide saddle for insulated pipe.
5. Insulated cold or hot piping eight inch (8”) and larger:
   a. Welded steel bracket with adjustable steel yoke pipe roll.
   b. Provide saddle for insulated pipe.

D. Floor Supports

1. Unless noted otherwise, all wall supports shall be galvanized steel sized to support the pipe and weight intended. Rollers shall be cast iron. Rollers shall be sized for the outside diameter of the pipe/insulation/shield assembly.

2. Hot piping six inch (6") and smaller and all cold piping:
   a. Galvanized steel adjustable pipe saddle and screwed locknut nipple attached to steel base stand.
3. Hot piping eight inch (8")and larger:
   a. Adjustable roller stand with steel base plate and set screws for height adjustment.

E. Roof Supports
1. Provide portable, non-penetrating rooftop support system using high density polypropylene bases and structural steel framing. Wood blocks are unacceptable.
2. Bases:
   a. Injection molded high density polypropylene with UV inhibitors.
   b. Size as required by loading conditions.
3. Framing:
   a. Minimum twelve gauge (12 ga.) structural steel, perforated tubular channel sized as required for loading.
   b. Hot dip galvanized finish after fabrication.
4. Pipe Supports and Hangers:
   a. As required by paragraphs above for applicable system.
   b. Finish shall be galvanized steel.
   c. All accessories such as nuts, bolts, washers, shall be hot-dip galvanized.

F. Vertical Supports
1. Galvanized steel four (4) bolt riser clamp (minimum two bolts on each side) clamp mounted on a cast-in-place sleeve for non-pumped systems.. Two bolt riser clamps are not acceptable. Each bolt shall have a flat washer at the bolt head and at the nut.
2. For pumped systems, galvanized steel pipe clamp or extensions mounted on vibration isolator as detailed on the Contract Drawings.

G. Copper Pipe Supports
1. All copper pipe supports shall be copper plated.
2. Provide neoprene inserts between base copper pipe and copper plated supports.
3. Adjustable copper plated steel swivel band hanger.
4. Copper plated malleable iron ring hanger.
5. Adjustable copper plated steel clevis hanger.

H. Plastic Pipe Supports
1. For rigid plastic pipe: Adjustable steel band hanger with flared edges.
2. For flexible plastic pipe: V-bottom clevis hanger with "V" support trough.

I. Pipe Shields
1. Pipe shield shall be used between all insulated pipe and hangers or saddles.
2. All pipe shields shall be galvanized steel.
3. Pipe shield inside diameter shall match the outside diameter of the pipe/insulation assembly.
4. Pipe shield shall cover bottom 180-degrees of pipe/insulation assembly and shall be sized as follows:
   a. For piping two inch (2") and smaller, the shield shall be minimum eighteen gauge (18 ga.), twelve inches (12") long.

b. For piping two and one-half inch (2-1/2”) to five inch (5”), the shield shall be minimum sixteen gauge (16 ga.), twelve inches (12”) long.

c. For piping six inch (6”) to twelve inch (12”), the shield shall be minimum fourteen gauge (14 ga.), twenty-four inches (24”) long.

d. For piping twelve inch (12”)and larger, the shield shall be minimum twelve gauge (12 ga.), twenty-four inches (24”) long.

e. Shield for uninsulated copper pipe riser shall be sheet lead.

2.3 HANGER RODS AND UPPER ATTACHMENTS

A. Hanger Rods: Galvanized steel, threaded at both ends, threaded one end or continuous threaded.

B. Beam Clamps:

a. Beam clamps, sized as required to support the load, shall be used where piping is indicated to be supported from building steel. All beam clamps shall have retaining straps or clips to maintain clamp position on beam.

b. Attachment of hanger rod to top flange of structural I-beams, channels, and wide flange beams: Reversible top or bottom flange carbon steel c-clamp with locknut. All beam clamps shall have retaining straps or clips to maintain clamp position on beam.

c. Attachment of hanger rod to center of bottom flange of I-beam: Center loaded carbon steel clamp sized for flange thickness. Use with eye rod or similar device.

d. Clamping to building steel must be approved by the project registered Structural Engineer.

C. Concrete Inserts:

a. Concrete inserts shall be used where piping is indicated to be supported from poured concrete structure. Size shall be as required for supported load.

b. Cast-in-place spot inserts: Steel or malleable iron body. Spot insert shall allow for lateral adjustment. Insert shall have means for attachment to concrete forms.

c. Continuous inserts: Minimum 12 gauge steel channels with end caps and nail holes for attachment to forms.

d. Embedding inserts into building structure must be approved by the project registered Structural Engineer.

2.4 EQUIPMENT BASES AND SUPPORTS

A. Provide 6" concrete pads and equipment bases for all outdoor equipment on grade, floor mounted equipment in main central plant areas, areas with floors below grade, penthouse equipment rooms, floor mounted air handling units and where shown on Drawings.

B. Provide prefabricated curbs for roof-mounted equipment with the equipment. Equipment curbs must compensate for sloped roof deck as required to set equipment level.

2.5 PIPE SLEEVES AND SEALS

A. Refer to Section 23 05 17 for sleeve requirements.

2.6 FLASHING

A. Metal Flashing: Minimum 26 gauge galvanized steel.

B. Lead Flashing: Minimum five pounds per square foot (5 lbs/sf) sheet lead for waterproofing.

C. Flexible Flashing: Minimum 47 mil thick sheet butyl; compatible with roofing.

D. Caps: Minimum 22 gauge steel at non-fire resistant elements or minimum 16 gauge steel at fire resistant elements.

2.7 FINISHES

A. Indoor hangers and supports: Galvanized steel unless noted otherwise in Specification or on Drawings.

B. Outdoor hangers and supports: Hot dip galvanized after fabrication in accordance with ASTM A123. Hanger hardware shall be either hot dip galvanized or stainless steel.

C. Hangers and strut located in corrosive areas or coastal regions (as defined by the Engineer of Record) shall be Type 316 stainless steel with stainless steel hardware.

PART 3 - EXECUTION

3.1 PIPE HANGERS AND SUPPORTS

A. Pipe shall be adequately supported by pipe hanger and/or supports.

B. Hangers for insulated pipes shall be sized to accommodate design insulation thickness.

C. Install hangers to provide minimum one and one-half inch (1-1/2”) space between finished covering and adjacent work.

D. Place a hanger within twelve inches (12”) of each horizontal elbow.

E. Use hangers with one and one-half inch (1-1/2”) minimum vertical adjustment.

F. Support vertical piping at every floor. Where possible, locate riser clamps directly below pipe couplings or shear lugs. Support vertical cast iron pipe at each floor at hub. Additionally, Vertical pipe support spacing shall not be greater than ten feet (10’).

G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers. Trapeze hangers shall be spaced according to the smallest pipe size.

H. Support riser piping independently of connected horizontal piping.

I. Select hangers and accessories to provide means of preventing dissimilar metal contact.

J. Piping shall not be supported from other pipes, ductwork, or other equipment.

K. Support horizontal steel piping in accordance with the following table:

Maximum Horizontal Spacing Between Pipe Supports – Std. Weight Steel Pipe		
Nominal Pipe Size (inch)	Rod Diameter (inch)	Max. Hanger Spacing
1/2 to 1-1/4	3/8	7’-0”
1-1/2	3/8	9’-0”
2	3/8	10’-0”
2-1/2	1/2	11’-0”
3	1/2	12’-0”
4	5/8	14’-0”
5	5/8	16’-0”
6	3/4	17’-0”
8	3/4	19’-0”
10	7/8	22’-0”
12	7/8	23’-0”
14	1	25’-0”
16	1	27’-0”
18	1-1/4	28’-0”
20	1-1/4	30’-0”
24	1-1/2	32’-0”
Notes: 1- Where local codes establish more stringent spacing standards, those standards shall be used in lieu of the values listed here. 2- Support spacing shown in table represent maximum allowable to support pipe. Shorter spacing may be required to meet building structural loading requirements. Verify with Structural Engineer.		

L. Support horizontal copper tubing in accordance with the following table:

Maximum Horizontal Spacing Between Pipe Supports – Copper Tubing		
Nominal Tube Size (inch)	Rod Diameter (inch)	Max. Hanger Spacing
1/2	3/8	5’-0”
3/4	3/8	5’-0”
1	3/8	6’-0”
1-1/4	3/8	7’-0”
1-1/2	3/8	8’-0”
2	3/8	8’-0”
2-1/2	1/2	9’-0”
3	1/2	10’-0”
3-1/2	1/2	11’-0”
4	1/2	12’-0”
5	1/2	13’-0”
6	5/8	14’-0”
8	3/4	16’-0”

Notes:
1- Where local codes establish more stringent spacing standards, those standards shall be used in lieu of the values listed here.
2- Support spacing shown in table represent maximum allowable to support pipe. Shorter spacing may be required to meet building structural loading requirements. Verify with Structural Engineer.

M. Support other horizontal piping types in accordance with the following table:

Maximum Horizontal Spacing Between Pipe Supports – Misc. Types	
Piping Material	Max. Hanger Spacing
ABS Pipe	4'-0"
Brass Tubing	6'-0"
Cast-Iron Pipe	5'-0"
CPVC Pipe (<=1-inch)	3'-0"
CPVC Pipe (>1-inch)	4'-0"
PEX Tubing	32-inches
PVC Pipe	4'-0"

3.2 CONCRETE INSERTS

A. Provide inserts for placement in concrete formwork.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over four inches (4").

D. Where concrete slabs form finished ceiling, provide inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.3 FLASHING

A. Provide flexible flashing and metal counter flashing where sleeves/piping penetrate weather or waterproofed walls, floors, and roofs.

B. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.

C. Flexible sheet flash and counter flash all curbs for mechanical equipment on roof with sheet metal; seal watertight.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Coordinate installation of equipment bases of concrete type specified under Division 03 for all outdoor equipment on grade and indoor floor mounted equipment and where shown on Drawings. Where Division 03 is not present in the contract documents, provide concrete in accordance with industry standards suitable for the type of installation and loading characteristics.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct support of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

E. Provide base of a minimum height of six inches (6") above finished grade and a width that projects a minimum of three inches (3") beyond equipment on all sides. Bevel edges of base.

F. Prepare surface under bases by cleaning, clearing, chipping and roughing.

G. Provide curbs of fourteen inches (14") minimum height above roofing surface for installation of mechanical equipment on roof.

3.5 SLEEVES

A. Refer to section 22 05 17 for sleeve installation requirements.

3.6 INSULATION SHIELDS

A. Provide insulation shields at every hanger support.

B. Provide shields of the proper length to distribute weight evenly and to prevent sagging or indentation of insulation at hanger.

C. Install shield so that hanger is placed at the center of the shield.

D. Attach shield to insulation with adhesive to prevent slippage or movement; refer to Section piping insulation specification for additional requirements.

END OF SECTION 230529

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Materials for identification of mechanical products installed under Division 15 to include:
1. Pipe Painting.
2. Ductwork Painting.
3. Pipe Markers.
4. Valve and Equipment Tags.
5. Ductwork Labeling.
6. Ceiling Markers.

1.2 RELATED SECTIONS (where included in project documents)

A. Division 9 – Architectural Painting Specification.

B. Section 15212 - Laboratory Air and Vacuum Piping and Specialties.

C. Section 15213 - Medical Gas Piping and Specialties.

1.3 REFERENCES

A. ASME / ANSI A13.1 - Scheme for the Identification of Piping Systems.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

C. NFPA 99C – Health Care Facilities (Gas and Vacuum Systems)

1.4 SUBMITTALS

A. Submit painting / labeling schedule identifying the following:
1. System (i.e. Chilled Water Supply).
2. Pipe Color (i.e. Dark Blue).
3. Identification Tag Label (i.e. CHWR).
4. Identification Tag Color (i.e. Black Letters, Green Background.).
5. Identification Tag Text Size.

B. Submit manufacturer’s product data on paint.

C. Submit manufacturer’s product data on identification labels for piping, ductwork, valves, and equipment.

D. Submit valve schedule for all valves installed, including valve tag number, location, function, and valve manufacturer’s name and model number, including a plan indicating each valve with its tag and location.

E. Submit manufacturer's installation instructions for all products.

F. Refer to Section 01 33 30 for additional shop drawings and submittal preparation requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Brady Corporation.

B. Craftmark Identification Systems.

C. Markem Corporation.

D. Moore.

E. Seton

2.2 PAINT

A. Material Compatibility: Provide primers, undercoat, finish coat, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

B. Provide primer and undercoat materials with a minimum six-month guaranteed life against fade and/or color bleed-through.

C. Colors per schedule below.

D. Provide the paint manufacturer, name, color and part number (if applicable) for each paint. Coordinate paint manufacturer and finish color with the Owner.

2.3 PIPE MARKERS

A. Self-Adhesive Pipe Markers.
1. Polyester: Factory fabricated polyester, 0.05 mm (2 mil) thick, coated with acrylic adhesive.
2. Plastic: Factory fabricated plastic film, roll formed, clear laminated to protect lettering.

B. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape of not less than six inches (6") wide by four (4) mils thick, manufactured for direct burial service.

C. Color and Text per schedule hereinafter.

2.4 VALVE AND EQUIPMENT TAGS

A. Valve Tags:
1. Material / Finish: Brass / Natural brass finish.
2. Size: 1-1/2 inch diameter round, 1.1 mm (0.044 inch) thick, with 3/16" (5 mm) top hole for fastener.
3. Lettering: Stamped letters; character size and words according to schedule.
4. Tags shall be secured to the valve with brass “S” hook, Beaded Chains: No. 6 brass, 114 mm (4-1/2”) long beaded chain with locking link or plastic “ty-rap”.

B. Equipment Tags
1. Nameplates shall be constructed of black surface, white core laminated bakelite with engraved letters for non-emergency equipment. Provide red surface, white core bakelite labels for emergency equipment.
2. Plates shall be a minimum of 3” long by 1” high with 3/8” high letters.
3. Coordinate the equipment identification with Owner and drawing references.
4. Plates shall be permanently affixed to the equipment with two (2) counter- sunk, stainless steel screws. Adhesive applied plates are not acceptable.

2.5 DUCTWORK LABELING

A. Stencils: With clean-cut symbols and letters 2-1/2 inch high for ductwork and equipment.

B. Stencil Paint: Semi-gloss, high build epoxy esther or alkyd paint.

2.6 CEILING IDENTIFICATION MARKERS

A. “Moore” 5/8 inch diameter marking tacks with celluloid covering suitable for ink notation on a colored face.
B. Refer to the marker description hereinafter for the marker color.

PART 3 - EXECUTION

3.1 PREPARATION

A. Painting:
1. Thoroughly clean all surfaces to be painted as required to remove all oil, grease, loose scale, rust, and foreign matter.
2. Surfaces must be completely dry at the time of application.
3. The painting of non-insulated piping associated with an operating system is strictly prohibited.
4. Site touch-up of the factory applied coating or paint, to include preparation and painting of field welds, must be completed and approved by the Engineer prior to installation of insulation.

B. Identification: Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Pipe Painting: Paint all exposed piping, including insulated piping (on outside of insulation), in mechanical and equipment rooms with colors to meet standards outlined in schedule below.

B. Ductwork Painting.
1. Paint all exposed ductwork with primer and undercoat and finish coat. The term "exposed ductwork " is defined to include all visible or open-to-view areas, related hangers, supports, diffusers, grilles, and other similar components. Extend coatings in these areas, as required, to maintain the system integrity and provide the desired protection. Provide color samples to the Architect for selection from the manufacturer's full range of standard colors.
2. Ductwork in mechanical rooms shall not be painted.
3. Clean galvanized surfaces with non-petroleum based solvents so that the surface is completely free of oil and surface contaminates. Remove pre-treatment from galvanized sheetmetal by mechanical methods.
4. Apply paint to all ductwork surfaces, as previously indicated, according to manufacturer's directions. Use applicators and techniques best suited for the substrate and type of material being applied.
5. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
6. Apply additional coats if undercoats, stains, or other conditions show through finish coat of paint until paint film is of uniform finish, color, and appearance. Provide special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
7. Paint interior surfaces of all ducts, where visible through grilles, registers, or diffusers, with a flat, non-specular black paint.
8. Minimum Coating Thickness: Apply materials no thinner than the manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer or as herein specified, whichever is the greater.
    a. Primer: Apply a minimum of two (2) coats with a total dry film thickness of not less than 2.5 mils.
    b. Undercoat: Apply a minimum of two (2) coats over primer with a total dry film thickness of not less than 2.5 mils.
    c. Lusterless (Flat) Finish: Apply a minimum of two (2) coats over primer and undercoat with total dry film thickness not less than 2.5 mils.
    d. Semi-gloss Finish: Apply a minimum of two (2) coats over primer and undercoat with total dry film thickness not less than 3.0 mils.

C. Pipe Markers.
1. Install pipe markers according to manufacturer's instructions after the pipe painting and/or pipe covering installation is complete.
2. Identify all piping, concealed and exposed in accordance with ASME A13.1 and the schedule below. Include service, flow direction, and pressure.
3. Provide plastic self-adhesive pipe markers for all indoor pipes.
4. Provide wrap-around polyester pipe markers for outdoor pipes, and pipes carrying chemicals.
5. Install in clear view and align with axis of piping.

6. Install underground pipe tape on pipes six to eight inches (6" to 8") below finished grade, directly above buried pipe.
7. Locate identification at maximum ten feet (10') centers on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
8. Provide a flow arrow at each identification marker.
9. Identification shall, as a minimum, occur at the following locations:

    a. At no more than fifteen foot (15') intervals on a straight run of pipe.

    b. Wherever a pipe or duct turns 90 degrees or tees.

    c. Wherever a pipe or duct passes through a wall, floor, or ceiling, on both sides of the penetration.

    d. At each branch or riser takeoff.

    b. Adjacent to each valve, device, or fitting.

D. Ductwork Labeling
1. Paint all ductwork with stenciled painting. Identify as to air handling unit number, and zone number. Locate identification at air handling unit, at each side of all wall and floor penetrations or enclosures and at each obstruction.
2. Apply single coat sufficient to cover background completely with minimum 4 mils dry film thickness.
3. Stencil paint color shall be black.

E. Valve and Equipment Tags:
1. Valve Tags -
    a. Valve tags and equipment tags shall show the unit designation of the equipment tagged. Where new systems are installed in an existing building or plant, the existing naming convention in effect shall govern. Where new systems are installed in a new building or plant, the unit designations shall match those listed on the Drawing Schedule.
    b. Record Drawings shall indicate equipment and valves tagged with the correct designations.
    c. Identify all valves with tags.

2. Equipment Tags -
    a. Secure nameplates to equipment fronts using corrosive resistant, stainless steel, countersunk screws (minimum of two (2) per plate). Install nameplates parallel to equipment lines.
    b. All equipment tags shall utilize the equipment designation as scheduled on the Contract Documents.
    c. All air handling systems, air conditioning systems, remote condensers, condensing units associated tanks, pumps, air separators, heat transfer equipment, water treatment equipment, and associated equipment shall be identified with specified equipment tags indicating device. All equipment scheduled on Drawings shall have equipment tags.
    d. Where scheduled HVAC or plumbing equipment is concealed above a suspended ceiling space, provide an additional nameplate on the ceiling

below where the equipment is located, matching the tag on the equipment. Coordinate color of this nameplate with architect.

e. Identify control panels and major control components outside panels with a specified nameplate..

f. Label fire dampers, fire/smoke dampers, and smoke dampers with nameplates as specified in accordance with NFPA 90A.

g. Attach identification for items such as special switches, etc., located in finished areas, on or in the immediate vicinity of the item.

h. Each associated electrical starters, controller, VFD, etc. serving specified mechanical equipment shall have a nameplate indicating the equipment served by it.

F. Ceiling Identification Markers:

1. Provide markers on all removable ceilings and ceiling access panels to indicate the locations of valves, dampers and smoke detectors, etc. and other mechanical items that may require serving or adjustment. Glue marking tacks in place with white glue to prevent their falling out.

2. Color code markers as follows:

a. Red: Fire dampers, smoke dampers, sprinkler shutoff valves, duct type smoke detectors. Notation as follows:

1) "D" – Damper
2) "V" – Valve
3) "S" – Smoke Detector
4) "H" – Heat Detector

b. Yellow: Steam, radiation, reheat, chilled water, and snow melting valves: Notate marker with "V" – Valve.

c. Gold: Automatic and balancing dampers with notation as follows:

1) "V" – Valve
2) "D" - Damper

3.3 VALVE CHART AND SCHEDULE

A. Provide valve chart and schedule with a plan indicating the valve location in aluminum frame with clear plastic shield. Install one in each individual equipment room at location as directed A/E or Owner.

B. Valve chart and schedule shall also become part of the Record Drawings.

3.4 COLOR CODE FOR MARKING PIPE SCHEDULE

A. General:

1. Contractor shall label all piping and ductwork installed on the project. If a label is not defined in the table hereinafter for a system installed on the project, contractor shall notify the engineer to provide a label selection for the system in question.

2. All labeling materials including attachment devices, etc. installed on systems exposed outside shall be constructed of UV-resistant material.

B. Furnish and install the following labels on the appropriate systems. The pipe service description and color schemes noted are intended to be standard manufacturer's

labels. In some cases, multiple standard labels or standard and custom labels will be required to be combined to achieve the desired description. In all cases, the marker shall exactly match the plan description, i.e. “Secondary Chilled Water".

MATERIAL	*PIPE COLOR	**MARKING BAND	LETTERS AND ARROW COLOR	LEGEND
Domestic Cold Water (City Pressure)	Blue	Green	White	CITY CW (POTABLE)
Domestic Cold Water (Bldg.) (Downstream of pump)	Blue	Green	White	BLDG. CW (POTABLE)
Fire Protection Water	Red	Red	White	FIRE ROT.
Domestic Hot Water	White	Green	White	DOM. H.W.
Domestic Hot Water - Recirculating	White	Green	White	DOM. H.W.R.
Boiler Feed Water	Lt. Yellow	Yellow	Black	B.F.
Heating Hot Water Supply	Dk. Orange	Yellow	Black	L.T.W.S.
Heating Hot Water Return	Lt. Orange	Yellow	Black	L.T.W.R.
Chilled Water Supply	Dk. Blue	Green	White	C.H.W.S.
Chilled Water Return	Lt. Blue	Green	White	C.H.W.R.
Condenser Water Supply	Dk. Green	Green	White	C.W.S
Condenser Water Return	Lt. Green	Green	White	C.W.R.
Chemical Feed	Lt. Yellow	Yellow	Black	CH. FEED
Compressed Air (Non-Medical)	n/a	Yellow & White Diagonal Stripe	Black	COMP. AIR
Vacuum (Non-Medicaql)	n/a	White & Black Diagonal. Stripe	Black Boxed	VACUUM
Medical Gas - Oxygen	n/a	Green	White	OXYGEN
Medical Gas - Nitrous Oxide	n/a	Blue	White	NITROUS OXIDE
Medical Gas - Nitrogen	n/a	Black	White	NITROGEN
Medical Gas – Carbon Dioxide	n/a	Gray	Black	CARBON DIOXIDE
Medical Gas – Helium	n/a	Brown	White	HELIUM
Medical Air	n/a	Yellow	Black	MED. AIR
Medical Vacuum	n/a	White	Black	MED. VAC.
Waste Anesthetic Gas Disposal (WAGD)	n/a	Violet	White	W.A.G.D.
Laboratory Air	n/a	Yellow & White Checkerboard	Black	LAB AIR
Laboratory Vacuum	n/a	White & Black Checkerboard	Black Boxed	LAB VAC
Natural Gas	Gray	Yellow	Black	NAT. GAS
Refrigerant	Black	Yellow	Black	R-“XX”

MATERIAL	*PIPE COLOR	**MARKING BAND	LETTERS AND ARROW COLOR	LEGEND
Fuel Oil	Gray	Yellow	Black	FUEL OIL

* PAINT EXPOSED PIPING ONLY.
** ALL EXPOSED AND CONCEALED PIPING SHALL HAVE PIPE MARKERS AND ARROWS.
n/a – Not Applicable (not painted).

Identify all exposed piping and also piping in accessible concealed spaces, such as above lay-in type ceilings, below raised floors and at access panels in non-accessible ceilings as in walls.

C. COLOR CODE MARKING SIZES

OUTSIDE DIAMETER OF PIPE COVERING (INCHES)	LENGTH OF COLOR BAND (INCHES)	ARROW LENGTH BY WIDTH (INCHES)	SIZE OF LEGEND LETTERS AND NUMERALS (INCHES)
Less than 1-1/2”	8	8 x 2-1/4	1/2
1-1/2” to 2-3/8”	8	8 x 2-1/4	3/4
2-1/2” to 7-7/8”	12	8 x 2-1/4	1-1/4
8” to 10”	24	12 x 4-1/2	2-1/2
Over 10”	32	12 x 4-1/2	3-1/2

3.5 Electrical Equipment and Conduits: Label, as described in Section 26 05 53, all electrical equipment and conduits installed as part of this Division’s work. If no Section 26 05 53 exists as part of this project, request a copy from the Engineer.

END OF SECTION 230553

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section provides for testing of various mechanical systems by the installing contractor to ensure proper installation and operation.

B. This section provides for the coordination of Testing, Adjusting, and Balancing (TAB) of HVAC systems between the installing contractor and the TAB contractor. It includes bringing the systems to a state of readiness for TAB as well as coordination during and after TAB efforts.

C. This section provides for testing, adjusting, and balancing of the HVAC systems by the TAB contractor.

D. This section shall be supplied to both the installing contractor and the TAB contractor as their scope of work as relating to TAB of HVAC systems.

1.2 SCOPE OF WORK

A. Installing Contractor:
1. Initial function testing of all systems and equipment to bring equipment to a state of readiness and proper operation for the TAB work to begin, this includes but is not limited to: Equipment start-up tests, vibration testing, sound testing, duct leakage testing, hydronic systems testing, plumbing systems testing, and fire protection systems testing.
2. Changes or replacements to sheaves, belts, dampers, valves, etc. required for correct balance as advised by the TAB contractor, at no additional cost to the Owner or Engineer.
3. Corrections or repairs of deficient items as identified during the course of the project including the testing, adjusting, and balancing phase.
4. Provide the TAB contractor sufficient time to test, balance and adjust the systems prior to Substantial Completion.
5. Provide all devices in a manner that will leave them accessible and readily adjustable, and, should any devices not be able to be readily accessible, provide access to the TAB contractor at an appropriate time to allow TAB work.

B. TAB Contractor:
1. At the earliest possible time, review the mechanical drawings and specifications for balance-ability and provide commentary.
2. Check, adjust, and balance all components of the mechanical systems which will result in the optimal performance of this equipment.
3. Test, adjust, and balance all air moving equipment, air distribution systems, pumps, heating and cooling systems, and control systems verification.

4. Where smoke control systems, stairwell pressurization systems are provided in the contract documents, provide assessment of zone leakage, test and balance fans, and ensure proper differential pressures and airflows.
5. Provide a list of deficiencies for the installing contractor to correct for proper system balance.

1.3 REFERENCES

A. AABC - National Standards for Field Measurement and Instrumentation, Total System Balance.

B. ASHRAE - 1991 HVAC Applications Handbook: Chapter 34, Testing, Adjusting and Balancing.

C. ASHRAE - 1999 HVAC Application Handbook: Chapter 46, Sound and Vibration Control.

D. ASHRAE - 1999 Applications Handbook: Chapter 41 - Building Commissioning.

1.4 SUBMITTALS

A. Test Reports
1. Submit test report forms for review minimum ninety (90) days prior to requesting final review by A/E.
2. Furnish six individually bound copies of test data. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of test instrument and list all measurements taken, both prior to and after any corrections are made to the system. Record all failures and corrective action taken to remedy incorrect situation.
3. A/E will retain one copy. Remaining copies will be returned for inclusion in operation and maintenance manuals.
4. Submit draft copies of report for review prior to final acceptance of project. Provide final copies for A/E and for inclusion in operating and maintenance manuals.
5. Submit reports on AABC National Standards for Total System Balance forms and including all of the listed information.

B. Refer to Section 01 33 29 for shop drawing and submittal preparation and submission requirements.

1.5 CLOSEOUT SUBMITTALS

A. Record Drawings: Include a set of reduced drawings with air outlets and equipment identified to correspond with data sheets and indicating thermostat locations.

B. Submit Operation and Maintenance (O&M) Manuals for the project in accordance with Section 01 78 23.13.

1.6 QUALITY ASSURANCE

A. Testing: Perform tests by and under the supervision of fully experienced and qualified personnel. Advise each respective manufacturer's representative of tests on their equipment.

B. Testing, Adjusting, and Balancing:
1. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance – 6th Edition or Later.
2. The work shall be performed by a certified member of the Associated Air Balance Council (AABC) specializing in the testing, adjusting and balancing of systems specified with a minimum of three years of documented experience and a member in good standing, certified to perform services, of the AABC. Perform work under supervision of AABC Certified Test and Balance Engineer.

1.7 Warranty

A. The AABC contractor shall submit a National Project Performance Guaranty.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 INITIAL SYSTEMS TESTING BY THE INSTALLING CONTRACTOR PRIOR TO TAB WORK

A. Preparation
1. Furnish proposed test procedures, recording forms, list of personnel and test equipment for A/E review.
2. Follow industry standard practices and procedures for testing, balancing, and commissioning.
3. Document all data in the test report.
4. Cooperate with other trades and installers of other work during the testing, adjusting, balancing, and start-up of mechanical systems.
5. The A/E must be notified a minimum of 72 hours prior to any tests being conducted.
6. The TAB Contractor must be notified a minimum of five working days prior to conducting any duct leakage tests and same must be present to witness all duct leakage tests.

B. Start-Up Testing
1. Chillers
a. The chiller manufacturer's factory representative will be required to be present at start-up.
b. Demonstrate system operations, and verify specified performance
c. Except as otherwise indicated, start up chiller in accordance with chiller manufacturer’s instructions.

d. Do not place chiller in sustained operation prior to initial balancing of the mechanical systems affected by chiller operations.

e. Complete the report preparation, and review the report on related work prior to chiller start-up; do not start chiller until inadequacies have been corrected in manner acceptable to chiller installer

f. Include field capacity tests to verify the compliance of the installed equipment with the Contract Documents.

g. Provide factory trained representative that is qualified to supervise the testing operations, and to obtain test data required to enable the water chilling unit manufacturer to certify the capacity of the units based on field tests.

h. Conduct tests in accordance with methods prescribed by ARI Standard 550-88, with the exception that test quality evaporator and condenser pressure gauges may be used. Brush clean the water sides of the condensers and evaporators immediately prior to the test. Assume the water side fouling factor to be 0.00025 during the test. Certify that the units can produce at least the specified cooling capacity with a maximum kilowatt per ton input not to exceed 105 percent of the specified value. Provide all necessary instruments, thermometers, gauges, manometers, etc., required for the tests.

i. Review the installation of the water chilling units, and provide a written report that related work is satisfactory for proper operation and performance of chiller. Verify proper installation of the following:

1) Air-Cooled Chillers

a) Piping connections including provisions for disconnecting and servicing of chiller.

b) Isolation of chilled water piping connections to chiller.

c) Condenser fan operation.

d) Condenser coil tubes and fins. Comb out any bent fins.

e) Safety guards.

f) Necessary balancing valves in water piping (at no additional cost to owner whether shown on the drawings or not).

g) Pipe strainers to protect chiller components and controls including pumps, automatic modulating valves and controls.

h) Pipe supporting and bracing independent of chiller to prevent transfer of pipe stresses to chiller components.

i) Flow switches or pressure differential switches properly installed in horizontal piping near the chiller.

j) Vibration and noise provisions.

k) Wiring of flow switches or pressure differential switches with chiller interlock.

l) Pressure gauges and thermometers.

m) Electrical wiring to chiller control panel and unit motors from line disconnects.

n) Electrical wiring of oil pump/starter, refrigeration transfer compressor/starter and controls.

o) Electrical wiring of chilled water pump starters with chiller interlock.

p) Chiller safety wiring to include pump interlocks and control interfaces.

2) Water-Cooled Chillers

a) Piping connections including provisions for disconnecting and servicing of chiller.
b) Relief pipe, including dirt trap and flexible connection.
c) Tap in condenser lines for acid cleaning.
d) Isolation of chilled water piping connections to chiller.
e) Necessary balancing valves in water piping (at no additional cost to owner whether shown on the drawings or not).
f) Pipe strainers to protect chiller components and controls including pumps, automatic modulating valves and controls.
g) Pipe supporting and bracing independent of chiller to prevent transfer of pipe stresses to chiller components.
h) Flow switches or pressure differential switches properly installed in horizontal piping near the chiller.
i) Vibration and noise provisions.
j) Wiring of flow switches or pressure differential switches with chiller interlock.
k) Pressure gauges and thermometers.
l) Electrical wiring to chiller control panel and unit motors from line disconnects.

2. Cooling Towers
   a. The cooling tower manufacturer's factory representation will be required to be present during start-up
   b. Comply with CTI Standard Specification ATC-105 procedures for Cooling Tower Testing.
   c. Ensure water systems serving tower(s) are thoroughly cleaned of all dirt and foreign matter prior to operating.
   d. Ensure proper rotation of tower fans(s).
   e. Ensure interior fill of tower is free from scale, algae or tar.
   f. Maintain water level in tower basins at proper level.
   g. Verify centrifugal action of water is not causing entrainment of air.
   h. Test with full flow through tower. All valves except balancing valves should be full open during testing.
   i. Conduct water flow tests to determine volume of water in tower, and of make-up and blowdown water.
   j. Conduct water temperature tests and verify proper temperatures.
3. Boilers
   a. Boiler Combustion Test: In accordance with ASTM PTC 4.1.
   b. The boiler manufacturer's factory representation will be required to be present during start-up.
   c. Except as otherwise indicated, start up boiler in accordance with boiler manufacturer’s instructions.
   d. Do not place boiler in sustained operation prior to initial balancing of the mechanical systems affected by boiler operations.
   e. Include the following Demonstrate system operations, and verify specified performance;
      1) Boiler manufacturer.

2) Model.
3) Firing rate.
4) Overfire draft.
5) Gas meter timing dial size.
6) Gas meter time per revolution.
7) Gas pressure at meter outlet.
8) Gas flow rate.
9) Heat input.
10) Burner manifold gas pressure.
11) Percent carbon monoxide (CO).
12) Percent carbon dioxide (CO_2).
13) Percent oxygen (O_2)
14) Percent excess air.
15) Flue gas temperature at outlet.
16) Ambient temperature.
17) Net stack temperature.
18) Percent stack loss.
19) Percent combustion efficiency.
20) Heat output.

f. Complete the report preparation, and review the report on related work prior to boiler start-up; do not start boiler until inadequacies have been corrected in manner acceptable to boiler installer.

4. Air Handling Units
   a. Follow manufacturer's instructions for startup.
   b. Ensure units are clean and free of debris prior to operation. Verify no water in unit.
   c. Clean inside of unit to remove any dust and debris.
   d. Ensure proper mounting height of unit to ensure proper condensate trap level and drainage.
   e. Ensure filters are in place prior to testing.
   f. Ensure isolators are not tied down and adjust for proper isolation.
   g. Ensure dampers are operating as intended with no restrictions.
   h. Ensure all duct connections to unit are airtight.
   i. Seal all penetrations to unit airtight – do not seal with insulation.
   j. Ensure fan(s) turn freely without obstruction.
   k. Check fan wheel and shaft bearings and drive sheave set screws for proper torque.
   l. Ensure proper fan rotation.
   m. Provide proper sheaves on fan/motor assemble and adjust to proper tension.
   n. Verify correct fan speeds.
   o. Verify sound transmission data.
5. Fans/Pumps
   a. Ensure proper fan/pump operation.
   b. Check motor amperage and voltage. Verify proper wiring.
   c. Verify the proper the alignment of all couplings, drives, and shafts using calibrated dial gauges in all axes.
   d. Verify the fans and pumps are free of vibration
   e. Verify the correct coupling for motor size.
   f. Verify proper fan/impellor rotation.
   g. Ensure dampers/valves are in correct position and operable.

h. Ensure fan/pumps free of excessive vibration and noise in accordance with procedures referenced in this document.

6. Refrigerant Systems
   a. Clean lines of scale, direct and foreign matter before making connections and purge with dry nitrogen to prevent oxidation during brazing.
   b. After completion, pressure the high and low pressure sides of the piping system at the test pressures specified in ASHRAE 15 for the refrigerant type to be used. Leak test with a bubble solution followed by a Halide torch test. Repair any leaks and repeat tests until no further leaks are found and the system passes a static leak test pressure for a duration of 24 hours.
   c. After the pressure tests are complete, exhaust the system including the coils by a suitable vacuum pump connected to the liquid line. After 2.5 mm of mercury absolute pressure is obtained, continue the evacuation for 72 hours. Check the vacuum by a suitable mercury column gauge.
   d. After the dehydration of the system is thus completed, charge the system with refrigerant and put into operation.
   e. Follow the general test guidelines of ASHRAE 15 for the tests of the refrigerant piping system.
   f. Test refrigeration system in accordance with ASME B31.5.
   g. Provide written test report detailing methods, materials, and results.

C. Vibration Testing
   1. Perform vibration test and provide required data on each piece of air handling/ventilation equipment or fan. Vibration testing must be completed in compliance with the requirements of ASHRAE - 1999 HVAC applications Handbook: Chapter 46, Sound and Vibration Control and the maximum listed RMS values listed therein.
   2. Location of Points for Air Handling Unit Fans and all other Fans:
      a. Fan bearing, drive end.
      b. Fan bearing, opposite end.
      c. Motor bearing, center (if applicable).
      d. Motor bearing, drive end.
      e. Motor bearing, opposite end.
   3. Test Readings:
      a. Horizontal, velocity and displacement.
      b. Vertical, velocity and displacement.
      c. Axial, velocity and displacement.
   4. Normally acceptable readings, velocity and acceleration.
   5. Unusual conditions at time of test.
   6. Vibration source (if non-complying).
   7. Adjust systems so that all readings are in compliance.

D. Sound Testing
   1. Perform sound power level tests and provide required data on each occupied space adjacent to, above, or below mechanical/air handling unit equipment rooms.

E. Duct-Leakage Testing
   1. Test all supply air ductwork, to include, but not limited to, downstream of all single zone and multi-zone air handling units, downstream of all VAV air

handling units and upstream of fan powered terminal units at 2-1/2 inches of static pressure (except where this requirement would exceed the ductwork design pressure classification) to have a total leakage value not to exceed 2% of the total system design airflow

2. Test all supply, return, and exhaust air ductwork, to include, but not limited to, downstream of fan coil units and fan powered terminal units, upstream of air handling units, and upstream and downstream (where applicable) of fans at 1-1/2 inches of static pressure to have a total leakage value not to exceed 2% of the total system design airflow
3. Ductwork that initially fails these tests shall be replaced, modified, resealed, etc. as required to meet the leakage requirement and then re-tested to ensure compliance.

F. Hydronic Systems Testing

1. Hydrostatic Pressure Testing: After the piping systems are complete and prior to flushing, cleaning, finishing and/or insulating of the piping systems, hydrostatically test all chilled water, condenser water and heating hot water piping with the connected equipment isolated. All non-threaded piping systems shall be tested with a hydrostatic test pressure equal to 150% of the system working pressure at the lowest level of the building. The pressure shall be maintained without any change for a period of twenty-four (24) hours. Piping systems utilizing threaded piping shall be tested at the system working pressure for the fittings but, not less than 150 psig, for twelve (12) hours without a drop in pressure. If the system maintains test pressure, the threaded systems will be isolated from the remaining system and the remaining system shall be tested at 150% of the system working pressure for the remaining twelve (12) hours without a drop in pressure. A drop in pressure during the testing shall require the contractor to make the necessary repairs and re-run the test until it is successful completed (no drop in pressure for a period of twenty-four (24) hours). The testing shall be performed when the temperature is 60 ˚F or higher. After the successful completion of the hydrostatic testing, completely flush the entire piping system.
2. Cleaning, Flushing, and Finishing:
   a. General: Prior to any field activity, Contractor must submit for approval a cleaning and flushing plan detailing all equipment to be used in the cleaning and flushing process and a schematic drawing showing the arrangement of pumps. strainers, piping, valves, hoses, etc.[and frac tanks.] All equipment must be certified clean and free of any oils or other contamination. All chemical treatment equipment must include secondary containment.
   b. Pre-operational cleaning of pipe: After chilled water, condenser water, and heating hot water piping have been pressure tested and approved for tightness, fill the new pipe with City water and add (appropriate chemicals as directed by Airport accepted vendor) and circulate continuously at a velocity between 4 and 10 fps for a period of forty-eight (48) hours to remove debris, oils and surface rust. During the circulation period, the water shall be tested for iron. The water chemistry shall be adjusted until the iron concentration stabilizes for a minimum of two (2) testing cycles. [When the chemical testing indicates the pipe is clean, the water contained in the section of pipe being cleaned plus one complete flush of the pipes with City water shall be discharged into frac

tanks and held for sampling and testing by A/E. Pollutants required for analytical testing shall be determined by City of Houston approved testing company.] Written authorization from the City of Houston required for all proposed discharges that include any chemistry introduced to the water pipe system. Authorization to discharge shall be approved only upon the review of analytical data representative of the proposed discharge, and the analytical methods employed must be in accordance with 40 CFR Part 136. The City of Houston may elect to collect a confirmation sample of the proposed discharge prior to providing authorization to discharge. Completion of this step shall be documented with signatures from the contractor and chemical treatment vendor. Contractor is responsible for the integrity of the containment and daily inspections of all equipment. Water supply and disposal are the Contractor's responsibility.

c. Pre-operational rinsing: of pipe: Fill the pipe with City water and circulate at 8 fps for one (1) hour before discharging to sanitary sewer per City of Houston requirements. Continue rinsing the pipe with City water until all of the following criteria are met:
   1) The discharge water is clear.
   2) The iron and pH levels are within acceptable limits as determined by the chemical treatment vendor.
   3) The conductivity of the discharge water is the same as the conductivity of the City supply water

   Completion of this phase shall be documented with signatures of representatives for the Contractor(s), HAS, and chemical treatment vendor. Water supply and disposal are the Contractor's responsibility.

d. Finishing: When the pre-operational steps have been completed, chemical treatment vendor shall add approved treatment chemicals and circulate water as specified and the piping system can be insulated.

3.2 COORDINATION OF TAB EFFORTS BETWEEN INSTALLING CONTRACTOR AND TAB CONTRACTOR

A. HVAC System Verification
   1. Perform all testing required under the testing section of these specifications prior to commencing TAB coordination.
   2. Complete the installation and operate all systems to ensure they are operating in accordance with the requirements of these specifications and drawings, and perform all other items as described hereinafter to assist the balancing firm in performing the balancing, testing and adjusting of the systems. The items include, but are not limited to, the following.

B. Air Distribution Systems
   1. Verify installation of all supply, return and exhaust ducts for conformity to design.
   2. Verify all volume, splitter, extractor and fire dampers are properly located and functional. Provide tight damper closure and full opening, smooth and free operation.
   3. Air supply, return, exhaust, transfer grilles, registers, diffusers and terminal units installed and operational.

4. Blank and/or seal air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., to eliminate excessive bypass or leakage of air.
5. All fans (supply, return, relief and exhaust) operating and verified for freedom from vibration, proper fan rotation and belt tension; correct overload heater elements; and clean filters installed.

C. Hydronic Systems
1. Check and verify pump alignment and rotation.
2. Clean water systems and strainers by circulation for normal operation.
3. Check each pump motor amperage and voltage to ensure readings do not exceed nameplate rating.
4. Verify electrical overload heater elements to be of proper size and ratings.
5. Fill all water circulating systems and verify they are free of air and all vents installed at high points of systems.
6. Check and set operating temperatures of heat exchangers to design conditions.

D. Controls
1. Verify that all control components are installed in accordance with project requirements, including all electrical interlocks, damper sequence air and water resets, fire and freezestats. Stroke all controls through the full range.
2. Calibrate all controlling instruments and set for the design conditions.

E. Sequencing and Scheduling
1. Sequence work to commence after completion of systems and prior to substantial completion of project.

F. Start-Up Documentation and Verification
1. Cooperate with the balancing firm to provide all necessary data on the design and proper application of the system components and furnish all labor and material required to eliminate any deficiencies. List all motors, nameplate data and size of overload heater installed. Record motor amperage during operation.
2. The drawings and specifications indicate valves, dampers, sheaves, and miscellaneous adjustment devices required to obtain optimum operating conditions to verify that all adjustment devices are accessible and readily adjustable. Provide any additional devices, at no additional cost, as directed by the TAB contractor for proper systems balancing and operation.
3. Accurately record actual locations of balancing valves and rough setting.
4. Verify the following for all equipment:
    a. Equipment is operable and operates in a safe and normal condition.
    b. Temperature control systems are installed complete and operable
    c. Proper thermal overload protection is in place for electrical equipment.
    d. Final filters are clean and in place. If required, install temporary media in addition to final filters.
    e. Duct systems are clean of debris.
    f. Correct fan rotation.
    g. Fire and volume dampers are in place and open.
    h. Coil fins have been cleaned and combed.
    i. Access doors are closed and duct end caps are in place.
    j. Air outlets are installed and operable.
    k. Duct system leakage has been minimized.

l. Pretest components in the VFD. Provide factory certification of testing the entire VFD with varying induction motor loads for 24 hours prior to shipment.
m. Proper sequencing and operation of all DDC Control System components and equipment as required by ASHRAE Standard on Total Building Mechanical System Commissioning.

G. Rework of Deficiencies
1. After initial review and testing, the TAB contractor shall prepare a List of Deficient Items. This list shall be provided to the installing contractor. The installing contractor shall immediately undertake actions to fix every deficiency in a timely manner.
2. Deficiencies shall be fixed at no additional cost to the Owner or Engineer.
3. Installing contractor shall notify the TAB contractor and Engineer of status of deficiencies, expected completion dates and actual completion dates.
4. Provide any additional balancing devices required for complete system balancing.

3.3 TESTING, ADJUSTING, AND BALANCING OF SYSTEMS BY THE TAB CONTRACTOR

A. Preparation
1. Conform to the specifications which include, but are not limited to, the following:
a. Air and water flows balanced to specified quantities.
b. Temperature regulation verification by hourly readings for three consecutive eight-hour days.
c. Three inspections within 90 days of occupancy for temperature verification.
d. Opposite season adjustment of systems.
2. Furnish proposed test procedures, recording forms, list of personnel and test equipment for A/E review.
3. Follow recommended procedures for testing as published by test equipment manufacturer.
4. Provide instruments required for testing, adjusting and balancing operations. Make instruments available to A/E to facilitate spot checks during testing.
5. The TAB contractor shall provide to the installing contractor and design team a List of Deficient items to be corrected as soon as possible during the TAB work.

B. Air Distribution Systems
1. Installation Tolerances: Adjust air handling systems to scheduled values plus or minus 5 percent for supply systems and plus or minus 10 percent for return and exhaust systems.
2. Test Procedures:
a. Adjust all new air handling and distribution systems to provide design supply, return, and exhaust air quantities.
b. Make air quantity measurements in ducts by pitot tube traverse of entire cross sectional area of duct.
c. Measure air quantities at air inlets and outlets.
d. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

e. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Control volume by internal duct devices such as dampers and splitters.

f. Vary total system air quantities by adjustment of sheaves. Provide drive changes required. Vary branch air quantities by damper regulation.

g. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

h. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

i. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

j. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

k. Where modulating dampers are provided, take measurements and balance at extreme conditions.

l. On multi-zone air handling units, in addition to the balancing requirements for other air handling units and after the fan has been adjusted to deliver the scheduled fan air quantity at the listed static pressure with zone damper section open (cooling damper damper full open and the bypass damper partially open), the zone balancing damper fully open and the air device dampers full open; the contractor shall traverse each zone duct and adjust manual balancing damper to attain the minimum scheduled zone air quantity. After the zone balancing dampers are set, the contractor shall verify the zone duct air quantity by again traversing the ducts prior to trimming the air flow at the air devices. Adjust the air device dampers to final balance the zone air quantity.

m. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain positive static pressure near the building entries to outside (not to exceed 0.05 inches).

n. Constant volume systems shall be tested as follows:

1) Test run fan/motor combinations, volume dampers and controls.
2) Maximum Allowable Damper Leakage: Two percent (2%) of design air flow at inlet static pressure.
3) Set volume with damper operator attached to assembly allowing modulation from one-hundred percent (100%) of design cooling air flow to one-hundred percent (100%) design heating air flow.
4) Check control sequence.
5) Provide record data that represents the actual measured, and observed conditions.
6) Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
7) After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
8) Leave systems in proper working order, replace adjustable sheaves with permanent fixed position sheaves, replace belt guards, closing access doors, and restoring thermostats to specified settings.

9) At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by A/E.
10) Check and adjust systems for opposite season performance approximately six months after final acceptance and submit report.

C. Hydronic Systems
1. Adjust all new and existing water systems to provide required or design quantities.
2. Use calibrated metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
3. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
4. Balance system with automatic control valves fully open to heat transfer elements.
5. Adjust water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shutoff valves for balancing unless indexed for balance point. Adjust hydronic systems to plus or minus ten percent (10%) of design conditions indicated.
6. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

D. Controls
1. Work with the controls contractor to ensure the most effective total system operation is within the design limitations, and to obtain a mutual understanding of the intended control performance.
2. Verify that all control devices are properly connected and operated by the intended controller.
3. Verify that all valves are properly installed in the piping system in relation to direction of flow and location. Verify proper application of normally open and closed valves.
4. Observe locations of all sensors to determine their functional appropriateness.
5. Verify operation of all interlocks.
6. Verify action of variable volume systems between minimum and maximum flow.
7. Verify sequences of operation are in accordance with design.

E. Equipment Tests
1. Chillers
a. Balance flow of water through each evaporator to be within a range of one-hundred percent (100%) to one-hundred and ten percent (110%) of design flow with all pumps operating. With only one pump operating, the maximum flow shall not exceed the maximum tube velocity recommended by the manufacturer.
b. Observe demonstration that all safety interlocks and controls are functioning properly. Record observations.

c. With each chiller operating at near design temperature conditions, measure and record the appropriate data in the chiller test form.

2. Cooling Towers
   a. Balance flow of water through each tower/cell to be within a range of to one-hundred and ten percent (110%) of design flow with all pumps operating. With only one pump operating, the maximum flow shall not exceed the maximum velocity recommended by the manufacturer.
   b. Observe demonstration that all safety interlocks and controls are functioning properly. Record observations.
   c. With each tower operating at near design temperature conditions, measure and record the appropriate data in the cooling tower test form.
3. Boilers
   a. Observe demonstration that all controls and safety devices are functioning properly. Record observations.
   b. Check for proper operation and with operation at near design conditions, and record the appropriate data in the boiler form.
4. Heat Exchangers
   a. Observe demonstration that all controls and safety devices are functioning properly. Record observations.
   b. With each unit operating at near design conditions, measure and record the appropriate data on the heat exchanger form.
5. Air-Cooled Condensing Units
   a. Observe demonstration that all controls are functioning properly. Record observations.
   b. With each unit operating at design conditions, measure and record the appropriate data on the condensing unit form.
6. Air Handling Units/Coils
   a. Observe demonstration that all controls and safety devices are functioning properly. Record observations.
   b. Check for proper operation and with operation at design conditions, and record the appropriate data in the air moving equipment, fan data, and coil forms.
7. Fans
   a. Observe demonstration that all controls are functioning properly. Record observations.
   b. With each unit operating at design conditions, measure and record the appropriate data on the fan data form.
   c. Record all air pressure readings.
8. Pumps
   a. Observe demonstration that all controls are functioning properly. Record observations.
   b. With each unit operating at design conditions, measure and record the appropriate data on the pump data form.
   c. If discharge valves on pumps are used for balancing, record the head being restricted by valves.
   d. Record all water pressure readings.
9. Terminal Units
   a. Adjust all terminal unit minimum and maximum airflow values.
   b. Record Airflows and pressure drops.
10. Miscellaneous Systems

a. Observe demonstration that all controls are functioning properly. Record observations.
b. With each unit operating at design conditions, measure and record the data on the appropriate form.
c. Record all air pressure, water, temperature, etc. readings.

END OF SECTION 230593

SECTION 230713

DUCT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ductwork Insulation, jacketing, and lining.

1.2 REFERENCES

A. ASHRAE 90.1 – Energy Conservation Standard for Commercial Buildings.

B. ASTM C165 – Test Method for Measuring Compressive Properties of Thermal Insulation.

C. ASTN C167 – Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.

D. ASTM C168 – Terminology Relating to Thermal Insulating Materials.

E. ASTM C177 – Test Method for Thermal Transmission properties at a Range of Mean temperatures.

F. ASTM C411 – Test Method for Hot-Surface Performance of High Temperature Thermal Insulation.

G. ASTM C423 – Test Method for Sound Absorption by the Reverberation Room Method.

H. ASTM C553 – Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

I. ASTM C612 – Specification for Mineral Fiber Block and Board Thermal Insulation.

J. ASTM C916 – Specification for Adhesives for Duct Thermal Insulation.

K. ASTM C1071 – Standard Specification for Flexible and Rigid Plenum Liner.

L. ASTM A1136 – Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

M. ASTM C1290 – Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC ducts.

N. ASTM C1338 – Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

O. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

P. NAIMA (North American Insulation Manufacturers Association) – Fibrous Glass Duct Liner Standard.

Q. UL 181 – Standard for Factory Made Air Ducts and Connectors.

R. UL 1978 – Standard for grease Ducts.

1.3 SUBMITTALS

A. Manufacturer's product data to include the following:
1. Application Company Qualifications
2. Product descriptions.
3. Provide a table indicating ductwork system, with insulation type and thickness for each type of ductwork system in the project.
4. Manufacturer's installation instructions.

B. Submit product data for:
1. Duct insulation.
2. Duct insulation jackets.
3. Sealants.
4. Adhesives.
5. General materials.

C. Refer to Section 01 33 30 for additional shop drawings and submittal preparation requirements.

1.4 CLOSEOUT SUBMITTALS

A. Submit Operation and Maintenance Manuals for the project in accordance with section 01 78 23.11.

1.5 QUALITY ASSURANCE

A. Application Company Qualifications: The installing company must be in the business of insulation installation for the previous consecutive five year period. The installing company must also be regularly engaged in installing the specific specified insulation material types on projects of equal or greater magnitude and scope as this project for the previous consecutive five-year period.

B. Application Personnel Qualifications: The installing company must provide qualified installation personnel on this project jobsite directly employed by them who are skilled and proficient at installing the specific specified insulation material types.

C. All materials (to include, but not limited to, insulation, jackets, facings, coatings, mastics, adhesives, sealants, etc.) installed inside the building must have a certified and tested composite flame spread/smoke developed rating of 25/50 in accordance with ASTM E84

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Certainteed Corporation.

B. Johns Manville Corporation.

C. Knauf Fiber Glass.

D. Owens-Corning.

E. 3M (Grease Duct Insulation).

F. Kingspan Corporation (Koolphen/Kooltherm)

2.2 DUCTWORK INSULATION MATERIALS

A. Type D1: Flexible Fiberglass Blanket.
1. Specification Compliance: ASTM C553 Types I, II, III, and ASTM C1290.
2. 'K' Value: 0.29 at 75 Degrees-F (ASTM C177).
3. Maximum Service Temperature: 250 Degrees-F (faced).
4. Vapor Retarder Jacket: FSK (Foil Scrim Kraft) facing (ASTM C1136 – Type II).

B. Type D2: Rigid Fiberglass Board.
1. Specification Compliance: ASTM C612 Types IA, IB.
2. 'K' Value: 0.23 at 75 Degrees-F (ASTM C177).
3. Maximum Service Temperature: 450 Degrees-F (faced).
4. Vapor Retarder Jacket:
   a. FSK (Foil Scrim Kraft) facing (ASTM C1136 – Type II).
   b. ASJ (All-Service Jacket) facing (ASTM C1136 – Type I).

C. Type D3: Internal Acoustic Rigid Fiberglass Plenum Liner (with Polymer Resin)
1. Specification Compliance: ASTM C1071 – Type II, NFPA 90A & 90B.
2. 'K' Value: 0.24 at 75 Degrees-F (ASTM C177).
3. Maximum Service Temperature: 250 Degrees-F.
4. Noise Reduction Coefficient (NRC): 0.70 for 1-inch liner (ASTM C423 – Type A).
5. Maximum Air Velocity: 4000 FPM.
6. Does not support the growth of mold, fungi, or bacteria (ASTM C1338).
7. Internal liner shall be glass fibers bonded with a thermosetting resin. The surface shall be an acrylic or mat-faced coating system. Edge coating shall be factory applied.

D. Type D4: Fire-Rated Grease Duct Insulation
1. Refractory grade fiberous (non-asbestos containing) fire barrier to be used in lieu of 1 or 2 hour fire resistant rated shaft enclosure. System may have one or more layers to achieve desired rating.
2. Specification Compliance: ASTM C411, ASTM C518, ASTM E119, ASTM E136, ASTM E814, and UL 1978.
3. 'K' Value: 0.92 at 1000 Degrees-F (ASTM C177).

4. Minimum Service Temperature: 2,000 Degrees-F.
5. Jacket: Foil Encapsulated.
6. Surface Burning Characteristics: Flame Spread: 0; Smoke Developed: 0 (ASTM E84).
7. Insulation shall have passed UL 1987.

E. Type D5: Phenolic Foam Duct Insulation
1. Specification Compliance: ASTM C1126, Grade 1.
2. K' Value: 0.13 at 75 Degrees-F (ASTM C177).
3. Maximum Service Temperature: 175 Degrees-F.
4. Vapor Retarder Jacket:
   a. FSK (Foil Scrim Kraft) facing (ASTM C1136 - Type I).
   b. ASJ (All-Service Jacket) facing (ASTM C1136 -Type I).

2.3 INSULATION ACCESSORIES

A. Adhesives:
1. Adhesives shall conform to ASTM C916 and ASTM E84.
2. Lagging Adhesive: Suitable for bonding fibrous glass cloth to faced and unfaced insulation, or for bonding fibrous glass insulation to metal surfaces.
3. Contact Adhesive: Neoprene based, rubber based, or elastomeric type. Adhesive shall not adversely affect, at any time, the insulation to which it is applied. Adhesive shall not emit any odors, or toxic chemicals after drying. Solvent dispersing mediums shall not contain benzene or carbon tetrachloride.

B. Vapor Retarder:
1. ASTM C921, Type I.
2. Mastic Coating:
   a. Appropriately selected for indoor or outdoor application.
   b. Color: White.
   c. Vapor Permeance: Determined according to procedure B of ASTM E96.
   d. Application and Service properties in accordance with ASTM C647.

C. Cements:
1. Mineral fiber insulation cement shall conform to ASTM C195.
2. Finishing Cement: ASTM C449 mineral fiber hydraulic setting thermal insulating and finishing cement.

D. Mechanical Fasteners/Impale anchors (self-stick pins): Provide with self locking washers.

E. Fibrous Glass Cloth and Glass Tape:
1. Mesh Size: 20x20.
2. Tape Size: 4-inch wide roll.
3. Class 3 tape shall be 4.5 oz./square yard.

F. Caulking: ASTM C920, Type S, Grade NS, Class 25, Use A.

G. External Duct Jackets:
1. Aluminum Jackets:
   a. Construction: Smooth sheet.

b. Thickness: 0.016 inch nominal (27 gauge).
c. ASTM B209 with factory applied polyethylene and kraft paper moisture barrier on inside surface.
d. Securing Bands:
   1) Type 304 stainless steel.
   2) 0.015 inch thick.
   3) 1/2 inch wide.
e. Seam bands shall be 2 x 0.016 inch aluminum matching jacket material.

H. Insulation Bands: 1/2 inch wide, 26 gauge stainless steel

I. Wire: Soft annealed ASTM A580 Type 304 stainless steel – 16 gauge.

J. Sealants:
1. Butyl polymer type, styrene-butadiene rubber type or butyl type.
2. Maximum vapor transmission of 0.02 perms.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install materials after ductwork has been sealed, tested, and approved.

B. Clean and dry all surfaces prior to installation of insulation and adhesives. All ducts must be cleaned of debris and overspray prior to installation.

3.2 INSTALLATION

A. General:
1. All portions of duct designated to receive insulation shall be completely covered with the specified thickness.
2. Locate insulation and cover seams in the least visible location.
3. Extend all surface finishes to protect all raw edges, ends, and surfaces of insulation.
4. On cold surfaces (below ambient temperature), insulation shall be applied with a continuous unbroken moisture and vapor seal.
5. All hangers, supports, anchors, and other projections secured to cold surfaces (below ambient temperature) shall be insulated and vapor sealed to prevent condensation.
6. Duct insulation shall be continuous through walls, ceiling, or floor openings, or sleeves except where firestop or fire-safing materials are required.
7. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces.
8. Duct insulation shall be continuous over the damper collar and retaining angle of fire dampers.
9. Vapor retarder materials shall be applied to form a complete unbroken vapor seal over the insulation at joints and any other penetrations that compromise the vapor seal of the ductwork.
10. All hangers shall be external to insulation jacket. Provide rigid insulation with a minimum density of five pounds per cubic foot (5 lbs./cu.ft.) that matches the

adjoining insulation applied to the duct. Rigid insulation shall extend a minimum of six inches (6") on inch side of the hanger. Provide an insulation isolation seal between the rigid insulation at hanger and the adjoining insulation.

B. Insulation application shall be as listed on following table.

Insulation Material Application Schedule*				
	Insulation Type	**Insulation Density (lb. per cu. ft.)**	**Insulation Thickness (in.)**	**Insulation Jacket**
Indoor – Concealed (R-5 Minimum)**				
Supply, Return, and Outside Air Ductwork				
Rectangular	D1	1.5	2"	FSK
Round/Oval	D1	0.75	2"	FSK
Exhaust / Relief Air Ductwork – only within 10-feet of fan or exterior opening				
Rectangular	D1	1.5	1"	FSK
Round/Oval	D1	0.75	1"	FSK
Indoor – Exposed (R-5 Minimum)**				
Supply, Return, and Outside Air Ductwork				
Rectangular	D2 / D5	3 / 2.5	1-1/2" / 1"	ASJ / ASJ
Round/Oval	(Factory insulated double-wall duct. Re: Ductwork Specification)			
Exhaust / Relief Air Ductwork – only within 10-feet of fan or exterior opening				
Rectangular	D2 / D5	3 / 2.5	1" / 1"	ASJ / ASJ
Round/Oval	D5	2.2	1"	ASJ
Outdoor (R-8 Minimum)**				
All Ductwork installed outdoors shall be double wall insulated construction.				
Rectangular	D5	2.5	2"	FSK
Round/Oval	(Factory insulated double-wall duct. Re: Ductwork Specification)			
Return Air Sound Boots	D3	3	1"	Poly-Resin
Grease / Kitchen Hood Exhaust Duct	D4	2.7	3"	FSK

* Where multiple insulation types are listed for a service, any of those listed may be used for that service. Where multiple thicknesses are listed – they correspond to the position of the insulation type before and after the "/" symbol.

** Values represent an "installed" R-value, not the "out-of-box" R-Value.

C. Installation of Type D1 – Flexible Fiberglass Blanket:

1. Cut insulation to length according to manufacturer's "stretch-out" instructions to avoid compression at corners. Leave two inch (2") end facing overlaps.
2. Wrap insulation around duct with facing to outside so that the facing overlap completely covers the facing and insulation of the opposite end of the section to create longitudinal seams.
3. The longitudinal and circumferential seams of the vapor retarder shall be overlapped a minimum of two inches (2"). Circumferential seams shall be overlapped in the same manner as longitudinal seams but using the integral factory overlap flaps.
4. Install blanket to obtain specified thickness (and minimum R-Value) (Re: Insulation Schedule above) using a maximum compression of 25%.
5. All joints shall be firmly butted with no interruptions or gaps.
6. Secure circumferential and longitudinal seams with outward clinching staples on six inch (6") centers. Each staple shall be repaired as specified hereinafter for penetration repair.
7. Insulation over rectangular ductwork over 18-inches in width shall be additionally secured using mechanical fasteners on 18-inch centers.
8. Seal circumferential and longitudinal seams with two (2) coats of mastic reinforced with one (1) layer of open weave glass fabric. PRESSURE SENSITIVE TAPE SHALL NOT BE USED.
9. At facer terminations and at all penetrations of the facing for hangers, supports, anchors, or projections the facer shall be sealed to the adjacent surface with two (2) coats of UL listed vapor retarder mastic reinforced with one (1) layer of four inch (4") wide, open weave glass fabric.
10. Any penetrations and damage to the facing shall be repaired using as a minimum two (2) layers of mastic reinforced with glass fabric.

D. Installation of Type D2 – Rigid Fiberglass Board:

1. Cut board to size and trim to provide a staple flap.
2. All joints shall be firmly butted with no interruptions or gaps.
3. Secure insulation board using mechanical fasteners starting three inches (3")from butt joint. Space fasteners on 18-inch centers.
4. Secure seams with outward clinching staples / impale anchors on six inch (6") centers.
5. Seal seams and joints with two coats of mastic reinforced with one layer of open weave glass fabric. PRESSURE SENSITIVE TAPE SHALL NOT BE USED.
6. At facer terminations and at all penetrations of the facing for hangers, supports, anchors, or projections the facer shall be sealed to the adjacent surface with two coats of UL listed vapor retarder mastic reinforced with one layer of 4-inch wide, open weave glass fabric.
7. Any penetrations and damage to the facing shall be repaired using mastic.

E. Installation of Type D3 - Internal Acoustic Rigid Fiberglass Plenum Liner

1. Liner shall be applied in strict accordance with NAIMA's "Fibrous Glass Duct Liner Standard".
2. All joints shall be firmly butted with no interruptions or gaps.
3. Longitudinal corner joints shall be overlapped and compressed.
4. Apply adhesive to sheet metal with a 90-percent minimum coverage. Coat all exposed edges of the liner with the adhesive.
5. Mechanical fasteners shall be installed perpendicular to the duct surface, and in no instance shall the pin compress the liner more than one-eighth inch (1/8") relative to the nominal thickness of the insulation. Install fasteners at eighteen inches (18") on center.
6. Length of mechanical fasteners shall be selected based on the manufacturer's recommendation as listed for each product.

F. Installation of Type D4 – Fire-Rated Grease Duct Insulation
1. External duct wrap system requires a minimum two (2) hour fire rating of lightweight, flexible wrap to provide an effective fire barrier in lieu of a two (2) hour shaft enclosure. One or more layers may be used as required to achieve a minimum two (2) hour rating.
2. The barrier shall be installed in twenty-four inch (24") or forty-eight inch (48") wide sections.
3. Insulation pins (as recommended by the insulation manufacturer) shall be welded in certain locations and clips used to maintain the fire barrier material up against the duct.
4. Install wrap using a telescoping overlap wrap method where each blanket overlaps one adjacent blanket and each blanket has one edge exposed and one edge covered by the next blanket.
5. Weld insulation pins to duct at centers of overlaps a minimum of one and one-half inches (1-1/2 ") from the edge of each blanket. Space a maximum of ten and one-half inches (10-1/2 ") on center along the perimeter overlap and along longitudinal overlaps.
6. Where two layers are used to meet rating, impale first layer of blanket over pins and hold in place with clips.
7. The joints of the second layer of wrap (where required) shall be staggered a minimum of twelve inches (12") from the first layer and joints overlapped like first layer.
8. Stainless steel banding shall be used to secure the second layer of wrap over the first (over first and only layer if only one layer required to meet 2-hour rating. Banding shall be applied one and one-half inches (1-1/2 ") from the edge of the blanket at maximum of ten and one-half inches (10-1/2 ") on center.

G. Installation of Type D5 – Phenolic Foam Duct Insulation
1. Install phenolic foam insulation in accordance with manufacturer's instructions.
2. For Rectangular Ducts:
   a. Cut insulation so that top and bottom pieces overlap the side pieces by the insulation thickness. All joints shall be firmly butted with no interruptions or gaps.
   b. Fully adhere insulation to duct using manufacturer's general purpose adhesive specifically designed for phenolic foam insulation.
   c. Provide insulation pins on widths 24-inches or greater. Space pins at 18-inch centers.

d. Seal seams and joints with two coats of mastic reinforced with one layer of open weave glass fabric. PRESSURE SENSITIVE TAPE SHALL NOT BE USED.

3. For Exterior Installation:
   a. Follow installation instructions for round or rectangular ducts as indicated above but add two (2) additional coats of mastic to exterior of insulation ensuring full insulation coverage. Mastic shall be suitable for exterior commercial / industrial use.
   b. Provide additional aluminum jacketing with banding on exterior of insulation. Bands shall be placed at twelve inch (12") centers. Jacketing shall be lapped in a water shed fashion.
   c. Ensure Seams on rectangular jacketing are at bottom of duct.
   d. Ensure exterior duct is sloped so that water will not stand or pool on ductwork/insulation.
   e. Ensure jacketing is "moisture-tight".
   f. Seal all junctions and penetrations with water-proof sealant.

3.3 EXAMINATION

A. Any materials found, by the A/E, to be improperly installed or not installed in total compliance with the specific installation instructions and methods (written or implied) of the material manufacturer must be removed and reinstalled by the installing company at no additional cost.

B. The preparation instructions must be followed prior to the re-installation of the insulation material using the correct installation instructions and methods of the material manufacturer.

END OF SECTION 230713

SECTION 230716

HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Thermal insulation for mechanical equipment including jackets and accessories.

1.2 REFERENCES

A. ASHRAE 90.1 – Energy Conservation Standard for Commercial Buildings.

B. ASTM A167 – Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

C. ASTM A240 – Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip for Pressure Vessels for General Applications.

D. ASTM B209 – Aluminum and Aluminum Alloy Sheet and Plate.

E. ASTM C165 – Test Method for Measuring Compressive Properties of Thermal Insulation.

F. ASTN C167 – Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.

G. ASTM C168 – Terminology Relating to Thermal Insulating Materials.

H. ASTM C177 – Test Method for Thermal Transmission properties at a Range of Mean temperatures.

I. ASTM C195 – Specification for Mineral Fiber Thermal Insulating Cement.

J. ASTM C411 – Test Method for Hot-Surface Performance of High Temperature Thermal Insulation.

K. ASTM C533 – Specification for Calcium Silicate Block and Pipe Thermal Insulation.

L. ASTM C534 – Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

M. ASTM C553 – Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

N. ASTM C591 – Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

O. ASTM C612 – Specification for Mineral Fiber Block and Board Thermal Insulation.

P. ASTM C921 – Jackets for Thermal Insulation.

Q. ASTM C1126 – Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.

R. ASTM C1136 – Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

S. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Manufacturer's product data to include the following:
1. Application Company Qualifications.
2. Product descriptions.
3. Provide a table indicating equipment designation, insulation type, density, and thickness for each piece of equipment in the project.
4. Manufacturer's installation instructions.

B. Submit product data for:
1. Equipment insulation.
2. Equipment insulation jackets.
3. Adhesives.
4. Sealants.
5. General materials.

C. Refer to Section 01 33 30 for additional shop drawings and submittal preparation requirements.

1.4 CLOSEOUT SUBMITTALS

A. Submit Operation and Maintenance Manuals for the project in accordance with section 01 78 23.13.

1.5 QUALITY ASSURANCE

A. Application Company Qualifications: The installing company must be in the business of insulation installation for the previous consecutive five year period. The installing company must also be regularly engaged in installing the specific specified insulation material types on projects of equal or greater magnitude and scope as this project for the previous consecutive five-year period.

B. Application Personnel Qualifications: The installing company must provide qualified installation personnel on this project jobsite directly employed by them who are skilled and proficient at installing the specific specified insulation material types.

C. All materials (to include, but not limited to, insulation, jackets, facings, coatings, mastics, adhesives, sealants, etc.) Installed inside the building must have a certified and tested composite flame spread/smoke developed rating of 25/50 in accordance with ASTM E84

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Armstrong/Armacell (Type E4)

B. Certainteed Corporation (Type E2).

C. Dow Chemical Company (Type E5).

D. Johns Manville Corporation (Type E2 / Type E3).

E. Knauf Fiber Glass (Type E2).

F. Kingspan Corporation (Type E1 / Type E5).

G. Owens-Corning (Type E2).

H. RBX Industries/Rubatex (Type E4).

I. Pittsburgh Corning (Type E6).

2.2 EQUIPMENT INSULATION MATERIALS

A. Type E1: Rigid Phenolic ("Koolphen K").
1. Specification Compliance: ASTM C1126, Type 3, ASTM C795.
2. 'K' Value: 0.13 at 75 Degrees-F (ASTM C518).
3. Maximum Service Temperature: 225 Degrees-F.
4. Factory Vapor Retarder Jacket: ASJ (All-Service Jacket) facing (ASTM C1136 – Type 1.

B. Type E2: Mineral Fiber ("Fiberglass").
1. Specification Compliance: ASTM C553 (Flexible), ASTM C612 (Board).
2. 'K' Value: 0.24 at 75 Degrees-F (ASTM C335).
3. Maximum Service Temperature: 850 Degrees-F.
4. Factory Vapor Retarder: None.

C. Type E3: Hydrous Calcium Silicate.
1. Specification Compliance: ASTM C533, Type 1
2. 'K' Value: 0.41 at 200 Degrees-F (ASTM C518).
3. Maximum Service Temperature: 1200 Degrees-F.
4. Factory Vapor Retarder Jacket: None.

D. Type E4: Flexible Elastomeric ("Armaflex").
1. Specification Compliance: ASTM C534, Type 1

2. 'K' Value: 0.27 at 75 Degrees-F (ASTM C518).
3. Maximum Service Temperature: 220 Degrees-F.
4. Factory Vapor Retarder Jacket: None.

E. Type E5: Polyisocyanurate ("Trymer", "Nilflam").
1. Specification Compliance: ASTM C591, Type 1
2. 'K' Value: 0.16 at 75 Degrees-F (ASTM C177).
3. Maximum Service Temperature: 300 Degrees-F
4. Factory Vapor Retarder Jacket: None.
5. Note: Does not meet Smoke Developed requirement of less than 50 when tested in accordance with ASTM E84. Use for outdoor systems only.

F. Type E6: Cellular Glass ("Foamglas").
1. Specification Compliance: ASTM C552.
2. 'K' Value: 0.29 at 75 Degrees-F (ASTM C177).
3. Maximum Service Temperature: 900 Degrees-F
4. Factory Vapor Retarder Jacket: None

2.3 INSULATION ACCESSORIES

A. Jackets:
1. Factory vapor retarder jacket as specified above.
2. Fiberglass Cloth Reinforcing Mesh: #10 glass cloth with minumum weight of 3.9 ounces per square yard.
3. Canvas Jackets: UL listed treated cotton fabric, 6 ounces per square yard.
4. Aluminum Jackets: ASTM B 209; 0.020 inch thick; smooth finish with factory applied moisture barrier.
5. Stainless Steel Jackets: Type 304 stainless steel; 0.010 inch thick; smooth finish.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel to match jacket

B. Adhesives:
1. Adhesives shall conform to ASTM C916 and ASTM E84.
2. Lagging Adhesive: Suitable for bonding fibrous glass cloth to faced and unfaced insulation, or for bonding fibrous glass insulation to metal surfaces. Provide products suitable for type of insulation being used.
3. Contact Adhesive: Neoprene based, rubber based, or elastomeric type. Adhesive shall not adversely affect, at any time, the insulation to which it is applied. Adhesive shall not emit any odors, or toxic chemicals after drying. Solvent dispersing mediums shall not contain benzene or carbon tetrachloride.
4. Provide products suitable for type of insulation being used.

C. Vapor Retarder Mastic Coating:
1. Water-based, flexible, high solids vapor barrier finish.
2. Appropriately selected for indoor or outdoor application.
3. Color: White.
4. Vapor Permeance: 0.013 perms at 43 mils dry, as determined according to procedure B of ASTM E96.
5. Suitable for service temperature of pipe.

D. Joint Sealant/Vapor Stop:
   1. Butyl polymer type, styrene-butadiene rubber type or butyl type.
   2. Maximum vapor transmission of 0.02 perms.
   3. Combustibility: Negligible.

E. Cements:
   1. Mineral fiber insulation cement shall conform to ASTM C195.
   2. Finishing Cement: ASTM C449 mineral fiber hydraulic setting thermal insulating and finishing cement.

F. Fibrous Glass Cloth and Glass Tape:
   1. Mesh Size: 20x20.
   2. Tape Size: 4-inch wide roll.
   3. Class 3 tape shall be 4.5 oz./square yard.

G. Caulking: ASTM C920, Type S, Grade NS, Class 25, Use A.

H. Insulation Bands: 3/4 inch wide, 26 gauge stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Thoroughly clean all surfaces to be insulated as required to remove all oil, grease, loose scale, rust, and foreign matter.

B. Equipment must be completely dry at the time of application. The installation of equipment insulation associated with an operating chilled water system is strictly prohibited.

C. PROVIDE PRIMER COAT ON ALL BARE STEEL EQUIPMENT TO BE INSULATED, TO INCLUDE FIELD WELDS. Refer to Mechanical identification Section of the Specifications. Primer paint shall be approved by the insulation manufacturer for installation contact with their insulation type. Painting must be completed and approved by the Engineer prior to installation of insulation.

3.2 INSTALLATION

A. Any materials found, by the A/E, to be improperly installed or not installed in total compliance with the specific installation instructions and methods (written or implied) of the material manufacture, must be removed by the installing company. The preparation instructions must be followed prior to the re-installation of the insulation material using the correct installation instructions and methods of the material manufacturer.

B. Install materials in complete and total compliance with the specific manufacturer's installation instructions and the following instructions.

C. Removable insulation sections shall be provided to cover parts of equipment that must be opened periodically for maintenance, including vessel covers, fasteners, flanges, and accessories.

D. Do not insulate factory insulated equipment.

E. Equipment insulation shall be omitted on the following:
1. Hand-holes.
2. Boiler manholes.
3. Cleanouts.
4. ASME stamps.
5. Manufacturer's nameplates.

F. Provide insulation for equipment handling media below 60 Deg-F to include the following:
1. Pumps.
2. Refrigeration equipment parts that are not factory insulated.
3. Drip pans under chilled equipment.
4. Cold water storage tanks.
5. Duct-Mounted coils.
6. Pneumatic water tanks.
7. Air handling equipment parts that are not factory insulated.
8. Expansion and air separation tanks.

G. Provide insulation for equipment handling media above 60 Deg-F to include the following:
1. Converters.
2. Heat exchangers.
3. Pumps handling media above 130 Deg-F.
4. Fuel oil heaters.
5. Hot water storage tanks.
6. Air separators.
7. Surge tanks.
8. Flash tanks.
9. Condensate receivers
10. Feed-water heaters.
11. Unjacketed boilers or unjacketed parts of boilers.
12. Boiler flue gas connection from boiler to stack (if inside).
13. Induced draft fans.
14. Fly ash and soot collectors

H. Pump Insulation:
1. Insulate pumps by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints that do not leave raw ends of the insulation exposed. Joints between sides and bottom shall be joined by adhesive with lap strips for board insulation and contact adhesive for flexible elastomeric cellular insulation. The box shall conform to the requirements of MICA Insulation Standards Plate 49 when using flexible elastomeric cellular insulation. Joint between top cover and sides shall fit tightly forming a female

shiplap joint on the side pieces and a male joint on the top cover, thus making the top cover removable.

2. Exposed insulation corners shall be protected with corner angles.
3. Two coats of vapor retarder shall be applied to the finished box with a layer of glass cloths embedded between the coats. The total dry thickness shall be 1/16 inch. A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. Caulking shall be applied to the parting line, between equipment and removable section insulation, and at all penetrations.

I. Other Equipment:
1. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.
2. Apply insulation as close as possible to equipment by grooving, scoring, and bevelling insulation, if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires or bands.
3. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
4. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not more than 12-inch centers except flexible elastomeric cellular which shall be adhered with contact adhesive. Insulation corners shall be protected under wires and bands with suitable corner angles.
5. Phenolic foam insulation shall be set in a coating of bedding compound and joints shall be sealed with bedding compound as recommended by the manufacturer. Joints and ends shall be sealed with a joint sealant and sealed with a vapor retarder coating.
6. Insulation on the heads of heat exchangers shall be removable. Removable section joints shall be fabricated using a male-female shiplap type joint. The entire surface of the removable section shall be finished by applying two coats of vapor retarder coating with a layer of glass cloth embedded between the two coats. The total dry thickness shall be 1/16 inch.
7. Upon completion of installation of insulation, penetrations shall be caulked. Two coats of vapor retarder coating shall be applied over insulation, including removable sections, with a layer of open mesh synthetic fabric embedded between the two coats. The total dry thickness shall be 1/16 inch. Caulking shall be applied to parting line between equipment and removable insulation sections.

J. Equipment Exposed to Weather: In addition to the insulation requirements above, equipment exposed to weather shall be finished as per the following.
1. Cylindrical Equipment: Provide an aluminum jacket with factory applied moisture retarder with joints lapped at not less than 3-inches and secured with bands located at circumferential laps and at not more than 12-inch intervals throughout. Horizontal joints shall lap down to shed water and shall be located at the 4 or 8 o'clock position. Joints shall be sealed with caulking to prevent moisture penetration. Where jacketing abuts an un-insulated surface, joints shall be sealed with caulking.
2. Other Equipment: Provide two coats of weather barrier mastic reinforced with fabric or mesh for outdoor application applied to the entire surface. Each coat

shall be 1/16 inch minimum thickness. The exterior shall be a aluminum or stainless steel jacketing applied for mechanical abuse and weather protection, and secured with screws. All joints shall be overlapped and sealed.

3.3 Insulation shall be suitable for the temperature encountered. Material and thickness shall be as shown in following table.

Equipment Insulation Material Application and Thickness Schedule

Application	Insulation Type	Insulation Density (lb/ft^3)	Insulation Thickness (in.)
Indoor – Concealed or Exposed **1- Finished Space: Factory ASJ – Painted according to Architect's Instructions** **2- Exposed in Mechanical Room or Unfinished Space:** **a) 6'-0" AFF or higher: Factory ASJ** **b) Below 6'-0" AFF: Canvas or Aluminum Outer Jacket** **3- Central Plant/Machinery Room** **a) 6'-0" AFF or higher: Factory ASJ** **b) Below 6'-0" AFF: Canvas or Aluminum Outer Jacket**			
Hot Thermal Storage Tanks	E2	2.5	1-1/2"
Boiler Feed Water Storage Tanks	E2	2.5	1-1/2"
Steam Condensate Receivers	E2	2.5	1-1/2"
Flash Tanks	E3	14.5	1-1/2"
Dearaetors	E3	14.5	1-1/2"
Flue Gas Breeching	E3	14.5	2-1/2"
Induced Draft Fan Scrolls	E3	14.5	2-1/2"
Flue Stacks to Roof	E3	14.5	2-1/2"
Boiler and Flue Boxes	E3	14.5	2-1/2"
Boiler Drum Heads	E3	14.5	2-1/2"
Muffler	E3	14.5	2-1/2"
Hot Water Expansion Tanks	E3	14.5	1"
Air Separators	E2	2.5	1"
Condensate Tanks	E2	2.5	1"
Heat Exchangers/Converters	E3	14.5	1-1/2"
Chilled and Hot Water Chemical Feed	E4	3.0	3/4"
Chilled and Hot Water Pump Bodies	E1	3.75	1"
Chiller Cold Surfaces (Not Factory Insulated)	E4	3.0	3/4"
Chilled Water Expansion Tanks	E1	3.75	1"
Refrigeration Equipment Parts Not Factory Insulated	E4	3.0	3/4"

Equipment Insulation Material Application and Thickness Schedule			
Application	**Insulation Type**	**Insulation Density (lb/ft^3)**	**Insulation Thickness (in.)**
Drip Pans	E4	3.0	3/4"
Duct-Mounted Coils	E2	1.5	2”
AHU Parts Not Factory Insulated	E1	3.75	2”
Outdoor **Jacket: Aluminum or Stainless Steel Outer Jacket.**			
Hot Water Expansion Tanks	E5 / E6	2.2 / 7.5	1-1/2” / 2-1/2”
Air Separators	E5 / E6	2.2 / 7.5	1-1/2” / 2-1/2”
Chilled and Hot Water Chemical Feed	E4	3.0	1-1/2"
Chilled and Hot Water Pump Bodies	E5 / E6	2.2 / 7.5	1-1/2” / 2-1/2”
Chiller Cold Surfaces (Not Factory Insulated)	E5 / E6	2.2 / 7.5	1-1/2” / 2-1/2”
Chilled Water Expansion Tanks	E5 / E6	2.2 / 7.5	1-1/2” / 2-1/2”
Refrigeration Equipment Parts Not Factory Insulated	E4	3.0	1-1/2"
AHU Parts Not Factory Insulated	E5 / E6	2.2 / 7.5	1-1/2” / 2-1/2”

* Where multiple insulation types are listed for a service, any of those listed may be used for that service. Where multiple thicknesses are listed – they correspond to the position of the insulation type before and after the “/” symbol.

END OF SECTION 230716

SECTION 233100

HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ductwork.

1.2 REFERENCES

A. ASHRAE – Handbook of Fundamentals; Duct Design.

B. ASHRAE – Handbook of HVAC Systems and Equipment; Duct Construction.

C. ASTM A167 – Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

D. ASTM A653 – Steel Sheet, Zinc-Coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

E. ASTM B209 – Aluminum and Aluminum-Alloy Sheet and Plate.

F. ASTM C1071 – Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

G. AWS D9.1 – Sheet Metal Welding Code.

H. NAIMA (North American Insulation Manufacturers Association) – Fibrous Glass Duct Liner Standard.

I. NFPA 37 – Installation and Use of Stationary Combustion Engines and Gas Turbines.

J. NFPA 45 – Fire Protection For Laboratories using Chemicals.

K. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

L. NFPA 90B – Installation of Warm Air Heating and Air Conditioning Systems.

M. NFPA 91 – Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Non-Combustible Particulate Solids.

N. NFPA 96 – Ventilation Control and Fire Protection of Commercial Cooking Operations.

O. NFPA 211 – Chimneys, Fireplaces, Vents, and Solid Fuel–Burning Appliances.

P. SMACNA – Fibrous Glass Duct Construction Standards.

Q. SMACNA – HVAC Air Duct Leakage Test Manual.

R. SMACNA – HVAC Duct Construction Standards – Metal and Flexible.

S. SMACNA – Round Industrial Duct Construction Standards.

T. UL 181 – Standard for Factory Made Air Ducts and Connectors.

U. UL 1978 – Standard for Grease Ducts.

1.3 SUBMITTALS

A. Provide enlarged scale shop drawings for all ductwork (one scale larger than the Contract Documents but not less than one-quarter inch (1/4") per foot).
   1. Ductwork layouts shall match, as closely as possible, the duct routings indicated on the Contract Drawings. All deviations shall be clouded clearly indicating the deviation as well as the item or items creating the deviation. Upon request, justification shall be provided for any deviations from the Contract Documents.
   2. The ductwork drawings shall indicate, as a minimum, ductwork section lengths; fittings; gauge; sizes, joints; bottom of duct elevation with the reference floor elevation indicated; offsets in in elevation ("up", "down", "rise", "drop", etc.); transition lengths; insulation and its thickness; and connections to equipment. All ductwork sections shall be dimensioned from two (2) perpendicular building column lines.
   3. Indicate ductwork pressure classification.
   4. Clearly designate fire and fire/smoke partitions on the shop drawings.
   5. Refer to air handling unit specifications for mechanical room layout requirements.
   6. Indicate coordination of all ductwork sizes and locations with all Architectural and Structural features and materials, as well as with all other building trades.
   7. No sheet metal ductwork shall be fabricated prior to review and comment by the engineer.
   8. The shop drawings should be prepared to address the portion of the building covered by each Contract Drawings (i.e. sectors, floors, quadrants, etc.). If multiple shop drawings are required to address the area covered by a Contract Drawing then the contractor shall provide a key plan on the shop drawing for the area covered by the Contract Drawing indicating the portion of the area addressed by the subject shop drawing. The shop drawing sheet number shall be composed using of the Contract Drawing number with a reference to the portion of the area covered by the shop drawing submission (i.e. "*Contract Drawing Number-Area Reference").*

B. Provide shop drawings for sheet metal fabricated casings or plenums, indicating materials, pressure class, reinforcing bars, joints, access doors, and penetrations. Indicate sealing methods.

C. Provide the following for each sheet metal system furnished on the project:
   1. System name and type.
   2. Duct system design pressure.
   3. Duct material.
   4. Duct gauge.
   5. Transverse joint methods.

6. Longitudinal seam type.
7. Sealant type.
8. SMACNA reinforcement types.

1.4 QUALITY ASSURANCE

A. Ductwork shall conform to SMACNA – HVAC Duct Construction Standards, Metal and Flexible.

B. Construct ductwork to NFPA 90A and NFPA 90B.

C. Ducts shall be noncombustible, Class 0 in accordance with NFPA 90A (UL 181). Low pressure, horizontal run, fibrous glass ductwork and associated closure systems may be Class 1 in accordance with UL 181.

D. Construct grease hood ducts and laboratory exhaust ducts to NFPA 96 and NFPA 45 respectively.

E. Fabric ducts shall be treated with an EPA registered antimicrobial agent.

1.5 WARRANTY

A. All ductwork shown on the Drawings, specified or required for the air conditioning and ventilating systems shall be constructed and erected in a first class workmanlike manner. The work shall be guaranteed for a period of one (1) year from and after the date of Substantial Completion of the project against noise, chatter, whistling, vibration, and free from pulsation under all conditions of operation. After the system is in operation, should these defects occur, they shall be corrected as directed by the Owner or Owner's representative at Contractor's expense.

B. Provide ten (10) year warranty on fabric duct systems.

C. Provide ten (10) year warranty of generator exhaust duct systems.

1.6 DUCT DIMENSIONS

A. Duct dimensions shown on the Drawings are for airflow area (free area dimensions). When ducts are acoustically lined, their dimension shall be increased as necessary to accommodate for lining thickness.

B. Duct dimensions shown for factory double-wall ducts are for the interior wall dimension.

1.7 DEFINITIONS

A. Transverse Joints: Connections of two ducts oriented perpendicular to flow. Connections such as but not limited to spin-ins, taps, and other branch connections, access door frames and duct connections to equipment are considered transverse joints.

B. Longitudinal Joints: Joints oriented in the direction of airflow.

C. Duct Wall Penetrations: Openings made in ducts by screws, non-self sealing fasteners, pipe, tubing, rods, wire, etc….

1.8 PRESSURE CLASSIFICATIONS

A. Low Pressure Ductwork:
1. 2" w.g. SMACNA Pressure Class - ductwork systems up to 2" w.g. positive or negative static pressure with velocities less than or equal to 1600 fpm.

B. Medium Pressure Ductwork:
1. 3" w.g. SMACNA Pressure Class – ductwork systems over 2" w.g. and up to 3" w.g. with velocities less than or equal to 2,500 fpm.
2. 4" w.g. SMACNA Pressure Class – ductwork systems over 3" w.g. and up to 4" w.g. with velocities less than or equal to 2,500 fpm.
3. 6" w.g. SMACNA Pressure Class – ductwork systems over 4" w.g. and up to 6" w.g. with velocities less than or equal to 2,500 fpm.

C. High Pressure Ductwork:
1. 6" w.g. SMACNA Pressure Class – ductwork systems over 6" w.g. and up to 10" w.g. with velocities greater than 2,500 fpm.

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1.9 SEAL CLASS

A. All ductwork, regardless of system type and pressure classification, shall be sealed according to SMACNA Seal Class A which includes all transverse joints, longitudinal seams, and duct wall penetrations.

PART 2 - PRODUCTS

2.1 METAL DUCTS

A. Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality; coating designation G90. Duct surfaces to be painted shall be treated by phosphatizing.

B. Aluminum Ducts: ASTM B209 alloy 3003-H14 for aluminum sheet and alloy 6061-T6 or equivalent strength for aluminum connectors and bar stock.

C. Stainless Steel Ducts: ASTM A167. Type shall vary with application. See specific systems below.

2.2 DUCTWORK

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A. Leakage:
1. Low Pressure Ducts: Air leakage shall be less than two percent (2%) of the system capacity.
2. Medium Pressure Ducts: The rate of air leakage (CL) shall be less than or equal to 6.0 as determined in accordance with the leakage test procedures and

computations of SMACNA HVAC Air Duct Leakage Test Manual. [Air leakage shall be less than two percent (2%) of the system capacity.]

3. High Pressure Ducts: The rate of air leakage (CL) shall be less than or equal to 6.0 as determined in accordance with the leakage test procedures and computations of SMACNA HVAC Air Duct Leakage Test Manual.

B. Construction:
1. All air distribution ductwork shall be fabricated, erected, supported, etc., in accordance with all applicable standards of SMACNA where such standards do not conflict with NFPA 90A and where class of construction equals or exceeds that noted herein.
2. Refer to Ductwork System Application Table in this specification for system materials and minimum pressure classifications.
3. Metal gauges shall be per SMACNA HVAC Duct Construction Standards based on the duct size and material but in no case shall ductwork be less than 24-gauge.
4. Ducts shall not pulsate or vibrate when in operation.
5. Pressure sensitive tape shall not be used as a primary sealant on metal ductwork.
6. All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punched (not pin punched), and shall not be any larger than necessary.
7. Sheet metal shall conform to SMACNA sheet metal tolerances as stated in SMACNA HVAC Duct Construction Standards.

C. Duct Sealing:
1. All ductwork shall be sealed to the appropriate seal class indicated herein.
2. Seams and joints shall be sealed by applying one (1) layer of water-based latex UL181 sealant, then immediately spanning the joint with a single layer of 3-inch wide open weave fiberglass scrim tape. Sufficient additional sealant shall then be applied to completely embed the cloth.
3. Sealant shall be suitable for use at the system pressure classification of applicable ductwork, for the material specified and for the location (indoors vs. outdoors). Solvent-based sealants may only be used for outdoor applications.

D. Joints:
1. Duct components shall fit so the joints are not mismatched. Duct sealant and tape shall not be used to compensate for mismatched joints.
2. Apply fire-resistant sealing compound to exposed male part of fitting collars so that sealer will be on inside of joint and fully protected by the metal of the duct and fitting. Apply a coat of sealing compound over outside of joint covering screwheads and joint gap.
3. Joints shall be as per SMACNA standards, consistent with the specified pressure classification, material, and other provisions for proper assembly of ductwork.
4. Coupling systems by DuctMate Industries or Ward Industries may be used. Install per manufacturer's instructions.

E. Fittings:
1. Curved elbows shall have a centerline radius not less than 1-1/2 times the width of the ducts.

2. Where curved elbows are not possible due to limited space and where rectangular elbows are indicated, provide double thickness turning vanes in the rectangular elbow.
3. Increase duct sizes gradually, not exceeding fifteen (15) degree transition angle wherever possible not to exceed forty-five (45) degrees on concentric transitions and thirty (30) degrees on eccentric transitions.
4. Provide standard forty-five (45) degree entry takeoffs unless otherwise indicated as a ninety (90) degree conical tee connection.

F. Test Holes:
1. Provide factory fabricated, airtight, and noncorrosive test holes with screw cap and gasket.
2. Provide extended neck fittings to clear insulation

G. Round and Oval Ducts:
1. Round ducts shall be spiral wound. Flat-oval ducts shall be spiral wound flat oval or welded flat oval. Fittings shall be factory-fabricated.
2. Make joints between sections of duct and fittings with mating angle rings, beaded sleeve joints, or slide-on gasketed flange connections.
3. Slide-on gasketed flange joints shall consist of two mating flange rings. Flanges shall be fabricated with an integral mastic to make them self-sealing and shall be joined to the duct with spot welds or self-tapping screws. A neoprene gasket shall be used between the flanges.

H. Rectangular Ducts:
1. Make joints between sections of ducts and between ducts and fittings with mating angle flange joints, other joints recommended in SMACNA HVAC Duct Construction Standards-Chapter 1, or slide-on gasketed flange connections.
2. Reinforce at joints and between joints per SMACNA Standards.

2.3 FACTORY PRE-INSULATED DOUBLE-WALL DUCTWORK

A. Manufacturers:
1. Lindab.
2. McGill Airflow.

B. General:
1. Rigid round and flat oval ductwork shall be double wall construction with a factory installed insulation liner sandwiched between a solid inner shell and a solid outer shell.
2. The duct system shall consist of fittings that are factory fitted with a sealing gasket and spiral duct which, when installed according to the manufacturer's instructions, will seal the duct joints without the use of duct sealer.

C. Materials:
1. Unless otherwise noted, all duct and fittings shall be G90 galvanized steel in accordance with ASTM A653 and A924.
2. Glass fiber insulation shall have a maximum conductivity factor (K) of 0.26 BTU-in/hr-ft^2-deg F at 75 degrees-F mean ambient temperature.
3. Insulation stop shall be closed cell polyethylene foam, 1.7 lb./ft^3 in accordance with ASTM E84, ASTM E162.

D. All double wall duct and fittings shall be constructed as shown in the following gauge table:

DIAMETER (in)	SPIRAL DUCT		FITTINGS	
	Inner	Outer	Inner	Outer
3-12	26	26	24	24
14-24	24	24	24	22
26-34	24	22	22	20
36-50	22	20	22	20
50-58	20	18	20	18

E. Fittings:
1. All double wall fitting ends shall come factory equipped with a double lipped, U-profile, EPDM rubber gasket. Gasket shall be manufactured to gauge and flexibility so as to insure that system will meet the performance criteria set forth in the manufacturer's literature. Gasket shall be classified by Underwriter's Laboratories to conform to ASTM E84 and NFPA 90A flame spread and smoke developed ratings of 25/50.
2. Double wall duct and fittings shall consist of a solid inner liner, a two inch (2”), 1.50 lb/ft^3 (unless otherwise specified) layer of fiberglass insulation and a solid outer pressure shell.
3. All double wall duct and fittings shall be furnished with a foam insulation stop. Fitting inner liner shall be flush with the outer shell. Duct inner liner shall be recessed.
4. All fitting ends shall be calibrated to manufacturer's published dimensional tolerance standard.
5. All fitting end outer diameters shall have rolled over edges for added strength and rigidity during installation and shipping.
6. Double wall to single wall transitions shall be provided where insulated duct connects to non-insulated or externally insulated, single wall duct. Transitions reduce the double wall outer shell diameter to the inner shell diameter.

7. When contract documents require divided flow fittings, only full body fittings will be accepted. Double wall saddle taps are unacceptable.
8. The inner liners shall not be fastened together to allow for expansion and contraction.

F. Construction:
1. Spiral duct shall be calibrated to manufacturer's published dimensional tolerance standard.
2. All spiral duct twelve inch (12") diameter and larger shall be corrugated for added strength and rigidity. Inner and outer duct shall be of spiral lockseam construction.
3. Spiral seam slippage shall be prevented by means of a flat seam and a mechanically formed indentation evenly spaced along the spiral seam.

G. Performance: Duct system performance shall meet SMACNA Leakage Class 3 requirements at the design static pressure as indicated on the Contract Documents not to exceed negative twenty inches water gage (-20 in. W.G.) or positive twelve inch water gage (+12 in. W.G.). Ductwork exterior shall have a uniform finished appearance and be suitable for painting.

2.4 FLEXIBLE DUCTS AND CONNECTORS

A. Manufacturers:
1. Atco
2. Flexmaster.
3. Thermaflex.

B. Flexible duct shall be used where flexible duct connections are shown on the Drawings to air distribution devices and terminal units and as scheduled under the “Ductwork System Application Table” within this specification.

C. Acoustical Insulated Flexible Ducts From Trunk Ducts to Air Devices:
1. Duct shall comply with NFPA 90 and be listed and labeled by UL Standard 181 as a Class I air duct.
2. Duct shall be rated for a minimum positive working pressure of 6” w.g. and a minimum negative working pressure of 1” w.g.
3. Core shall be factory pre-insulated with a total thermal performance of R-4.2 or greater.
4. Duct shall be fabricated with an acoustically transparent CPE inner film, mechanically locked without adhesives by a corrosion resistant galvanized steel helix. Insulation shall be a fiberglass insulation blanket, factory-wrapped around the helix. The outer layer shall be a reinforced, metalized aluminum vapor barrier.
5. Maximum flexible duct length shall be 6’-0”, installed with no more than 90-degrees of bend. Where longer duct runs or more bends are necessary, provide rigid round ductwork.

D. Metal Flexible Duct From Trunk Ducts to Terminal Unit Inlet Ducts:
   1. Duct shall comply with NFPA 90 and be listed and labeled by UL Standard 181 as a Class 0 air duct.
   2. Duct shall be rated for a minimum positive working pressure of 6" w.g. and a minimum negative working pressure of 4" w.g.
   3. Duct shall be factory uninsulated, ready for field application of duct insulation of same R-value as the adjacent connected rigid duct.
   4. Duct shall be fabricated of 0.005inch thick 3003-H14 aluminum alloy in accordance with ASTM B209. Duct shall be spiral wound into a tube and spiral corrugated to provide strength and flexibility.
   5. Maximum flexible duct length shall be 2'-0", installed in straight runs only. Flexible metal duct shall not be used to connect offset ducts.

2.5 CASINGS AND PLENUMS

A. All casings and plenums regardless of system or working pressure shall be constructed to minimum SMACNA 6" w.g. pressure class. If working pressure is greater than 6" w.g., the casing/plenum shall be constructed to the higher pressure class. This requirement includes field fabricated return air plenums and mixing boxes attached to back of air handling units.

B. Casings shall not pulsate or vibrate when in operation.

C. Casing/Plenums shall be sealed to a SMACNA Seal Class A.

D. Wall and roof deflections at the rated pressure shall not exceed 1/8-inch per foot of width. Provide rod and angle stiffeners as required.

E. Casing panels shall be G90 coated galvanized steel.

F. Casing walls shall be constructed from continuous standing seam reinforced panels, or an alternative construction of the same pressure classification and rigidity.

G. All openings to the casing shall be properly sealed to prevent air leakage. Install doors as required for easy access to or inspection of equipment. Access doors shall be air tight, double-skin insulated with frames welded in place. Doors shall be rubber gasketed and equipped with Ventlok-type latches and industrial hinges, operable from both inside and outside of casing. Doors shall open against air pressure.

H. Anchor casing per SMACNA Standards.

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2.6 FIBROUS GLASS DUCTS

A. Fibrous glass ducts shall be factory fabricated flat sheets of resin bonded inert inorganic fibrous glass, faced with an external vapor barrier, conforming to UL 181, Class I, NFPA 90A, and SMACNA Fibrous Glass Duct Construction Standards.

B. Fiberglass ducts shall only be used for low pressure systems.

C. Installed duct shall have a minimum of [R-6] insulation which equates to an [1-1/2 inch] thick fiberglass product with a minimum thermal conductivity (k-value) of 0.25 BTU-in / ft^2-hr-Deg F.

D. Material Properties: Stiffness: 475 pound per square inch; Permeance 0.02 perms maximum.

E. Ducts joints shall be sealed with mastic used in conjunction with a 3-inch glass fabric tape.

2.7 FABRIC DUCT SYSTEM

A. Manufacturers:
1. DuctSox Corporation.
2. FabricAir.

B. Fabric:
1. 100-percent flame retardant washable woven fabric, factory treated with a machine-washable anti-microbial agent. Anti-microbial agent shall remain 99-percent effective after 10 laundry cycles.
2. Weight: 6.75 oz. per square yard.
3. Air Permeability: 2 cubic feet per minute per square foot.
4. Temperature Range: 0 – 180 Degree-F.

C. Suspension System:
1. Tension Cable: System shall be installed using a tension cable system including a single strand of cable located 3-inches above top of the fabric duct. Fabric ducts 32-inches and larger shall have two cables suspending the duct. Cable(s) shall be [galvanized steel] [stainless steel] [heavyweight stainless steel] [plastic coated stainless steel]. Hardware shall include all necessary cable, eye bolts, cable clamps, snap clips, and turnbuckles.
2. Suspended Track: System shall be installed using a aluminum track system located 1.5-inches above top of the fabric duct. Fabric ducts 32-inches and larger shall have two tracks suspending the duct. Hardware shall include all necessary track, splice connectors, track end caps and vertical cable support kits consisting of cable with locking stud end and quick connects. Radius sections shall have radius tracks.
3. Flush-Mount Track: System shall be installed using a flush-mount aluminum track system located 1.5-inches above top of the fabric duct. Fabric ducts 32-inches and larger shall have two tracks suspending the duct. Hardware shall include all necessary track, splice connectors, track end caps and snap tabs. Radius sections shall have radius tracks
4. Surface-Mount: System shall be installed using an aluminum flush-mount system located flush with the top of the fabric duct. Hardware shall include track, splice connections and end caps. Attachment shall be made by a cord sewn into the top side flaps of the fabric duct along the entire length.

D. System Fabrication:

1. Air dispersion shall be accomplished by linear vents and permeable fabric. Linear vents shall consist of an array of open orifices designed to minimize dusting on fabric surface.
2. Size and location of linear vents shall be by manufacturer for proper air diffusion into the space.
3. Connection to metal duct shall be by a fabric draw band with anchor patches as supplied by manufacturer. Metal duct anchor duct patches shall be secured to metal duct with zip-screw fasteners.
4. Inlet connection shall have zipper for easy duct removal. End caps shall have zipper for easy maintenance.
5. System shall include adjustable flow devices to balance turbulence, airflow, and distribution as needed.
6. Fabric duct shall have connectors as required to accommodate suspension system specified.

2.8 SPECIAL SYSTEMS

A. KITCHEN HOOD EXHAUST DUCTWORK

1. Comply with requirements of NFPA 96. A factory-built grease duct, laboratory tested and listed by UL for use with commercial cooking equipment as described in NFPA 96, may be used.
2. Ducts and Fittings: 18 gauge, Type 316 stainless steel with joints welded. Weld joints with same material as ductwork. All seams, joints, penetrations, and duct-to-hood collar connections shall have a liquidtight continuous external weld.
3. Butt welded connections are not permitted. Refer to NFPA 96 for acceptable connections.
4. Ductwork and insulation (refer to ductwork insulation specification) shall constitute a fire-rated assembly.
5. No turning vanes, dampers or other interior intrusions shall be installed in the ductwork system.
6. All changes in directions shall use log-radius elbows.
7. Provide insulated access doors for cleaning. Access doors shall be same construction as ductwork.
8. Support systems for horizontal grease duct systems 24 inches and larger in any cross-sectional dimension shall be designed for the weight of the ductwork plus 800 lb at any point in the duct systems.
9. Master kitchen exhaust ducts that serve multiple tenants shall include provision to bleed air from outdoors or from adjacent spaces into the master exhaust duct where required to maintain the necessary minimum air velocity in the master exhaust duct.

B. HIGH-MOISTURE DUCTWORK

1. High moisture ductwork shall be used for duct systems transporting air from high-moisture areas such as but not limited to dishwashers, shower/locker rooms having four or more showers, steam cleaning or washdown chambers, swimming pools and saunas.
2. Ducts and Fittings: 18 gauge, Type 316 stainless steel with joints welded. Weld joints with same material as ductwork.
3. All joints shall be water proof. Minimize use of transverse joints.
4. Do not locate longitudinal seams on bottom of duct.

5. Pitch ducts for moisture control and provide low point drains with ball-valve and screw cap in ductwork where needed.
6. Provide drains on the bottom of high-moisture duct risers.
7. Where ductwork is connected to a dishwasher, slope ductwork back to dishwasher.

C. LABORATORY EXHAUST DUCTWORK

1. Generally applies to laboratory exhaust systems, including chemical fume hoods, special local exhaust devices, and other systems for exhausting air from laboratory work areas in which flammable gases, vapors, or particulate matter are released.
2. Ducts from chemical fume hoods and from local exhaust systems shall be constructed entirely of noncombustible materials.
3. Refer to Ductwork System Application Table in this specification for system materials and minimum pressure classifications.
4. Controls and dampers, where required for balancing or control of the exhaust system, shall be of a type that, in event of failure, will fail open to ensure continuous draft.
5. Duct velocities of laboratory exhaust systems shall be high enough to minimize the deposition of liquids or condensable solids in the exhaust systems during normal operations in the chemical fume hood.
6. Perchloric Acid Ducts:
    a. Perchloric acid exhaust ductwork shall be constructed of materials that are acid resistant, nonreactive, and impervious to perchloric acid.
    b. Ductwork for perchloric acid hoods and exhaust systems shall take the shortest and straightest path to the outside of the building and shall not be manifolded with other exhaust systems.
    c. Horizontal runs shall be as short as possible, with no sharp turns or bends.
    d. The ductwork shall provide a positive drainage slope back into the hood.
    e. Ductwork shall consist of sealed sections.
    f. Flexible connectors shall not be used.

D. GENERATOR EXHAUST DUCTWORK

1. Provide a factory-built modular double-wall exhaust system. Minimum standard weight black steel pipe with calcium silicate insulation is acceptable in lieu of double wall system specified herein.
2. Furnish all parts required to completely install the exhaust system including all flashing, storm collar, miter cuts, supports, bracing, ventilated roof thimble, sealants, tensioner, wall guide, rings, tee cap, adapter, bellows, etc..
3. Exhaust system shall be laboratory tested and listed by Underwriters Laboratories, Inc., for use with building heating equipment and appliances which produce exhaust flue gases at a temperature not exceeding 1400 Degree-F under continuous operating conditions. This exhaust system shall be designed to compensate for all flue gas induced thermal expansions.
4. Exhaust system shall be double wall and have an outer jacket of Type 316 stainless steel, .025-inch thick in 6-inch through 24-inch diameters and .034-inch thick for large diameters. The inner flue gas carrying conduit shall be Type 316 stainless steel. The inner liner shall be .035-inch nominal thickness for all diameters.

5. To control the venting pressure should a backfire occur, an explosion relief valve shall be incorporated in the exhaust system per NFPA 37.
6. Fiber insulated exhaust system shall have 2-inch fiber insulation between the interior and exterior walls. Asbestos materials shall not be used.
7. Inner pipe joints shall be sealed by use of overlapping type V-bands with a premixed 2000 Degree-F sealant. The outer channel bands shall be sealed with a 600 Degree-F sealant where exposed to weather.
8. Exhaust system shall terminate as shown on the Drawings and as required by NFPA 37 and NFPA 211.
9. All parts exposed to the atmosphere shall be protected by a minimum of one base coat and one finished coat of paint.

E. DUCTWORK LOCATED WITHIN STRONG MAGNETIC FIELDS
1. Typically applied to ductwork installed within MRI rooms.
2. Ductwork shall be constructed of 6061-T6 Aluminum with soldered connections. Material gauge and reinforcements shall be per SMACNA standards and shall typically be one gauge heavier than for the same size galvanized duct.
3. Construction methods shall be similar to those for galvanized steel, however no ferrous materials shall be used to fabricate, connect, support, anchor, etc. ductwork.

F. CRYOGEN VENT PIPE
1. For cryogenic venting, welded stainless steel or aluminum pipe shall be used.
2. Stainless steel pipe shall be Type 304 non-ferromagnetic, 0.035-inch thickness minimum and 0.125-inch thickness maximum.
3. Aluminum pipe shall be Type 6061-T6. 0.083-inch minimum thickness and 0.125-inch thickness maximum.
4. Piping shall be installed with bracing as required to withstand the forces encountered during a cryogenic release event.

2.9 DUCTWORK SYSTEM APPLICATION TABLE

SYSTEM	DUCTWORK MATERIAL	MINIMUM PRESSURE CLASSIFICATION
Supply Ductwork:		
Single Zone CV	Galvanized Steel	Low Pressure-2” w.g.
Single Zone VAV To Terminal Units	Galvanized Steel	Medium Pressure
Downstream of Terminal Units	Galvanized Steel	Low Pressure-2” w.g.
Multi-Zone Ducts	Galvanized Steel	Medium Pressure
Return Ductwork:		
Air Device to Trunk Duct	Galvanized Steel	Low Pressure-2” w.g.
Return Air Trunk Duct Back to	Galvanized Steel	Medium Pressure

Plenum		
Return Air Plenum / Return Air-Outside Air Mixing Plenum	Galvanized Steel	Medium Pressure-6" w.g.
Outside Air Ductwork:		
Untreated from Air Intake (louver) to AHU Plenum	Galvanized Steel	Low Pressure-2" w.g.
Treated from OAHU to AHU	Galvanized Steel	Medium Pressure
Exhaust Ductwork:		
Air Device to Trunk Duct	Galvanized Steel	Low Pressure-2" w.g.
Exhaust Air Trunk Duct to Discharge	Galvanized Steel	Medium Pressure
Kitchen Hood Exhaust	316 Stainless Steel	Medium Pressure
Dishwasher Exhaust	316 Stainless Steel	Medium Pressure
High Moisture Exhaust	316 Stainless Steel	Medium Pressure
Lab Exhaust Ductwork:		
General Lab Exhaust from Air Device to Trunk Duct	Galvanized Steel	Low Pressure-2" w.g.
General Lab Exhaust Trunk Duct to Discharge	Galvanized Steel	Medium Pressure
Hood / Biosafety Cabinet Exhaust	316 Stainless Steel	Medium Pressure

PART 3 - EXECUTION

3.1 PROTECTION

A. Provide temporary closures of metal or taped polyethylene on open ductwork during construction to prevent construction dust from entering ductwork system.

3.2 INSTALLATION

A. Install and support ductwork in accordance with SMACNA requirements and the requirements presented herein. Where manufactured systems are used – install those systems according to manufacturer's installation instructions and according to code requirements. On externally insulated ductwork, all hangers and supports shall be installed outside of the insulation as described in the duct insulation specification.

B. Ductwork shall be installed clean and cleaned after installation.

C. Where ducts are exposed to view (including mechanical rooms) and pass through walls, floors or ceilings, furnish and install sheet metal collars around duct.

D. Provide balancing dampers at points of supply, return, and exhaust where branches are

taken from larger ducts as required for air balancing. Use splitter dampers where indicated. Refer to ductwork accessories specification for damper requirements

E. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw cap to ensure against air leakage. Extend tube to clear insulation.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

G. Adhere to Drawings as closely as possible. If approved by A/E, run and shape of ducts may vary and offsets may be made during progress of work, if required to meet structural or other interferences.

H. Fabricate ducts to prevent seams of joints being cut for installation of grilles, registers, or outlets.

I. Reinforce ducts to prevent buckling, breathing, vibrations, or unnecessary noises, as during start-up, shutdown, and continuous operation of air handling system. Reinforcing shall be as recommended in SMACNA HVAC Duct Construction Standards - Metal and Flexible, and local building and mechanical codes.

J. Slope duct for moisture-laden ducts. Provide drain and trap at elbow of main moisture exhaust duct system.

K. Refer to testing, adjusting, and balancing section of the specifications for leakage testing requirements

3.3 FLEXIBLE DUCT

A. Maximum flexible duct length shall be 6’-0”, installed with no more than 90-degrees of bend. Where longer duct runs or more bends are necessary, provide rigid round ductwork.

B. The terminal ends of the duct core shall be secured by compression coupling or stainless steel worm gear type clamp.

C. Insulation connections shall be sealed by embedding fiberglass tape in the sealant and coating with more sealant to provide a vapor barrier.

D. Support flexible ducts as per SMACNA standards to prevent sags, kinks and to have 90 degree turns.

3.4 DUCT SLEEVES, PREPARED OPENINGS, AND CLOSURE COLLARS

A. Provide for ductwork penetrations in floors, walls, and partitions through which ductwork passes.

B. Mineral Fiber packing for sleeves and openings shall be ASTM C553, Type 1, Class B-2.

C. Duct Sleeves: Duct sleeves shall be provided where ductwork passes through concrete, masonry, or brick walls. Fabricate sleeves of 20-gauge galvanized steel. Where sleeves are installed in bearing walls, provide structural steel sleeves – consult with structural engineer. Size sleeves to provide 1-inch clearance between duct and sleeve or between insulation and sleeve (for insulated ducts). Fill space with mineral fiber, except at air devices.

D. Prepared Openings: Prepared openings shall be provided where ducts pass through frame walls. The opening shall be sanded smooth with no screw, nail or other sharp protrusions into opening. Fill space between duct and opening or between insulation and opening (for insulated ducts) with mineral fiber, except at air devices.

E. Closure Collars: Closure collars shall be 4-inches wide, fabricated from 20-gauge galvanized steel. Fit collars snugly around ducts or insulation. Grind edges of collar smooth to preclude tearing or puncturing insulation covering or vapor barrier. Provide nails at maximum 6-inch centers on collars.

3.5 PAINTING

A. All exposed ductwork in finished areas shall be painted. This includes but is not limited to double-wall, insulated ductwork.

B. Comply will all the requirements of the architectural painting specification section and the mechanical identification specification section.

B. Submit manufacturer’s full range of color selections to architect for selection.

3.6 ADDITIONAL INSTALLATION FOR LABORATORY EXHAUST DUCTS

A. All visible welds in ductwork between biosafety cabinets, canopy hoods and fume hoods and the ceiling shall be ground and polished.

END OF SECTION 233100

SECTION 233300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General Use Dampers:
   1. Manual volume dampers.
   2. Backdraft and pressure relief dampers.

B. Rated Dampers:
   1. Fire dampers.
   2. Ceiling radiation dampers.

C. Flexible Connections.

D. Fittings and Taps:
   1. Spin-In fittings.
   2. Conical bellmouth fittings.

E. Ductwork Access Doors.

F. Test Openings.

G. Screens.

H. Guy-Wire Systems.

1.2 REFERENCES

A. AMCA 500-D – Laboratory Methods of Testing Dampers for Rating.

B. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

C. SMACNA – HVAC Duct Construction Standards – Metal and Flexible.

D. UL 33 – Standard for Heat Responsive Links for Fire-Protection Service

E. UL 555 – Standard for Fire Dampers.

F. UL 555C – Standard for Ceiling Dampers.

G. UL 555S – Standard for Smoke Dampers.

1.3 SUBMITTALS

A. Provide product data for shop fabricated assemblies including but not limited to volume control dampers, duct access doors, duct test holes. Provide product data for hardware used.

B. Fire Dampers: Provide performance data developed from testing in accordance with AMCA 500D standards and shall show the pressure drops for all sizes of dampers required at anticipated air flow rates. Maximum pressure drop through fire damper shall not exceed 0.05-inch water gauge.

C. Include manufacturer's installation instructions.

D. Provide operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Damper testing and ratings shall be in accordance with AMCA 500-D.

1.5 COORDINATION WITH OTHER TRADES

A. This mechanical contractor shall work closely with other trades to ensure all work is completed so as to provide a fully functional and operating system in accordance with the contract documents and Owner's expectations. This does not in any way relieve the prime contractor from the overall responsibility to ensure that all work is coordinated and that all of its subcontractors are aware of their responsibilities.

B. The following products shall be furnished by this Section but installed under a separate Section of these specifications. The specification section reference in parentheses indicates the section responsible for installation.
   1. Duct Static Pressure Sensors (Controls).

C. The following products shall be installed by this Section but furnished under a separate Section of these specifications. The specification section reference in parentheses indicates the section responsible for furnishing.
   1. Airflow measuring stations (Controls).
   2. Automated Dampers (Controls).
   3. Smoke and Combination Fire/Smoke Dampers (Controls) – Integrated with Fire Alarm system.

PART 2 - PRODUCTS

2.1 GENERAL USE DAMPERS

A. Manufacturers
   1. Greenheck.
   2. Louvers and Dampers, Inc.
   3. Nailor Industries.
   4. Prefco.
   5. Ruskin.
   6. Ventfabrics (Regulators and Locking Quadrants).

B. Manual Volume Dampers:
1. Provide dampers where shown on the Drawings and wherever necessary for complete control of airflow, including all supply, return, outside air, and exhaust branches, divisions in main supply, return, and exhaust ducts, and each individual air supply outlet. Provide manual volume dampers in each zone trunk duct of multi-zone units whether or not shown on Drawings.
2. Where access to dampers through a permanent suspended ceiling is necessary, provide appropriately located access doors. Where access doors are not desirable, provide a concealed damper regulator, with a cover suitable for painting, mounted in ceiling.
3. Damper blades shall not exceed 48-inches in length or 10-inches in width.
4. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Provide regulator at both ends where rod lengths exceed 30 inches.
5. Rectangular dampers shall be fabricated of minimum 16-gauge galvanized steel with a channel type frame. Damper multi-blade type in an opposed blade configuration. Blades shall be constructed of 16-gauge galvanized steel. Blade linkages shall be concealed in jamb. Axles shall be 1/2-inch diameter plated steel. Locking manual quadrant shall be installed with standoff bracket to accommodate the thickness of the duct insulation so that the damper quadrant is completely accessible from outside of the insulation installed on the duct.
6. Round dampers shall be fabricated of minimum 20-gauge galvanized steel with a reinforced frame. Fame depth shall be 6-inches, nominal. Damper blade shall be constructed of 20-gauge galvanized steel. Axle shall be 3/8-inch plated steel turning in synthetic sleeve type bearings. Locking manual quadrant shall be installed with standoff bracket to accommodate the thickness of the duct insulation so that the damper quadrant is completely accessible from outside of the insulation installed on the duct. Dampers for round ductwork greater than 20-inches width shall be rectangular opposed blade type within round frame.
7. Splitter dampers shall be fabricated of steel minimum 16-gauge thickness. The leading edge of the damper shall be hemmed. Each splitter shall be a minimum of 12" long or 1-1/2 times the width of the smaller of the two branches it controls, whichever is greater.

C. Backdraft and Pressure Relief Dampers:
1. Backdraft Dampers: Provide multi-blade, parallel action gravity balanced backdraft damper fabricated of 16-gauge galvanized steel channel with 18-gauge V-type galvanized steel blades with vinyl sealed edges. Axles shall be 1/2-inch plated steel. Linkage shall have galvanized steel clevis arms and plated steel tie bars with pivot pins and nylon pivot bearings, and blade counterbalance weights. Bearings shall be galvanized steel. Damper shall be rattle-free.
2. Pressure Relief Dampers: Provide multi-blade, parallel action pressure relief damper fabricated of 0.081-inch thick 6063T5 extruded aluminum channel with 0.070-inch thick 6063T5 extruded aluminum blades with extruded vinyl blade edge seals mechanically locked into blade edge. Blades shall include field adjustable, zinc plated steel counter balanced weights to allow pressure relief at less than 0.01 inches w.g.. Bearings shall be dustproof ball type. Linkage shall be ½-inch tie bar connected to stainless steel pivot pins. Blades shall start to open at 0.01 inches w.g. and be fully open at 0.05 inches w.g..

2.2 RATED DAMPERS

A. MANUFACTURERS
1. Greenheck.
2. Nailor Industries.
3. Prefco.
4. Ruskin.

B. FIRE DAMPERS
1. Each fire damper shall be constructed, tested in accordance with UL 555 and installed in accordance with UL 555 and manufacturer's instructions. All dampers shall possess a 1-1/2 hour or 3 hour (as appropriate for the construction shown in the architectural drawings) protection rating, 160 or 165 degree F fusible link, and shall bear a U.L. label in accordance with Underwriters' Laboratories labeling procedures.
2. Fire dampers shall be curtain blade type and damper shall be constructed so that the blades are out of the air stream to provide 100 percent free area of duct in which the damper is housed.

C. CEILING RADIATION DAMPERS
1. Each ceiling radiation damper shall be tested and labeled under UL 555C for protection of ceiling openings in fire rated floor/ceiling assemblies with fire resistance ratings of 3-hours or less. Provide with 165 degree F fusible link. Damper shall bear a U.L. label in accordance with Underwriters' Laboratories labeling procedures.
2. Provide round or rectangular dampers as appropriate for air device/duct connection.
3. Provide ceiling radiation dampers on all duct/air device penetrations of a fire rated ceiling assembly. Typically these devices will not be shown on the Drawings and may or may not be scheduled with the air devices.

2.3 FLEXIBLE CONNECTIONS

A. Manufacturers: Ventfabrics, Duro Dyne.

B. Where ducts connect to fans, flexible connections shall be made using neoprene coated fabric that is temperature-resistant, fire-resistant, waterproof, mildew-resistant and airtight. Weight shall be approximately thirty ounces (30 oz.) per square yard. There shall be a minimum of one-half inch (1/2-inch) slack in the connections, and a minimum of two and one-half inches (2-1/2-inch) distance between the edges of the ducts. There shall also be a minimum one-inch (1-inch) of slack for each inch of static pressure on the fan system. This does not apply to air handling units with internal isolation.

C. For outdoor connections the fabric shall be the same as above but shall be coated with chlorosulfurated polyethylene for resistance to ozone, sunlight, and weather.

2.4 FITTINGS AND TAPS

A. Spin-In Fittings: Spin-in collar fittings shall be entirely formed of minimum 26-gauge G90 galvanized sheet metal with a deep spin groove. Joints shall be welded. Fittings shall include an integral manual volume damper. Damper shaft shall be extended to clear insulation. Where indicated on the Drawings (typically in detail), the spin-in fitting shall be provided with an integral air scoop.

B. Conical Bellmouth Fittings: Conical bellmouth fittings shall be entirely formed of minimum 24-gauge G90 galvanized sheet metal and shall not have an integral damper unless indicated or shown on the Drawings. Joints shall be welded. Bellmouth radius shall be 1-1/2 inches. Provide with 1/2-inch x 1/8-inch neoprene gasket on 1/2-inch flange with predrilled holes for sheet metal screws. Fitting shall be secured by a minimum of 4 evenly spaced screws.

2.5 DUCTWORK ACCESS DOORS

A. Manufacturers:
1. Flexmaster.
2. McGill Airflow.
3. Ventfabrics.

B. General:
1. Access doors shall be provided in ductwork to provide access to all rated dampers, mixed air plenums, automatic dampers, electric reheat coils and where required or indicated on the Drawings.
2. Construction and airtightness shall be suitable for the duct pressure class used. Provide doors as large as practical.
3. Door shall be provided with two or more chrome plated, zinc plated, or galvanized hinges. A single continuous hinge on a factory-fabricated door shall be acceptable.
4. Doors shall be provided with quick fastening locking devices - typically, one or two zinc-plated cam latches. Access doors smaller than 12-inches square may be secured with sash locks. Doors shall not have sheet metal screw fasteners.
5. Round access doors shall be spin-in type with removable doors.
6. Doors for personnel access to ductwork shall be nominal 24-inches in diameter, fabricated in accordance with SMACNA Standards, with operable latches from both sides.
7. Provide pressure relief-type access doors downstream of any dampers subject to sudden closure when there in not a branch take-off sufficiently close to relive the negative pressure if the damper closes suddenly.
8. Provide doors with sealing gaskets.
9. Access Doors For Insulated Ductwork: Double wall with 22-gauge G90 galvanized steel door frame and 24 gauge G90 Galvanized steel door panels with minimum 1-inch. 0.75 lb density fiberglass insulation sandwiched between the panels.

2.6 TEST OPENINGS

A. The test holes shall be installed in locations as required to measure pressure drops across each item in the system, e.g., outside air louvers, filters, fans, coils, intermediate points in duct runs, etc.

B. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

C. Provide factory fabricated permanent test holes, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.7 SCREENS

A. Bird Screens:
1. This specification applied to screens for fabricated assemblies, for bird and/or insect screens indicated to be provided with a fan assembly, they shall be the fan manufacturer's standard product unless otherwise noted.
2. General industrial use wire cloth, Grade C, medium light or heavier, nominal 2 mesh, 0.063 inch wire diameter aluminum or galvanized steel. Where indicated, provide removable insect screen of grooved type with vinyl or neoprene spline insert for securing screen cloth.

B. Intake Screens:
1. Screens shall be No. 16 gauge, one-half inch (1/2") mesh in removable galvanized steel frame.
2. Provide safety screens meeting OSHA requirements for protection of maintenance personnel on all fan inlets and fan outlets to which no ductwork is connected.

2.8 GUY-WIRE SYSTEMS

A. Provide 1/4-inch diameter American Aircraft Steel Cable (plastic coated) with clip for vertical stack off utility fan on roof, with eyebolts for attachment to existing anchor system on roof.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Except as specified or indicated otherwise, conform to NFPA 90A, and SMACNA HVAC Duct Construction Standards, Metal and Flexible. Allow clearances for inspection, repair, replacement, and service of accessories.

B. Install accessories in accordance with manufacturer's instructions

C. Provide electrical isolation, consisting of fluorinated elastomers or sponge-rubber gaskets, between dissimilar metals.

3.2 GENERAL USE DAMPERS

A. Install all dampers in strict accordance with the manufacturer's recommendations and requirements of these Specifications.

B. Provide manual volume balancing dampers at points of supply, return, and exhaust where branches are taken from larger ducts as required for air balancing. Use splitter dampers where indicated.

C. Provide manual volume balancing dampers for each zone duct of multi-zone units whether or not such dampers are shown on the Drawings.

D. Provide volume control dampers on branch duct connections as required for balancing (as directed by the TAB Contractor), whether indicated on Drawings or not.

E. Dampers shall be 100 percent open prior to beginning testing and balancing.

F. Provide backdraft dampers on exhaust fans or exhaust ducts where indicated.

3.3 RATED DAMPERS

A. Install fire dampers at locations indicated, where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

B. Provide ceiling radiation dampers in ductwork at air devices where required in rated ceiling assemblies.

C. Access doors as specified elsewhere shall be provided for access to all parts of the fire and combination fire and smoke dampers. Doors shall open not less than 90 degrees following installation and shall be insulated type where installed in insulated ducts.

D. Install all smoke and combination fire/smoke dampers, furnished by the control system contractor, in strict accordance with manufacturer's written installation instruction and requirements of these Specifications, where ducts and outlets pass through fire rated components.
   1. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
   2. Coordinate smoke damper system interlock requirements with the fire alarm system.

3.4 AUTOMATIC CONTROL DAMPERS

A. Install all dampers furnished by the control system contractor in strict accordance with manufacturer's written installation instruction and requirements of these Specifications.

3.5 FLEXIBLE CONNECTIONS

A. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Cover connections to medium and high pressure fans with leaded vinyl sheet, held in place with metal straps.

3.6 FITTINGS AND TAPS

A. Install spin-in fittings and bellmouth conical taps as indicated on the Drawings and in this Specification. Where air-scoops are required, ensure air scoop is oriented correctly so that the scoop opening is exactly perpendicular to airflow.

3.7 DUCTWORK ACCESS DOORS

A. Provide duct access doors for inspection and cleaning before and after duct mounted filters, coils, fans, automatic dampers, and elsewhere as indicated on Drawings. Provide

minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.

3.8 TEST OPENINGS

A. Provide duct test holes where indicated and where required for testing and balancing purposes.

B. Provide required straight section of duct upstream and downstream of flow measuring devices. Refer to manufacturer's data for required dimensions.

3.9 SCREENS

A. Install screens in accordance with Drawing Details and as needed for fabricated outdoor and indoor air intakes.

B. Install OSHA screens in accordance with OSHA Standards.

3.10 GUY-WIRE SYSTEMS

A. Install guy-wire systems as needed in accordance with Drawing Details and as required to support chimneys and stacks extending vertically.

3.11 AIRFLOW MEASURING STATIONS

A. Install airflow measuring stations, provided by the controls contractor, in accordance with manufacturer's instructions.

B. Maintain required inlet and outlet straight duct requirements of the manufacturer.

C. Coordinate installation with the controls contractor.

3.12 PAINTING

A. Paint exposed ductwork and devices, excluding flexible connections.

END OF SECTION 233300

SECTION 233600

AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Single duct air terminal units.

B. Constant volume (series) fan-powered air terminal units.

C. Variable volume (parallel) fan-powered air terminal units.

D. Dual duct air terminal units.

1.2 REFERENCES

A. AHRI 410 – Forced-Circulation Air-Cooling and Air-Heating Coils.

B. AHRI 880 – Air Terminals.

C. AHRI 885 – Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

D. ASHRAE 90.1 – Energy Conservation Standard for Commercial Buildings.

E. NFPA 90A – Installation of Air Conditioning and Ventilating Systems.

F. UL 181 – Standard for Factory Made Air Ducts and Connectors.

G. UL 1995 – Standard for Heating and Cooling Equipment.

1.3 QUALITY ASSURANCE

A. Terminal units shall be certified under AHRI 880 and carry the AHRI seal. All electrical components shall be UL listed.

B. Terminal Units sound pressure levels shall be based on AHRI 885 or ASHRAE Handbook – Fundamentals, and designed and provided to achieve an RC-30 average sound pressure level.

C. Provide terminal units that are designed, built, and tested as a single unit including motor and fan assemblies, water or electric coils (as scheduled), primary air damper assembly, and accessories. Units shall require no field assembly.

D. Certification:

1. Each size of each terminal unit to be used on this Project shall be completely tested for air performance and acoustics by a certified independent testing laboratory. The acceptability of the independent testing laboratory is subject to review by the Owner and the Engineer. The qualifications of a proposed independent laboratory shall be submitted for review by the engineer prior to bid date. The terminal unit manufacturer shall submit complete details, brochures, instrumentation information, etc., for review. The laboratory shall be capable of properly testing the largest terminal unit on this Project.

2. The air volume listed on the Drawings for the terminal units shall be supplied for the test with the primary cold duct supplying air at the scheduled air handling unit coil leaving air temperature.

3. The maximum and minimum air volume of each terminal unit shall be certified with a discharge static pressure of 0.35 in. wg. The air terminal unit pressure drop through the primary air damper (or heating and cooling damper on double duct air terminal units) shall be certified with twenty-five per cent (25%), fifty per cent (50%) and one-hundred per cent (100%) of the design air flow. The pressure drop through the terminal unit and its associated heating coil at full plenum mode (primary air damper tightly closed) for series flow fan powered terminal units and full heating mode and full cooling mode for single zone terminal units and parallel fan powered terminal units.. The pressure drop through the terminal unit in the full heating mode and full cooling mode for the double duct terminal units.

4. Radiated and discharge sound power data for each size terminal unit with inlet duct static pressures of 0.5 in. wg., 1.0 in. wg., and 1.5 in. wg.. For single zone air terminal units air terminal units with primary cold air volumes of 0%, 25%, 50%, 75% and 100% the scheduled design air volume. For parallel flow fan powered terminal unit shall be tested as per the single zone air terminal units except the rating shall be also certified with the fan operating with the downstream static pressure listed hereinbefore. For series flow fan powered air terminal units with primary cold air volumes of 0%, 25%, 50%, 75% and 100% the scheduled design air volume.and design discharge cfm (constant fan powered terminal units only) and static pressure. For double duct terminal units primary cold and hot air volumes of 0%, 25%, 50%, 75% and 100% the scheduled design air volume.

5. The mixing performance for fan powered terminals shall be certified using the inlet air temperature indicated hereinbefore and the plenum bypass air at 78˚F. With the primary air damper or valve at the positions as indicated hereinafter with an inlet static pressure of 0.20 in. wg., 0.50 in. wg., and 1.0 in. wg., the mixing device shall be capable of producing a mixed air stream of which the temperature shall not vary more than ±2.5˚F over the discharge duct area at a distance of forty-eight inches (48") downstream of the terminal unit outlet for each 30˚F temperature difference between the temperatures of the entering warm and cold air. The variation of temperature shall be proportionally less at smaller temperature differences. There shall be at least fifteen temperature readings made at the discharge outlet duct over the entire discharge area with the air entering the device in each of the following proportions:

   a. 25% cold air and 75% plenum air.

b. 50% cold air and 50% plenum air.
c. 75% cold air and 25% plenum air.

6. The mixing performance for double duct air terminal units shall be certified using the inlet air temperature indicated hereinbefore and the heating inlet air at 80˚F. With the terminal air dampers at the positions as indicated hereinafter with an inlet static pressure of 0.20 in. wg., 0.50 in. wg., and 1.0 in. wg., the mixing device shall be capable of producing a mixed air stream of which the temperature shall not vary more than ±2.5˚F over the discharge duct area at a distance of forty-eight inches (48") downstream of the terminal unit outlet for each 30˚F temperature difference between the temperatures of the entering warm and cold air. The variation of temperature shall be proportionally less at smaller temperature differences. There shall be at least fifteen temperature readings made at the discharge outlet duct over the entire discharge area with the air entering the device in each of the following proportions:

   a. 25% cold air and 75% heating air.
   b. 50% cold air and 50% heating air.
   c. 75% cold air and 25% heating air.

7. Operation of the flow control device shall be demonstrated to repeat under all conditions of operation of the primary air damper or valve and duct pressures as specified hereinbefore. If the air terminal unit manufacturer has conducted the hereinbefore specified air performance and air mixing tests and has demonstrated to the Engineer and Owner compliance with the specified criteria the previous testing will be accepted and will not need to be repeated. Test results shall clearly state fan performance at test altitude and at Project altitude.

8. The Engineer may desire to witness the laboratory tests to verify compliance with the Specifications. The manufacturer shall bear the cost of the testing as well as the expenses required for the engineer to witness the testing.

1.4 SUBMITTALS

A. Shop drawing submittals shall include, but not be limited to, the following:
   1. Cut sheets on each terminal unit, clearly marked to show sizes, configuration, construction, unique features, controls, clearances, accessories, performance data, sound data, operating sequence and other pertinent information.
   2. Air valve and fan curves or charts which clearly show air valve and fan performance.
   3. Performance characteristics for each terminal unit.
   4. Wiring and control diagrams and air flow sensor calibration curves for each terminal unit type.
   5. Copies of factory-certified sound, leakage and performance test results from actual tests of units of the same model and construction to those which will be provided for the project.
   6. Factory certified test performance as indicated hereinbefore.
   7. Certified dimensioned drawings showing the locations of all openings, support points, connections, sizes for same, overall dimensions of all boxes and any other pertinent information that may affect the installation of the boxes.

B. Refer to Section 01 33 30 for additional shop and submittal preparation and submission requirements.

1.5 CLOSEOUT SUBMITTALS

A. Provide installation instructions for all air terminal units

B. Submit Operations and Maintenance (O&M) data in accordance with the requirements of Section 01 78 23.13.

1.6 COORDINATION WITH OTHER TRADES

A. This mechanical contractor shall work closely with other trades to ensure all work is completed so as to provide a fully functional and operating system in accordance with the contract documents and Owner's expectations. This does not in any way relieve the prime contractor from the overall responsibility to ensure that all work is coordinated and that all of it's subcontractors are aware of their responsibilities.

B. The following products shall be installed by this Section but furnished under a separate Section of these specifications. The specification section reference in parentheses indicated the section responsible for furnishing.
1. Terminal Unit Controller (Section 255000) – Controls contractor shall furnish controls to terminal unit vendor for factory installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Krueger.

B. Nailor

C. Price.

D. Titus.

2.2 GENERAL:

A. All air terminal units utilized on the project shall be the product of one (1) manufacturer.

B. Each air terminal unit shall have a factory calibrated multipoint, multi-axis air flow sensor (single point or single axis sensors are not acceptable) for inlet air volume measurement for each air inlet. The air sensor shall provide a signal to the damper controller to adjust the damper setting to provide pressure independent control.

C. Provide air terminal units of standard materials and components designed and constructed as recommended by the manufacturer and as required for a complete installation in compliance with these Specifications. Units with electrical equipment shall be constructed in accordance with NEMA and NEC and shall include disconnects or fused disconnects where specified required by the NEC.

D. Air terminal unit dampers low leak, opposed blade or single blade design self-lubricated bearings suitable for use with electric operators.

E. The damper actuators shall be capable of supplying at least spring return, 35 in-lbs. of torque to the damper shaft to tightly close and fully open the air terminal unit damper or dampers with an inlet pressure of 1.5 in. wg. The actuator shall be provided by the controls contractor to the terminal unit manufacturer to install them at the their factory. The actuator shall be mounted externally for service access.

2.3 SINGLE DUCT AIR TERMINAL UNITS

A. Casing:
1. The terminal casing shall be minimum 20 gauge galvanized steel.
2. Provide stiffeners and construct with sufficient rigidity to prevent vibration due to the action of turbulent air on the panel of the cabinet.
3. Provide entire assembly capable of withstanding a maximum static pressure of six (6) in. wg.
4. Unit casing shall incorporate a minimum of four (one at each corner) galvanized steel angel hanger brackets to accept minimum 1/2-inch diameter all-thread rod and vibration isolator. Brackets shall be located as required to allow removal of ductwork, heating coil without removing unit and shall be a minimum of 1-inch above bottom of unit casing.
5. Air Inlet: Round stub connections for duct attachment.
6. Air Outlet: Rectangular flange duct attachment.
7. Cabinet Air Leakage: Limit air leakage from cabinet to a maximum of 2 percent at 3.0 inches w.g. interior casing pressure.

B. Insulation:
1. [Casing shall be internally lined with 1/2-inch dual density insulation which complies with UL 181 and NFPA 90A. All exposed insulation edges shall be coated with NFPA 90A approved sealant to prevent entrainment of fibers in the airstream.]
2. [Casing shall be internally lined with engineered polymer foam insulation which complies to UL181 and NFPA 90A. Insulation shall be 1½ pound density, closed cell foam. Exposed fiberglass is not acceptable. The insulation shall be mechanically fastened to the unit casing.]
3. [Casing shall be internally lined with a non-porous, sealed liner which complies with UL 181 and NFPA 90A. Insulation shall be 4 lb. density. All cut edges must be sealed from the airstream using mechanically bonded metal barrier strips. Liners made of Mylar, Tedlar, Silane or woven fiberglass cloth are not acceptable.]
4. [Casing shall be internally lined with 1-inch thick matte faced insulation, meeting UL 181 and NFPA 90A, enclosed between the unit casing and a non-perforated internal 22-gauge sheet metal cover extending over the fiberglass insulation, as well as covering the liner cut edges. The discharge connection shall be slip and drive construction for attachment to metal ductwork.]

C. Damper:
1. The damper shall be heavy gauge steel with shaft rotating in Delrin® self-lubricating bearings. Shaft shall be clearly marked on the end to indicate damper

position. Stickers or other removable markings are not acceptable. The damper shall incorporate a mechanical stop to prevent overstroking and a synthetic seal to limit close-off leakage .

2. Actuators shall be capable of supplying at least 35-inch lbs. of torque to the damper shaft and shall be mounted externally for service access. Terminals with internal actuator mounting or linkage connection must include gasketed access panel, removable without disturbing ductwork. The differential static pressure required to operate damper shall not exceed 0.20 inches w.g. at 2,000 feet per minute.

2.4 CONSTANT VOLUME (SERIES) FAN-POWERED AIR TERMINAL UNITS

A. General: Provide constant volume, pressure independent fan-powered terminal units consisting of a sheet metal housing with a control damper, damper operator, fan assembly, heating coil (where scheduled), and flow controls. Fan powered terminal units shall be compatible with the temperature controls as specified in the Controls Specification. Terminal unit capacities and sizes shall be as scheduled and shown on the Drawings.

B. Housing: The housing shall be constructed of 20 gauge minimum galvanized sheet metal with a rigid frame with mechanical seals and gaskets to minimize housing leakage. It shall be capable of installation right hand or left in field. Housing shall be lined with three-quarter inch (3/4") thick dual density fiberglass. Insulation shall meet the requirements of NFPA 90A and UL 181 and be protected with a steel inner liner. Gasketed access doors with a maximum of four (4) speed latches shall be provided on the top and bottom of each unit. Housing shall be provided with a round or oval inlet for use with flexible duct (1800 fpm maximum velocity) and a rectangular outlet for slip and drive or flanged connection to sheet metal ductwork (1600 fpm maximum velocity).

C. Control Damper: Shall be of a low leakage, opposed blade or single blade design with self-lubricated bearings. Dampers shall be suitable for use with electric operators.

D. Damper Operators: Shall be a electric type normally closed damper operator rigidly attached to the terminal unit and connected to the damper with an adjustable linkage. Operators shall be sized to properly operate the unit dampers. Dampers shall be factory-mounted and wired including all controls required for operation, except control wiring connections. Operator shall be selected to coordinate with the control sequence shown on the Drawings and specified in Controls specification. All exposed operator/linkage components shall be protected with removable metal covers.

E. Fans: Provide fans balanced statically and dynamically, of the indicated capacity, designed and assembled to be easily removed for servicing. Fans shall move design airflow at all times of box operation. Fans shall be of metal construction. Provide centrifugal fan wheels designed for discharge static pressures indicated on the Drawings. System shall be non-overloading. Provide vibration isolation as required.

F. Motors: Provide ECM fan motors of the indicated or required capacity, installed for easy removal, with automatic reset thermal overload protection suitable for use with a fan speed controller. The ECM motor shall maintain the specified air flow with varying inlet and outlet conditions. Provide sleeve type motor bearings, graphite bronze or equivalent. Motor voltage shall be as scheduled on the Drawings. Fan-motor combination shall be a

manufactured product with sufficient actual installed experience to verify a minimum fifteen (15) year average service life. Average service life shall be certified by an authorized officer of the company. Motors shall be of a type suitable for use in the specified terminal unit. Motor shall turn fan in the proper rotation, irrespective of condition at fan start up. Provide full range speed controls for final balancing. Speed controls shall have minimum voltage stops factory-set to protect motors from low speed burnout. Motors shall have anti-backward rotation design or device that will arrest backward rotation and prevent backward running should the fan be rotating backwards before the motor is energized.

G. Electrical Connections: Provide fan powered terminal units designed for a single electrical power feed and complying with all applicable NEC and UL requirements and all other applicable Codes and Standards. For terminal units without electric heating coils, provide unit-mounted fused disconnect switches with factory wiring from the load side of the disconnect switch to the fan motor. The only field wiring shall be to the line side of the disconnect switch. For terminal units with electric heating coils, provide individual unit-mounted fused disconnect switches, one for the fan motor and one for the heating coil. Disconnect switches shall be factory-wired on the load side to the load served and shall be tapped together on the load side such that only a single incoming electrical feeder connection is required. Refer to Division 26, "Electrical", for fuse and disconnect switch specifications. Fuses shall be sized for a nominal 125% of full load amperes of the load served.

H. Heating Coils: Hot water heating coils constructed of copper tubes and aluminum plate fins shall be provided on fan powered terminal units where scheduled or shown on the Contract Drawings.

I. Leakage: Overall leakage for the control damper and pressurized portions of the housing shall be less than 3% of nominal cfm at 6" inlet SP and scheduled outlet SP, as rated by the current edition of ARI 880 and ASHRAE 130.

J. Controls: Fans, pressure independent volume controls and heater controls shall be factory-installed, including a multipoint, multi-axis air flow sensor (single point and for single axis sensors are not acceptable) for inlet air volume measurement, a DDC terminal unit controller, fan contactor, heater stage contactors and related accessories and components. Controls shall provide adjustable minimum and maximum cfm limits, adjustable throttling range and a constant throttling range option. Adjustments for control settings and gauge tees for flow measurement and balancing shall be easily accessible. DDC controllers and damper operators shall be furnished by the Temperature Control Contractor for factory installation, wiring and testing by the terminal unit manufacturer. Fan and heater contactors and PE switches shall be provided by the terminal unit manufacturer. Coordinate control voltages with the Temperature Control Contractor. Controllers operators and contactors shall be located for easy access from the ceiling below the unit. Temperature control functions and sequences shall be as specified in HVAC Sequences of Operation and as shown on the Drawings. The terminal unit manufacturer shall provide an appropriately sized 277 volt control power transformer to serve the terminal unit controller. An air flow sensor calibration curve label shall be attached to each terminal unit in a location visible from the unit controller. Each unit shall have a factory provided and installed programming to maintain the airflow setpoint with varying inlet conditions at the primary inlet or return air inlet.

K. Unit Performance: The following performance tests shall be performed by an independent testing lab to verify compliance prior to equipment submittal. Acceptability of the testing facilities shall be subject to review by the Engineer. Cold air shall be supplied at 48°F and bypass air at 78°F. Test results and criteria which shall be considered acceptable are as follows:

1. Radiated sound levels shall be charted by the manufacturer as tested under paragraph 1.3 A. 6 above. Each unit shall have a maximum and minimum performance level with no heat, with electric heat and with water heat. All selections shall comply with the charted performance as tested at the independent laboratory. Units with sound power levels as charted below may be acceptable, but lab testing in mock up conditions shall set the operating levels of each unit.

Band	Hertz	NC 35 Criteria
1	63	60 dB
2	125	53 dB
3	250	46 dB
4	500	40 dB
5	1000	36 dB
6	2000	34 dB
7	4000	33 dB
8	8000	32 dB

Test to be conducted in a mock-up condition approved by the Engineer.

2. Discharge sound shall be measured in laboratory two-room mock up. The discharge room shall have the primary duct run through the center of the room and two outlets arranged in the room.
3. Temperature mixing as measured in accordance with AHRI 880 and ASHRAE 130, shall be at least 2.5:30 as listed in 1.04 A. 6.
4. Cold deck cfm fluctuation at any given flow setting over static pressure range shall be a maximum of +10%.
5. Maximum fan motor horsepower shall be as indicated on the Drawings and at no time shall power draw exceed motor rating. Fans shall be balanced or arranged to prevent motor overload.

L. Samples: A sample production run unit of each type of terminal unit specified on the project shall be submitted for examination and approval by the Engineer, Owner and Testing and Balancing (TAB) Contractor. If approved, the unit shall remain at the job site for comparison with units as shipped to project. The unit may be installed in the project at an accessible, marked location. The unit manufacturer shall test and certify that each terminal unit provided for the project has been constructed and tested as specified and are the same as the sample units. Where only one unit of each type is required for testing, the submitted unit shall be the largest size unit of that type scheduled for the project..

M. Shipment Testing: A random sampling of the terminal unit supplied for the project and selected by the Engineer or Owner's Representative will be tested for conformance to this

specification. The contractor shall allow sufficient time during construction and space for the TAB Contractor to perform all testing as may be required.

1. If the results of the Shipment Testing show that any of the units do not perform as specified, then additional units shall be tested. If this testing in the Engineer's opinion shows that 10% or more of the units tested do not perform as specified, then 100% of all sizes of the units shall be tested for conformance with these specifications. The results of that testing shall be reviewed carefully between the Contractor, manufacturer, Owner, and the Engineer. A method of repair or replacing the units shall be negotiated. The Owner, however, shall maintain the right of final approval of any proposed solution. All testing shall be at no additional expense to the Owner or Engineer.

N. Should for any reason the testing described above under "Sample" and "Shipment Testing" prove that any of the units do not perform as specified, the unit manufacturer shall be responsible for all subsequent testing, labor, travel, and incidental expenses, penalties, or other costs required to prove that the units perform as specified. This shall include, but not be limited to, the labor, travel and incidental expenses of Engineer, Owner and TAB Contractor.

2.5 VARIABLE VOLUME (PARALLEL) FAN-POWERED AIR TERMINAL UNITS

A. Casing:
1. The terminal casing shall be minimum 20-gauge galvanized steel.
2. Provide stiffeners and construct with sufficient rigidity to prevent vibration due to the action of turbulent air on the panel of the cabinet.
3. Unit casing shall incorporate a minimum of four (one at each corner) galvanized steel angel hanger brackets to accept minimum 1/2-inch diameter all-thread rod and vibration isolator. Brackets shall be located as required to allow removal of ductwork, heating coil without removing unit and shall be a minimum of 1-inch above bottom of unit casing.
4. Air Inlet: Round stub connections for duct attachment.
5. Air Outlet: Rectangular flange duct attachment.
6. Cabinet Air Leakage: Limit air leakage from cabinet to a maximum of 2 percent at 3.0 inches w.g. interior casing pressure
7. The terminal casing shall have top and bottom access panels, which allows removal of fan assembly and servicing of terminal without disturbing duct connections.
8. The terminals shall include a gasketed backdraft damper at the fan section discharge to prevent primary air from flowing back through the fan section into the return air plenum.
9. Provide with 1-inch nominal air filter at induced air inlet.

B. Insulation:
1. [Casing shall be internally lined with 1/2-inch dual density insulation which complies with UL 181 and NFPA 90A. All exposed insulation edges shall be coated with NFPA 90A approved sealant to prevent entrainment of fibers in the airstream.]
2. [Casing shall be internally lined with engineered polymer foam insulation which complies to UL181 and NFPA 90A. Insulation shall be 1½ pound density, closed

cell foam. Exposed fiberglass is not acceptable. The insulation shall be mechanically fastened to the unit casing.]

3. [Casing shall be internally lined with a non-porous, sealed liner which complies with UL 181 and NFPA 90A. Insulation shall be 4 lb. density. All cut edges must be sealed from the airstream using mechanically bonded metal barrier strips. Liners made of Mylar, Tedlar, Silane or woven fiberglass cloth are not acceptable.]

C. Damper:

1. The primary air damper assembly shall be heavy gauge steel with shaft rotating in Delrin self-lubricating bearings. Shaft shall be clearly marked on the end to indicate damper position. Stickers or other removable markings are not acceptable. The damper shall incorporate a mechanical stop to prevent overstroking, and a synthetic seal to limit close-off leakage.
2. Provide a four point, center-averaging differential pressure airflow sensor. Balancing taps and airflow calibration charts shall be provided for field airflow measurements.

D. Fan/Motor:

1. The fan shall be constructed of steel and have a forward curved, dynamically balanced wheel with direct drive motor.
2. The motor shall be suitable for 120, 208, 240, or 277 volt, 60 cycle, single phase power. The motor shall be of energy efficient design, permanent split capacitor type, with integral thermal overload protection and permanently lubricated bearings, and be specifically designed for use with an SCR for fan speed adjustment.
3. Fan assembly shall include a tuned spring steel suspension and isolation between motor and fan housing.
4. The terminal shall utilize a manual SCR, which allows continuously adjustable fan speed from maximum to minimum, as a means of setting fan airflow. Setting fan airflow with any device that raises the pressure across the fan to reduce airflow is not acceptable. The speed control shall incorporate a minimum voltage stop to insure that the motor cannot operate in a stall mode
5. Electrical connection shall be single point. Where an 460 volt, 3-phase electric heater is scheduled, provide unit with a 4-wire wye connection. All electrical components, including low voltage controls, shall be mounted in sheet metal control enclosures. Fan-powered air terminals shall be ETL listed as a complete assembly.

2.6 DUAL DUCT AIR TERMINAL UNITS

A. Casing:

1. The terminal casing shall be minimum 22-gauge galvanized steel.
2. Provide stiffeners and construct with sufficient rigidity to prevent vibration due to the action of turbulent air on the panel of the cabinet.
3. Provide entire assembly capable of withstanding a maximum static pressure of 6.0 inches w.g.
4. Unit casing shall incorporate a minimum of four (one at each corner) galvanized steel angel hanger brackets to accept minimum 1/2-inch diameter all-thread rod and vibration isolator. Brackets shall be located as required to allow removal of

ductwork, heating coil without removing unit and shall be a minimum of 1-inch above bottom of unit casing.

5. Air Inlets: Round stub connections for duct attachment.
6. Air Outlet: Rectangular flange duct attachment.
7. Cabinet Air Leakage: Limit air leakage from cabinet to a maximum of 2 percent at 3.0 inches w.g. interior casing pressure.
8. Each terminal shall include a mixer-attenuator section as an integral part of the terminal to minimize downstream stratification. The terminal shall provide less than 1 Degree-F discharge temperature variation with a 20 Degree-F differential in inlet temperature.

B. Insulation:

1. [Casing shall be internally lined with 1/2-inch dual density insulation which complies with UL 181 and NFPA 90A. All exposed insulation edges shall be coated with NFPA 90A approved sealant to prevent entrainment of fibers in the airstream.]
2. [Casing shall be internally lined with engineered polymer foam insulation which complies to UL181 and NFPA 90A. Insulation shall be 1½ pound density, closed cell foam. Exposed fiberglass is not acceptable. The insulation shall be mechanically fastened to the unit casing.]
3. [Casing shall be internally lined with a non-porous, sealed liner which complies with UL 181 and NFPA 90A. Insulation shall be 4 lb. density. All cut edges must be sealed from the airstream using mechanically bonded metal barrier strips. Liners made of Mylar, Tedlar, Silane or woven fiberglass cloth are not acceptable.]

C. Dampers:

1. Cooling and heating inlets shall have separate damper assemblies for complete pressure independent control of each airstream for variable or constant volume total discharge applications (as scheduled).
2. The dampers shall be heavy gauge steel with solid shaft rotating in Delrin® self-lubricating bearings. Nylon bearings are not acceptable. Shaft shall be clearly marked on the end to indicate damper position. Stickers or other removable markings are not acceptable. The damper shall incorporate a mechanical stop to prevent overstroking and a synthetic seal to limit close-off leakage.
3. Actuators shall be capable of supplying at least 35 inches per pound of torque to the damper shaft and shall be mounted externally for service access. Terminals with internal actuator mounting or linkage connection must include gasketed access panel, removable without disturbing ductwork.

2.7 INTEGRAL HOT WATER COILS (Where Scheduled)

A. Hot water reheat coils shall be enclosed in a minimum 20-gauge galvanized steel casing with slip and drive construction for attachment to metal ductwork. Coils shall be factory installed on the terminal discharge.

B. Fins shall be rippled and corrugated heavy gauge aluminum, mechanically bonded to tubes. Tubes shall be copper with minimum wall thickness of 0.016-inch with male solder header connections. Coils shall be leak tested to 300 psig. Number of coil rows and circuits shall be selected to provide performance as required per the plans.

C. Coil performance data shall be based on tests run in accordance with ARI 410.

D. Coil shall be installed at the unit discharge.

2.8 INTEGRAL ELECTRIC COILS (Where Scheduled)

A. Electric coils shall be supplied and installed on the terminal by the terminal manufacturer. Coils shall be ETL listed. All individual components shall be UL listed or recognized.

B. Single duct coils shall be housed in an attenuator section integral with the terminal with element grid recessed from unit discharge a minimum of 5 inches to prevent damage to elements during shipping and installation.

C. Elements shall be 80/20 nickel chrome, supported by ceramic isolators a maximum of 3.5 inches apart, staggered for maximum thermal transfer and element life and balanced to ensure equal output per step.

D. The integral control panel shall be housed in a NEMA 1 enclosure with hinged access door for access to all controls and safety devices.

E. Electric coils shall contain a primary automatic reset thermal cutout, a secondary manual reset thermal cutout, airflow switch for proof of flow, and line terminal block. Unit shall include an optional integral door interlock type disconnect switch that will not allow the access door to be opened while power is on.

F. Electric coils shall include line fusing, mercury contactors mounted and wired within the control enclosure.

G. Coil shall be installed at the unit discharge.

H. SCR Electric Heat:
1. The proportional electronic airflow sensor shall be totally independent of the duct static pressure and shall adjust the heater capacity according to the available airflow. The heaters shall deliver maximum heating when needed with normal minimum airflow, reduce heating with lower than minimum airflow and stop heating with no airflow.
2. Heaters shall be equipped with a proportional SCR controller to modulate the heater load according to the temperature control signal. The electronic controller shall be compatible with the following input signals:
   a. Variable voltage signal 0-10 VDC.
   b. Pulse width modulation AC or DC.

I. Lynergy Electric Heat:
1. Heaters shall be equipped with a Lynergy Comfort Controller to control heater coil firing. The control panel shall include an interface to control heater coil firing in proportion to the temperature control system signal. The temperature control system signal shall connect to low voltage universal signal interface circuitry supplied and installed by the terminal manufacturer. The universal interface shall allow at least the following seven interface options without additional interface circuitry (Temperature control system equipment providers

with 0-20mA or 4-20mA signals shall supply and install a suitable dropping resistor to convert the current signal to a 0-10VDC signal or 2-10VDC signals)
a. PWM heat.
b. 2 stage heat.
c. 0-10V / 0-20mA.
d. 2-10V /4-20mA.
e. Incremental T-stat.
f. Binary.
g. 3 point floating.

2. A downstream air temperature limit and control shall be automatically invoked by adding a downstream air temperature sensor. When invoked, the downstream air from the heater shall not exceed an adjustable maximum temperature set point. When the temperature control system's call for heat is less than 100%, the heater shall control the downstream air temperature to a point in proportion to the span between the heater's probable entering air temperature and the maximum air temperature set point.

2.9 INTEGRAL CONTROLS

A. Controls shall be pressure independent type, factory mounted.

B. Provide factory-installed inlet multi-point inlet velocity sensor with center averaging, connected to the terminal controller.

C. Provide bi-directional, synchronous, 24 volt, electric damper actuator.

D. Provide a Class II 24 VAC transformer and disconnect switch in NEMA 1 enclosure.

E. Terminal Equipment Controller (TEC): The TEC's shall be furnished by the building automation system manufacturer to the unit manufacturer for installation, wiring and testing at their factory.
1. Controller shall be digital electronic, 100 percent compatible for connection to all control sensors, actuators, and other devices specified.
2. Communication address, sequence of operation, and maximum and minimum airflow limits factory set in accordance with scheduled vales.
3. Mount controller in NEMA-1 enclosure with access panel sealed from airflow and mounted on side of unit.

2.10 DAMPER LEAKAGE PERFORMANCE CRITERIA

A. Damper Leakage: Units shall be tested for leakage with 4" w.g. static pressure imposed. The maximum percent leakage from all tests shall be reported. The following table provides the maximum allowable damper leakage for the various size diameter inlets at 4" w.g. differential pressure.

Allowable Damper Leakage Table		
Diameter of Inlet (in.)	Maximum Allowed Airflow (area x 2,000 fpm) (cfm)	Maximum Allowable Airflow Leakage (cfm)
4" , 5", 6"	393	6.0
7", 8"	698	11.0

10”	1091	17.0
12”	1571	20.0
14”	2138	30.0

2.11 SOUND PERFORMANCE CRITERIA

A. Provide terminal units meeting the following maximum allowable discharge and radiated sound power levels.

Maximum Radiated Sound Power Level, dB, at Band No. and Center Freq., Hz						
Fan and 100% Primary, CFM	2 125	3 250	4 500	5 1,000	6 2,000	7 4,000
350 to 500	55	55	50	42	39	31
501 to 800	63	60	56	49	44	37
801 to 1,000	70	65	61	55	49	43
1,001 to 1,400	68	64	58	53	47	42
1,401 to 1,600	71	66	60	56	50	44
1,601 to 2,150	73	61	53	47	47	47
Maximum Discharge Sound Power Level, dB at Band No. and Center Freq., Hz						
Fan and 100% Primary, CFM	2 125	3 250	4 500	5 1,000	6 2,000	7 4,000
350 to 600	62	57	55	51	47	47
601 to 800	68	64	59	58	55	55
801 to 1,000	73	69	64	63	61	61
1,001 to 1,400	72	63	63	62	60	60
1,401 to 1,600	74	66	65	64	63	60
1,601 to 2,150	76	66	63	58	60	55

Notes:
1. All ratings at 1.0" inlet static pressure and 0.25" discharge static pressure.
2. Up to +2 dB variation allowed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from building structure. Do not support from adjacent ductwork.

D. Identify each airflow unit with clearly marked identification label and airflow indicator. Include unit nominal air flow, maximum factory set airflow, minimum factory set airflow, and coil type on label.

E. Provide clearance for inspection, repair, replacement, and service. The mechanical contractor shall ensure accessibility to all terminal unit electrical control panel doors, controllers and operators are located a minimum of 24" from all obstructions (walls, pipe, etc.).

F. Install terminal units with a minimum of four diameters of straight rigid duct directly prior to the entry into each terminal unit connection.

G. Connect to ductwork. Install disposable filters on plenum induction inlets.

H. Wiring and controller compartments, electronic motors and damper motors shall have a minimum 24 inch clear wide and deep working space readily accessible from lift out ceiling tiles or access panels.

END OF SECTION 233600

SECTION 233713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ceiling, wall, floor, and roof air outlets and inlets including:
1. Diffusers.
2. Registers
3. Grilles.
4. Critical Environment Diffusers.
5. Louvers

1.2 REFERENCES

A. AMCA 500L – Laboratory Methods of Testing Louvers for Rating.

B. ARI 885 – Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

C. ARI 890 – Ratings of Air Diffusers and Air Diffuser Assemblies.

D. ASHRAE 70 – Method of Testing for Rating the Performance of Air Outlets and Inlets.

E. NFPA 90A – Installation of Air Conditioning and Ventilating Systems.

F. SMACNA – HVAC Duct Construction Standards, Metal and Flexible.

1.3 SUBMITTALS

A. Include product data for outlets and inlets indicating type, size, location, application, and noise level.

B. Review requirements of outlets and inlets as to size, finish, and type of mounting prior to submitting product data and schedules of outlets and inlets.

C. Include manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. Test and rate performance of air outlets and inlets in accordance with ASHRAE 70.

B. Test and rate performance of louvers in accordance with AMCA 500L.

C. Conform to NFPA 90A.

PART 2 - PRODUCTS

2.1 DIFFUSERS, REGISTERS, AND GRILLES

A. Manufacturers
1. Krueger.
2. Metal-Aire.
3. Nailor.
4. Titus.

B. General
1. Grilles, registers and diffusers shall be as scheduled on the Drawings and shall be provided with sponge rubber or soft felt gaskets.
2. If a manufacturer other than the one scheduled is used, the sizes shown on the Drawings shall be checked for performance, noise level, face velocity, throw, pressure drop, etc., before the submittal is made. Selections shall meet the manufacturer's own published data for the above performance criteria. The throw shall be such that the velocity at the end of the throw in the five (5) foot occupancy zone will not exceed 50 FPM nor be less than 25 FPM except where indicated otherwise. Noise levels shall not exceed those published in ASHRAE for the type of space being served (NC level). In the vicinity of lab hoods, terminal velocity at face of hood shall exceed 20 fpm.
3. Locations of outlets on Drawings are approximate and shall be coordinated with other trades to make symmetrical patterns and shall be influenced by the established general pattern of the lighting fixtures or architectural reflected ceiling plan, but primary located as required to maintain proper air distribution.
4. Where called for on the schedules, grilles, registers and diffusers shall be provided with deflecting devices and manual damper. These Grilles, registers and diffusers shall be the standard product of the manufacturer, and subject to review by the Architect.
5. Provide a frame compatible with the type of ceiling or wall in which the devices are installed. Refer to Architectural Drawings for exact type of ceiling specified.
6. A round or rectangular duct inlet shall be provided based on duct configuration
7. Diffusers shall be painted with a baked anodic acrylic paint unless otherwise noted. Colors and finishes are scheduled on the Drawings. Coordinate color and finish of the devices with the Architect.

C. RECTANGULAR LOUVERED FACE CEILING DIFFUSERS
1. Rectangular, adjustable pattern, louvered, multicore type diffuser to discharge air in 1, 2, 3, or 4-way pattern. Diffuser shall be supplied with 4-way pattern unless noted otherwise.

D. PERFORATED FACE CEILING DIFFUSERS
1. Perforated face with 3/16-inch diameter holes on 1/4-inch staggered centers with no less than 51-percent free area. Provide fully adjustable curved blade pattern controller in the diffuser neck.

E. CEILING PLENUM SLOT DIFFUSERS
1. Continuous 3/4-inch wide high induction single slot, with two horizontal outside sections and a center down-blow section. The length of the down-blow section shall be as scheduled.

2. The outside supply sections shall have extruded aluminum curved deflector blades. The down-blow section shall have an adjustable steel pattern controller to vary the vertical discharge and discharge volume.
3. Center down-blow section shall have 1/4-inch thick insulated internal lining on each side opposite of the pattern controller.

F. CONTINUOUS SLOT LINEAR SUPPLY/RETURN/EXHAUST DIFFUSERS
1. Continuous slot that integrates into ceiling system. Where curved linear slot diffusers are indicated, they shall be factory stretch curved to exact radii required. Diffuser shall be capable of supporting the ceiling system with integral support clips. Refer to air device schedule for mounting types.
2. Diffuser shall have number of slots and slot width as scheduled on the Drawings. Provide factory-installed mitered ends as required.
3. Pattern controllers shall be provided in supply diffusers and shall be minimum one-piece 0.062 extruded aluminum, positioned between spring steel loaded spacers. Pattern controllers shall allow vertical and horizontal throw control, and shall allow airstream to be "jetted" and vectored into the space (where specified). Provide with fully adjustable integral pattern controllers.
4. Supply Plenums shall be factory-provided by the same manufacturer as the continuous linear slot diffuser. Plenum length shall be as shown on Drawings. Plenum shall be constructed of 24-gauge galvanized steel and internally lined with black matte fiberglass insulation meeting requirements of NFPA 90A to prevent erosion.
5. Return hoods shall be provided on all return air slots and shall have 51-percent free area and constructed of 24-gauge perforated galvanized steel metal painted flat black.
6. Where indicated on Drawings, provide a friction-type volume damper located in the entry collar of the supply air plenum, accessible through the slot diffuser.
7. Refer to architectural drawings for curve radius and exact length.

G. ROUND CEILING DIFFUSERS
1. Round, adjustable pattern, stamped or spun, multi-cone type diffuser to discharge air in 360-degree pattern.
2. Round diffuser collar shall not project more than 1-inch above ceiling face and connect to duct with duct ring. In plaster ceilings, provide plaster ring and ceiling plaque.
3. Fabricate of 18-gauge steel or 0.051 aluminum (as scheduled) with baked anodic acrylic paint #26 white finish.

H. CEILING/WALL SUPPLY REGISTERS/GRILLES
1. Streamlined and individually adjustable curved blades spaced 3/4-inch on centers to discharge air along face of grille, two-way deflection.
2. Fabricate 1-1/4-inch margin frame with concealed mounting and gasket.
3. Screw holes shall be countersunk for neat appearance.

I. CEILING/WALL LINEAR BAR EXHAUST AND RETURN GRILLES
1. Linear bar grille with 1/4-inch bars at 1/2-inch spacing with 0-degree deflection.
2. Fabricate 1-1/4-inch margin frame with countersunk screw mounting.
3. Bars shall be fixed and parallel to long dimension. Support bars shall be placed behind the deflection bars parallel to short dimension and shall be spaced at n more than 9-inches apart.

4. Optional factory-diffuser curving shall be done where indicated on the Drawings.

J. PERFORATED FACE RETURN/EXHAUST GRILLES
1. Perforated face with 3/16-inch diameter holes on 1/4-inch staggered centers with no less than 51-percent free area.

K. CEILING/WALL EGGCRATE EXHAUST AND RETURN REGISTERS/GRILLES
1. Fixed grilles of 1/2-inch by 1/2-inch by 1/2-inch louvers.
2. Fabricate 1-1/4-inch margin frame with countersunk screw mounting for gypsum board ceiling or lay-in frame for suspended grid ceilings.

L. CONTINUOUS SLOT LINEAR SUPPLY/RETURN/EXHAUST DIFFUSERS
1. Same as Type D diffuser but without pattern controller.
2. Where scheduled, provide factory fabricated return hood/light shield consisting of 51 percent free area perforated galvanized steel, painted flat black.

M. CEILING/WALL EXHAUST AND RETURN REGISTERS/GRILLES
1. Streamlined and individually adjustable curved blades spaced 3/4-inch on centers. Blades shall have a 35-degree fixed deflection.
2. Fabricate 1-1/4-inch margin frame with concealed mounting and gasket.
3. Screw holes shall be countersunk for neat appearance.

2.2 CRITICAL ENVIRONMENT DIFFUSERS

A. LAMINAR FLOW CRITICAL ENVIRONMENT DIFFUSERS
1. Provide diffuser constructed using 6” tall (maximum) back pan with integral hanger tabs to secure unit to structure above. Diffuser shall have integral internal baffle and integral volume damper accessible through face of diffuser. Face shall be secured in place by 1/4-turn fasteners for quick removal. Provide with removable center plug for adjusting damper.
2. Fabricate diffuser of 22-gauge Type 304 stainless steel perforated with 3/32-inch diagram holes on 1/4-inch centers. Face free area shall be 13 percent.
3. Provide with retainer cable (safety chain).
4. Where indicated, multiple laminar flow diffusers shall be factory integrated with the vertical air curtain slots to form a room clean zone.

B. VERTICAL AIR CURTAIN CRITICAL ENVIRONMENT SLOT DIFFUSER
1. Provide 2-slot diffuser constructed for a 12-inch wide plenum. Diffuser shall have provision for disabling one slot. For multi-sectional diffusers, provide with joiner mullions. Slot blades shall be adjustable from 5 degrees to 15 degrees. Diffuser shall be secured in place by 1/4-turn fasteners for quick removal.
2. Diffuser plenum and frame shall be factory manufactured and installed on the diffuser and shall have a mill finish. Plenum shall have all outer corners radiused with a 3/4-inch minimum radius. Plenum inlet height shall be 5-inch, 6-inch, or 8-inch high and of sufficient length to reduce the incoming air velocity to 1,000 feet per minute or less.
3. Fabricate diffuser and plenum of 22-gauge Type 304 stainless steel.
4. Where indicated, multiple laminar flow diffusers shall be factory integrated with the vertical air curtain slots to form a room clean zone

2.3 LOUVERS

A. Manufacturers
   1. Arrow United.
   2. Greenheck.
   3. Louvers and Dampers, Inc.
   4. Ruskin.

B. Where louvers are specified elsewhere in the Architectural Specifications, those sections shall govern, except that free area discrepancies shall be brought to the attention of the Engineer.

C. Provide stationary 6-inch deep louvers with blades on 45-degree slope with hidden mullions, heavy channel frame, birdscreen on interior side with 0.75-inch x 0.051-inch. Provide a minimum of 45 percent free area.

D. Fabricate frame of 0.125-inch extruded aluminum, welded assembly. Blades shall be 0.090-inch extruded aluminum, J-style blades. Provide factory prime coat finish. Exterior finish coat shall be per architectural painting specification selection with color as selected by architect. Louver design shall incorporate structural supports required to withstand an equivalent wind load of 120 miles per hour.

E. Furnish with exterior angle flange for installation.

F. Pass 750 feet per minute free velocity with less than 0.10 inches of water pressure drop (exhaust), based in accordance with AMCA 500L. Water penetration less than 0.025 ounce of water per foot of free area at 750 feet per minute.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install items in accordance with manufacturers' instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, regardless of whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black.

F. Provide all specialties and frames for air devices required for installation in ceiling type indicated in architectural documents. Provide all cutting and patching of T-bars, gypsum board and other ceiling systems as required for installation of air devices.

END OF SECTION 233713

SECTION 238126

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Factory assembled and tested, split system air conditioning system consisting of indoor air handling/fan coil unit or furnace, outdoor condensing unit, refrigerant piping, fittings and accessories, and controls.

1.2 REFERENCES

A. ANSI Z21.47 – Gas-Fired Central Furnaces.

B. ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. ARI 210 / 240 – Unitary Air Conditioning and Air-Source Heat Pump Equipment.

D. ARI 270 – Sound Rating of Outdoor Unitary Equipment.

E. NFPA 54 – National Fuel Gas Code.

F. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

G. NFPA 90B – Installation of Warm Air Heating and Air-Conditioning Systems.

H. UL 1995 - Heating and Cooling Equipment.

1.3 SUBMITTALS

A. Include product data and schematic layouts showing condensing units, air handling/fan coil unit, refrigerant piping and accessories required for complete system. Include complete pipe sizing data.

B. Include rated capacities, dimensions, weights, accessories, required clearances, electrical requirements, wiring diagrams and location and size of field connections.

C. Include manufacturer's installation instructions.

D. Provide operation and maintenance manual.

1.4 QUALITY ASSURANCE

A. Unit shall comply with the energy efficiency requirements of ASHRAE 90.1.

B. Unit shall be rated in accordance with ARI 210 / 240 and shall be ARI certified for capacity and efficiency.

C. Unit shall be designed to operate at outdoor ambient temperatures up to 115 Degree-F.

D. Units shall be UL listed.

E. Indoor and Outdoor units shall be factory matched to meet required load and provide the best efficiency.

F. Unit shall be suitable for ground or rooftop installation.

G. Furnaces shall be of the Low NOx type.

1.5 WARRANTY

A. Provide five-year manufacturer's replacement warranty on compressor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Carrier.

B. McQuay.

C. Trane.

D. York.

2.2 AIR HANDLING / FAN COIL UNIT

A. General: Factory assembled including coil, condensate drain pan, fan, motor, filters, and controls.

B. Casing:
1. Galvanized sheet metal and steel frame construction.
2. Factory painted with and enamel.
3. Insulated with a foil-faced insulation minimum R-Value of 4.2.

C. Evaporator Coil:
1. Coil shall be constructed of aluminum fins mechanically bonded to 3/8-inch OD copper tubing.
2. Coil shall have minimum 3 rows and maximum 14 fins per inch.
3. Coil shall be factory pressure and leak tested.
4. Refrigeration circuit shall be controlled by a factory-mounted thermal expansion valve.
5. Coil drain pan shall be polycarbonate or stainless steel.

D. Fans / Motors:
1. Fan shall be forward curved centrifugal type, 3-speed direct drive, statically and dynamically balanced.
2. Fan motor bearings shall be permanently lubricated.

E. Filter: Provide filter frame holding section suitable for standard 1-inch throwaway filters.

F. Electric Heat: Where scheduled, provide manufacturer's matched electric heater at capacity scheduled.

2.3 GAS-FIRED FURNACE WITH COOLING COIL

A. General:
1. Self-contained, forced air, gas-fired heating type furnace.
2. All components shall be factory assembled and wired.
3. Furnace shall be of the high efficiency type in accordance with ANSI Z21.47 and have a minimum Annual Fuel Utilization Efficiency (AFUE) of not less than 80-percent.
4. Electronic furnace controls shall be provided by the furnace manufacturer as an integral part of the furnace.

B. Casing:
1. Galvanized sheet metal and steel frame construction.
2. Factory painted with and enamel.
3. Insulated with a foil-faced insulation minimum R-Value of 4.2.

C. Blower / Motor:
1. Blower shall be centrifugal type, direct drive, statically and dynamically balanced.
2. Blower rotation shall be clearly and permanently marked on each blower housing.
3. Blower shall be single speed or multi-speed as scheduled.

D. Combustion Section:
1. Shall include gas burners, ignition equipment, control valve, piping, pressure regulating valve, high and low pressure switches, and accessories.
2. Ignition system shall be direct-spark, hot surface, or interrupted intermittent type with automatic electric ignition.
3. Burner shall be designed in accordance with NFPA 54.

E. Cooling Coil:
1. Coil shall be constructed of aluminum fins mechanically bonded to 3/8-inch OD copper tubing.
2. Coil shall have minimum 3 rows and maximum 14 fins per inch.
3. Coil shall be factory pressure and leak tested.
4. Refrigeration circuit shall be controlled by a factory-mounted thermal expansion valve.
5. Coil drain pan shall be polycarbonate or stainless steel.
6. Coil shall be [cased] [uncased] and suitable for [vertical] [horizontal] airflow.

2.4 AIR-COOLED CONDENSING UNIT

A. General:
1. Unit shall utilize a non-ozone depleting refrigerant with an ozone depletion potential of zero.

2. Refrigerant R-22 will not be acceptable.
3. The condenser shall balance the heat rejection of the compressor at [95] [105] Degrees-F ambient.

B. Casing:
1. Constructed of heavy gauge galvanized steel.
2. Powder-coated for outdoor use.
3. Provide with stamped metal coil guard.
4. All wiring, piping, controls, compressor, and condenser coils shall be contained within the unit casing.
5. Unit shall have a single-point electrical connection.
6. Control circuit shall be 24v.

C. Compressor / Refrigeration Circuit:
1. Compressor shall be hermetically sealed with internal over temperature and pressure protection.
2. Compressor shall be mounted on vibration isolators.
3. Refrigeration circuit shall include shutoff valves, oil pump, high pressure switch, low pressure switch, and filter dryer.

D. Condenser:
1. Condenser fan shall be direct-drive propeller type – statically and dynamically balanced.
2. Condenser fan motor shall be totally enclosed, split-capacitor type.
3. Provide fan motor with permanently lubricated ball bearing type with built-in current and overload protection.
4. Condenser coil shall be aluminum fins mechanically bonded to copper tubes.
5. Condenser coil shall be factory pressure and leak tested.

E. Accessories:
1. Anti-Short Cycle Timer: Device shall be solid state and shall prevent compressor recycling until 5-minutes elapsed time.
2. Evaporator Defrost Control: Temperature actuated switch that will cycle the condenser off as indoor coil reaches freeze-up condition.
3. Hard Start: Start capacitor and relay for compressor motor start assist.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Verify proper refrigerant charge and operating pressures. Supplement factory charge if necessary.

END OF SECTION 238126

SECTION 260500
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Except as modified in this section, General Conditions, Supplementary Conditions, applicable provisions of Division 1, General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 16.

B. Each section included in Division 16 is incomplete without the provisions stated herein.

1.2 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

A. Access doors.

1.3 REFERENCES

A. ASTM D 698 - Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600kN-m/cu. m.)).

B. ASTM E 814 - Fire Tests of Through-Penetration Fire Stops.

C. IEEE C2 - National Electrical Safety Code.

D. NFPA 70 - National Electrical Code.

E. UL 1479 - Fire Tests of Through-Penetration Firestops.

1.4 DEFINITIONS

A. Provide: Where the word "provide" is used, the word is understood to mean "the Contractor shall furnish and install" the equipment, tests, inspections, etc. referenced.

B. Related Work: The sections referenced under RELATED SECTIONS shall be understood to include provisions, which directly affect the work being specified in the section where RELATED SECTIONS occurs.

C. Concealed: Where the word "concealed" is used in conjunction with raceways, equipment, and the like, the word shall be understood to mean hidden from sight as in chases, furred spaces, or suspended ceilings.

D. Exposed: Where the word "exposed" is used, the word shall be understood to mean open to view.

1.5 SUBMITTALS

A. Access Doors: Indicate detailed dimension.

1.6 REGULATORY REQUIREMENTS

A. Perform work in accordance with the National Electrical Code and all editions, revisions, amendments, or supplements of applicable statutes, ordinances, codes, or regulations of Federal, State, and Local Authorities having jurisdiction in effect on the date bids are received.

B. Where approval standards have been established by OSHA, UL, ASME, AGA, AMCA, ANSI, ARI, NFPA, State Fire Insurance Regulatory Body, and FM, follow these standards whether or not indicated on the Drawings and Specifications. Include cost of work required to comply with requirements of these authorities in the original proposal. Comply with IEEE C2 where applicable.

C. Requirements in reference specifications and standards are minimum for equipment, material, and work. In instances where capacities, size, or other scheduled features of equipment, devices, or materials exceed these minimums, meet scheduled or specified capacities.

D. Resolve code interpretations discovered in Contract Documents with A/E prior to Contract award. After Contract award, make corrections or additions necessary for compliance with applicable codes.

E. Arrange with local and state authorities and utility companies for permits, fees, and service connections, verifying locations and arrangement, and pay charges including inspections.

1.7 CONTRACT DRAWINGS

A. Drawings are generally diagrammatic and are intended to encompass a system that will not interfere with the structural and architectural design of the building. Coordinate work to avoid interferences between conduit, equipment, architectural, and structural work. Provide a complete operational fire alarm system. Provide all necessary interfaces with the electrical BAS and HVAC systems. Route conduit raceways and install equipment to avoid conflicts with other trades and to enhance maintainability of system.

B. Coordinate with architectural features, trim and millwork, and install equipment in cabinets or other special areas as directed by A/E.

C. Drawings are based on equipment specified. Make adjustments, modifications, or changes required, due to use of other equipment at no additional cost to the Owner.

1.8 PROJECT/SITE CONDITIONS

A. Site Visitation: Visit the site of the proposed construction to become thoroughly familiar with details of work and working conditions, verify dimensions in the field, and advise A/E of discrepancies before performing work.

B. Space Requirements
   1. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material, which is not suitable in this respect.
   2. Make changes in equipment location of up to 5 feet, to allow for field conditions prior to actual installation, and as directed by A/E.
   3. Conceal conduit in finished areas. Conduit may be exposed in mechanical rooms, electrical rooms and where specifically allowed on Drawings. Route conduit through the building without interfering with other equipment or construction. Where existing construction prohibits the installation of conduit concealed provide wire mold metallic raceway and boxes.
   4. Provide maximum possible clear height underneath conduit. Install conduit as high as possible.
   5. Install equipment requiring service so that it is easily accessible.
   6. Compare the equipment sizes with the space allotted for installation before installation and make written notice of possible conflict. Disassemble large equipment to permit installation through normal room openings when required. Should written notice not be made in a timely manner, make adjustments and modifications necessary without additional compensation.
   7. Timely place equipment too large to fit through finished openings, and stairways.

C. Site Obstructions:
   1. Drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed as to accuracy of location or completeness of information.
   2. Verify with A/E, utility companies, municipalities, and other interested parties that available information has been provided before cutting or trenching operations are begun. Verify locations given.
   3. Alter routing of new work should obstruction be encountered, whether or not shown on Drawings. Reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
   4. Assume total responsibility for and repair damage to existing utilities or construction, whether or not such existing facilities are shown. Repair the lines, if damaged.

D. Cutting and Patching:
   1. Submit written request to A/E in advance of cutting or alterations.
   2. Execute cutting and demolition by methods which will prevent damages to other work and will provide proper surfaces to receive installation of repairs.
   3. Restore work which has been cut or removed; install new products complying with specified products, functions, tolerances and finishes as specified.
   4. Escutcheon Plates
      a. Heavy chrome-plated or nickel-plated escutcheon plates for penetrations of finished surface.
      b. Product: B&C No. 10 with concealed hinges.

5. Fit work airtight to conduit, sleeves, and other penetrations through surfaces. For fire-rated penetrations, provide assemblies in accordance with UL 1479 and ASTM E 814 utilizing products and materials equal to rating of surfaces penetrated.

1.9 MATERIALS AND WORKMANSHIP

A. Provide new materials and equipment of a domestic manufacturer by those regularly engaged in the production and manufacture of specified materials and equipment. Where UL or other agency has established standards for materials, provide materials which are listed and labeled accordingly. The commercially standard items of equipment and the specific names mentioned herein are intended to identify standards of quality and performance necessary for the proper functioning of the work.

B. Install materials and equipment to present a neat appearance when completed and in accordance with the approved recommendations of the manufacturer and in accordance with Contract Documents.

C. Provide labor, materials, apparatus, and appliances essential to the complete functioning of the systems described or indicated herein, or which may be reasonably implied as essential whether mentioned in the Contract Documents or not.

D. Make written request to A/E for supplementary instructions in cases of doubt as to Work intended or in event of need for explanation thereof.

E. Performance and material requirements scheduled or specified are minimum standards acceptable. The right to judge the quality of equipment that deviates from the Contract Documents remains solely with A/E.

1.10 DELIVERY, STORAGE AND HANDLING

A. Follow the manufacturer's directions completely in the delivery, storage, and handling of equipment and materials.

B. Store equipment in a clean, dry place, protected from other construction. While stored, maintain factory wrappings or tightly cover and protect equipment against dirt, water, construction debris, chemical, physical or weather damage, traffic and theft.

C. Adequately brace and package equipment to prevent breakage and distortion while in transit.

1.11 EXCAVATION

A. Trenching:
   1. Perform excavation of every description and of whatever substance encountered to depths indicated or specified. Pile materials suitable for backfilling a sufficient distance from banks of trenches to prevent slides or cave-ins. Comply with OSHA requirements for excavation, trenching, and shoring. Keep surface drainage of adjoining areas unobstructed. Waste excavated materials not required or satisfactory for backfill. Remove water by pumping or other approved methods, discharge at a safe distance from the excavation.
   2. Provide trenches of necessary width for proper laying of conduit and comply with latest publication of OSHA 2226 Excavating and Trenching Operations. Coordinate trench

excavation with pipe installation to avoid open trenches for prolonged periods. Accurately grade to bottoms of trenches to provide uniform bearing and support for each section of conduit on undisturbed soil or the required thickness of bedding material at every point along its entire length.

3. Provide minimum 12 inches between outer surfaces and embankment or shoring which may be used, when excavating for manholes, pull boxes, and similar structures. Remove unstable soil that is incapable of supporting the structure in the bottom of the excavation to the depth necessary to obtain design bearing.
4. Material to be excavated is "unclassified." No adjustment in the contract price will be made on account of the presence or absence of rock, shale, masonry, or other materials.
5. Protect existing utility lines that are indicated or the locations of which are made known prior to excavating and trenching and that are to be retained. Protect utility lines constructed during excavating and trenching operations, from damage during excavating, trenching and backfilling; if damaged, repair lines as directed by utilities, Owner, and A/E. Issue notices when utility lines that are to be removed are encountered within the area of operations in ample time for the necessary measures to be taken to prevent interruption of the service.
6. Provide trenches for utilities of a depth that will provide the following minimum depths of cover from existing grade or from indicated finish grades, whichever is lower:
   a. 3-Foot Minimum Cover: Raceways for primary voltage conductors.
   b. 2-Foot Minimum Cover: Raceways for secondary conductors.

B. Backfilling:
1. Backfill trenches after conduit, fittings, and joints have been tested and approved.
2. Backfill trenches with sand to provide 6 inches sand below conduit and 12 inches sand cover. Backfill remainder of trenches with satisfactory materials consisting of earth, loam, sandy clay, sand, and gravel, or soft shale, free from large clods of earth and stones not over 1-1/2 inch in size, and deposit in 9 inch maximum layers, loose depth as indicated or specified. Provide 6” wide red warning tape 6”below grade. Take care not to damage utility lines. Deposit the remainder of backfill materials in the trench in 1 foot maximum layers, and compact by mechanical means. Re-open trenches and excavation pits improperly backfilled or where settlement occurs to the depth required to obtain the specified compaction, then refill and compact with the surface restored to the required grade and compaction.
3. Where trenches cross streets, driveways, building slabs, or other pavements, backfill trench utility line with sand backfill material in 6 inch layers. Moisten each layer and compact to 95 percent of the maximum soil density as determined by ASTM D 698. Accomplish backfilling in such a manner as to permit the rolling and compaction of the filled trench with the adjoining material to provide the required bearing value so that paving of the area can proceed immediately after backfilling is complete.
4. Restore surface/ slab/ drive to original “new” condition.

1.12 PAINTING

A. Properly prepare surfaces to receive paint. Prime prepared surfaces and finish with two coats of exterior oil base paint. Verify primer and paint are rated for application.

B. Repair damage to factory painted finishes.

C. Remove splattered and incidental paint from electrical equipment.

1.13 ACCESS DOORS

A. Provide hinged access doors in walls, floors and ceilings to permit access to equipment requiring service or adjustment.

B. Provide hinged access doors and frames as follows:
   1. Drywall Construction:
      a. Provide with concealed spring hinges and flush screwdriver operated cam locks in sufficient number of the size of the panel. Factory prime paint surfaces not galvanized.
      b. Product: Milcor, “Style DW”.
   2. Visible Masonry and Ceramic Tile: Milcor, “Style M”.
   3. Gypsum and Cement Plaster: Milcor, “Style K”.
   4. Acoustic Plaster:
      a. Reinforce panel as required to prevent sagging. Provide continuous steel piano type hinge for the length of the panel, and sleeved and grommeted screwdriver operated cam locks in sufficient number for the size of the panel. Factory prime paint surfaces not galvanized.
      b. Product: Milcor, “Style AP”.
   5. Acoustic Tile: Milcor, “Style AT”.
   6. Inmate Accessible Areas: Security access doors in all hard ceilings as specified by the Architect.

C. Provide continuous concealed hinges and cam locks.

D. Provide UL listed 1-1/2 hour Label "B" access doors with automatic self-closing latching mechanism where required.

E. Provide removable ceiling access tile section immediately adjacent to each mechanical or electrical device located in the ceiling plenum above removable tile ceiling.

F. Coordinate approval and location of doors with A/E.

1.14 NOISE AND VIBRATION

A. Provide the entire operating system and its component items of equipment free of objectionable vibration or noises. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, ballasts, or other parts of the work, rectify such condition at no additional compensation.

1.15 OPERATING INSTRUCTIONS

A. Provide services of authorized representatives of manufacturer to ensure that the equipment is installed according to the manufacturer's recommendations, is operating properly, and to instruct Owner's operating personnel during start-up and operating tests of complete electrical system. Notify A/E seven days prior to beginning equipment start-up.

B. Certify in writing that these services have been performed.

C. Perform tests as specified in Section 26 08 00.

1.16 SERVICE

A. Inspect, clean, and service light fixtures; replace fluorescent or HID lamps if utilized for construction lighting immediately prior to final acceptance of project.
B. Clean and polish fixtures, equipment, and materials thoroughly, and return to "as new" condition.

C. Remove excess material and debris. Place fire alarm systems in complete working order before request for final review. Broom clean areas.

1.17 ARC FLASH HAZARD

A. Perform calculations to determine the ARC flash hazard at switchboards, panelboards, motor control centers, starters and industrial control panels.

B. Install ARC flash hazard labels at each piece of equipment in accordance with NFPA 70, Article 110.16.

1.18 PROJECT RECORD DOCUMENTS

A. Maintain a set of Contract Documents at the job site for the purpose of recording final size, location, and interrelation of work under this Division. Mark this set of drawings as the job progresses to indicate "as-built" location of equipment, including concealed conduit and equipment.

B. Clearly and accurately delineate the work by dimensions on the record drawings as installed, with equipment locations identified by at least two dimensions to permanent structures.

C. Final record drawings shall be marked "AS-BUILT," and signed and dated by Contractor.

D. Provide certified "AS-BUILT" drawings at the conclusion of project.

1.19 FINAL REVIEW

A. Obtain necessary Certificates of Occupancy from local authorities.

B. Submit final approved operation and maintenance manuals including approved submittals, test reports, and "AS-BUILT" drawings prior to requesting final payment. Delivery of operation and maintenance manuals is a condition of final acceptance.

1.20 GUARANTEE

A. Guarantee materials, parts and labor for Work for one year from the date of issuance of occupancy permit. During that period make good faults or imperfections that may arise due to defects or omissions in materials or workmanship with no additional compensation and as directed by A/E.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 26 05 00

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Copper building wire rated 600 V or less.
   2. Metal-clad cable, Type MC, rated 600 V or less.
   3. Armored cable, Type AC, rated 600 V or less.
   4. Fire-alarm wire and cable.
   5. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer's authorized service representative.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. General Cable Technologies Corporation.
   2. Okonite Company (The).
   3. Southwire Company.

C. Standards:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
   2. RoHS compliant.
   3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Conductor Insulation:
   1. Type THHN and Type THWN-2: Comply with UL 83.
   2. Type XHHW-2: Comply with UL 44.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. 3M Electrical Products.
   2. Ideal Industries, Inc.
   3. ILSCO.
   4. O-Z/Gedney; a brand of Emerson Industrial Automation.
   5. Thomas & Betts Corporation; A Member of the ABB Group.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
   1. Material: Copper.
   2. Type: Two hole with long barrels.
   3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.

D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.

F. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

I. Branch Circuits Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.

J. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

K. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

L. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

M. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

N. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

O. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

P. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.4 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor. Identify as spare conductor.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
   2. Perform each of the following visual and electrical tests:
      a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
      b. Test bolted connections for high resistance using one of the following:
         1) A low-resistance ohmmeter.
         2) Calibrated torque wrench.
         3) Thermographic survey.
      c. Inspect compression-applied connectors for correct cable match and indentation.
      d. Inspect for correct identification.
      e. Inspect cable jacket and condition.
      f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
      g. Continuity test on each conductor and cable.
      h. Uniform resistance of parallel conductors.
   3. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
      a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
      b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
   4. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports to record the following:
   1. Procedures used.
   2. Results that comply with requirements.
   3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:
   1. Underground distribution grounding.
   2. Ground bonding common with lightning protection system.
   3. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
   1. Test wells.
   2. Ground rods.
   3. Ground rings.
   4. Grounding arrangements and connections for separately derived systems.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      a. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:
         1) Test wells.

2) Ground rods.
3) Ground rings.
4) Grounding arrangements and connections for separately derived systems.

b. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, grounding connections for separately derived systems based on NETA MTS.
1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
2) Include recommended testing intervals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advanced Lightning Technology, Ltd.
2. Burndy; Part of Hubbell Electrical Systems.
3. ERICO; a brand of nVent.
4. Harger Lightning & Grounding.
5. ILSCO.
6. O-Z/Gedney; a brand of Emerson Industrial Automation.
7. Robbins Lightning, Inc.
8. Thomas & Betts Corporation; A Member of the ABB Group.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.

4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.CONNECTORS

D. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

E. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

F. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

G. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

H. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

I. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

J. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

K. Conduit Hubs: Mechanical type, terminal with threaded hub.

L. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

M. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt. nbm

N. Lay-in Lug Connector: Mechanical type, aluminum or copper rated for direct burial terminal with set screw.

O. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

P. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

Q. Straps: Braided copper, cast-bronze clamp. Rated for 600 A.

R. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal one-piece clamp.

S. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

T. Water Pipe Clamps:
   1. Mechanical type, two pieces with zinc-plated bolts.
      a. Material: Die-cast zinc alloy.
      b. Listed for direct burial.
   2. U-bolt type with malleable-iron clamp and copper ground connector.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
   1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
   2. Backfill Material: Electrode manufacturer's recommended material.

C. Ground Plates: 1/4 inch thick, hot-dip galvanized.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
   1. Bury at least 30 inches below grade.
   2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.

D. Isolated Grounding Conductors: Green-colored insulation with more than one continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

E. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
   1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 60 inches above finished floor unless otherwise indicated.
   2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

F. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   4. Single-phase motor and appliance branch circuits.

5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

H. Metallic Fences: Comply with requirements of IEEE C2.
1. Grounding Conductor: Bare copper, not less than No. 8 AWG.
2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.6 FENCE GROUNDING

A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:
1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
a. Gates and Other Fence Openings: Ground fence on each side of opening.
1) Bond metal gates to gate posts.
2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

F. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.7 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
   2. Use exothermic welds for all below-grade connections.
   3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
   1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column indicated, extending around the perimeter of building or area or item indicated.
1. Install tinned-copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building's foundation.

J. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

K. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.

L. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Tests and Inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal**,** at ground test wells. Make tests at ground rods before any conductors are connected.
    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity to 1000 kVA: 5 ohms.
2. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Steel slotted support systems.
2. Aluminum slotted support systems.
3. Nonmetallic slotted support systems.
4. Conduit and cable support devices.
5. Support for conductors in vertical conduit.
6. Structural steel for fabricated supports and restraints.
7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
8. Fabricated metal equipment support assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
a. Slotted support systems, hardware, and accessories.
b. Clamps.
c. Hangers.
d. Sockets.
e. Eye nuts.
f. Fasteners.
g. Anchors.
h. Saddles.
i. Brackets.
2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.

4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame Rating: Class 1.
   2. Self-extinguishing according to ASTM D635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- diameter holes at a maximum of 8 inches o.c. in at least one surface.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. B-line, an Eaton business.
      b. CADDY; a brand of nVent.
      c. Thomas & Betts Corporation; A Member of the ABB Group.
      d. Super Strut
      e. Unistrut; Part of Atkore International.
   2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
   3. Material for Channel, Fittings, and Accessories: Galvanized steel
   4. Channel Width: Selected for applicable load criteria
   5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
   7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
   8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Aluminum Slotted Support Systems: Extruded-aluminum channels and angles with minimum 13/32-inch- diameter holes at a maximum of 8 inches o.c. in at least one surface.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper Industries, Inc.
      b. Thomas & Betts Corporation; A Member of the ABB Group.
      c. Unistrut; Part of Atkore International.
   2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
   3. Channel Material: 6063-T5 aluminum alloy.
   4. Fittings and Accessories Material: 5052-H32 aluminum alloy.
   5. Channel Width: Selected for applicable load criteria.

6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with minimum 13/32-inch- diameter holes at a maximum of 8 inches o.c., in at least one surface.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. B-line, an Eaton business.
   b. G-Strut.
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Channel Width: Selected for applicable load criteria.
4. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
5. Fitting and Accessory Materials: Same as those for channels and angles, except metal items may be stainless steel.
6. Rated Strength: Selected to suit applicable load criteria.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      1) Hilti, Inc.
      2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      3) Red Head
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1) B-line, an Eaton business.
   2) Hilti, Inc.
   3) ITW Ramset/Red Head; Illinois Tool Works, Inc.
   4) Red Head

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125.
6. Toggle Bolts: All steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
   1. NECA 1.
   2. NECA 101
   3. NECA 102.
   4. NECA 105.
   5. NECA 111.

B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and] RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. To Existing Concrete: Expansion anchor fasteners.
   5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
   6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
   7. To Light Steel: Sheet metal screws.
   8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete.

C. Anchor equipment to concrete base as follows:
   1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor bolts to elevations required for proper attachment to supported equipment.
   3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 099113 "Exterior Painting", Section 099123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:
1. Section 078413 "Penetration Firestopping" for firestopping at conduit and box entrances.
2. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
3. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AFC Cable Systems; a part of Atkore International.
   b. Allied Tube & Conduit; a part of Atkore International.
   c. Electri-Flex Company.
   d. O-Z/Gedney; a brand of Emerson Industrial Automation.
   e. Perma-Cote.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. ARC: Comply with ANSI C80.5 and UL 6A.
5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
   a. Comply with NEMA RN 1.
   b. Coating Thickness: 0.040 inch , minimum.
6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; zinc-coated steel.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AFC Cable Systems; a part of Atkore International.
   b. Allied Tube & Conduit; a part of Atkore International.
   c. Anamet Electrical, Inc.
   d. Electri-Flex Company.
   e. O-Z/Gedney; a brand of Emerson Industrial Automation.
2. Comply with NEMA FB 1 and UL 514B.
3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Fittings, General: Listed and labeled for type of conduit, location, and use.
5. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
6. Fittings for EMT:
   a. Material: Steel.
   b. Type: compression.
7. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
8. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

C. Joint Compound for GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. CANTEX INC.
      b. Carlon.
      c. CertainTeed Corporation.
   2. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   3. ENT: Comply with NEMA TC 13 and UL 1653.
   4. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
   5. LFNC: Comply with UL 1660.
   6. Rigid HDPE: Comply with UL 651A.
   7. Continuous HDPE: Comply with UL 651A.
   8. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D3485.
   9. RTRC: Comply with UL 2515A and NEMA TC 14.

B. Nonmetallic Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CANTEX INC.
      b. Carlon.
      c. CertainTeed Corporation.
   2. Fittings, General: Listed and labeled for type of conduit, location, and use.
   3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
      a. Fittings for LFNC: Comply with UL 514B.
   4. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. B-line, an Eaton business.
   2. Hoffman; a brand of nVent.
   3. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R, Type 4 unless otherwise indicated, and sized according to NFPA 70.
   1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Hoffman; a brand of nVent.

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

F. Solvents and Adhesives: As recommended by conduit manufacturer.

2.5 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Hubbell Incorporated; Wiring Device-Kellems.
      a. MonoSystems, Inc.
      b. Wiremold / Legrand.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hubbell Incorporated.

b. MonoSystems, Inc.
c. Panduit Corp.
d. Wiremold / Legrand.

D. Tele-Power Poles:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. MonoSystems, Inc.
b. Wiremold / Legrand.
2. Material: Aluminum with clear anodized finish.
3. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Crouse-Hinds, an Eaton business.
2. EGS/Appleton Electric.
3. FSR Inc.
4. Hoffman; a brand of nVent.
5. Hubbell Incorporated.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Metal Floor Boxes:
1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable or Semi-adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Nonmetallic Floor Boxes: Nonadjustable, rectangular.
1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

I. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb (32 kg).
   1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

J. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

K. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

L. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

M. Device Box Dimensions: 4 inches square by 2-1/8 inches deep or 4 inches by 2-1/8 inches by 2-1/8 inches deep.

N. Gangable boxes are allowed.

O. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, Type 3R or Type 4 with continuous-hinge cover with flush latch unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Nonmetallic Enclosures: Fiberglass.
   3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

P. Cabinets:
   1. NEMA 250, Type 1 or Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.
   6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:
   1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
   2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Oldcastle Precast, Inc.
   2. Standard: Comply with SCTE 77.

3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC.".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Nordic Fiberglass, Inc.
b. Oldcastle Enclosure Solutions.
c. Quazite: Hubbell Power Systems, Inc.
2. Standard: Comply with SCTE 77.
3. Color of Frame and Cover: Gray.
4. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
7. Cover Legend: Molded lettering, "ELECTRIC.".
8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
9. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC, PVC coated.
2. Concealed Conduit, Aboveground: GRC.

3. Underground Conduit: RNC, Type EPC-40-PVC or Type EPC-80-PVC, direct buried or concrete encased.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or Type 4.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
   d. Gymnasiums.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: GRC.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Complete raceway installation before starting conductor installation.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches of enclosures to which attached.

L. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
   4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
   5. Change from ENT to GRC before rising above floor.

M. Stub-Ups to Above Recessed Ceilings:
   1. Use EMT or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

Q. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

R. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

S. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

T. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

U. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

V. Surface Raceways:
   1. Install surface raceway with a minimum 2-inch radius control at bend points.
   2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

W. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

X. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service raceway enters a building or structure.
   3. Conduit extending from interior to exterior of building.
   4. Conduit extending into pressurized duct and equipment.
   5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
   6. Where otherwise required by NFPA 70.

Y. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

Z. Expansion-Joint Fittings:
   1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where

environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
   d. Attics: 135 deg F temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

AA. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

BB. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

CC. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

DD. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

EE. Locate boxes so that cover or plate will not span different building finishes.

FF. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

GG. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

HH. Set metal floor boxes level and flush with finished floor surface.

II. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured PVC coated rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install 0sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
   2. Sleeve-seal systems.
   3. Sleeve-seal fittings.
   4. Grout.
   5. Silicone sealants.

B. Related Requirements:
   1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:
   1. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
   2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:
   1. Material: Galvanized sheet steel.
   2. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
      b. For sleeve cross-section rectangle perimeter 50 inchesor more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Advance Products & Systems, Inc.
      b. Flexicraft Industries.
      c. Metraflex Company (The).
      d. Proco Products, Inc.
   2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Carbon steel.
   4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. HOLDRITE; Reliance Worldwide Company.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
      b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
   2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
   3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed
   4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
   5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inchesabove finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inchannular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inchannular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:
   1. Orange letters on a black background.
   2. Legend: Indicate voltage, system and service type.
   3. Example:
      a. 480VAC/ 3PH
      b. 60HZ
      c. LIGHTING AND POWER

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
   1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG.
   2. Colors for 208/120-V Circuits:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
   3. Colors for 240-V Circuits:
      a. Phase A: Black.
      b. Phase B: Red.
   4. Colors for 480/277-V Circuits:
      a. Phase A: Brown.
      b. Phase B: Purple.
      c. Phase C: Yellow.
   5. Color for Neutral: White or gray.
   6. Color for Equipment Grounds: Green.
   7. Colors for Isolated Grounds: Green with two or more yellow stripes.

C. Raceways and Cables Carrying Circuits at More Than 600 V:
   1. Black letters on an orange field.
   2. Legend: "DANGER - HIGH VOLTAGE WIRING."

D. Warning Label Colors:
   1. Identify system voltage with black letters on an orange background.

E. Warning labels and signs shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

F. Equipment Identification Labels:
   1. Black letters on a white background.
   2. Include equipment designation 1/4”H.
   3. Include source and circuit number 1/8”H.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Brady Corporation.
      b. Panduit Corp.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Brady Corporation.
      b. Panduit Corp.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Brady Corporation.
      b. Panduit Corp.
   2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
   3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Brady Corporation.
      b. Panduit Corp.
   2. Minimum Nominal Size:
      a. 1-1/2 by 6 inches for raceway and conductors.
      b. 3-1/2 by 5 inches for equipment.

2.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Panduit Corp.

2.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Ideal Industries, Inc.
b. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Brady Corporation.

C. Underground-Line Warning Tape:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Brady Corporation.
b. Ideal Industries, Inc.
2. Tape:
a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
b. Printing on tape shall be permanent and shall not be damaged by burial operations.
c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
3. Color and Printing:
a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
b. Inscriptions for Red-Colored Tapes: "CAUTION ELECTRIC LINE

2.6 TAGS

A. Metal Tags for use in Vaults, Manholes and Handholes: Brass, stainless steel or aluminum, 2 by 2 by 0.05 inch with stamped legend, punched for use with self-locking cable tie fastener.

2.7 SIGNS

A. Laminated Acrylic Signs:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Brady Corporation.
2. Engraved legend.
3. Thickness:
   a. For signs up to 20 sq. in., minimum 1/16 inch thick.
   b. For signs larger than 20 sq. in., 1/8 inch thick.
   c. Engraved legend with white letters on black background.
   d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
   e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.
   4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 Deg F according to ASTM D638: 7000 psi.
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 50 to plus 284 deg F.
   5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
   1. Secure tight to surface of conductor, cable, or raceway.

H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
   1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

L. Accessible Fittings for Raceways: Paint the covers of each junction and pull box of the following systems as follows:
   1. Emergency – Yellow.

2. Fire Alarm – Red.

M. Vinyl Wraparound Labels:
1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

O. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

P. Self-Adhesive Labels:
1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a text with 1/2-inch-high letters on 1-1/2-inch- or 2-inch high label.

Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

R. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

S. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

T. Underground Line Warning Tape:
1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
2. Limit use of underground-line warning tape to direct-buried cables.
3. Install underground-line warning tape for direct-buried cables and cables in raceways.

U. Metal Tags:
1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

V. Laminated Acrylic Signs:
1. Attach signs that are not self-adhesive type with stainless steel or brass screws.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high sign; where two lines of text are required, use labels 2 inches high.

W. Cable Ties: General purpose, for attaching tags, except as listed below:
1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil. Stencil legend "DANGER - HIGH-VOLTAGE WIRING" with 3-inch-high, black letters on 20-inch centers.
   1. Locate identification at changes in direction, at penetrations of walls and floors, and at 30-foot maximum intervals.

D. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Vinyl wraparound labels.
   1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

E. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.
   1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box with panel and circuit number in indelible ink.

G. Power-Circuit Conductor Identification, 600 V or Less: For conductors in pull and junction boxes, use vinyl self-adhesive wraparound labels to identify the phase and circuit designation.
   1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

H. Power-Circuit Conductor Identification for conductors in vaults, manholes, and handholes, use metal tags to indicate phase, and circuit designation.

I. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.

J. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.

K. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

L. Auxiliary Electrical Systems Conductor Identification: Marker tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

M. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

N. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

O. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.
   1. Apply to exterior of door, cover, or other access.
   2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
      a. Power-transfer switches.
      b. Controls with external control power connections.

P. Arc Flash Warning Labeling: Self-adhesive labels.

Q. Operating Instruction Signs: Laminated acrylic signs.

R. Emergency Operating Instruction Signs: Laminated acrylic signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

S. Equipment Identification Labels:
   1. Indoor Equipment: Laminated acrylic nameplates.
   2. Outdoor Equipment: Laminated acrylic nameplates.
   3. Equipment to Be Labeled:
      a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved laminated acrylic nameplate.
      b. Enclosures and electrical cabinets.
      c. Access doors and panels for concealed electrical items.
      d. Switchgear.
      e. Switchboards.
      f. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
      g. Substations.
      h. Emergency system boxes and enclosures.
      i. Motor-control centers.
      j. Enclosed switches.
      k. Enclosed circuit breakers.
      l. Enclosed controllers.
      m. Variable-speed controllers.
      n. Push-button stations.
      o. Power-transfer equipment.
      p. Contactors.
      q. Remote-controlled switches, dimmer modules, and control devices.
      r. Battery-inverter units.
      s. Battery racks.

t. Power-generating units.
u. Monitoring and control equipment.
v. UPS equipment.

END OF SECTION 260553

SECTION 260573.13 - SHORT-CIRCUIT STUDIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.

B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.

C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

E. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

G. SCCR: Short-circuit current rating.

H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

I. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data:
   1. For computer software program to be used for studies.
   2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.
      a. Short-circuit study input data, including completed computer program input data sheets.
      b. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.
         1) Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
         2) Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:
   1. For Power Systems Analysis Software Developer.
   2. For Power System Analysis Specialist.
   3. For Field Adjusting Agency.

B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:
   1. For overcurrent protective devices to include in emergency, operation, and maintenance manuals.
   2. The following are from the Short-Circuit Study Report:
      a. Final one-line diagram.
      b. Final Short-Circuit Study Report.
      c. Short-circuit study data files.
      d. Power system data.

1.7 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

1. Power System Analysis Software Qualifications: Computer program shall be designed to perform short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

D. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

E. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed and sealed by Power Systems Analysis Specialist.

F. Field Adjusting Agency Qualifications:
1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
2. A member company of NETA.
3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. SKM Systems Analysis, Inc.

B. Comply with IEEE 399 and IEEE 551.
1. Analytical features of power systems analysis software program shall have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:
1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.

6. Derating factors and environmental conditions.
7. Any revisions to electrical equipment required by the study.

D. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.

E. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data:
1. One-line diagram of system being studied.
2. Power sources available.
3. Manufacturer, model, and interrupting rating of protective devices.
4. Conductors.
5. Transformer data.

G. Short-Circuit Study Output Reports:
1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
    a. Voltage.
    b. Calculated fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Equivalent impedance.
2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Calculated asymmetrical fault currents:
        1) Based on fault-point X/R ratio.
        2) Based on calculated symmetrical value multiplied by 1.6.
        3) Based on calculated symmetrical value multiplied by 2.7.
3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. No AC Decrement (NACD) ratio.
    e. Equivalent impedance.

f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the study.
1. Verify completeness of data supplied on one-line diagram. Call any discrepancies to Architect's attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.

B. Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
11. Derating factors.

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on device characteristics supplied by device manufacturer.

D. Extent of electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at the service, extending down to system overcurrent protective devices as follows:
   1. To normal system low-voltage load buses where fault current is 10 kA or less.
   2. Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
   1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

I. Include in the report identification of any protective device applied outside its capacity.

END OF SECTION 260573.13

SECTION 260573.16 - COORDINATION STUDIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.
   1. Study results shall be used to determine coordination of series-rated devices.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.

B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.

C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

E. Power System Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

G. SCCR: Short-circuit current rating.

H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

I. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data:
   1. For computer software program to be used for studies.
   2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.
      a. Coordination-study input data, including completed computer program input data sheets.
      b. Study and equipment evaluation reports.
   3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.
      a. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:
   1. For Power System Analysis Software Developer.
   2. For Power Systems Analysis Specialist.
   3. For Field Adjusting Agency.

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For overcurrent protective devices to include in emergency, operation, and maintenance manuals.
   1. The following are from the Coordination Study Report:
      a. Final one-line diagram.
      b. Final protective device coordination study.
      c. Coordination study data files.
      d. List of all protective device settings.
      e. Time-current coordination curves.
      f. Power system data.

1.7 QUALITY ASSURANCE

A. Studies shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Power System Analysis Software Qualifications:
   1. Computer program shall be designed to perform coordination studies or have a function, component, or add-on module designed to perform coordination studies.
   2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

F. Field Adjusting Agency Qualifications:
   1. Employer of a NETA ETT-Certified Technician Level III responsible for all field adjusting of the Work.
   2. A member company of NETA.
   3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. SKM Systems Analysis, Inc.

B. Comply with IEEE 242 and IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.
   1. Optional Features:
      a. Arcing faults.
      b. Simultaneous faults.
      c. Explicit negative sequence.
      d. Mutual coupling in zero sequence.

2.2 COORDINATION STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:
   1. Protective device designations and ampere ratings.
   2. Conductor types, sizes, and lengths.
   3. Transformer kilovolt ampere (kVA) and voltage ratings.
   4. Motor and generator designations and kVA ratings.
   5. Switchgear, switchboard, motor-control center, and panelboard designations.
   6. Any revisions to electrical equipment required by the study.
   7. Study Input Data: As described in "Power System Data" Article.
      a. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

D. Protective Device Coordination Study:
   1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
      a. Phase and Ground Relays:
         1) Device tag.
         2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
         3) Recommendations on improved relaying systems, if applicable.
      b. Circuit Breakers:
         1) Adjustable pickups and time delays (long time, short time, and ground).
         2) Adjustable time-current characteristic.
         3) Adjustable instantaneous pickup.
         4) Recommendations on improved trip systems, if applicable.
      c. Fuses: Show current rating, voltage, and class.

E. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
   1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
   2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
   3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
   4. Plot the following listed characteristic curves, as applicable:
      a. Power utility's overcurrent protective device.
      b. Medium-voltage equipment overcurrent relays.
      c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
      d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
      e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
      f. Cables and conductors damage curves.
      g. Ground-fault protective devices.
      h. Motor-starting characteristics and motor damage points.

i. Generator short-circuit decrement curve and generator damage point.
j. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Maintain selectivity for tripping currents caused by overloads.
6. Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.
7. Provide adequate time margins between device characteristics such that selective operation is achieved.
8. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.
   1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the overcurrent protective device study.
   1. Verify completeness of data supplied in one-line diagram on Drawings. Call any discrepancies to Architect's attention.
   2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
   3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.

B. Gather and tabulate all required input data to support the coordination study. List below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
   1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
   2. Electrical power utility impedance at the service.
   3. Power sources and ties.
   4. Short-circuit current at each system bus (three phase and line to ground).
   5. Full-load current of all loads.
   6. Voltage level at each bus.
   7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.

8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, cable construction, metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).
17. Data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, showing the following:
    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
    k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.3 COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. Base study on device characteristics supplied by device manufacturer.

D. Extent of electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to system overcurrent protective devices as follows:
   1. To normal system low-voltage load buses where fault current is 10 kA or less.
   2. Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Transformer Primary Overcurrent Protective Devices:
   1. Device shall not operate in response to the following:
      a. Inrush current when first energized.
      b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
      c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
   2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

H. Motor Protection:
   1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
   2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

J. Generator Protection: Select protection according to manufacturer's written instructions and to IEEE 242.

K. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.

L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
   1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

M. Protective Device Evaluation:
   1. Evaluate equipment and protective devices and compare to short-circuit ratings.

2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Any application of series-rated devices shall be recertified, complying with requirements in NFPA 70.
4. Include in the report identification of any protective device applied outside its capacity.

3.4 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:
   1. Determine load flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
   2. Determine load flow and voltage drop based on 80 percent of the design capacity of load buses.
   3. Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.5 MOTOR-STARTING STUDY

A. Perform a motor-starting study to analyze the transient effect of system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze the effects of motor starting on the power system stability.

B. Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141, and voltage sags so as not to affect operation of other utilization equipment on system supplying the motor.

3.6 FIELD ADJUSTING

A. Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of equipment manufacturer under the "Startup and Acceptance Testing" contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.
   1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.7 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in the following:
   1. Acquaint personnel in fundamentals of operating the power system in normal and emergency modes.
   2. Hand-out and explain the coordination study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.
   3. For Owner's maintenance staff certified as NETA ETT-Certified Technicians Level III or NICET Electrical Power Testing Level III Technicians, teach how to adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 260573.16

SECTION 260573.19 - ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.

C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

E. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

G. SCCR: Short-circuit current rating.

H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

I. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals may be in digital form:
   1. Arc-flash study input data, including completed computer program input data sheets.
   2. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.
   3. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:
   1. For Power Systems Analysis Software Developer.
   2. For Power System Analysis Specialist.
   3. For Field Adjusting Agency.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:
   1. Provide maintenance procedures in equipment manuals according to requirements in NFPA 70E.
   2. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.7 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
   1. Computer program shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.

2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.

G. Field Adjusting Agency Qualifications:
1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
2. A member company of NETA.
3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. SKM Systems Analysis, Inc.

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram, showing the following:
1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

F. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

G. Arc-Flash Study Output Reports:
   1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:
      a. Voltage.
      b. Calculated symmetrical fault-current magnitude and angle.
      c. Fault-point X/R ratio.
      d. No AC Decrement (NACD) ratio.
      e. Equivalent impedance.
      f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
      g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

H. Incident Energy and Flash Protection Boundary Calculations:
   1. Arcing fault magnitude.
   2. Protective device clearing time.
   3. Duration of arc.
   4. Arc-flash boundary.
   5. Restricted approach boundary.
   6. Limited approach boundary.
   7. Working distance.
   8. Incident energy.
   9. Hazard risk category.
   10. Recommendations for arc-flash energy reduction.

I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.

B. Label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
   1. Location designation.
   2. Nominal voltage.
   3. Protection boundaries.
      a. Arc-flash boundary.
      b. Restricted approach boundary.
      c. Limited approach boundary.
   4. Arc flash PPE category.
   5. Required minimum arc rating of PPE in Cal/cm squared.

6. Available incident energy.
7. Working distance.
8. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination study studies prior to starting the Arc-Flash Hazard Analysis.
1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
2. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

C. Calculate maximum and minimum contributions of fault-current size.
1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
3. Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.
4. Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.

D. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except equipment rated 240 V ac or less fed from transformers less than 125 kVA.

F. Calculate the limited, restricted, and prohibited approach boundaries for each location.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or

decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors shall not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.
2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance or available short circuit current at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus (three phase and line to ground).
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating and impedance.

9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

3.4 LABELING

A. Apply one arc-flash label on the front cover for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.

B. Each piece of equipment listed below shall have an arc-flash label applied to it:
   1. Motor-control center.
   2. Low-voltage switchboard.
   3. Switchgear.
   4. Medium-voltage switch.
   5. Medium voltage transformers
   6. Low voltage transformers. Exclude transformers with high voltage side 240 V or less and less than 125 kVA.
   7. Panelboard and safety switch over 250 V.
   8. Applicable panelboard and safety switch under 250 V.
   9. Control panel.

C. Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.
   1. Indicate arc-flash energy.
   2. Indicate protection level required.

3.5 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.6 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION 260573.19

SECTION 26 22 13
LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install dry-type non-linear transformers.

1.2 REFERENCES

A. IEEE C57.12.91 - Test Code for Dry-Type Distribution and Power Transformers.

B. NEMA ST 20 - Dry-Type Transformers for General Applications.

C. UL 1561 - Dry-Type General Purpose and Power Transformers.

1.3 SUBMITTALS

A. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, no load core loss, full load winding conductor loss, full load losses, efficiency at 25 percent, 50 percent, 75 percent and 100 percent rated loads, percent regulation with 80 percent and 100 percent power factor loads, sound level, tap configurations, insulation system type and rated temperature rise.

B. Indicate K-factor where applicable.

C. Base data for electrical characteristics on actual laboratory tests of typical transformers.

D. Provide operation and maintenance manual.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store in a warm, dry location with uniform temperature. Cover ventilating openings to keep out dust.

B. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, or snow if handled in inclement weather.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Dry-Type and Non-Linear Transformers
   1. Square D.

2. General Electric.
3. Cutler-Hammer.
4. Siemens.

2.2 DRY-TYPE NON-LINEAR TRANSFORMERS

A. Factory assembled, air cooled, dry-type, shielded isolation transformers; ratings as scheduled; capable of operating at 100 percent load continuously at an ambient temperature of 40 degrees C.

B. Insulation system and average winding temperatures rise for rated kVA as follows:
1. kVA Rating: 15-300.
2. Insulation Class: 220.
3. Temperature Rise degrees C: 150.

C. Provide electrostatic winding sheild with separate insulated grounding connection.

D. Provide neutral bar sized for 200 percent of secondary phase conductors.

E. Manufactured and tested in accordance with IEEE C57.12.91, UL 1561, and NEMA ST 20 at K factor rating of 13.

2.3 GENERAL

A. Maximum Case Temperature: 50 degrees C rise above ambient at its warmest point.

B. Winding Taps, Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.

C. Winding Taps, Transformers 15 kVA and Larger: Two 2-1/2 percent below and two 2-1/2 percent above rated voltage, full capacity taps on primary winding.

D. Sound Levels: Maximum noise level as follows:

kVA Rating	Noise Level Decibels
0 - 9	40
10 - 50	45
51 - 150	50
151 - 300	55

E. Basic Impulse Level: 10 kV for transformers less than 300 kVA; 30 kV for transformers 300 kVA and larger.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Mounting: Provide transformers 75 kVA and below suitable for wall, floor or trapeze mounting; transformers larger than 75 kVA suitable for floor mounting.

H. Coil Conductors: Continuous copper windings with terminations welded or brazed to ends of the windings.

I. Core: High grade, non-aging silicon steel with high magnetic permeability.

J. Isolate core and coil from enclosure using vibration absorbing mounts.

K. Nameplate: Include transformer connection data.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set transformer plumb and level. Mount enclosure on vibration isolators to minimize noise transmission from the enclosure to supporting structure. Set floor mounted transformers at 10-degree angle to wall on a neoprene pad on housekeeping pads.

B. Install transformer so that enclosure does not make contact with wall surface.

C. Use flexible conduit, 2-foot minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

D. Ground neutral connection to service ground per codes.

3.2 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION 262213

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. SPD: Surge protective device.

G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.
   1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
   2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details.
   2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
   3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
   4. Detail bus configuration, current, and voltage ratings.

5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of NRTL listing for SPD as installed in panelboard.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
   2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Keys: Two spares for each type of panelboard cabinet lock.
   2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.9 FIELD CONDITIONS

A. Environmental Limitations:
   1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
   2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
      a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of electric service.
   2. Do not proceed with interruption of electric service without Owner's written permission.
   3. Comply with NFPA 70E.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
   1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.
   1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARD COMMON REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: Flush or Surface-mounted, dead-front cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
      b. Outdoor Locations: NEMA 250, Type 3R or 4X as indicated on drawings.
      c. Wash-Down Areas: NEMA 250, Type 4X.
      d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4X.
   2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
   3. Finishes:
      a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      b. Back Boxes: Same finish as panels and trim.
      c.

E. Incoming Mains:
   1. Location: Top or Bottom.
   2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

F. Phase, Neutral, and Ground Buses:
   1. Material: Hard-drawn copper, 98 percent conductivity.
      a. Plating shall run entire length of bus.
      b. Bus shall be fully rated the entire length.
   2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
   3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
5. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on Drawings as “NL”. Connectors shall be sized for double-sized or parallel conductors as indicated on Drawings. Do not mount neutral bus in gutter.

G. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard. Provide main lugs to accommodate T&B compression connector on end of cable.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

H. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
   1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker or Lugs only.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.
   1.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. General Electric Company; GE Energy Management - Electrical Distribution.
   2. Siemens Industry, Inc., Energy Management Division.
   3. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Eaton.
   2. General Electric Company; GE Energy Management - Electrical Distribution.
   3. Siemens Industry, Inc., Energy Management Division.
   4. Square D; by Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers:
      a. Inverse time-current element for low-level overloads.
      b. Instantaneous magnetic trip element for short circuits.
      c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:
    a. RMS sensing.
    b. Field-replaceable rating plug or electronic trip.
    c. Digital display of settings, trip targets, and indicated metering displays.
    d. Multi-button keypad to access programmable functions and monitored data.
    e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
    f. Integral test jack for connection to portable test set or laptop computer.
    g. Field-Adjustable Settings:
        1) Instantaneous trip.
        2) Long- and short-time pickup levels.
        3) Long and short time adjustments.
        4) Ground-fault pickup level, time delay, and I squared T response.
4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
5. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. Subfeed Circuit Breakers: Vertically mounted.
7. MCCB Features and Accessories:
    a. Standard frame sizes, trip ratings, and number of poles.
    b. Breaker handle indicates tripped status.
    c. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    d. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    e. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    f. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
    g. Multipole units factory assembled to operate as a single unit.
    h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.6 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.
1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NECA 407.

D. Equipment Mounting:
   1. Install floor mounted panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete".
   2. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 90 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.

2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

J. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

K. Install filler plates in unused spaces.

L. Stub four 1-inch empty conduits from flush mounted panelboard into accessible ceiling space or space designated to be ceiling space in the future.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:
1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Perform optional tests. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:
    1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573.16 "Coordination Studies."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Standard-grade receptacles, 125 V, 20 A.
2. USB receptacles.
3. GFCI receptacles, 125 V, 20 A.
4. Twist-locking receptacles.
5. Toggle switches, 120/277 V, 20 A.
6. Decorator-style devices, 20 A.
7. Occupancy sensors.
8. Wall-box dimmers.
9. Wall plates.
10. Floor service fittings.
11. Poke-through assemblies.
12. Prefabricated multioutlet assemblies.
13. Service poles.

1.3 DEFINITIONS

A. AFCI: Arc-fault circuit interrupter.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Comply with NEMA WD 1.
   1. Cord and Plug Sets: Match equipment requirements.

E. Device Color:
   1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
   2. Wiring Devices Connected to Essential Electrical System: Red.

F. Wall Plate Color: For plastic covers, match device color.

G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Hubbell Incorporated; Wiring Device-Kellems.
      b. Leviton Manufacturing Co., Inc.
      c. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 and FS W-C-596.

B. Weather-Resistant Duplex Receptacle, 125 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498.
5. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

2.3 USB RECEPTACLES

A. USB Charging Receptacles:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
3. USB Receptacles: Dual, USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
4. Standards: Comply with UL 1310 and USB 3.0 devices.

2.4 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc.
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Non-feed through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

2.5 TWIST-LOCKING RECEPTACLES

A. Twist-Lock, Single Receptacles, 120 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour/Legrand (Pass & Seymour).
2. Configuration: NEMA WD 6, Configuration L5-20R.
3. Standards: Comply with UL 498.

B. Twist-Lock, Single Receptacles, 250 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Hubbell Premise Wiring.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour/Legrand (Pass & Seymour).
2. Configuration: NEMA WD 6, Configuration L6-20R.
3. Standards: Comply with UL 498.

2.6 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour/Legrand (Pass & Seymour).
2. Standards: Comply with UL 20 and FS W-S-896.

B. Two-Pole Switches, 120/277 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour/Legrand (Pass & Seymour).
2. Comply with UL 20 and FS W-S-896.

C. Three-Way Switches, 120/277 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour/Legrand (Pass & Seymour).

2. Comply with UL 20 and FS W-S-896.

D. Four-Way Switches, 120/277 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour/Legrand (Pass & Seymour).
2. Standards: Comply with UL 20 and FS W-S-896.

E. Key-Operated, Single-Pole Switches, 120/277 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Factory-supplied key in lieu of switch handle.
3. Standards: Comply with UL 20 and FS W-S-896.

2.7 DECORATOR-STYLE DEVICES, 20 A

A. Decorator Duplex Receptacles, 125 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Two pole, three wire, and self-grounding. Square face.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498.

B. Decorator Single-Pole Switches, 120/277 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour/Legrand (Pass & Seymour).
2. Comply with UL 20.

2.8 OCCUPANCY SENSORS

A. Wall Switch Sensor Light Switch, Dual Technology:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hubbell Incorporated; Wiring Device-Kellems.

b. Leviton Manufacturing Co., Inc.
c. Pass & Seymour/Legrand (Pass & Seymour).
d. Wattstopper.

2. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
3. Standards: Comply with UL 20.
4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
5. Adjustable time delay of 20 minutes.
6. Able to be locked to Automatic-On mode.
7. Connections: Provisions for connection to BAS.

2.9 DIMMERS

A. Wall-Box Dimmers:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Hubbell Incorporated; Wiring Device-Kellems.
b. Leviton Manufacturing Co., Inc.
c. Lutron Electronics Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).
2. Description: Modular, full-wave, solid-state dimmer switch with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
3. Control: Continuously adjustable slider; with single-pole or three-way switching.
4. Standards: Comply with UL 1472.
5. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.
6. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.10 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact nylon, or satin-finished, Type 302 stainless steel 0.04-inch-thick for Essential Electrical System.
3. Material for Unfinished Spaces: Galvanized steel.

C. Wet-Location, Weatherproof While-In-Use Cover Plates: NEMA 250, complying with Type 3R, weather-resistant**,** die-cast aluminum with lockable cover. Hubbell WP26E vertical, WP26EH horizontal.

2.11 FLOOR SERVICE FITTINGS

A. Flush-Type Floor Service Fittings:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Hubbell Premise Wiring.
      b. Thomas & Betts Corporation; A Member of the ABB Group.
      c. Wiremold / Legrand.
   2. Description: Type: Modular, flush-type, dual-service units suitable for wiring method used, with cover flush with finished floor.
   3. Compartments: Barrier separates power from voice and data communication cabling.
   4. Service Plate and Cover: Rectangular or Round, die-cast aluminum with satin finish.
   5. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
   6. Data Communication Outlet: Blank cover with bushed cable opening**.**

B. Above-Floor Service Fittings:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Hubbell Premise Wiring.
      b. Thomas & Betts Corporation; A Member of the ABB Group.
      c. Wiremold / Legrand.
   2. Description: Type: Modular, above-floor, dual-service units suitable for wiring method used.
   3. Compartments: Barrier separates power from voice and data communication cabling.
   4. Service Plate: Rectangular, die-cast aluminum with satin finish.
   5. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
   6. Data Communication Outlet: Blank cover with bushed cable opening.

2.12 POKE-THROUGH ASSEMBLIES

A. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Pass & Seymour/Legrand (Pass & Seymour).
   2. Square D; by Schneider Electric.
   3. Wiremold / Legrand.

C. Standards: Comply with scrub water exclusion requirements in UL 514.

D. Service-Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks, complying with requirements in Section 271513 "Communications Copper Horizontal Cabling."

E. Size: Selected to fit nominal 3 or 4-inch cored holes in floor and matched to floor thickness.

F. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.

G. Closure Plug: Arranged to close unused 3-inch or 4-inch cored openings and reestablish fire rating of floor.

H. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables that comply with requirements in Section 271513 "Communications Copper Horizontal Cabling."

2.13 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Description: Two-piece surface metal raceway, with factory-wired multioutlet harness.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Hubbell Incorporated; Wiring Device-Kellems.
   2. Wiremold / Legrand.

C. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

D. Raceway Material: Metal, with manufacturer's standard finish.

E. Multioutlet Harness:
   1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
   2. Receptacle Spacing: 12 inches.
   3. Wiring: No. 12 AWG solid, Type THHN copper, single circuit or two circuit, connecting alternating receptacles.

2.14 SERVICE POLES

A. Dual-Channel Service Poles:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Hubbell Premise Wiring.
      b. Panduit Corp.
   2. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
   3. Poles: Nominal 2.5-inch- square cross-section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
   4. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
   5. Material: Aluminum.

6. Finishes: Satin-anodized aluminum.
7. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, balanced twisted pair data communication cables.
8. Power Receptacles: Two duplex, 20-A, straight-blade receptacles complying with requirements in this Section.
9. Data Communication Outlets: Blank insert with bushed cable opening.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
   1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
   1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
   4. Existing Conductors:
      a. Cut back and pigtail, or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.
      c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:
   1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
   2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
   4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
   5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
   6. Use a torque screwdriver when a torque is recommended or required by manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through GFCI receptacles.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate for normal building power, red-filled lettering on face of Essential Electrical System receptacles, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:
1. Test Instruments: Use instruments that comply with UL 1436.

2. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Wiring device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Cartridge fuses rated 600 V ac and less for use in the following:
      a. Control circuits.
      b. Motor-control centers.
      c. Panelboards.
      d. Switchboards.
      e. Enclosed controllers.
      f. Enclosed switches.
   2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
   1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
   2. Current-limitation curves for fuses with current-limiting characteristics.
   3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in PDF format.
   4. Coordination charts and tables and related data.
   5. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Current-limitation curves for fuses with current-limiting characteristics.
   2. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. in PDF format.
   3. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Bussmann, an Eaton business.
   2. Littelfuse, Inc.

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
   1. Type RK-5: 250 or 600-V, zero- to 600-A rating, 200 kAIC, time delay.
   2. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
   3. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.3 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
   1. Size: Adequate for storage of spare fuses specified.
   2. Finish: Gray, baked enamel.
   3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
   4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:
1. Service Entrance: Class L, time delay or Class J, time delay.
2. Feeders: Class L, time delay or Class J, time delay.
3. Motor Branch Circuits: Class RK5, time delay.
4. Large Motor Branch (601-4000 A): Class L, time delay.
5. Power Electronics Circuits:[Class J, high speed.
6. Other Branch Circuits Class J, time delay.
7. Control Transformer Circuits: Class CC, time delay, control transformer duty.
8. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by Construction Manager.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Fusible switches.
   2. Nonfusible switches.
   3. Molded-case circuit breakers (MCCBs).
   4. Molded-case switches.
   5. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
   1. Enclosure types and details.
   2. Current and voltage ratings.
   3. Short-circuit current ratings (interrupting and withstand, as appropriate).
   4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
   5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

B. Shop Drawings: For enclosed switches and circuit breakers.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
      b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
   2. Fuse Pullers: Two for each size and type.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F .
   2. Altitude: Not exceeding 6600 feet.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. Comply with NFPA 70.

2.2 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Eaton.
2. General Electric Company.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty:
1. Single or Double throw.
2. Three pole.
3. 240 or 600-V ac.
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.3 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Eaton.
2. General Electric Company.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Three Pole, Single Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Three Pole, Double Throw, 240 and 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac.
   4. Lugs: Mechanical type, suitable for number, size, and conductor material.
   5. Service-Rated Switches: Labeled for use as service equipment.

2.4 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Eaton.
   2. General Electric Company.
   3. Siemens Industry, Inc., Energy Management Division.
   4. Square D; by Schneider Electric.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. MCCBs shall be equipped with a device for locking in the isolated position.

E. Lugs shall be suitable for 60 deg C rated wire on 125-A circuit breakers and below. 75 deg C and 90 deg C rated wire for breakers larger than 125 A.

F. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

H. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

I. Electronic Trip Circuit Breakers 400 A and larger: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
   1. Instantaneous trip.
   2. Long- and short-time pickup levels.

3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I-squared t response.

J. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

K. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

L. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
10. Accessory Control Power Voltage: Integrally mounted, self-powered.

2.5 MOLDED-CASE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Eaton.
2. General Electric Company.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; by Schneider Electric.

B. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

C. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

D. Features and Accessories:
1. Standard frame sizes and number of poles.
2. Lugs:
a. Mechanical type, suitable for number, size, trip ratings, and conductor material.
b. Lugs shall be suitable for 60 deg C rated wire on 125-A circuit breakers and below. 75 deg C and 90 deg C rated wire greater than 125 A.

3. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
4. Alarm Switch: One NO contact that operates only when switch has tripped.
5. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
6. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
7. Accessory Control Power Voltage: Integrally mounted, self-powered.

2.6 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1), gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (NEMA 250 Types 3R, 12), brush finish on Type 304 stainless steel (NEMA 250 Type 4-4X stainless steel).

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.

D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
   2. Indicate method of providing temporary electric service.
   3. Do not proceed with interruption of electric service without Owner's written permission.
   4. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Outdoor Locations: NEMA 250, Type 3R.
   3. Kitchen, Wash-Down, and outside corrosive environment Areas: NEMA 250, Type 4X, stainless steel.
   4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

3.4 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:
    a. Inspect physical and mechanical condition.
    b. Inspect anchorage, alignment, grounding, and clearances.
    c. Verify that the unit is clean.
    d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
    e. Verify that fuse sizes and types match the Specifications and Drawings.
    f. Verify that each fuse has adequate mechanical support and contact integrity.
    g. Inspect bolted electrical connections for high resistance using one of the two following methods:
        1) Use a low-resistance ohmmeter.
            a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
        2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
            a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
    h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
    i. Verify correct phase barrier installation.
    j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
2. Electrical Tests:
    a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
    b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
    c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
    d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
    e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

B. Tests and Inspections for Molded Case Circuit Breakers:
1. Visual and Mechanical Inspection:
    a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
    b. Inspect physical and mechanical condition.
    c. Inspect anchorage, alignment, grounding, and clearances.
    d. Verify that the unit is clean.
    e. Operate the circuit breaker to ensure smooth operation.

f. Inspect bolted electrical connections for high resistance using one of the two following methods:
   1) Use a low-resistance ohmmeter.
      a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
   2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
      a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
g. Inspect operating mechanism, contacts, and chutes in unsealed units.
h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:
   a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
   b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
   c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
   d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
   e. Determine the following by primary current injection:
      1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
      2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
      3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
      4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
4. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.
1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573.16 "Coordination Studies.".

END OF SECTION 262816

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. General:
1. Shop drawings shall clearly indicate the Contract Drawing number of fixture details used as reference in the development of the shop drawings and the names of the job, Architect and Lighting Consultant.
2. Coordinate all luminaire fixture drawings with the Drawings and details to the Architectural, Structural, Electrical, Mechanical, and other related trades to assure a correct and efficient installation.
3. No variation from the general arrangement and details indicated on the Drawings shall be made on the shop drawings unless required to suit the actual conditions on the premises, and then only with the written acceptance of the Architect. All variations must be clearly marked as such on drawings submitted for approval.

4. Catalogue Cutsheets lacking sufficient detail to indicate compliance with contract documents will not be acceptable.
5. Timely submission: Shop drawings for all luminaire fixtures shall be received no later than sixty days after award of Contract.
6. Owner and A/E Review of shop drawings or samples does not waive contract requirements.
7. Obtain from supplying lighting manufacturers, for each type of luminaire fixture, a recommended maintenance manual including:
   a. Tools required.
   b. Types of cleaners to be used.
   c. Replacement parts identification lists.
   d. Final, as-built shop drawings.

B. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79 and IES LM-80.

   a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

C. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 SAMPLES

A. After shop drawing review, and prior to release for manufacturing, furnish one sample of each fixture on the Lighting Fixture schedule and contract Drawings for which sample requirement is noted.

B. Each Sample shall include the following:
1. Lamps and ballasts, installed.
2. Cords and plugs.
3. Pendant support system.

C. Shipping: The samples shall be complete with specified lamps and compatible ballast, ready for hanging, energizing, and examining, and shall be shipped, prepaid, to the Lighting Consultant or as otherwise advised.

D. Two weeks from date received shall be allowed for thorough examination of the samples by the Lighting Consultant.

E. Not returnable: Samples are not returnable, nor included in quantities listed for a project.

F. Samples must be actual working unit of materials to be supplied.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Product Certificates: For each type of luminaire.

C. Product Test Reports: For each type of luminaire, for tests performed by a qualified testing agency.

D. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.9 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as

defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.11 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Ten year from date of Substantial Completion on entire lighting fixture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Ambient Temperature: 5 to 104 deg F.

1. Relative Humidity: Zero to 95 percent.

B. Altitude: Sea level to 1000 feet.

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

F. California Title 24 compliant.

G. Nominal Operating Voltage: 120 V ac or 277 V ac as scheduled.

H. Lamp:
1. Minimum allowable efficacy of 80 lumens/W.
2. CRI of minimum 80. Rated lamp life of 50,000 hours to L70.
3. Color 35K unless scheduled otherwise.
4. Internal driver.

I. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.

2.3 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

C. Stainless Steel:

1. 1. Manufacturer's standard grade.
2. 2. Manufacturer's standard type, ASTM A240/240M.

D. Galvanized Steel: ASTM A653/A653M.

E. Aluminum: ASTM B209.

2.4 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.5 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gauge.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaires:
   1. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaires:

   1. Ceiling Mount:
      a. Pendant mount with aircraft cable.
      b. Chain hung.
      c. Surface mount.
      d. Hook mount.

   2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
   4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod support for suspension for each unit length of luminaire chassis, including one at each end.
   5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

   1. Secure to any required outlet box.
   2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
   3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265119

SECTION 265213 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Battery and charger for light units.
4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.
    a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Product Schedule:

1. For emergency lighting units. Use same designations indicated on Drawings.
2. For exit signs. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Product Certificates: For each type of luminaire.

C. Product Test Reports: For each luminaire for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Luminaire-mounted, emergency battery pack: One for every 50 emergency lighting units. Furnish at least one of each type.
2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
1.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Power Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.
2. Warranty Period for Self-Powered Exit Sign Batteries: Five years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Lamp Base: Comply with ANSI C81.61 or IEC 60061-1.

F. Bulb Shape: Complying with ANSI C79.1.etain one or both paragraphs in this article to specify emergency battery units for and operation of fluorescent, incandescent, and LED luminaires to provide code-required egress lighting. Indicate luminaire types to be equipped with these devices in the Interior Luminaire Schedule on Drawings, and indicate connections on lighting plans.

G. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body.

1. Emergency Connection: Operate one lamp continuously at an output of 1100 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay

disconnects lamps from battery, and battery is automatically recharged and floated on charger.

3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
    b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
    c. Humidity: More than 95 percent (condensing).
    d. Altitude: Exceeding 3300 feet.

4. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

5. Battery: Sealed, maintenance-free, nickel-cadmium type.
6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.2 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:
    1. Emergency Luminaires: Designation as indicated on Luminaire Schedule.
    2. Lamp color: 35K unless scheduled otherwise.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
    1. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
    2. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

C. Self-Luminous Signs:
    1. Powered by tritium gas, with universal bracket for flush-ceiling, wall, or end mounting. Signs shall be guaranteed by manufacturer to maintain the minimum brightness requirements in UL 924 for 20 years.

2. Use strontium oxide aluminate compound to store ambient light and release the stored energy when the light is removed. Include universal bracket for flush-ceiling, wall, or end mounting.

2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

2.5 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire and emergency power unit weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:
1. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service:

1. Charge emergency power units minimum of one hour and depress switch to conduct short-duration test.

3.6 ADJUSTING

A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.

a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 265213

SECTION 27 05 26 - TELECOMMUNICATIONS GROUNDING & BONDING

PART 1 - GENERAL

1.1 PROJECT SCOPE SUMMARY

A. Renovation of the IAH FIS Building.

1.2 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

D. Communication system grounding.

E. Electrical equipment and raceway grounding and bonding.

F. Control equipment grounding.

1.3 REFERENCES

A. Related Specification Sections
1. Section 27 05 53 Identification and Labeling of Communication Infrastructure
2. Section 27 11 00 Communication Cabinets and Equipment Rooms
3. Section 27 13 00 Backbone and Riser Media Infrastructure
4. Section 27 15 00 Horizontal Media Infrastructure
5. Section 27 05 43 External Communication Pathways

B. American Society for Testing and Materials (ASTM):
1. B 3 Soft or Annealed Copper Wires
2. B 8 Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft
3. B 33 Tinned Soft or Annealed Copper Wire for Electrical Purposes

C. Institute of Electrical and Electronics Engineers (IEEE):
1. 142-82 Recommended Practice for Grounding of Industrial and Commercial Power Systems
2. 383-2.5 IEEE Standard for Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations.
3. 1100 IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems.

D. Underwriters' Laboratories (UL):
1. 83 Thermoplastic Insulated Wire and Cables
2. 96 Lightning Protection Components
3. 96A System Installation
4. 467 Grounding and Bonding Equipment

E. National Fire Protection Association (NFPA):
   1. 780 Lightning Protection Code
   2. 70 National Electrical Code (NEC)
      a. NEC Article No. 250 - Grounding

F. American National Standards Institute/Telecommunications Industry Association/Electronic Industries Alliance (ANSI/TIA/EIA):
   1. J-STD-607-B Commercial Building Grounding and Bonding Requirements.
   2. Telcordia – Network Equipment Building Systems (NEBS) GR-1275.

G. Building Industry Consulting Services International (BICSI):
   1. Telecommunications Distribution Methods Manual (Latest Issue)
   2. Customer Owned Outside Plant Design Manual (Latest Issue)
   3. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

H. Local, county, state and federal regulations and codes in effect as of date of "notice to proceed" shall be complied with.

I. Equipment of foreign manufacture must meet U.S. codes and standards. It shall be indicated in the proposal the components which may be of foreign manufacture, if any, and the country of origin.

J. Reference attached Figure 1 for general grounding infrastructure layout and connectivity.

K. Conflicts:
   1. Between referenced requirements: Comply with the one establishing the more stringent requirements.
   2. Between reference requirements and contract documents: Comply with the one establishing the more stringent requirements.

1.4 DESIGN REQUIREMENTS

A. Design grounding system following ANSI J-STD 607-B – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications, BICSI Telecommunications Distribution Methods Manual, NECA/BICSI 607-2011, NEC Article No. 250 - Grounding, IEEE 1100 – Recommended Practices for Powering and Grounding Sensitive Electronic Equipment, and IEEE 142-82 - Recommended Practice for Grounding of Industrial and Commercial Power Systems, by a firm acceptable to Owner's insurance underwriter. All labeling shall follow standards set forth by ANSI/TIA/EIA-606 and Houston Airport System's Information Technology (HAS-IT) requirements.

B. Design Standards:
   1. Completely protect above-surface structures and equipment.
   2. Calculate system on the basis of existing soil resistivity.
   3. If cathodic protection for underground sewer pipe is installed (see applicable Division 2 Sections), ensure the pipe is not connected to the general grounding system, either directly through grounding cable or indirectly through grounded electrical devices connected to the pipe. Electrically isolate electrical devices from sewer pipe.

C. Radio Equipment
   1. All Radio equipment/systems shall be grounded per Motorola Standard R56.

1.5 SUBMITTALS

A. Follow Section 01340 for the following:

B. Product Data:
1. Manufacturers catalog data and applicable special fabrication and installation details.
2. Installation, terminating and splicing procedures.
3. Instructions for handling and storage.
4. Dimensions and weights.
5. Conformance Certificate and Quality Assurance Release: Signed by QAP Manager (Section 01450). Specifically identify products and include purchase order number, supplements, and item number where applicable. Indicate that requirements are met and identify approved deviations.
6. Include spares list to be approved by HAS IT Project Manager for approval.

1.6 QUALITY CONTROL

A. Furnish products of latest proven design, new and in current production. Do not use obsolete components or out-of-production products.

B. Tests for Insulated Cable: Pass vertical tray flame test following IEEE 383-2.5.

C. HAS retains the right to inspect all work during the entire duration of the project and any items that do not adhere to the reference, contract, bid, or project documents will be corrected immediately at the expense of the contractor.

1.7 SHIPPING AND HANDLING

A. Ship on manufacturer's standard reel sizes of one continuous length. Where cut lengths are specified, mark reel quantity accordingly.

B. Protect wire wood lagging or suitable barrier across the traverse of reels. Provide heat-shrink self-sealing end caps on cable.

C. Equipment shall be delivered in original packages with labels intact and identification clearly marked. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other containments. Equipment damaged prior to system acceptance shall be replaced at no cost to the HAS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Cable Manufacturers/Suppliers:
1. Houston Wire and Cable Company
2. Okonite Company
3. Anixter

4. Graybar
5. CSC (Communication Supply Company)
6. Cablec Continental Cables Company
7. Pirelli Cable Corporation
8. Triangle Wire and Cable, Inc.

B. Ground Rod and Connector Manufacturers:
1. Copperweld
2. Thomas & Betts
3. Blackburn

C. Exothermic Connector Manufacturers:
1. Erico Products (Cadweld)
2. Burndy Corporation (Therm-O-Weld)
3. OZ Gedney

D. Grounding Connector Manufacturers:
1. Thomas & Betts
2. Burndy Corporation
3. O.Z. Gedney
4. Panduit

E. Telecommunications Busbars:
1. Erico Products
2. Cooper B-Line
3. CPI Chatsworth
4. Panduit

2.2 MATERIALS

A. Grounding Conductors: Bare or insulated copper AWG wire following ASTM-B3, ASTM-B8 and ASTM-B33, of following sizes:
1. A minimum of 6 AWG, stranded, insulated (green) copper conductor shall be used for communications since this accommodates different code requirements and allows for future changes.
2. Metallic cable shield shall NOT be used as a Telecommunication Bonding Backbone (TBB).
3. Interior water piping system shall NOT be used as a TBB

B. Grounding Connectors: It is recommended that connectors should be one of the following:
1. Tin-plated copper.
2. Copper.
3. Copper alloy.

C. Ground Rods: A minimum of 10 feet long, 3/4-inch diameter, copper-clad steel.

D. Where single conductor insulated grounding conductors is required, furnish green color (or tape marking) insulation rated for 600 volts.

E. Telecommunications Main Grounding Busbar (TMGB):
1. The TMGB shall be a predrilled copper busbar with standard NEMA

bolt hole sizing and spacing for the type of connectors to be used. (Both holes in two holed lugs must be attached to busbar)
2. The TMGB shall be sized for the immediate requirements and allow for 100% growth.
3. The minimum busbar dimensions are .25" thick x 4" wide x 20" long.
4. The busbar shall be electrotin plated for reduced contact resistance.

F. Telecommunications Grounding Busbar (TGB):
1. The TGB shall be a predrilled copper busbar with standard NEMA bolt hole sizing and spacing for the type of connectors to be used. (Both holes in two holed lugs must be attached to busbar)
2. The TGB shall be sized for the immediate requirements and allow for 100% growth.
3. The minimum busbar dimensions are .25" thick x 2" wide x 12" long.
4. The busbar shall be electrotin plated for reduced contact resistance.

G. Rack-Mounted Grounding Busbar (RMGB):
1. The RMGB shall be a predrilled copper busbar with standard NEMA bolt hole sizing and spacing for the type of connectors to be used. (Both holes in two holed lugs must be attached to busbar)
2. The TGB shall be sized for the immediate requirements and allow for 100% growth.
3. The minimum busbar dimensions are 3 /16" thick x 19" wide x 3/4" long.
4. The busbar shall be electrotin plated for reduced contact resistance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Complete site preparation and soil compaction before trenching and driving ground rods for underground use.

B. Verify exact location of stub-up points for grounding of equipment, fences and building or steel structures.

C. Verify wiring for lighting systems is single conductor cable in conduit and each conduit contains a green-color insulated equipment-grounding conductor connected to lighting system. If no ground conductor is present, install conductors as required.

D. Copper and copper alloy connections shall be cleaned prior to connection.

E. In new construction, the electrical contractor must provide accessible means to a direct electrical service ground, which is one of the best points for grounding communications systems. NEC Section 250.94 and 800.100 requires an intersystem bonding connection accessible at the electrical service equipment, such as:
1. Approved external connection on the power service panel. The NEC allows direct connection to a provided minimum 6 AWG copper conductor. See Chart 1
2. Exposed metallic service raceway (using an approved bonding connector).

3. Grounding electrode conductor.
4. For connectivity between buildings and rooms, all bonding conductors are to be placed in conduit end to end and conduit shall be properly grounded. 3/0 conductor to be placed in 2 inch conduit and minimum 6 AWG to be placed in a 1 inch conduit run.

TBB Conductor Size vs. Length	
TBB/GE Linear Length	TBB/GE Size
Feet (m)	(AWG)
Less than 13' (4) 6	6
14–20' (4 -6)	4
21–26' (6–8)	3
27–33' (8–10)	2
34–41' (10–13)	1
42–52' (13–16)	1/0
53–66' (16–20)	2/0
37–84' (20–26)	3/0
85–105' (26–32)	4/0
*Reference ANSI-J-STD-607-B for more information.	

Chart 1

3.2 INSTALLATION

A. Install work following drawings, manufacturer's instructions and approved submittal data.

B. Bonding conductors shall be routed with minimum bends or changes in direction and shall be made directly to the points being bonded, and shall be one continuous run NO splices.

C. Bonding connections shall be made by using:
1. Double crimp connectors only for all horizontal runs (cabinets trays etc.). Use listed hardware that has been laboratory tested. For double crimp connectors use 2 hole type connector.
2. Exothermic welding (per NEC) within the ground electrode system, for parts of a grounding system that are subject to corrosion or that must carry high currents reliably, or for locations that require minimum maintenance. Exothermic-weld to be used on the Telecommunications Bonding Backbone (TBB) conductor for all connections.

D. Install main ground loop minimum 18" (inches) below ground surface.

E. Drive grounding rods vertically, so at least 8 feet of rod is in contact with the soil. All connections shall be exothermic-weld. Install additional ground rods as required to pass resistance test.

F. Make connections only to dry surfaces with paint, rust, oxidation, scales, grease, dirt or other foreign material is removed. Ensure proper conductivity.

G. Make above-grade grounding connections with Exothermic-weld.
   1. Ground small groups of isolated equipment with No. 3/0 minimum insulated conductor connected to the main loop.

H. Equipment Grounding:
   1. Make grounding connections to electrical equipment, vessels, mechanical equipment, equipment enclosure, relay racks, and ground rods in accordance with NEC.
   2. Make grounding connections to tanks and vessels to integral structural supports or to existing grounding lugs or pads, and not to the body of the tank or vessel.

I. Telecommunications Raceway and Support Systems Grounding:
   1. Bond and ground raceway, cable rack or tray and conduit together and permanently ground to the equipment grounding busbar. Connection to conduit may be with grounding bushing.
   2. Connect ladder-type cable tray to grounding electrode system. Telecommunications cable tray that is located in the same room, as the TGB shall be connected to the TMGB.
   3. Bond and ground raceway at low voltage motor control centers or other low voltage control equipment, except conduit which is effectively grounded to sheet metal enclosure by bonding bushing or hubs need not be otherwise bonded.
   4. Where only grounding conductor is installed in a metal conduit, bond both ends of conduit to grounding conductors.
   5. Provide flexible "jumpers" around raceway expansion joints and across cable tray joints parted to allow for expansion and hinged cable tray connections. Provide copper bonding straps for steel conduit.

J. Telecommunications Grounding and Bonding Infrastructure:
   1. Install the TMGB in the Telecommunications Entrance Facility (TEF) or Main Distribution Frame (MDF) as close to the panel-board as possible. The TMGB shall also be located so that the bonding conductor is as short and straight as possible. Maintain clearances required by applicable electrical codes.
   2. If a panel-board is not installed in the TEF or MDF, locate the TMGB near the backbone cabling and terminations.
   3. The TMGB shall be insulated from its support with a recommended separation of 2 inches.
   4. Connect the TMGB to the electrical service ground and telecommunications primary protectors.
   5. The minimum Telecommunications Bonding Backbone (TBB) conductor size shall be No. 2 AWG. The TBB originates at the TMGB and extends throughout the building using the telecommunications backbone pathways, and connects to the TGB(s) in all telecommunication closets and equipment rooms.
   6. Install the TGBs in the telecommunications closets and equipment rooms as close to the panel-board as possible. The TGB shall also be located so that the bonding conductor is as short and straight as possible. Maintain clearances required by applicable electrical codes.
   7. The TGB shall be insulated from its support with a recommended separation of 2 inches.
   8. Properly bond and ground all communications cabinets, equipment racks, raceway, cable rack or tray, and conduit directly to TMGB or TGB. Daisy chaining of equipment is not permitted
   9. Refer to the Telecom Grounding diagram in the design documentation (see figure 1).

10. Preparation: Copper and copper alloy connections shall be cleaned prior to connecting.
11. Bonding conductors shall be routed with minimum bends or changes in direction and shall be made directly to the point being bonded. Change of direction shall be taken over as wide a radius as possible with a minimum radius of one foot.
12. Make connections only to dry surfaces with paint, rust, oxides, scales, grease and dirt removed. Ensure proper conductivity.
13. Grounding conductors, by gauge, shall be continuous, with splices, from a larger gauge feeder to the last frame or component served by the grounding lead (ex. 750 KCM to 500 KCM to 1/0, etc.).
14. C-Taps from Aisle equalizer to a frame can be the same gauge (ex. E.g., 6 AWG to 6 AWG).
15. Cable to Cable taps shall be made with exothermic weld, or listed compression connectors.
16. No aluminum conductors or connectors shall be used in any bonding and grounding system.
17. Ground bars not supplied as part of a standard assembly shall be copper or tinned copper.
18. Refer Telecommunications Grounding drawings for additional information.
19. Both ends of the grounding conductors shall be equipped with a printed destination label recording the far end termination. The label shall be applied within 6 inches of the termination and be visible from the floor.
20. All metallic items that interact electro-magnetically with Network/Telecommunications equipment shall have their framework bonded and grounded to the Telecommunications grounding system with a minimum #6 AWG grounding conductor. Example includes switch frames, power plants frames, battery stands, storage cabinets and other metallic objects, etc. “Daisy Chaining” or frame to frame connecting of these conductors is NOT permitted.
21. TMGB and TGB shall be stenciled and labeled per HAS requirements.

K. Fences and Gates in the equipment rooms:
1. Ground fences, fence posts and gates to nearest TMGB or TGB.

L. Telecommunications Cable Armored and/or Shielded:
1. Terminate and ground shield of shielded control cable at one end only, preferably at the control panel end for instrument and communication cable and at the supply end for electronic power cables. Maintain shield continuity by jumpering the ground shield across connection point where it is broken at junction boxes or other splice points.
2. Connect ground wire in power cable assemblies at each terminal point to a ground bus, if available, or to the equipment enclosure. Do not extend these ground wires through "doughnut" CTs used for ground fault relaying, but do extend ground leads from stress cones. Ground power cable armor and shield at each terminal point.
3. Bond and ground exposed cable shields and metallic sheaths according to the manufacturer’s guidelines. They shall also be grounded as close as possible to the point of entrance.
4. Intra-building telecommunications cabling that is armored or has a metallic shield must be bonded to the building grounding system at each end.

3.3 TESTING

A. Follow Section 01450.

B. Test grounding system before grid trenches are back-filled. Test for ground resistance after installation of underground grid and grounding connections.

C. Install ground access test wells at locations as required for testing, using a pipe surrounding the rod and connections with a cover placed on top at grade level.

D. Test system resistance at each test well using "Fall of Potential" method Per IEEE Standard No. 81-1983) with a maximum resistance of 5 ohms.

E. Upon completion of the electrical system, including all grounding, the Electrical Contractor shall test the system for stray currents, ground shorts, etc. Approved instruments, apparatus, service, and qualified personnel shall be utilized. If stray currents, shorts, etc., are detected, eliminate or correct as required. The test procedure shall be as follows:
   1. Open all main disconnects for the system being tested.
   2. Disconnect the system neutral from the service entrance or step-down transformer neutral connection.
   3. Connect a DC ohmmeter across the system neutral and equipment ground.
   4. An ohmmeter reading in excess of 100 ohms shall indicate that the system neutral and equipment ground are properly isolated.
   5. An ohmmeter reading less than 100 ohms shall indicate that the system contains ground shorts (stray currents) at some point along the system neutral.
   6. Grounded neutrals may be identified by disconnecting individual neutral conductors from the system, one at a time, while monitoring the ohmmeter.
   7. The systems shall be re-tested after correction of all ground shorts is complete.

END OF SECTION – 27 05 26

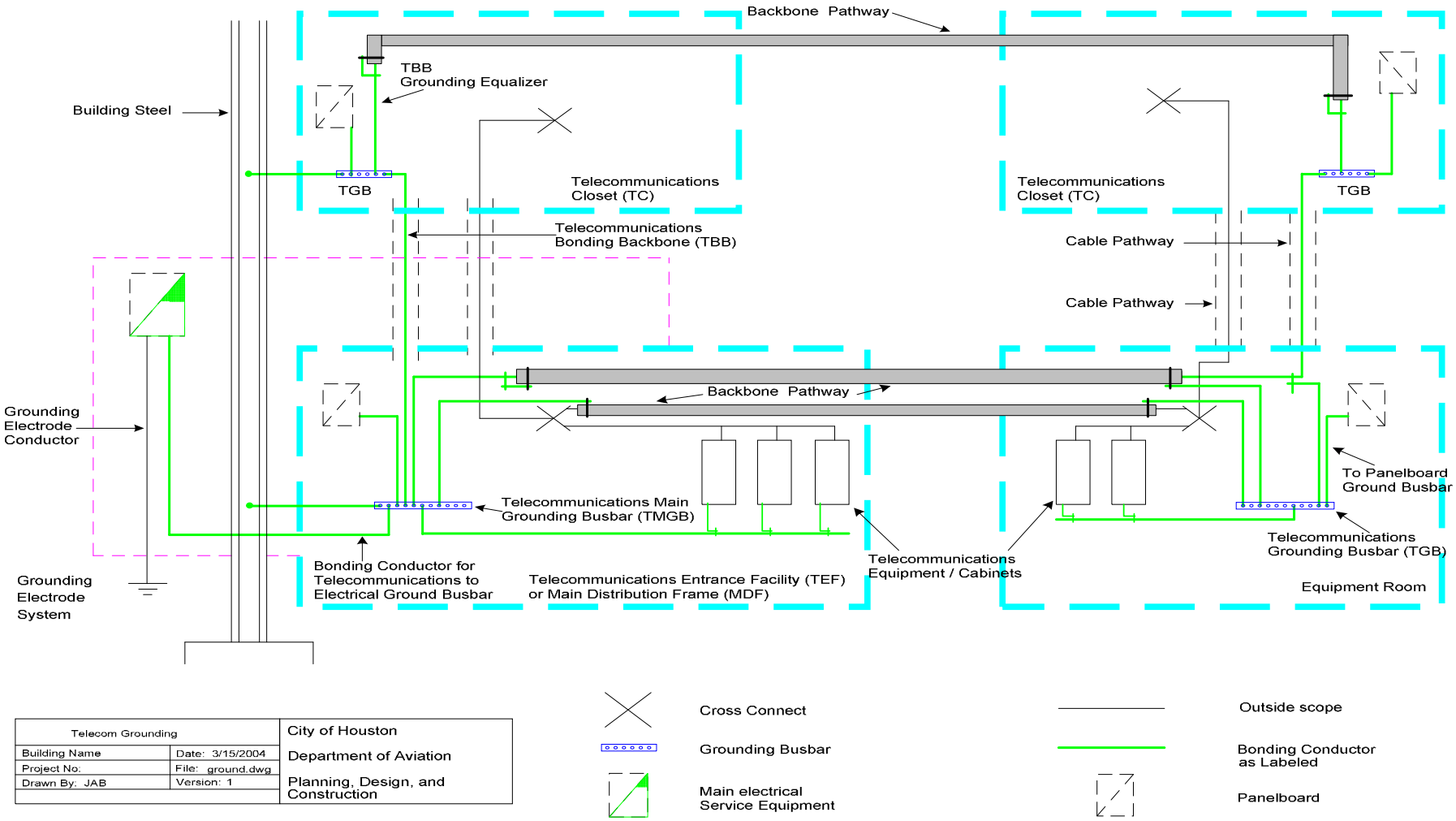
Backbone Pathway
TBB
Grounding Equalizer
Building Steel
TGB
Telecommunications
Closet (TC)
Telecommunications
Bonding Backbone (TBB)
Telecommunications
Closet (TC)
TGB
Cable Pathway
Cable Pathway
Backbone Pathway
Grounding
Electrode
Conductor
To Panelboard
Ground Busbar
Telecommunications Main
Grounding Busbar (TMGB)
Telecommunications
Grounding Busbar (TGB)
Bonding Conductor for
Telecommunications to
Electrical Ground Busbar
Telecommunications Entrance Facility (TEF)
or Main Distribution Frame (MDF)
Telecommunications
Equipment / Cabinets
Equipment Room
Grounding
Electrode
System
Telecom Grounding
Building Name
Date: 3/15/2004
Project No:
File: ground.dwg
Drawn By: JAB
Version: 1
City of Houston
Department of Aviation
Planning, Design, and
Construction
Cross Connect
Grounding Busbar
Main electrical
Service Equipment
Outside scope
Bonding Conductor
as Labeled
Panelboard

Figure 1

SECTION 27 05 28 - INTERIOR COMMUNICATION PATHWAYS

PART 1 - GENERAL

1.1 PROJECT SCOPE SUMMARY

A. Renovation of the IAH FIS Building.

1.2 SECTIONS INCLUDES

B. This section includes specifications for the installation of interior communications pathways.

C. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification sections, apply to the work of this section.

D. Interior Communication Pathways are defined to include, but are not limited to innerduct, flexible multi-cell innerduct, conduit, pull boxes, cable/j-hooks, cable trays, supports, accessories, associated hardware and fire stopping materials.

1.3 REFERENCES

A. Related Sections: Use these Specifications for all related work not specifically covered in this specification.
1. Section 27 05 26: Telecommunication Grounding and Bonding
2. Section 27 05 43: Exterior Communication Pathways
3. Section 27 05 53: Identification and Labeling of Communication Infrastructure
4. Section 27 11 00: Communication Cabinets and Equipment Rooms
5. Section 27 13 00: Backbone and Riser Media Infrastructure
6. Section 27 15 00: Horizontal Media Infrastructure
7. Section 28 13 00: Access Control System
8. Section 28 23 00: Video Surveillance Control and Management System

B. American National Standards Institute / Telecommunications Industry Association / Electronic Industries Alliance (ANSI/TIA/EIA): Most current standard revision
1. 569-B, Commercial Building Standard for Telecommunications Pathways and Spaces.
2. 568-D, Commercial Building Telecommunications Cabling Standard

C. American National Standards Institute (ANSI):
1. C80.1 Rigid Steel Conduit - Zinc Coated
2. C80.4 Fittings for Rigid Metal Conduit

D. Federal Specifications (FS):
1. W-C-58C Conduit Outlet Boxes, Bodies Aluminum and Malleable Iron
2. W-C-1094 Conduit and Conduit Fittings Rigid
4. WW-C-581D Coatings on Steel Conduit

E. Building Industry Consulting Services International (BICSI):
1. Telecommunications Distribution Methods Manual (latest issue)
2. Customer Owned Outside Plant Design Manual (latest issue)

F. National Electrical Manufacturers Association (NEMA).
1. VE 1-1998 - Metallic Cable Tray Systems

2. VE 2-2000 - Cable Tray Installation Guidelines
3. RN1 Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing
4. TC2 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
5. TC3 PVC Fittings for Use with Rigid PVC Conduit and Tubing

G. Underwriters laboratories (UL) Cable Certification and Follow Up program
1. UL 6: Rigid Metal Electrical Conduit.
2. UL 514B: Fittings for Conduit and Outlet Boxes.
3. UL 651: Schedule 40 and 80 Rigid PVC Conduit.
4. UL 651A: Type EB and A Rigid PVC Conduit and High-Density Polyethylene (HDPE) Conduit.
5. UL 886: Electrical Outlet Boxes and Fittings for Use in Hazardous Locations.

H. American Society for Testing Materials (ASTM).
1. ASTM B633 – specification for Electro-Deposit Coating of Zinc on iron and Steel.
2. ASTM A653 – Specification for Steel Sheet, Zinc-Coated by the Hot-Dip Process.
3. ASTM A123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
4. ASTM A1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High Strength Low Alloy with Improved Formability (Formerly ASTM A570 &A607)
5. ASTM A1008 – Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability (Formerly ASTM A611)

I. National Electrical Code (NEC latest issue).

J. Institute of Electrical and Electronic Engineers (IEEE).

K. Systimax generic specifications: Fiber Optic outside Plant Cable, Latest issue.

L. International Standards Organization/International

M. Electromechanical Commission (ISO/IEC) DIS 11801

N. Conflicts:
1. Between referenced requirements: Comply with the one establishing the more stringent requirements.
2. Between reference requirements and contract documents: Comply with the one establishing the more stringent requirements.

1.4 SUBMITTALS

A. Submit Shop Drawings to include but not limited to plan and section drawings detailing proposed communication pathway routing prior to installation. Communication pathway installation plan to include but not limited to:
1. Room penetration plan.
2. Communication pathway extension plan.
3. Riser conduit anchoring plan.
4. Conduit chase plan.
5. Communication pathway labeling plan.

6. Junction box, gutter, and pull-box labeling plan.

B. Shop Drawings shall be submitted and approved before implementation is started. Shop Drawings shall be submitted in accordance with Specification 01340.

C. Submit prototype test reports for all vault covers verifying conformance to the specification requirements in this document and HAS.

D. Submit catalog data sheets of conduit, innerduct, raceway, cable tray, cable hook, and associated hardware. Product data to include, but not limited to materials, finishes, approvals, load ratings, and dimensional information.

E. Test Reports: Submit certified test reports indicating compliance with material reference standard indicated for material performance characteristics and physical properties of fire stopping materials

F. Certificates: Submit product certificates, signed by manufacturer certifying materials comply with specified performance characteristics and physical properties of fire stopping materials.

G. Copy of Building Industry Consulting Services International (BICSI) Registered Communication Distribution Designer (RCDD) certificate for Contractor's on-site RCDD supervisor. RCDD shall supervise all parts of communications installation at all times.

1.5 QUALITY ASSURANCE

A. Verify conduit, raceway, cable tray runs, etc. Shall not interfere with existing or new systems within each facility.

B. Fire stopping: Manufacturer trained and approved installer to perform fire-stopping work who has specialized in the installation of work similar to that required for this project.

C. Communication Pathway Minimum Clearances:
1. Motors or transformers: 4 feet
2. Power cables and conduits: 1 foot parallel, 3 inches crossover
3. Fluorescent lights: 5 inches
4. Above ceiling tiles: 3 inches
5. Access above cable tray: 12 inches
6. Hot Flues, Steam pipes, Hot water pipes and other hot surfaces: at least 6"

D. Furnish products of latest proven design, new and in current production. Do not use obsolete components or out-of-production products.

E. Assure that the "as installed" system is correctly and completely documented including engineering drawings, manuals, and operational procedures in such a manner as to support maintenance and future expansion of the system.

F. All installed materials and accessories shall be new from the manufacture. No used components shall be accepted by HAS.

G. All Documentation submittals shall be reviewed by the supervising RCDD and stamped prior to submittal.

H. Contractor Qualifications:

1. The Contractor shall submit references and other related evidence of installation experience for a period of three years prior to the issue date of this Specification.
2. A BICSI RCDD shall supervise ALL work on-site. Must demonstrate knowledge and compliance with all BICSI, ANSI/TIA/EIA, UL, and NEC standards, and codes.

I. HAS retains the right to have access and inspect all work during the entire duration of the project and any items that do not adhere to the standards, reference, contract, bid, or project documents will be corrected immediately at NO cost to HAS.

J. All communication media will be installed in conduit or cable tray unless alternate method has been approved by HAS/IT.
1. Exception: MATV/CATV horizontal media must be installed in conduit from faceplate to MDF/IDF

PART 2 - PRODUCTS

2.1 GENERAL

A. Where conduit, pull boxes, cable tray and other raceway sizes are not specifically shown on contract drawings. All communication pathways shall be sized in accordance with the requirements of BICSI and the NEC. No conduit shall be less than 1". [Except for those locations specified in the contract documents under section 281300 Access Control with HAS approval.]

B. All raceways exposed to the elements or possible physical damage or installed below 8 feet shall be Rigid Metal Conduit.

C. Raceway exposed to elements, not exposed to physical damage and above 8 feet shall be Intermediate Metal Conduit.

D. Raceways installed in stud walls or above suspended ceilings shall be Electrical Metallic Tubing.

E. All backbone and riser conduits installed shall be populated with MaxCell flexible innerduct. Cable fill ratio not to exceed 40%.

2.2 CONDUIT AND ACCESSORIES

A. MANUFACTURES:
1. Allied
2. Triangle
3. Wheatland

B. Rigid Steel Conduit shall pass all bending, ductility, and thickness of zinc coating in ANSI C80.1 and UL 6. Conduit shall be galvanized have threaded end with 1” minimum size and 4” maximum size. Fittings shall be cast iron or alloy steel, threaded and galvanized.

C. Intermediate Metal Conduit (IMC) shall be manufactured in accordance with UL 1242. Conduit shall be low carbon, hot-dipped galvanized inside and out, with threaded ends, 1” minimum size, and 4-inch maximum size. Fittings shall be cast iron or alloy steel, threaded and galvanized.

D. Electrical Metallic Tubing (EMT) shall be manufactured in accordance with UL 797 and ANSI C80.3. EMT shall be high-strength, zinc-coated, 1-inch minimum size. EMT may be used for sizes greater than 2" where physically protected. EMT shall not be utilized for service entrance

conductors. Fittings shall be of same finish and material as tubing. Fittings shall be compression type with insulated throat and screw on bushings.

E. Expansion Joint Fittings: OZ type AX or Appleton type XJB, watertight, permitting two-way movement up to 4 inches, equipped with bonding jumpers around or through each fitting.

F. Thruwall Sealing Fittings: Type WSK by O-Z Gedney Company.

G. Fire-Seal Fittings: Type CFSI by O-Z Gedney Company.

H. Sealing Material for Sealing Fittings: Chico X Fiberdam, and Chico A sealing compound, or Chico A-P interpak by Crouse-Hinds or Apelco sealing cement and fiber filler by Appleton.

I. Insulated Bushings: Type B or SBT, as applicable, by O-Z Gedney or series B1900, series BU500 or series TC700, as applicable, by Steel City.

J. Provide a measured pull tape in each empty conduit, empty innerduct for backbone and riser pathways.

K. Provide a pull string for all horizontal conduits with a minimum pulling tension of 200 pounds.

L. Thread lubricant/sealant shall be Crouse-Hinds type STL or T & B Kopr-Shield except, when required on joints for heat producing elements such as lighting fixtures; it shall be Crouse-Hinds type HTL.

M. PVC Conduit shall not be used in intercommunication pathways. Except when encased in concrete.

2.3 FLEXIBLE MULTI-CELL INNERDUCT

A. Manufacturers:
1. MaxCell
2. Or HAS approved equivalent

B. Flexible Innerduct
1. Flexible innerduct is the HAS standard for multi-path applications within conduit.
2. All riser/backbone fiber shall be installed in flexible innerduct.
3. Flexible Innerduct shall be UL Listed with Flame Propagation compliant with UL 2024A.
4. All flexible innerduct shall be installed per manufacture requirements.
5. Only manufacturer’s fittings, transition adapters, terminators, accessories, and installation kits shall be used.
6. All flexible innerduct will be populated with a measured pull tape.
7. All interior flexible innerduct shall be plenum rated.
8. Flexible innerduct shall only be used when installed in conduit and shall consist of a different color for the maxcell.

MaxCell 4” 3 Cell

Min Conduit ID	Suggested Product	Max # of Packs	Max # of Cables	Maximum Cable Diameter per Cell	Rec. Pull Length*	Max Pull Length*
3"	MaxCell 4" 3 Cell	1	3	1.34"	1500'	2000'
4"	MaxCell 4" 3 Cell	2	6	1.34"	1500'	2500"
5"	MaxCell 4" 3 Cell	3	9	1.34"	1500'	2500'
6"	MaxCell 4" 3 Cell	4	12	1.34"	1500'	2500'

*Use of Optical Fiber Nonconductive Riser (OFNR) cable may result in reduced pulling lengths

MaxCell 3" 3 Cell

Min Conduit ID	Suggested Product	Max # of Packs	Max # of Cables	Maximum Cable Diameter per Cell	Rec. Pull Length*	Max Pull Length*
3"	MaxCell 3" 3 Cell	2	6	1.03"	1200'	2000'
4"	MaxCell 3" 3 Cell	3	9	1.03"	1500'	2500"
5"	MaxCell 3" 3 Cell	4	12	1.03"	1500'	2500'
6"	MaxCell 3" 3 Cell	5	15	1.03"	1500'	2500'

*Use of Optical Fiber Nonconductive Riser (OFNR) cable may result in reduced pulling lengths

MaxCell 2" 3 Cell

Min Conduit ID	Suggested Product	Max # of Packs	Max # of Cables	Maximum Cable Diameter per Cell	Rec. Pull Length*	Max Pull Length*
2"	MaxCell 2" 3 Cell	1	3	.70"	800'	1500'

*Use of Optical Fiber Nonconductive Riser (OFNR) cable may result in reduced pulling lengths

2.4 INNERDUCT

B. Manufacturers:
1. Carlon
2. Pyramid
3. Or HAS approved equivalent

C. Innerduct
1. All fiber placed in cable tray shall be installed in corrugated innerduct.
2. One-inch corrugated non-metallic innerduct.
3. Innerduct shall be UL Listed with Flame Propagation compliant with UL 2024.
4. Only manufacturer's fittings, transition adapters, terminators, and fixed bends shall be used.
5. All empty innerduct will be populated with a measured pull tape.
6. Where more than one innerduct is routed in a conduit, each innerduct shall consist of a different color from end to end (ex. Orange, Blue, Black, and White). Do not couple innerduct of different colors without HAS approval.
7. All interior innerduct shall be plenum rated, unless installed in conduit.

2.5 CABLE TRAYS

A. Manufacturers:
   1. B-Line
   2. Cope
   3. Panduit

B. CABLE TRAY

   1. Except as otherwise indicated, provide metal cable trays, of types, classes and sizes indicated; with splice plates, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
   2. Materials and Finish: Material and finish specifications for each tray type are as follows:
      a. Aluminum: Straight section and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052.
      b. Pre-galvanized Steel: Straight sections, fitting side rails, rungs, and covers shall be made from steel meeting the minimum mechanical properties in accordance with ASTM A653 SS.
      c. Hot-dip Galvanized Steel: Straight section and fitting side rails and rungs shall be made from steel meeting the minimum mechanical properties of ASTM A1011 SS, Grade 33 for 14 gauge and heavier, ASTM A1008, Grade 33, Type 2 for 16 gauge and lighter, and shall be hot-dip galvanized after fabrication in accordance with ASTM A123. All covers and splice plates must also be hot-dip galvanized after fabrication; mill galvanized covers are not acceptable for hot-dipped galvanized cable tray.
      d. Stainless Steel: Straight section and fitting side rails and rungs shall be made of AISI Type 304 or Type 316 stainless steel. Transverse members (rungs) or corrugated bottoms shall be welded to the side rails with Type 316 stainless steel welding wire.
      e. Rigid PVC (Channel), ABS (Fittings) with the Flammability rating 94V-0, UL listed to 2024A Optical Fiber Cable Routing Assemblies Compliant with the applicable tests in Telcordia GR-63-CORE Network Equipment Building Systems Level 3

2.6 TYPE OF TRAY SYSTEMS

A. Ladder type trays shall consist of two longitudinal members (side rails) with transverse members (rungs) welded to the side rails. Rungs shall be spaced 6 or 12 inches on center. Rungs shall have a minimum cable-bearing surface of 7/8 inch with radiuses edges. No portion of the rungs shall protrude below the bottom plane of the side rails. Each rung must be capable of supporting the maximum cable load, with a safety factor of 1.5 and a 200-pound concentrated load when tested in accordance with NEMA VE-1, section 5.4.

B. Ventilated trough type trays shall consist of two longitudinal members (side rails) with a corrugated bottom welded to the side rails. The peaks of the corrugated bottom shall have a minimum flat cable-bearing surface of 2-3/4 inches and shall be spaced 6 inches on center. To provide ventilation in the tray, the valleys of the corrugated bottom shall have 2-1/4 inch by 4-inch rectangular holes punched along the width of the bottom.

C. Basket tray shall Easily modified for both horizontal and vertical transitions. “T” weld safety-edge protects the cable during installation.

D. All tray sizes and types shall have a minimum of 4-inch usable load depth.

E. All straight sections shall be supplied in standard 10-foot length, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on drawings.

F. Tray widths shall be 6, 12, 18, 24, or 36 inches.

G. All fittings must have a minimum radius of 12, 24, 36, or 48 inches.

H. Splice plates shall be the bolted type made as indicated below for each tray type. The resistance of fixed splice connections between adjacent sections of tray shall not exceed .00033 ohms. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing rated loading capacity of the cable tray.
   1. Aluminum Tray - Splice plates shall be made of 6063-T6 aluminum, using four square neck carriage bolts and serrated flange locknuts. Hardware shall be zinc plated in accordance with ASTM B633, SC1.
   2. Steel (including Pre-galvanized and Hot-dip galvanized) - Splice plates shall be manufactured of high strength steel, meeting the minimum mechanical properties of ASTM A1011 HSLAS, Grade 50, Class 1. Hardware shall be zinc plated in accordance with ASTM B633 SC1 for pre-galvanized cable trays, or Chromium Zinc in accordance with ASTM F-1136-88 for hot-dip galvanized cable trays.

I. Cable Tray Support shall be placed so that the support spans do not exceed maximum span indicated on drawings or by the manufacturer. Supports shall be Trapeze style support. Cable trays installed adjacent to walls shall be supported on wall-mounted brackets as specified by the manufacturer.

J. Trapeze hangers shall be supported by 3/8-inch (minimum) diameter all thread rods.

K. Accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, waterfall plates, barriers, etc.

L. All cable tray components and accessories will be from the same manufacturer. Parts from different manufacturer will not be intermixed.

2.7 CABLE HOOK SYSTEMS (J-Hooks)

A. Cable hooks must be pre-approved by HAS/IT prior to installation.

B. Cable hooks shall have a flat bottom and provide a minimum of 1-5/8-inch cable bearing surface.

C. Cable hooks shall have 90-degree radiused edges to prevent damage while installing cables.

D. Cable hooks shall be designed so the mounting hardware is recessed to prevent cable damage.

E. Cable hooks shall have a cable latch retainer to provide containment of cables within the hook. The retainer shall be removable and reusable.

F. Cable hooks shall be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc. to meet job conditions.

G. Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.

H. Cable hooks for corrosive areas shall be stainless steel, AMERICAN IRON STEEL INSTITUTE Type 304.

I. All Cable Hooks shall be supported with minimum ¼" all thread with the appropriate fasteners.

2.8 FIRESTOPPING MATERIALS

A. Manufacturers:
1. Johns Manville
2. Hilti
3. 3M
4. Unique

B. Description:
1. Performance requirements: Provide firestopping systems that are produced and installed to resist spread of fire according to requirement indicated, resist passage of smoke and other gases, and maintain fire resistance rating of assembly.
   a. F-Rated Systems: in accordance with ASTM E 814
   b. T-Rated Systems: in accordance with ASTM E 814
2. Fire stopping flame spread performance requirements: Provide products with flame-spread ratings of less than 25 and smoke development ratings of less than 50 as determined in accordance with ASTM E 84.
3. Fire Stopping UL performance requirements: Provide products with UL ratings specified for assembly indicated as determined in accordance with UL listings.

2.9 JUNCTION BOXES/PULL BOXES

A. All pull boxes shall be constructed with a minimum of 14 gauge-galvanized steel with an ANSI 61 grey polyester powder finish inside and out over phosphatized surfaces or galvanizes steel unless otherwise specified.

B. All pull boxes shall have flat, removable covers fastened with plated steel screws with unique keyhole screw slots in the cover to permit removal of the cover without extracting screws unless otherwise specified.
1. All removable box covers shall be connected to box with a safety strap or chain for all boxes 8" X 8" or larger.

C. All pull boxes shall provide the appropriate provisioning for grounding.

D. All pull boxes shall be NEMA Type 1 and sized according to the table below unless otherwise specified.

Maximum Trade	Minimum Box Size (inches)	For Each

Size of Conduit (inches)	Width	Length	Depth	Additional Conduit Increase Width (Inches)
1	4	16	3	2
1.25	6	20	3	3
1.5	8	27	4	4
2	8	36	4	5
2.5	10	42	5	6
3	12	48	5	6
3.5	12	54	6	6
4	15	60	8	8

2.10 WALL BACKBOARD

A. Reference Specification 271100 Section 2.04

PART 3 - EXECUTION

3.1 GENERAL

A. Raceways shall be mechanically and electrically connected to all boxes and fittings and shall be properly grounded per NEC.

B. The routing and location of all conduits, cable tray, cable hooks and other raceways shall be coordinated with other trades prior to and during building construction to avoid delays and conflicts.

C. Where raceways pass through walls, partitions and floors, seal penetrations to provide a neat installation, which will maintain the integrity of the waterproofing or fireproofing, as applicable, of the structure. Coordinate installation requirements with roofing installer where conduits pass through the roof.

D. All raceways entering a building from underground shall be sealed to prevent water, moisture, gas, or any other foreign matter from entering the building. Service conduits shall be sealed in accordance with NEC 230-8.

E. Contractor's on-site RCDD supervisor shall review, approve, and stamp all shop drawings, coordination drawings and records drawings.

F. Do NOT route communication pathways under HVAC condensing units.

G. Expansion Fittings:
   1. Raceways shall be provided with expansion fitting where necessary to compensate for thermal expansion and contraction.
   2. Use expansion-deflection fittings on conduit crossing structural expansion joints and on exposed conduit funs where necessary. Provide bonding jumpers across fittings in metal raceways systems

3.2 CONDUIT INSTALLATION

A. Rigid and IMC shall be installed with threaded fittings and couplings.

B. All metallic couplings, connectors, and fittings shall be malleable iron or steel and finished with zinc plating or by galvanizing.

C. All conduits shall be plugged immediately upon installation to prevent the entrance of construction dirt and debris. All conduits shall be swabbed and cleaned before wires are pulled.

D. Expansion fittings shall be utilized in all cases where conduits pass through building expansion joints. Fittings shall be of an approved weatherproof telescopic type permitting a movement of up to four inches and shall be provided with approved bonding jumpers around or through the fitting.

E. Connection of Conduit to pull / junction Boxes and Enclosures:
1. Connection to NEMA 1 type boxes and enclosures:
   a. Rigid: Install insulated bushings and double locknuts.
   b. IMC: Install insulated bushings and double locknuts.
   b. EMT: shall be installed with compression box connectors, insulated throats and bushings.
2. Connection to NEMA 3R, 4, 4X, and 12 type boxes: Install insulated bushings and sealing locknuts or hubs.
3. When conduits enter floor mounted enclosures from below and there is no sheet metal to which to attach; install grounding bushings on the conduit. Bond bushings to ground bus using a conductor the same size as required for an equipment grounding conductor sized for the given circuit.
4. Install sealing bushing within all conduits which have entered a building From outside, whether from above or below grade.

F. No section of conduit shall be longer than 30m (100ft) or contain more than two 90-degree bends between pull points, pull boxes, or reverse bends. Offset is considered two equal bends in opposite direction, the two angles of which cannot exceed 45 degrees in each direction. In all cases, the two angles comprising the offset shall be considered 90 degrees. Any conduit bends less than 90 degrees and is not associated with the offset as described herein is considered a 90 degree bend.

G. The inside radius of bends in conduit shall be:
1. 6 times the internal diameter for 2” or less.
2. 10 times the internal diameter for greater than 2”.

H. With prior HAS/IT APPROVAL. For Backbone and riser conduit runs ONLY (2” to 4”), a special LBD condulet (Crouse-Hinds or approved equal) may be used for CMU penetration where a swept 90 will not work. LBD condulets are designed for communications cable installation to maintain bend radius requirements.

I. A measured pull tape shall be placed in all installed conduit with pull strength of 200 pounds.

J. Any single conduit run extending from a Telecommunication Room shall not serve more than one outlets.

K. All communications conduits shall be identified with color coded orange tape marked “Communications” every 50 feet. Tag conduit termination points (to include J-box locations) with the origination and destination location.

Example: **IDF.AMDF > CAM.1023**

L. Conduit shall be reamed to eliminate sharp edges and terminated with an insulated throat

bushing along with a screw on bushing and/or grounding bushing.

M. Conduit protruding through the floor shall be terminated at a minimum of 4 inches above the floor surface.

N. All stubbed conduit ends shall be provided with a ground bushing.

O. All conduit penetrations shall be provided with the proper conduit sleeves.
1. Sleeves shall extend three inches AFF or four inches below finished ceiling, with a bushing.
2. Sleeves shall be installed in the communications room floor or ceiling a minimum of six inches on center from the wall.
3. Conduit floor sleeves shall be spaced to allow space for insulted ground bushing for cable protection.
4. Shall be installed in a single tier or row from left to right horizontally.
   If two tiers or rows are required, the conduits shall be staggered minimum of 2 inches between tiers.
5. Cable support anchors shall be installed 18 to 24 inches above the sleeves.

P. All cable (horizontal, riser, or backbone) wall or ceiling penetrations shall be provided with the proper conduit sleeves.
1. Sleeves shall extend three inches AFF or four inches below finished ceiling, with a bushing.
2. Sleeves shall be installed in the floor or ceiling a minimum of two to four inches on center from the wall.
3. Sleeves shall be installed in the walls at a minimum of two inches extended on each side of the wall.
4. Cable floor, ceiling, and wall sleeves shall be spaced to allow space for ground bushing and insulated bushing for cable protection.
5. Shall be installed in a single tier or row from left to right horizontally.
6. If two tiers or rows are required, the conduits shall be staggered minimum of 2 inches between tiers.
7. Cable support anchors shall be installed 18 to 24 inches above the sleeves.

Q. All conduit and cabinet entrances shall be sealed with an approved, re-enter able sealant material to prevent ingress of water, dust or other foreign materials.

R. Conduit shall not be embedded in the required fire protective covering of a structural member that is to be individually encased in accordance with Building Officials and Code Administrators International, Inc. (BOCA).

S. Install all exposed conduit parallel or perpendicular to lines of existing construction and grouped together where possible, without interfering with use of premises or working areas. Prevent safety hazards and interference with operating and maintenance procedures.

T. ALL Conduit Sizing and supports:
1. Support conduit 2 inches and larger at 10 feet on center maximum, and conduit less than 2 inches {1½ inch and smaller} at eight feet on center maximum.
2. Fasten 1½ inch and smaller conduit to concrete, masonry or steel with either one-hole malleable iron conduit straps, or "Korn" clamps, or U-bolts; for larger diameters, use two-hole straps. Use "clamp backs" for strapping conduits to planar surfaces.
3. Multiple runs shall be supported on channel adequately secured to walls or hung from structure above with conduits fastened to channel with clamps designed for the purpose.
4. When installation requires trapeze/rack support minimum 3/8 inch all thread shall be used.

5. When installation requires a single 1-inch conduit ¼ inch all thread shall be used. No hanger wire for any installation.
6. When installation requires single conduit greater than 1 inch, 3/8 inch all-thread shall be used.
7. Cable fill rates should not exceed 40% of the cross-sectional area of the installed conduit.

U. Horizontal Conduit Routes:
1. Horizontal (station) conduit is defined as the conduit run between the communications outlet and the cable tray or communications room as indicated on Drawings.
2. Each horizontal conduit run shall be a one-inch metallic conduit and shall be home run from each communications outlet box to the equipment room, terminating equipment or cable tray, as indicated in Drawings.
3. Each single horizontal conduit run shall be provided with a junction or pull box every 30m (100ft) or contain more than two 90-degree bends between pull points, pull boxes, or reverse bends. Offset is considered to be two equal bends in opposite direction, the two angles of which cannot exceed 45 degrees in each direction. In all cases, the two angles comprising the offset shall be considered 90 degrees. Any conduit bends less than 90 degrees and is not associated with the offset as described herein is considered a 90-degree bend.
4 Each dual horizontal conduit run shall be provided with a junction or pull box every 30m (100ft) or contain more than two 90-degree bends between pull points, pull boxes, or reverse bends. Offset is considered two equal bends in opposite direction, the two angles of which cannot exceed 45 degrees in each direction. In all cases, the two angles comprising the offset shall be considered 90 degrees. Any conduit bends less than 90 degrees and is not associated with an offset as described herein is considered a 90-degree bend. The quantity of conduits entering the junction or pull box shall equal the number of conduits exiting the junction or pull box.
5. Each terminating (outlet end) conduit connection shall be provided with the proper connecting insulated bushing or fitting.
6. Each originating end (communications room end) shall be provided with the proper connecting insulated ground bushing and properly bonded to ground.
7. If flexible conduit is required install must not be longer than 7 feet and must have HAS/IT approval prior to installation.

V. Horizontal conduit entrance in communications rooms – wall entry
1. Horizontal conduits shall enter the communications room wall 12 to 18 inches above the top of the cable tray. Maintain cable bend radius with supporting device as required.
2. Conduit wall stubs shall be spaced in increments equal to the conduit outside diameter (OD) from each other.
3. All conduit wall stubs shall be extended to the terminating equipment, electronics, or cable tray, as noted in Drawings.
4. Conduit crossovers are not permitted.

W. Horizontal conduit entrance in communications rooms – ceiling entry
1. Horizontal conduits shall enter or be extended from the equipment room ceiling 12 to 18 inches above the top of the cable tray.
2. Ceiling conduit stubs shall be spaced in increments equal to the conduit OD from each other.
3. All ceiling conduit stubs shall be extended to the terminating equipment, electronics, or cable tray, as noted in Drawings.
4. Conduit crossovers are not permitted.

X. Horizontal conduit entrance in communications rooms – floor entry

1 Horizontal conduits shall enter the communications room floor two inches to four inches on center from the wall and shall be stubbed 4 inches AFF.
2 Conduit floor stubs shall be spaced in increments equal to the conduit OD from each other.
3 Conduit crossovers are not permitted.

Y. Horizontal conduit to cable tray
1. No horizontal conduit runs shall be attached to the cable tray in any fashion.
2. Conduit terminating end shall be self-supporting above the cable tray side rail. Not attached. Minimum of 6 inches above the cable tray and not to exceed 12 inches above the cable tray.

Z. Horizontal Junction/Outlet Boxes
1. Each horizontal conduit shall be terminated into an outlet box.
2. Each outlet box shall be a deep four-inch square junction box with a minimum of two one-inch knockouts on each of the sides.
3. Each conduit home run shall be provided with a deep 4 11/16" inch square junction box (w/cover) at 100-foot intervals and six inches above each ceiling and wall intersection.

AA. Backbone/Riser conduit entrance in communications rooms – wall entry
1. BB/Riser conduits shall enter the communications room wall a minimum of 24 inches above the top of the cable tray.
2. Conduit wall stubs shall be spaced in increments to equal the conduit OD from each other.
3. BB/Riser conduits shall be installed in a single tier or row from left to right horizontally.
   a. If two tiers or rows are required the conduits shall be staggered between tiers.
   b. No more then two tiers or rows are permitted.
4. All conduit wall stubs shall be extended to and over the cable tray to access cable tray pathway.
5. All BB/riser conduit stubs shall be provided with the proper universal dropout/ waterfall cable exit runway, which shall be supported by and mounted to channel strut.
6. Conduit crossovers are not permitted.

BB. Backbone/Riser conduit entrance in communications rooms – floor entry
1. BB/Riser conduits shall enter the communications room floor two inches to four inches on center from the wall and shall stub up six inches AFF.
2. Conduit floor stubs shall be spaced in increments to equal the conduit OD from each other.
3. BB/Riser conduits shall be installed in a single tier or row from left to right horizontally.
   a. If two tiers or rows are required the conduits shall be staggered between tiers.
   b. No more then two tiers or rows are permitted.
4. Exiting cable shall be extended to the bottom of the cable tray and be provided with cable support anchors and secured with supporting hardware every six inches above the conduit bushings.
5. Conduit floor stubs shall be extended 6 inches from wall on center and 6 inches above AFF.
6. The BB/riser cable shall be extended in the cable tray to the terminating equipment, as noted in the Drawings.
7. Conduit crossovers are not permitted.

3.3 Cable Tray Installation

A. Cable tray shall be supported as follows:
1. Where tray is suspended above equipment cabinets, it shall be supported by a Trapeze type hanger and per manufacture instructions. In all other applications, uni-strut trapeze type hangers affixed to the structure above via minimum 3/8-inch threaded rod shall support the tray.

2. Threaded rod shall be fitted with a 6-inch long tube where it resides in cable tray to protect cables.
3. Minimum of 12 inches of vertical clearance above all cable tray.

B. Installation shall be in accordance with equipment manufacturer's instructions, and with recognized industry practices to ensure that cable tray equipment comply with requirements of NEC and applicable portions of NFPA 70B. Reference NEMA-VE2 for general cable tray installation guidelines.

C. Provide sufficient space encompassing cable trays to permit access for installing and maintaining cables.

D. Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE-2-2006 guidelines, or in accordance with manufacturer's instructions.

E. A support must be place within 24 inches on each side of a connection or fitting.

F. Maintain a minimum of 12 inches of clearance above cable tray for cable installation. Maintain a minimum of 3 inches between ceiling tile and bottom of cable tray support.

G. Cable tray installation will be completed in one continuous run with no separations between sections.

H. Vertical cable or ladder racks shall be used to route cable up and down the wall.

I. Dropout/Water Fall of the same make and size of the cable tray shall be used to route cables in or out of the tray.

J. Matted “T” and elbows shall be used of the same make and size for all interchanges and directional changes

3.4 Junction Box/Pull Box Installation

A. Pull boxes shall be installed in sections of conduit that are 100 feet in length, or that contain more than two 90-degree bends.

B. A pull box shall NOT be used in lieu of a conduit bends.

C. All pull boxes shall be installed in an easily accessible location with unobstructed entry to the pull box access panel.

D. Pull boxes 6”x 6” or larger shall be supported on all four corners in such a manner that the cable running through does not support the pull box or conduit attached to the pull box.

3.5 Cable Hook Installation (J-HOOKS)

A. Cable hook systems must be pre-approved by HAS/IT prior to installation.

B. Installation and configuration shall conform to the requirements of the ANSI/ EIA/TIA Standards 568A & 569, NFPA 70 (National Electrical Code), and applicable local codes.

C. Cable hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of three.

D. Spring steel cable hooks shall be capable of supporting a minimum of 100 pounds with a safety factor of three where extra strength is required.

E. Cable Hook spacing maximum four feet on center.

F. Maintain maximum cable sag between cable hooks of 12 inches.

G. Do not fill cable hook greater than manufacturer recommended guidelines.

3.6 FireStopping Material Installation

A. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instruction, and product carton instruction for installation.

B. Verify substrate conditions are acceptable for product installation in accordance with manufacturer's instructions.

C. Install fire stopping to comply with performance requirements specified herein.
   1. Install fire stopping to comply with listed fire rated assemblies in accordance with ASTM and UL requirements
   2. Installer shall be trained and approved by the manufacturer

D. Protect installed products from damage during construction operations until completions.

E. Inspection: Code official or building inspectors to review proper installation using manufacturer guidelines.

END OF SECTION – 27 05 28

SECTION 27 05 53.13 – IDENTIFICATION AND LABELING OF COMMUNICATIONS INFRASTRUCTURE STRUCTURES

PART 1 - INTRODUCTION

1.1 GENERAL

A. As the Houston Airport System (HAS) continues to develop both its private and commercial interests, it is essential that an effective telecommunications infrastructure be developed and maintained to ensure the support of any and all services which rely on the electronic transport of information. To effectively administer these assets requires a disciplined effort that begins with a systematic practice and procedure for capturing useful data regarding inventories that might be conducted at any point during the lifecycle of a project.

1.2 OBJECTIVE

A. The objective and intent of this standard is to provide uniform GIS inventory and documentation practices/guidelines for any person or party directly involved with data collection, administration and/or accountability of the HAS IT telecommunications infrastructure or related systems.

1.3 INTENDED USE

A. Any designer, consultant or engineering entity contracting with the Houston Airport System to inventory/document the telecommunications physical and network configurations will need to refer to this document for clarification regarding standard operating procedures. The guidelines given here provide for effective documentation of the HAS telecommunications network. The result of following this standard will be a telecommunications infrastructure that is well documented and easily managed by the administrator.

B. Note: For specific criteria concerning GIS/GPS datum, refer to the OASIS Standards document maintained by direction under the HAS Planning Design and Construction department. Said datum is not specific to the Information Technology department and thus will not be replicated here.

1.4 LIFE OF THE STANDARD

A. This standard is a living document. The criteria contained in this standard are subject to revision without notice, as warranted by advances in administration techniques related to telecommunications technology.

B. This manual is the property of the Houston Airport System. The contents of this manual are proprietary and should not be copied or disclosed without prior written permission of the Houston Airport System. Any variation from the standards in this manual should be addressed by the Houston Airport System IT GIS contact listed below for approval prior to implementation on a project

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1.5 GENERAL

A. This standard specifies the GIS inventory and documentation requirements for the Houston Airport System IT Telecommunications Infrastructure, Network Engineer and associated information databases. Areas of the infrastructure and/or databases to be inventoried, administered, monitored or maintained include:

1. Terminations for the telecommunications media located in work areas, telecommunications closets, equipment rooms, and entrance facilities;

2. Equipment/devices hosting physical terminations;

3. Telecommunications media (cable) between terminations;

4. Pathways (spans) between terminations that contain the media;

5. Spaces (structures) where terminations are located;

6. Bonding/grounding as it applies to telecommunications;

7. Geophysical plant networks i.e., manhole, handhole, pullbox, cabinet, pedestal, building access points;

8. Splice enclosures.

9. NOTE: Whereas this document provides an outline and overview of the GIS documentation process, the following Telecommunications Infrastructure Specifications for the Houston Airport System should be referenced for detailed administrative requirements:

B. This standard also specifies requirements for the collection, organization, and presentation of as-built data.

C. In addition to providing requirements and guidelines for a traditional paper-based documentation system, this standard will serve as the reference for all associated computer-based administration tools.

D. Contracting parties, by this standard, are required to attend an HAS-IT coordination meeting prior to commencement of any documentation effort; the scope of work and project expectations will be discussed at length. You will be given additional direction as required and any useful maps, diagrams, numerical sequences, etc. will be provided to you at this time.

1.6 REFERENCES

A. The latest published version at the date of contract applies to all references. Related Documents include all Drawings and General Provisions of the Contract. In Conflict between contract documents, the most stringent will be applied.

B. Related Specifications: Use these Specifications for all related work not specifically covered in this specification.

1. Section 270526.13: Telecommunication Grounding and Bonding - Structures
2. Section 270528: Interior Communication Pathways
3. Section 271100: Communication Cabinets and Equipment Rooms
4. Section 271300: Backbone and Riser Media Infrastructure
5. Section 271500: Horizontal Media Infrastructure
6. Section 272100: Data Communication Network Equipment
7. Section 281300: Access Control System
8. Section 282313: Video Surveillance Control and Management System

1.7 DEFINITIONS

A. This section contains definitions of terms, acronyms, abbreviations, and formats that have special technical meaning or that are unique to the technical content of this standard.

B. For the purposes of this standard, the following definitions apply:

1. Assignment

a. A unique designation assigned to a person who is expected to use the circuit, equipment, service, etc., serving a particular work area. Examples of an assignment: telephone number, a name, a circuit number or a logical address.

2. Backbone

a. Network of copper and fiber connections between termination panels/switches.

3. Cable

a. An assembly of one or more copper conductors or optical fibers within an enveloping
sheath, constructed so as to permit use of the conductors singly or in groups.

4. Campus

    a. The buildings and grounds have legal contiguous interconnection. (TIA)

5. Equipment

    a. Generally, an endpoint for cable lengths; any hardware device/component. Used to terminate cable for cross-connection or interconnection to other cables or devices.

6. Grounding electrode conductor

    a. The conductor used to connect the grounding electrode to the equipment grounding conductor and/or to the grounded conductor of the circuit at the service equipment or at the source of a separately derived system.

7. Handhole (HH)

    a. A structure similar to a small maintenance hole in which cable can be pulled, but not large enough for a person to fully enter to perform work.

8. Identifier

    a. An item of information that links a specific element of the telecommunications infrastructure with its corresponding record. (TIA)

9. Linkage

    a. A connection between a record and an identifier or between records.(TIA)

10. Location

    a. A position occupied or available for occupancy within a site or infrastructure network.

11. Manhole (MH)

    a. A vault located in the ground or earth as part of an underground duct system and used to facilitate placing, establishing connections and maintenance of cables as well as placing associated equipment, in which it is expected that a person will enter to perform work. (TIA).

12. Outlet box (telecommunications)

    a. A metallic or nonmetallic box mounted within a floor, wall or ceiling and used to hold telecommunications outlet/connectors or transition device. (TIA)

13. Outlet / connector (telecommunications)

a. A connecting device in the work area on which horizontal cable or outlet cables terminates. (TIA)

14. Pathways

a. A raceway, conduit, sleeve, or exposed location, for the placing of telecommunications cable that links telecommunications spaces together.

15. Record

a. The permanent documentation of installed telecommunications infrastructure obtained from as-builts.

16. Record drawing (as-built)

a. The documentation of measurements, location, and quantities of material work performed. May be in the form of marked up documents or other work order forms.

17. Report

a. A presentation of a collection of information from various records.

18. Site

a. Spatial location of an actual or planned structure or set of structures.

19. Span

a. A raceway, conduit, sleeve, or exposed location, for the placing of telecommunications cable that links telecommunications spaces together.

20. Splice

a. A joining of conductors meant to be permanent. (TIA)

21. Splice box

a. A box, located in a pathway run, intended to house a cable splice.(TIA)

22. Splice enclosure

a. A device used to protect a cable or wire splice.(TIA)

23. Structure

a. Generally an endpoint for span lengths; i.e., manhole, handhole, cabinet, junction box, pedestal, building access point, communications rooms, work areas.

24. Structure unit

a. A component of the structure; usually housing equipment i.e., cabinet, rack.

25. Telecommunications

a. Any transmission, emission, or reception of signs, signals, writings, images, and sounds; that is, information of any nature by cable, radio, optical or other electromagnetic systems. (TIA)

26. Telecommunications infrastructure

a. The components (telecommunications spaces, cable pathways, grounding, wiring and termination hardware) that together provide the basic support for the distribution of all telecommunications information.

27. Telecommunications media

a. Wire, cable, or conductor used for telecommunications.

28. Telecommunications space

a. Areas used for the installation and termination of telecommunications equipment and cable, e.g., telecommunications closets, work areas, false ceilings, and manholes/handholes.

29. Termination position

a. A discrete element of termination hardware where telecommunications conductors are terminated.

30. Work area; (work station)

a. A building space where the occupants interact with telecommunications equipment.(TIA)

1.8 DOCUMENTATION CONCEPTS

A. This section describes the concepts of identifiers, records, linkages among records, and presentation of information necessary to administer infrastructure cable, spans and structures.

1.9 IDENTIFIERS

A. An identifier is assigned to an element of the telecommunications infrastructure to link it to its corresponding record. Identifiers shall be marked at the elements to be administered.

B. Identifiers used to access record sets of the same type shall be unique. For example, each identifier for each one of the set of cable records shall be unique. Unique identifiers across all types of telecommunications records are mandatory. For example, no cable record identifier should be identical to any pathway record identifier.

C. Labeling is the marking of an element of the telecommunications infrastructure with an identifier and (optionally) other relevant information. Labeling shall be accomplished in either of two ways: separate labels may be securely affixed to the element to be administered, or the element itself may be marked.

1.10 RECORDS

A. A record is a collection of information about or related to a specific element of the telecommunications infrastructure.

B. Elements identified as required information and required linkages shall constitute the minimum requirements for these records. Specific information and other linkages suggest additional elements that may be useful to the administrative system, such as cable length.

C. Telecommunications records are typically used in conjunction with other records. For example, a user record or assignment may contain an identifier to the record of the cable that serves an individual's workspace. Conversely, a cable record may also contain an identifier for a user record or assignment.

D. By this standard, the Houston Airport System utilizes AutoCAD and ArcGIS as the software platforms by which all telecommunications infrastructure records and linkages are recorded and maintained.

1.11 RELATIONSHIPS

A. Relationships are the logical connections between identifiers and records. The records for infrastructure elements shall be interlinked. For example, in a cable record, termination port identifiers point to specific termination port records that contain additional information about each of the cable termination ports.

1.12 ASSIGNMENT

B. An "assignment" is a specific term of reference that allows the association of the end location, cable pairing record or termination port record with additional information. For example, an assignment such as a telephone number or circuit number can associate a user with elements of the telecommunications infrastructure. This aids in troubleshooting by identifying both the physical and logical connectivity from a single circuit assignment.

1.13 PRESENTATION OF INFORMATION

A. A typical documentation system includes labels, records, reports, drawings, and work orders. Reports compile and present information found in the records. Graphical information regarding the relationship of the telecommunications infrastructure to other infrastructures within the campus or site is presented in drawing format. Work orders document the operations needed to implement changes affecting the telecommunications infrastructure.

B. Reports present information selected from the various telecommunications infrastructure records. Reports may be generated from a single set of records or from several sets of interlinked records.

C. Drawings are used to illustrate different stages of telecommunications infrastructure planning and development. Generally, conceptual and installation drawings supply input to the record drawings that graphically document the telecommunications infrastructure. These record drawings as well as some equipment schedules and installation drawings (i.e., rack layouts) become part of the administration system documentation.

D. drawings (i.e., one-line or riser diagrams) are used to illustrate the proposed design intent. They do not typically include all telecommunications infrastructure elements or identifiers and do not necessarily become part of the administration documentation.

E. Installation or bid drawings are used to document (graphically) the telecommunications infrastructure to be installed. They should illustrate relevant infrastructure elements and may also describe the means of installation. Identifiers may or may not be included on the drawings.

F. Record drawings (as-builts) graphically document the installed telecommunications infrastructure through floor plans, elevation, and detail drawings. These drawings may differ from installation drawings because of changes and specific site conditions. Key elements of the telecommunications infrastructure shall have identifiers assigned. The span/structure and wiring portions of the infrastructure each may have separate drawings if warranted by the complexity of the installation or the scale of the drawings.

G. ESRI (ArcGIS) formatted feature class and feature class layers graphically depict data in a spatial environment and are linked via physical relationship protocols established by the administrator through the utilization of software engineered towards GIS applications.

1.14 WORK ORDERS (SYMANTEC)

A. Work orders document the actions needed to implement changes affecting the telecommunications infrastructure as it was actually installed. The changes may involve several telecommunications components as well as other related systems. The Documentation Team utilizes Symantec software as its change-management notification platform. Typical Symantec tickets document actions such as moving a patch cord, installing a conduit, cross-connect or relocating an outlet box. A Symantec ticket may involve structures, spans, cable, splices, terminations, or grounding, either individually or in combination. A Symantec ticket should list both the personnel responsible for the physical action and those responsible for updating various portions of the documentation to assure its accuracy. Prior to commencement of an action that would result in a change to any telecommunications infrastructure component or related system; a Symantec ticket should be submitted in accordance with departmental and operational requirements.

1.15 SUMMARY

A. This section has presented basic concepts of documentation for the Houston Airport System Telecommunications Infrastructure. The sections that follow specify the administration of each of the components of the infrastructure in greater detail.

1.16 DATA COLLECTION AND ADMINISTRATION CONCEPTS

A. This section describes the documentation of assets within the **administrative** jurisdiction of the Houston Airport System - Public Safety and Information Technology department. As changes are made to the assets, affected labels, records, reports and drawings shall be updated or revised.

B. The following outline assumes that the contracting parties understand the GIS/GPS datum specifications and requirements as provided in the OASIS standards. Further, that the equipment to be used towards gathering the data has been configured accordingly.

1.17 STRUCTURES

A. Standard structures

1. Manhole
2. Handhole
3. Pullbox
4. Cabinet (Pole Mounted, Pedestal)
5. Building Access
6. Dog House
7. Remote Location
8. Entrance Facility
9. Workspace
10. Main Distribution Frame (MDF)
11. Building Distribution Frame (BDF)
12. Intermediate Distribution Frame (IDF)
13. Point of Presence (POP)
14. Pathway Transition
15. Aerial Pole

B. Identification

1. Each Structure has been assigned a unique GIS database identifier. This identifier serves as a primary-key for each database record. Each record contains additional fields and values relative to the feature identified by the primary-key.
2. All structure identifiers follow a specific schema; new structures must be identified accordingly. In the event that a determination cannot be made regarding the identification of a structure, please contact an HAS IT GIS representative prior to documenting.
3. All structures are identified through a numerical range with prefix characters specific to a respective airport campus, technology asset designation, and feature-category.
4. Airport Campus Characters:

    a. IAH: I
    b. HOU: H
    c. EFD: E

5. Asset Designation Character:
    a. Technology: T

6. Feature-Category Characters:

a. Structure: S
b. Pathway: P
c. Equipment: E
d. Cable: C

7. Numerical Range:
   a. 0000 – 9999

8. Example:
   a. ITS0054 (IAH Structure), HTS0054 (HOU Structure), ETS0054 (EFD Structure)

9. Manhole Numerical Range:

   a. Note: When planning to identify newly constructed or newly placed HAS assets, the contractor is expected to coordinate with the HAS IT GIS staff prior to labeling. This action will account for all identifiers previously assigned and prevent duplications or omissions.

C. Labeling

1. Labeling should follow the identification schema and further be accomplished via an approved method described below.
2. Newly constructed structures (manhole, handhole, pullbox, cabinet) will require that their identifiers be etched onto the lid or affixed with an appropriate label material. Manholes and handholes should be stamped on the lid itself, as well as the metal ring/material surrounding the opening; or the concrete foundation (topside). Utilize an appropriate chisel or stamp, or labeling device to accomplish the task.
3. The Technology Infrastructure group does not maintain the specification for labeling newly constructed structures (dog house, remote location, entrance facility, workspace, MDF, BDF, IDF, POP, Pole). These should be placarded according to current HAS Infrastructure specification. The Technology Infrastructure GIS identifiers (described in the previous paragraphs) relevant to these spaces and locations are preserved for GIS database record keeping purposes only. Contact an HAS Infrastructure representative for clarification on physical labels for architectural spaces.
4. Required Fields
5. Each structure requires that specific data be collected per unit. GPS equipment should be formatted to account for this information:

   a. TELECOM_ID
   b. COORD_X
   c. COORD_Y
   d. COORD_Z
   e. AIRPORT
   f. AGENCY
   g. LID_TYPE
   h. DEPTH_INCH
   i. SPLICE_CLOSURE
   j. SLACK_LOOP
   k. GROUNDING
   l. COMMENTS

m. BUILDING_NAME
n. LEGACY_ID
o. STRUCTURE_TYPE
p. STRUCTURE_SUBTYPE
q. HAS_LEVEL
r. LID_SIZE
s. PROJECT
t. COLLECTION_DATE
u. LID_SHAPE
v. LID_MATERIAL
w. PROJECT_CLASS

D. GPS

1. Each manhole should be recorded as follows:
2. Single shots; taken on-center. Offset shots are acceptable for manholes not available to satellite coverage but these shots must be coordinated with an HAS-IT GIS contact prior to work.

E. Supporting documentation deliverables

1. Additional documentation records are required to support GPS data. The documentation is as follows:

2. Manholes and Handholes only

a. Digital photos – top (north to top of photo), north wall, west wall, south wall, east wall; for manholes not true to cardinal compass points adjust call-outs as necessary.
b. AutoCAD – butterfly diagram of manhole depicting pathway orientation, conduit layout, innerduct configurations, cabling locations, and cabling counts for each manhole unit in both .dwg 2010 or higher and .pdf formats; (See manhole AutoCAD butterfly exhibit; see also the OASIS standards for IT specific AutoCAD layering).
c. Video – 360 degree imagery of interior; .mpg format.

3. Communication Room

a. AutoCAD – floorplan (where applicable) layouts of structure units depicting orientation, and/or configurations in both .dwg 2010 or higher and .pdf formats; (See AutoCAD communications room exhibit).

4. Spatial Data Deliverables

a. The entire manhole inventory should be delivered separately in ArcGIS feature class (version 10) format along with any records outlined in the ‘Supporting Documentation” paragraph. This feature class (STRUCTURE) should contain the attribute values from the ‘Required Fields’ paragraph.

5. Special Instructions

a. None

PART 2 - PRODUCTS (Not used at this time)

PART 3 EXECUTION

3.1 CABINETS/RACKS

A. Identification

1. Each cabinet/rack has been assigned a unique campus identifier. All structure identifiers follow some specific schema; new structures must be identified accordingly. In the event that a determination can not be made regarding the identity of the structure, please contact the HAS IT GIS representative prior to documenting.
2. All cabinets are identified through a numerical range specific to its respective campus and should be prefixed with 'PC' (pedestal cabinet) or 'PM' (pole mounted cabinet). The ranges are as follows:
3. Example:

    a. ITS0054.02.01

        1) Translation: Cabinet or Rack in Room (Structure) ITS0054, row 02, column or position 01.

    b. ITS0054.BB01

        1) Translation: Backboard (plywood) 01 in Room (Structure) S103.1.

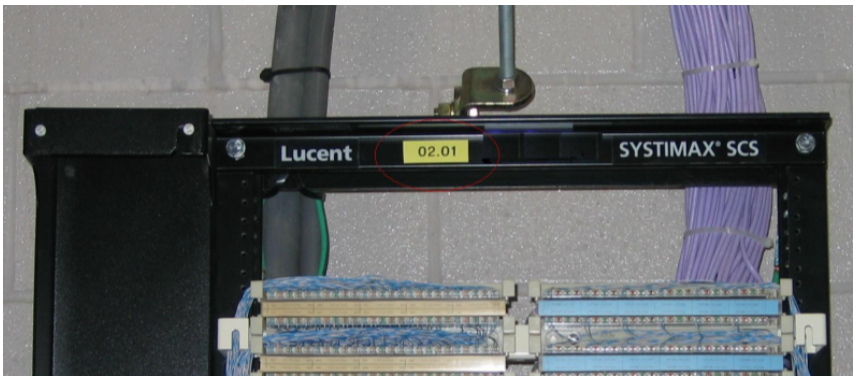
4. Note: Backboards tend to be randomly arranged within the structure and are usually not numbered according to wall orientation. Different identifiers are however assigned to each. Any one backboard could host a wide assortment of equipment; see EQUIPMENT for identifier schemas.
5. Note: Future expansion of rows should be a major consideration during identifier/labeling phase; numbering from low to high in the direction of any available space.

B. Labeling

1. Labeling should follow the identification schema and further be accomplished via the use of below specified labeling device or approved equivalent:

    a. DYMO RhinoPRO 5000 Industrial Label Maker
    b. ¾" Flexible Industrial Strength Nylon label tape – yellow

2. Labels should be affixed to the cabinet housing.
3. Labels should be affixed to top-center of identified structure unit. For labeling purposes only, the structure identifier can be omitted from the structure unit identifier to minimize space required for the label. It will be assumed that all structure units located in the same structure will carry the same structure identifier. Note: this is for labeling purposes only; data collection records/tables must use complete identifier including telecom structure identifier.



C. Required Fields

1. No Action required

D. GPS

1. No Action required

E. Supporting Documentation Deliverables

1. AutoCAD – floorplan and rackface layouts of structure units depicting orientation, and/or configurations in both .dwg 2010 or higher and .pdf formats; (See AutoCAD communications room exhibit)

F. Spatial Data Deliverables

1. No Action require

G. Special Instructions

1. Structure units are visibly marked with a reference tag identifying its column and row. The telecom structure (ITS, HTS, ETS) is omitted from the reference tag but should be included in the structure unit tables. Newly placed structure units will require that their identifiers be affixed to the cabinet face or rack frame. Utilize specified labeling device to accomplish the task.

3.2 PATHWAYS

A Pathway Types

1. Ductbank
2. Trench
3. Direct Buried
4. Cable Tray

B Identification

1. Each Pathway has been assigned a unique GIS database identifier. This identifier serves as a primary-key for each database record. Each record contains additional fields and values relative to the feature identified by the primary-key.
2. All pathway identifiers follow a specific schema; new pathways must be identified accordingly. In the event that a determination cannot be made regarding the identification of a pathway, please contact an HAS IT GIS representative prior to documenting.
3. All pathways are identified through a numerical range with prefix characters specific to a respective airport campus, technology asset designation, and feature-category.
4. Airport Campus Characters:

    a. IAH: I
    b. HOU: H
    c. EFD: E

5. Asset Designation Character:

    a. Technology: T

6. Feature-Category Characters:

    a. Structure: S
    b. Pathway: P
    c. Equipment: E
    d. Cable: C

7. Numerical Range:

    a. 0000 – 9999

8. Example:

    a. ITP0054 (IAH Pathway), HTP0054 (HOU Pathway), ETP0054 (EFD Pathway)

C Labeling

1. Pathways are identified for the purposes of GIS referencing and are linked to structure inventories but are not physically labeled per current guidelines.

D Required Fields

1. Each pathway requires that specific data be collected per unit. GPS equipment should be formatted to account for this information.

    a. CONDUIT_SIZE
    b. COMMENTS
    c. AIRPORT
    d. HAS_ENCASEMENT
    e. AGENCY
    f. CONDUIT_QTY
    g. PATH_ID

h. PATH_NUMBER
i. PATH_TYPE
j. END1_COORD_X
k. END1_COORD_Y
l. END1_COORD_Z
m. END2_COORD_X
n. END2_COORD_Y
o. END2_COORD_Z
p. HAS_LEVEL
q. COLLECTION_DATE
r. PROJECT
s. TICKET
t. LEGACY_ID
u. PATHWAY_MATERIAL
v. FROM_TELECOM_ID
w. TO_TELECOM_ID
x. TELECOM_ID
y. PROJECT_CLASS
z. DEPTH_END1
aa. DEPTH_END2
bb. GPS

2. Each pathway must be recorded as follows:

a. Care should be taken to accurately locate the pathways prior to commencing with documentation.
b. Continuous-line shots; taken on center. Line-shots should begin and end on-center of endpoint (structure) locations.

E. Spatial Data Deliverables

1. The entire pathway inventory should be delivered separately in ArcGIS feature class (version 10.x) format along with any records outlined in the ‘Supporting Documentation’ paragraph. This feature class (PATHWAY) should contain the attribute values from the ‘Required Fields’ paragraph.

F. Special Instructions

1. No action required

3.3 CABLE TRAY

A. Identification

1. no requirements per current guidelines

B. Required Fields

1. no requirements per current guidelines

C. GPS

1. no requirements per current guidelines

D. Supporting Documentation Deliverables

1. no requirements per current guidelines

E. Spatial Data Deliverables

1. no requirements per current guidelines

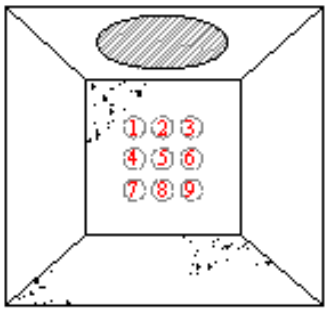
F. Special Instructions

1. no requirements per current guidelines

3.4 PATHWAY UNITS

A. Conduit Identification

1. For deliverable purposes conduits are only being depicted via AutoCAD formats; i.e. butterfly diagrams or floorplans (see Exhibits: Communication Room Exhibit, Rackface Exhibit)
2. In the outside plant environment, conduits should be identified where applicable by size, location and position respective to their endpoints (structures) i.e. handhole wall, building access point, etc.
3. Further, on manhole / handhole butterfly diagrams, OSP conduits are depicted relevant to their size, position and orientation. As a general rule, conduits are identified left-to-right and top-to-bottom as you're facing the wall to be inventoried and should be prefixed with 'CD' on the AutoCAD documents.



MANHOLE

B. For the purposes of illustration and to be included as part of the manhole butterfly diagram draft document, each wall should identify the following:

C. Ductbank (Telecom Pathway Identifier for each respective manhole / handhole wall face)

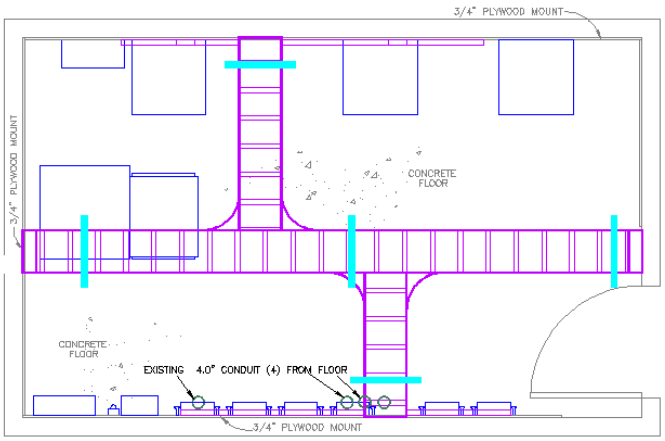
D. Conduits (Count, Orientation)

E. Cabling (Telecom Cable Identifier, Cable Type, Cable Count, location within respective conduit)

F. In the inside plant environment, conduits should be identified where applicable by position and location respective to their endpoints (telecom structures) i.e. communications rooms, vaults

G. ISP conduits are depicted on communication-room AutoCAD layouts as to their position and orientation; and are not numbered.

H. Example:



I. Labeling

1. Not physically labeled per current guidelines.

J. Required Fields

1. Conduit counts, and size as prescribed in the pathway sub-topic

K. GPS

1. No action required

L. Supporting Documentation Deliverables

1. AutoCAD manhole / handhole butterfly diagrams for OSP conduits and communication-room layouts for ISP conduits; (See manhole / handhole AutoCAD butterfly exhibit).).

M. Spatial Data Deliverables

1. No action required

N. Special Instructions

1. See note regarding annotation above.

3.5 CABLE

A. Cable Types

1. Inside Plant Copper
2. Inside Plant Fiber (Single-Mode, Multi-Mode)
3. Outside Plant Copper
4. Outside Plant Fiber (Single-Mode, Multi-Mode)
5. Inside Plant Copper Coax
6. Outside Plant Copper Coax
7. Inside Plant Hybrid
8. Outside Plant Hybrid

B. Identification

1. Each Cable has been assigned a unique GIS database identifier. This identifier serves as a primary-key for each database record. Each record contains additional fields and values relative to the feature identified by the primary-key.
2. All cable identifiers follow a specific schema; new cable must be identified accordingly. In the event that a determination cannot be made regarding the identification of a cable-run, please contact an HAS IT GIS representative prior to documenting.
3. All cables are identified through a numerical range with prefix characters specific to a respective airport campus, technology asset designation, and feature-category.

    a. Airport Campus Characters:

        1) IAH: I
        2) HOU: H
        3) EFD: E

    b. Asset Designation Character:

        1) Technology: T

    c. Feature-Category Characters:

        1) Structure: S
        2) Pathway: P
        3) Equipment: E
        4) Cable: C

4. Numerical Range:

    a. 0000 – 9999

5. Example:

    a. ITC0054 (IAH Cable), HTC0054 (HOU Cable), ETC0054 (EFD Cable)

6. Note: When planning to identify newly constructed or newly placed HAS assets, the contractor is expected to coordinate with the HAS IT GIS staff prior to labeling. This action will account for all identifiers previously assigned and prevent duplications or omissions.

C. Labeling

1. Labels should be affixed to all connection ends of identified cable and on any visible length at key access points, i.e. manhole, handhole cable ladder runs.
2. "All adhesive inside/outside plant cable labels for horizontal and backbone cables shall be covered with clear heat shrink tubing"

D. Each cable requires that specific data be collected per unit. GPS equipment should be formatted to account for this information.

1. TELECOM_ID
2. LEGACY_ID
3. AIRPORT
4. AGENCY
5. CABLE_TYPE
6. CABLE_COUNT
7. FROM_TELECOM_ID
8. TO_TELECOM_ID
9. FROM_STRUCTURE_UNIT_ID
10. TO_STRUCTURE_UNIT_ID
11. FROM_EQUIPMENT_ID
12. TO_EQUIPMENT_ID
13. HAS_LEVEL
14. PROJECT
15. PROJECT_CLASS
16. COLLECTION_DATE
17. SYMANTEC_TICKET
18. COMMENTS
19. GPS

E. OSP – continuous GPS shot between identified structures

F. ISP – conventional GPS services are unavailable inside-plant; therefore inside-plant cabling will need to be digitized and included in the ArcGIS CABLE feature class spatial data deliverable.

G. Supporting Documentation Deliverables

H. ISP Horizontal cabling (see Exhibits – iPatch SOP.pdf).

I. Cable testing records; .pdf format (see Exhibits – C_Cable Test Exhibit, F_Cable Test Exhibit.pdf).

J. Butterfly diagrams (OSP) AutoCAD format; (See AutoCAD manhole / handhole butterfly exhibit).

K. Spatial Data Deliverables

1. The entire OSP cable inventory should be delivered separately in ArcGIS feature class (version 10.x) format along with any records outlined in the 'Supporting Documentation' paragraph. This feature class (CABLE) should contain the attribute values from the 'Required Fields' paragraph.
2. No Spatial Data required for ISP inventory.

L. Special Instructions

1. No cable testing should be conducted on any live circuit. Ensure that necessary precautions are observed to guarantee existing network integrity and no active circuits are impacted.

3.6 JUMPER CABLES / PATCH CORDS / CROSS-CONNECTS:

A. Identification

1. No action required

B. Labeling

1. No action required

C. Required Fields

1. Refer to iPatch SOP (see Exhibits - iPatch SOP.pdf)

D. GPS

1. No action required

E. Supporting Documentation Deliverables

1. ISP cabling (see Exhibits - iPatch SOP.pdf)

F. Spatial Data Deliverables

1. No action required

G. Special Instructions

1. No cable testing should be conducted on any live circuit. Ensure that necessary precautions are observed to guarantee existing network integrity and no active circuits are impacted.
2. As iPatch is the administration application for these assets - all project managers, inspectors and consultants overseeing 'new-build' infrastructure configurations must strictly adhere to guidelines specified in the iPatch SOP (see Exhibits - iPatch SOP.pdf). Further, you must contact an iPatch database administrator directly to coordinate the data collection and documentation-deliverable evolution.
3. Bulk import of key iPatch modeling components can be facilitated by utilization of a specifically formatted spreadsheet (see Exhibits - iPatch Bulk Import.xls).
4. Updates/changes to fiber patching can be facilitated by utilization of a specifically formatted cut-sheet (see Exhibits – Fiber Patching Cut Sheets.xls).

3.7 EQUIPMENT

A. Termination Point

1. Patch Panel
2. Network Switch
3. 110 Block
4. Splice Enclosure
5. Cable Transition
6. EFSO Button
7. Copper Modem
8. Tap
9. Camera

B. Identification

1. All Equipment has been assigned a unique GIS database identifier. This identifier serves as a primary-key for each database record. Each record contains additional fields and values relative to the feature identified by the primary-key.
2. All equipment identifiers follow a specific schema; new equipment must be identified accordingly. In the event that a determination cannot be made regarding the identification of a piece of equipment, please contact an HAS IT GIS representative prior to documenting.
3. All equipment is identified through a numerical range with prefix characters specific to a respective airport campus, technology asset designation, and feature-category.
4. Airport Campus Characters:

    a. IAH: I
    b. HOU: H
    c. EFD: E

5. Asset Designation Character:

    a. Technology: T

6. Feature-Category Characters:

    a. Structure: S
    b. Pathway: P
    c. Equipment: E
    d. Cable: C

7. Numerical Range:

    a. 0000 – 9999

8. Example:

    a. ITE0054 (IAH Equipment), HTE0054 (HOU Equipment), ETE0054 (EFD Equipment)

C. Labeling

1. Labeling should follow the identification schema and further be accomplished via the use of below specified labeling device or approved equivalent:

    a. DYMO rhinoPRO 5000 Industrial Label Maker
    b. ¾" Flexible Industrial Strength Nylon label tape – yellow

2. Labels should be affixed to the splice enclosure housing.
3. Label placement should be affixed to or as near to equipment as possible.

D. Required Fields

1. All equipment requires that specific data be collected per unit. GPS equipment should be formatted to account for this information.

    a. EQUIPMENT_ID
    b. TELECOM_ID
    c. SYMANTEC_TICKET
    d. CABLE_ID
    e. TELECOM_CABLE_ID
    f. LEGACY_CABLE_ID
    g. AIRPORT
    h. AGENCY
    i. PROJECT
    j. PROJECT_CLASS
    k. COLLECTION_DATE
    l. COMMENTS
    m. LEGACY_ID
    n. EQUIPMENT_TYPE
    o. HAS_LEVEL

E. GPS

1. No action required for ISP equipment
2. Each splice enclosure (OSP) should be recorded as follows:
3. Single shots; taken on-center. Offset shots or other means of location are acceptable for splice enclosures not available to satellite coverage but these shots or options must be coordinated with an HAS-IT GIS contact prior to.

F. Supporting Documentation Deliverables

1. AutoCAD – one-line diagram of ACCESSIBLE for splice enclosures depicting cable identifiers, connections and cable counts for each splice enclosure in both .dwg 2010 or higher and .pdf formats; (See AutoCAD splice enclosure exhibit).
2. AutoCAD – rackface layouts of structure units depicting orientation, and/or configurations in both .dwg 2010 or higher and .pdf formats; (See AutoCAD communications room exhibit).

G. Spatial Data Deliverables

1. The entire equipment inventory should be delivered separately in ArcGIS feature class (version 10.x) format along with any records outlined in the 'Supporting Documentation" paragraph. This feature class (EQUIPMENT) should contain the attribute values from the 'Required Fields' paragraph.

H. Special Instructions

1. Do not attempt to open a splice enclosure that appears to be in a fragile state or does not provide for ready access (sealed). Note in 'comments' field that the enclosure was inaccessible.
2. Do not move, adjust 'live' equipment in order to identify or label. Ask for assistance from qualified HAS Technology Infrastructure personnel.
3. Do not disconnect cabling in order to identify or label. Ask for assistance from qualified HAS Technology Infrastructure personnel.

3.8 OUTLETS

A. Identification

1. Each outlet-faceplate is identified specific to its servicing IDF; regardless of the number of outlets within a given location. All outlet-faceplate ports are labeled to correspond with the servicing IDF panel port. Note: These space identifiers are architectural identifiers, and are designated by reference to the HAS Infrastructure schema for identifying building spaces. This is not a GIS Technology Infrastructure database identifier.
2. Example Outlet-Faceplate Identifier:
   a. S103.1
      1) Translation: Outlet serviced by IDF S103.1
3. In the event that a determination cannot be made regarding the identity of the outlet, please contact the HAS IT GIS representative prior to documenting.
4. Note: When planning to identify newly constructed or newly placed HAS assets, the contractor is expected to coordinate with the HAS IT GIS staff prior to labeling. This action will account for all identifiers previously assigned and prevent duplications or omissions.

B. Labeling

1. Outlet label placement 2-port: under top-aligned, Plexiglas cover – servicing IDF identifier over port identifiers. Ports should be identified left-to-right.

2. Outlet label placement 3-port: under top-aligned, Plexiglas cover – servicing IDF identifier over port identifiers. Ports should be identified left-to-right. Under bottom-aligned, Plexiglas cover – servicing IDF identifier over port identifiers. Ports should be identified left-to-right.
3. Outlet label placement 4-port: under top-aligned, Plexiglas cover – servicing IDF identifier over port identifiers. Ports should be identified left-to-right. Under bottom-aligned, Plexiglas cover – servicing IDF identifier over port identifiers. Ports should be identified left-to-right. Follow 3-port example.

4. Outlet label placement 6-port: under top-aligned, Plexiglas cover – servicing IDF identifier over port identifiers. Ports should be identified left-to-right. Any mid-faceplate ports will require an adhesive label - servicing IDF identifier over port identifiers. Ports should be identified left-to-right. Under bottom-aligned, Plexiglas cover – servicing IDF identifier

over port identifiers. Ports should be identified left-to-right. These types of outlets are 'Non-Standard'.

C. Required Fields

1. No action required

D. GPS

1. OSP – No GPS action required
2. ISP – No GPS action required

E. Supporting Documentation Deliverables

1. Additional documentation records are required to support iPatch data. The documentation is as follows:
2. AutoCAD – floorplan (where applicable) depicting outlet locations; (See AutoCAD communications room exhibit).).

F. Spatial Data Deliverables

1. No action required

G. Special Instructions

1. Outlets are visibly marked with a reference tag indicating the outlet identifier. Additionally any port associated to the outlet is identified with a port number related specifically back to its respective servicing equipment. Newly placed outlets will require that their identifiers be affixed to the outlet face. Utilize specified labeling device to accomplish the task.

3.9 DOOR CONTACTS

A. Identification

1. Each door-contact sensor (without card-reader) is identified by an alpha-numeric sequence specific to its location. All door-contact identifiers are coded with building or complex character, followed by level character, followed by numerical sequence character, followed by 'CCM' designation. "CCM' is an acronym for 'Control Contact Monitoring.'
2. Example Outlet-Faceplate Identifier: B-2057CCM

a. Translation:

b.	B	(building/complex character)	Terminal B
c.	2	(level character)	Level 2
d.	057	(numerical sequence character)	Contact # 057
e.	CCM	(CCM designation)	Control Contact Monitoring

3. In the event that a determination cannot be made regarding the identity of a door contact, please contact the HAS IT Project Manager prior to documenting.
4. Note: When planning to identify newly constructed or newly placed HAS assets, the contractor is expected to coordinate with the HAS IT Project Manager prior to labeling.

This action will account for all identifiers previously assigned and prevent duplications or omissions.

B. Labeling

1. Door-contacts (without card-reader) require identifier plates per 'Special Instruction' specification below

C. Required Fields

1. TBD

D. GPS

1. OSP – No GPS action required
2. ISP – No GPS action required

E. Supporting Documentation Deliverables

1. AutoCAD floorplans indicating door contact location including label plate identifier annotation

F. Spatial Data Deliverables

1. No action required

G. Special Instructions

1. Install Black Lexan Label Plate: sized 1 ½" X 4", black background, white lettering and Door Alarm Identifier engraved (i.e. B-2057CCM). Locate plate on door frame above contact. Clean door frame prior to placement. Affix with 3M double-sided tape.
2. Provide paper and electronic copies (.pdf format) of all Electronic Lock Permits and Submittal Documents for any door requiring City of Houston door lock permit to the HAS IT Project Manager prior to Acceptance Testing.

3.10 CARD READERS

A. Identification

1. Each electronic lock is identified by an alpha-numeric sequence specific to its location. All electronic lock identifiers are coded with building or complex character, followed by level character, followed by numerical sequence character.
2. Example Outlet-Faceplate Identifier:C-1015
3. Translation:

a.	C	(building/complex character)	Terminal C
b.	1	(level character)	Level 1
c.	015	(numerical sequence character)	Lock # 015

4. In the event that a determination cannot be made regarding the identity of a door contact, please contact the HAS IT Project Manager prior to documenting.
5. Note: When planning to identify newly constructed or newly placed HAS assets, the contractor is expected to coordinate with the HAS IT Project Manager prior to labeling. This action will account for all identifiers previously assigned and prevent duplications or omissions.

B. Labeling

1. Electronic locks require identifier plates per 'Special Instruction' specification below

C. Required Fields

1. TBD

D. GPS

1. OSP – No GPS action required
2. ISP – No GPS action required

E. Supporting Documentation Deliverables

1. AutoCAD floorplans indicating card reader location including label plate identifier annotation

F. Spatial Data Deliverables

1. No action required

G. Special Instructions

1. Install Black Lexan Label Plate: sized approximately 3 ¼" X 5 ½", black background, white lettering and Card Reader Identifier engraved (i.e. C-1015). Affix plate to single-gang cabinet with 5/32" screws.
2. Provide paper and electronic copies (.pdf format) of all Electronic Lock Permits and Submittal Documents for any door requiring City of Houston door lock permit to the HAS IT Project Manager prior to Acceptance Testing.

3.11 CONNECTIONS

1. Ports

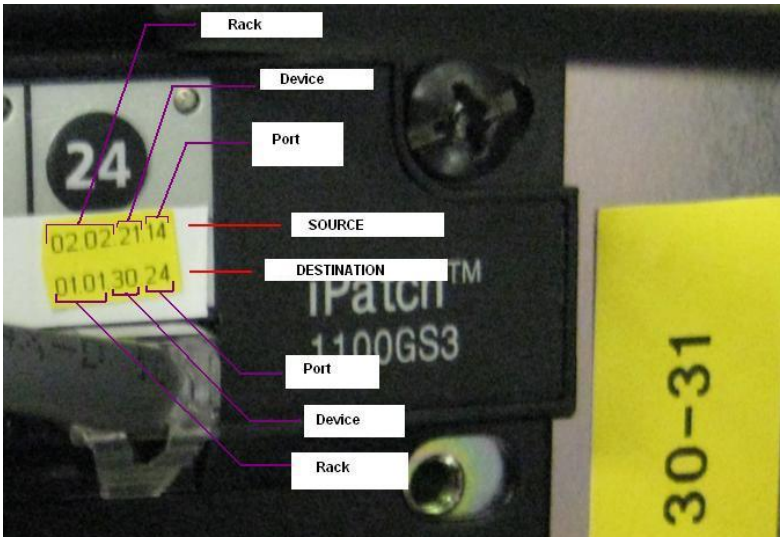
A. Identification

1. Each port has been assigned an identifier; combined with the equipment identifier, the sequence becomes unique. Therefore port identifiers may be replicated on separate pieces of equipment because again, the true and complete port ID is coupled to the equipment ID.
2. Example:

a. 100.20.01.02.35-39 (equipment ID) + FP03 = 100.20.01.02.35-39 FP03

b. 100.25.01.01.12-17 (equipment ID) + FP03 = 100.25.01.01.12-17 FP03

3. Fiber port 03 is replicated on two different pieces of equipment. Coupling it to the equipment ID makes the string unique
4. All ports are identified through a numerical range specific to its respective equipment. Ports may be prefixed with 'FP' (fiber port) or 'CP' (copper port) as is pertinent to the cable category and space allows on the equipment.
5. Regarding service outlets: ports are identified via reference to IDF and IDF equipment (see Outlet). This data should be recorded in the Excel data record tables.
6. Regarding termination panels: ports are identified according to equipment port capacity.
7. Regarding patch panels: ports are identified in sequence and may be prefixed with structure identifier references.
8. Regarding switches: ports are identified in sequence and may be prefixed according to cable compatibility; i.e. 'FP' or 'CP'. The port sequence should follow left-to-right and top-to-bottom.
9. Regarding devices housing multiple blades: ports are identified in sequence as related to respective blades and may be prefixed according to cable compatibility; i.e. 'FP' or 'CP'. The port sequence should follow left-to-right and top-to-bottom.
10. Regarding SYSTIMAX (iPatch) 'equipment panels': ports are identified with a source-over-destination, (panel-to-panel) schema and inclusive of rack/cabinet (structure-unit) identifiers.
11. Regarding SYSTIMAX (iPatch) 'service panels': ports are identified in sequence and may be prefixed with structure identifier references.



12. All port identifiers follow some specific schema; new ports must be identified accordingly. In the event that a determination cannot be made regarding the identity of the port, please contact the iPatch database administrator prior to documenting.
13. Note: When planning to identify newly constructed or newly placed HAS assets, the contractor is expected to coordinate with the HAS IT GIS staff prior to labeling. This action will account for all identifiers previously assigned and prevent duplications or omissions.

B. Labeling

1. Regarding switches: generally space does not allow for switch port labeling; ports must be identified however in order to correlate circuit connectivity to/from/through the device.
2. Labeling should follow the identification schema and further be accomplished via the use of below specified labeling device or approved equivalent:
3.
    a. DYMO rhinoPRO 5000 Industrial Label Maker
    b. ¾" Flexible Industrial Strength Nylon label tape – yellow

4. Labels should be affixed to applicable port locations. Not all ports allow for label placement but these ports should be identified and recorded as part of iPatch SOP; respective to cable or equipment.

C. Required Fields

1. Each port requires that its relationship be established between cable and equipment via use of the iPatch cut sheet (see Exhibits – iPatch SOP.pdf).

D. GPS

1. No action required

E. Supporting Documentation Deliverables

1. ISP cabling/port configurations (see Exhibits – iPatch SOP.pdf)

F. Spatial Data Deliverables

1. No action required

G. Special Instructions

1. Careful attention should be given to accurately accounting for and recording relationships established between ports – cable, and ports – equipment.

3.12 STANDARD OPERATING PROCEDURES – BEST PRACTICES

A. Data Collection Methodology

1. This section includes a general outline of procedures that can be utilized towards the collection and processing of HAS' IT physical data requirements. The outline establishes some of the recommended methods which have proven to be most successful during previous data collection cycles.
2. This guide does not mandate adherence to these methods provided that the contracting party can determine a like process to produce the intended results. Said process must

however provide for the specific formatting of all aforementioned physical data deliverables including data record tables, .DWF / .DWG, .PDF, feature class, feature class, and photo imagery.

3. Note: Safety is paramount and discussions with regard to OSHA and other regulatory or governing authorities including Airport Operations must be coordinated with the HAS IT representatives prior to commencement of any project scope.

A. Outside Plant

1. Identify outside plant network locations as defined by project scope of work including all structures, pathways, cable and equipment. This requires extensive communication and coordination with HAS airport campus authorities before and during the evolution. Contracting parties will be provided with respective contact information prior to commencement of data collection effort.
2. Coordinate with HAS IT representative to determine existing network identifiers and to specify any new network identifiers that must be incorporated into data deliverables.
3. If applicable to the GPS equipment that will be utilized to collect data, format custom projections to campus, format code-list.
4. GPS locate structures; ensure all attribute fields are populated. For MH, HH produce field sketch - butterfly layout depicting pathways unit counts orientation; cable types / counts, location. These field sketches should be used to create AutoCAD .DWF / .DWG deliverables.
5. Produce photo imagery
6. GPS locate all splice enclosures, slack loops.
7. Label all end-equipment, splice enclosures, slack loops, cable, pullboxes, cabinets, pedestals. Stamp all MH, HH per guidelines.
8. GPS locate pathways; ensure all attribute fields are populated.
9. Physically locate outside plant associated equipment; ensure all attribute fields are populated.
10. Building Access Points can be approximated where the PATHWAY intersects the building face for purposes of GPS data collection; single-shot.
11. GPS locate cable routing; ensure all attribute fields are populated including end-equipment identifiers.
12. QA/ QC to ensure that all data relationships have been established; i.e. equipment-structure, structure-pathways, pathways-cable and that all attribute fields have been populated.
13. Finalize, format deliverables

B. Inside Plant

1. Identify inside plant network locations as defined by project scope of work including all structures, cable and equipment. This requires extensive communication and coordination with HAS airport campus authorities before and during the evolution. Contracting parties will be provided with respective contact information prior to commencement of data collection effort.
2. Coordinate with iPatch database administrator to determine existing network identifiers and to specify any new network identifiers that must be incorporated into data deliverables.
3. Prepare field sketch (floorplan, rackface) of interior space and equipment. Document and dimension structure space and contents required to generate layouts for the floorplan, cable ladder, conduit, room details, and Install details. Rackface layouts should be created in a

separate document. These field sketches should be used to create AutoCAD .DWF / .DWG deliverables.

4. Label all structure units, cable and equipment per guidelines.
5. Record information specific to iPatch SOP for structure units, equipment, cable; this process will be covered in depth at the coordination meeting held prior to commencement of data collection effort. This information establishes infrastructure relationships that will be used to model the communications environment.
6. Test Cable.
7. QA/ QC to ensure that all data relationships have been established; i.e. structure – structure, structure – structure units, structure units – equipment, equipment – ports, ports – cable.
8. Finalize, format deliverables.

END OF SECTION 27 05 53.013

SPECIFICATION 27 11 00 - COMMUNICATIONS CABINETS AND EQUIPMENT ROOMS

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes the specifications for constructing and building out of Telecommunications Equipment Rooms (MDF/IDFs) to be used for supporting telecommunications and other special systems.

B. Upon completion of the installation, a third party field verification firm will independently verify the installation for compliance to the TIA/EIA-568 standard and/or additional requirements as stated in this specification. Contractor shall be responsible for fully rectifying all indicated faults by the third party field verification firm in accordance with the approved project schedule

1.2 RELATED SECTIONS:

A. Specification 27 05 53: Identification and Labeling of Communication Infrastructure
B. Specification 27 13 00: Backbone/Riser Media Infrastructure
C. Specification 27 15 00: Horizontal Media Infrastructure
D. Specification 27 05 43: External Communication Pathways
E. Specification 27 05 26: Telecommunications Grounding and Bonding

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean the latest printed edition of each in effect at the date of contract unless the document is shown dated.

C. Conflicts:

1. Between referenced requirements: Comply with the one establishing the more stringent requirements.
2. Between referenced requirements and contract documents: Comply with the one establishing the more stringent requirements.

D. Telecommunications Industry Association /Electronic Industries Association (TIA/EIA) 568-D - Commercial Building Telecommunications Wiring Standards.

E. TIA/EIA-569-B -Commercial Building Standard for Telecommunications Pathways and Spaces.

F. ANSI/TIA/EIA 607-B -Commercial Building Grounding and Bonding Requirements.

G. Underwriters Laboratories (UL®) Cable Certification and Follow Up Program.

H. National Electrical Manufacturers Association (NEMA).

I. National Electric Code (NEC®).

J. UL Testing Bulletin.

K. Houston Airport System Standards and Specifications

1.4 DEFINITIONS AND ABBREVIATIONS

A. Asynchronous Transfer Mode - ATM

B. American Wire Gauge – AWG

C. Computer Aided Drafting - CAD

D. Polyvinyl Chloride – PVC

E. Megabits per second - Mbps

F. Main Distribution Frame – MDF

G. Intermediate Distribution Frame - IDF

1.5 SUBMITTALS

A. Contractor shall submit the proposed layout for each communications room in the airport. This should be in accordance with the drawings in for a “typical” room layout and is required for every room.

B. The contractor will need to submit proposed layout and as-build drawings that depict the complete layout of each communications room prior to implementation. Drawings must be entered into the ECN process

C. Shop Drawings and Systems cutover schedules for all services to be submitted and approved before implementation is started. Shop Drawings to be submitted in accordance with Specification 01340.

D. Record Drawings: Furnish CAD drawings of all installed equipment within each communications room. All CAD work performed as part of the design effort shall be in compliance with the current City of Houston CAD standards as well as the U.S. National CAD Standard. This should apply to all CAD layering, symbols, etc.

E. Include spares list to be approved by HAS IT Project Manager for approval.

1.6 QUALITY CONTROL

A. Furnish, erect, install, connect, clean, adjust, test and condition all manufactured articles, materials, and equipment, and place in service in accordance with the manufacturer’s directions and recommendations except as otherwise indicated in the contract documents.

B. See Appendix A – MDF/IDF Readiness Checklist

C. See Appendix B – Typical Inspector Checklist

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. MDF space allocation shall be a minimum of 1000 sqft.

B. IDF space allocation shall be a minimum of 250 sqft.

C. The manufacturers and specific part numbers listed in this section are provided as an aid in the RFP process and are not meant to preclude other manufacturers that may be qualified to provide communications components. Other manufacturers with comparable qualifications may be proposed but shall be subject to review as an approved equivalent.

2.2 FREESTANDING VERTICAL EQUIPMENT CABINETS

A. Manufacturer: Chatsworth F Series Gen 3 cabinets or submitted and owner-approved equivalent.

B. General
1. The work covered here consists of the furnishing of all necessary labor, supervision, materials, accessories, parts, equipment, and services to provide and install a complete freestanding equipment cabinet.
2. The standard freestanding equipment cabinets are defined to include, but not limited to, cabinet frames, cabinet front and rear doors, top and side panels.
3. All internal cabinetry hardware shall be 19-inch rack mountable.
4. Provide and install freestanding vertical cabinets, with hinge placement as indicated in the Drawings.
5. Provide vertical and horizontal wire management for all cabinets
6. All cabinets once installed must have padlock eyes installed on front and back cabinet doors.
All Cabinets/Rack are to have a 24 port standard RJ45 patch panel installed with 12 ports cabled back to the Horizontal cable cabinet on a iPatch panel

C. Standard Network cabinet:
1. Cabinets shall be fully assembled by the manufacturer with the components listed below. Individual component part numbers provided for information only.
a. Chatsworth part # TS1023813 - 45RU ; 800mm W; 1075mm D; F Series Gen 3
1) 12-24 Tapped sliding rails / 2-pair
2) Single perforated metal front door with swing latch w/padlock feature
3) Double perforated metal rear door with swing latch w/padlock feature
4) Network / One-piece / 4 cable openings
5) Two solid two piece side panels
6) 6-slide
7) (4) Vertical Ring cable managers installed one on each corner (39087-E02)
8) (2) Full height PDU brackets installed one each left and right rear corners of cabinet (39086-E03)
9) Glacier white
b. All Network cabinets to have 24 iPatch panel installed. See Specification 271500
c. PDU Power Strips:
1) Core Switch Cabinet QTY (2) Chatsworth Vertical eConnect Monitored Pro PDUs (Part # P4-1F0C3) Input Nema L6-30P; Output (18) C13s and (6) C19s. And (1) Horizontal Metered Power Strip (Part # 13239-755) Input Nema 5-20P; Output (12) Nema 5-20R.

2) All other Cabinets QTY (2) Chatsworth Vertical eConnect Monitored Pro PDUs (Part # P4-1D0A5) L5-30P input; output (24) 5-20Rs.

2. Grounding Bus Bar:
   a. Provide Rack-Mounted Ground Bar. See Specification 270526

D. Co-location Cabinet – three compartment: Chatsworth Part #TS1034205 Rev B
1. Dimensions - 600MM W X 800MM D (650MM USEABLE DUE TO 150MM D CABLE RACEWAY)
2. Provide Rack-Mounted Ground Bar. See Specification 270526
3. 12-24 Tapped sliding rails / 2-pair
4. Single perforated metal front doors (with beam) per compartment
5. Single perforated metal rear door per compartment ; swing handle latches, with hasp lock
6. Standard top panel
7. Glacier white finish

E. Co-location Cabinet – two compartment: Chatsworth Part #TS1034203 Rev B
1. Dimensions - 750MM W X 800MM D (650MM USEABLE DUE TO 150MM D CABLE RACEWAY)
2. Provide Rack-Mounted Ground Bar. See Specification 270526
3. 12-24 Tapped sliding rails / 2-pair
4. Single perforated metal front doors (with beam) per compartment
5. Single perforated metal rear door per compartment ; swing handle latches, with hasp lock
6. Standard top panel
7. Glacier white finish

2.3 CBP WALL-MOUNTED FLOOR SUPPORTED EQUIPMENT CABINETS

A. Manufacturer: CUB-It cabinets or submitted and owner-approved equivalent.
1. Cabinets shall be fully assembled by the manufacturer with the components listed below. Individual component part numbers provided for information only.
   a. Chatsworth part # 13496-E72 - 40RU ; 693mm W; 760mm D; CUBE-iT
      1) 12-24 Tapped sliding rails / 2-pair
      2) Tempered glass front door with swing latch w/padlock feature
      3) Glacier white

2.4 WALL BACKBOARDS

A. All walls in telecommunication rooms (MDF/IDF's, Tenant etc.) will be covered with ¾ inch plywood installed in 4 x 8 sheets.

B. Plywood shall be A/C grade or better void-free with A grade side facing out.

C. Plywood shall be fire-rated and treated on all sides with at least 2 coats of fire-resistant light-colored paint. Do not paint the fire-rated stamp on the plywood, leave that area exposed.

D. Plywood to be installed 6 inches above finished floor or raised deck.

2.5 IDENTIFIERS, LABELS AND LABELING SYSTEM

A. All Identification and Labeling shall follow Specification: 270553–Identification and Labeling of Communication Infrastructure. **Any deviation from the specification must be approved by HAS IT prior to installation.**

2.6 Energy Efficient Lighting for IDFs

A. General
1. The work covered here consists of the furnishing of all necessary labor, supervision, materials, accessories, parts, equipment, and services to provide and install a complete lighting system.
2. Lights shall be LED and controlled by an occupancy sensor so lights are turned off when the room is not occupied.

2.7 Energy Efficient Lighting for MDFs Computer rooms

A. Manufacturer: Columbia Lighting or submitted and owner-approved equivalent.

B. General
1. The work covered here consists of the furnishing of all necessary labor, supervision, materials, accessories, parts, equipment, and services to provide and install a complete lighting system.
2. System must be cabled to the HAS network so it can be remotely managed.
3. System must be configured with installed occupancy sensors, to facilitate the lights being turned off when the room is not occupied.

C. Lighting System

1. Columbia Lighting (division of Hubbell Lighting) fixture RLA22.

2. At least one fixture must provide emergency lighting in case of a power outage.

3. All UTP cabling must follow section 271500 and all other HAS standards.

PART 3 – EXAMINATION

3.1 VERIFY FOR MINIMUM CRITERIA

A. Verify the following:

1. Minimum size of MDF is 1000 sqft.

2. Minimum size for IDF is 250 sqft.

3. HAS does not share MDF/IDF space with any other tenant and must be separated by a physical barrier be it a fence or wall. All tenants communication systems cabling and equipment shall be installed in the HAS controlled tenant space, as defined in the third item in this section. This shall apply to all tenants that do not have a dedicated MDF or IDF space for their individual telecommunications systems.

4. Conduit, raceways, and boxes are properly installed in accordance with BISCI recommended practices, ANSI/TIA/EIA 569B standards, and the City of Houston Intercontinental Airport Premises Distribution System Design Standards.
5. Conduit is minimum 1 -inch diameter.

6. Main grounding system is properly installed and tested.

7. The MDF is equipped with a smoke detector connected to the building alarm fire panel.

8. Portable fire extinguishers are provided and maintained within 75 feet travel distance from any part of the occupied space within the MDF per local code requirements. The size of the extinguisher shall be a minimum rating of 2-A:10-B:C

9. Ceiling protrusions have been placed to assure a minimum clear height of 8 feet 6 inches to provide space over the equipment frames for cables and suspended racks.

10. The doors are a minimum of 3 feet wide by 6 feet, 7 inches tall. If it is anticipated that large equipment will be delivered to the MDF, a double door 6 feet wide by 7 feet, 5 inches tall is recommended. The doors shall be keyed separately from other facility keys. Preferred method for keying communication room is badge access, limited to only IT personnel and related vendors. Doors shall open outward and be lockable. Access shall allow for future equipment changes. Door shall be fire rated for a minimum of one hour, or more as required by local code requirements.

11. Signage is consistent with Houston Airport System

12. The floor is sealed concrete or tile to minimize dust and static electricity. Carpet is strictly prohibited.

13. Floor loading capacity in the MDF is designed for a minimum distributed load rating of 100 lbf/ft^2 and a minimum concentrated load rating of at least 2000 lbf.

14. All HVAC systems that provide environmental conditioning (24 hours per day, 365 days per year) and UPS shall be connected to a motor generator for those cases of extend power outages.

15. The air handling system for MDF/IDF equipment rooms is designed to provide positive air flow and cooling even during times when the main building systems are shut down. This may require separate air handlers and/or small stand-alone cooling systems that are thermostatically controlled in this space.

16. Heating, ventilation, and air conditioning sensors and control equipment are located in the MDF/IDF.

17. The room temperature is between 64°F and 75°F, with a relative humidity between 30% and 55%.

18. Designer to provide heat load analysis for all equipment cabinets. Designer must use 100% name plate specifications to perform the heat load analysis. Note: Heat load with xx% diversity load factor is not recognized by HAS Technology.

19. The MDF/IDF is protected from contaminates and pollutants that could affect operation and material integrity of the installed equipment. When contaminates are present in concentrations greater than indicated in ANSI/TIA/EIA 569-A, Table 8.2-2, vapor barriers, positive room pressure or absolute filters shall be provided.

20. Positive air pressure differential is maintained with respect to surrounding areas.

21. Lighting to provide a minimum equivalent of 50 foot-candles when measured three feet above finished floor. The light fixtures shall be mounted a minimum of 8 feet, 6 inches above the finished floor. The light switches are located near the entrance of the MDF/IDF. Power for the lighting is from the same circuits as power for the telecommunications equipment. Emergency lighting has properly been placed that an absence of light will not hamper emergency exit. Lights must be energy efficient LED lights control by approved room lighting system utilizing UTP cabling.

22. The MDF/IDF cabinets are equipped with a minimum of two dedicated electrical circuits appropriately sized for equipment to be installed. Separate duplex 120V AC convenience outlets (for tools, test sets, etc.) shall also be installed at 18 inches above the finished floor at 6-foot intervals around perimeter walls. The outlets shall be on non-switched circuits and they shall be identified and labeled.

23. The MDF/IDF is provided with an electrical ground on a 4-inch or larger busbar as defined by NEC Article 250-71(b). The busbar shall be mounted 6 feet, 6 inches above the finished floor if ladder racking is included in the design. If ladder racking is not part of the design, the busbar shall be located near, but not behind, the riser sleeves between floors. This grounding bar is connected to a main building ground electrode, reference ANSI/EIA/TIA-607. (Refer to Specification 270526)

24. Connection between the MDF and IDF will be connected with both unshielded twisted pair Category 6 cable, when distance is less than 90 meters and fiber optics cable if the distance is beyond 90 meters. Fiber optics cable should include single-mode and multi-mode. The type of cable, actual count and termination of the fiber will be determined at the planning stage, taking into consideration the amount of network traffic between closets, the distance between the communications rooms and the difficulty of running other cables at future dates.

25. The MDF/IDF is equipped with a single Room wide Eaton Uninterruptible Power Supply that supports all active electronics for a minimum of 30 minutes. Eaton UPS will be connected to an emergency power such as motor generators for those cases of extend power outages. Designer to size for 50% growth.

26. All walls of MDF/IDF are lined with Trade Size 3/4-inch AC-grade plywood, 8 feet high. Plywood will be mounted vertically starting 6 inches above finished floor and shall be securely fastened to the wall-framing members. Plywood to be fire treated and painted with two coats fire-retardant paint. Do not paint the fire-rated stamp on the plywood, leave that area exposed.

27. Additional equipment such as fire alarm panels and/or building monitoring devices are not be housed in the MDF/IDF. Separate space for these services can be provided as part of the electrical room or in a separate space.

28. These rooms shall be on separate fire protection loops, and a “dry” fire protection system such as FM-200 or Inergen for MDF and preaction for IDF’s shall be used. However, an acceptable alternative for intermediate special systems rooms is a “dry” pipe sprinkler system, or no fire protection if enclosed by fire rated walls.

29. Access to the MDF/IDF shall be directly from hallways, not through offices, janitorial or mechanical rooms.

30. The MDF/IDF is located as close as possible to the center of the area served and preferably in the core area.

31. The MDF/IDF is located in any place that may not be subject to water or steam infiltration, humidity from nearby water or stream, heat, and any other corrosive atmospheric or environmental conditions.

32. The MDF/IDF is not located near electrical power supply transformers, motors, generators, x-ray equipment, radio transmitters, induction heating devices, and other potential sources of electromagnetic interference.

33. The MDF/IDF does not share space in or be located near or below electrical closets, boiler rooms, washrooms, janitorial closets, and storage rooms.

34. All new BDF, MDF, and/or Computer room spaces shall use Panduit fiber runner pathway to manage fiber optic patch cords between cabinets.

35. If any of these items are not provided, contact the HAS/IT representative.

3.02 INSTALLATION

A. Install work following drawings, manufacturer's instructions, and approved submittal data.

B. All installation shall be done in conformance with TIA/EIA 569B and BICSI installation guidelines. Failure to follow the appropriate guidelines will require the Contractor to provide, in a timely fashion, the additional material and labor necessary to properly rectify the situation.

C. The contractor shall adhere to the installation schedule of the general contractor and should attend all construction meetings scheduled by the general contractor.

D. As a general practice for rack mounted equipment, the contractor shall run power cables, control cables, and high-level cables on the left side of an equipment rack as viewed from the rear. The contractor shall run other cables on the right side of an equipment rack as viewed from the rear. For equipment mounted in drawers or on slides, provide the interconnecting cables with a service loop of not less than three feet and ensure that the cable is long enough to allow full extension of drawer or slide.

E. All racks and cabinets shall be floor mountable by design and permanently fixed to the floor with bolt-down kits. Manufacturer's procedures for floor mounting should be followed. Multiple racks and cabinets shall be connected together directly or indirectly via horizontal cable management hardware as indicated by drawings.

F. A minimum of 2 feet shall be left at the end of the row of equipment bays. A minimum of 5 feet between walls and equipment bays will allow space for wall mounted copper cable terminations and the required 36" distance from equipment for work space.

3.3 CONTRACTOR'S FIELD QUALITY CONTROL

A. The contractor shall be responsible for performing field inspections to ensure that all communications are installed in accordance with the contract drawings, specifications, and City of Houston requirements prior to the performance of field inspections by the City.

B. Should there be any discrepancies or a question of intent, refer the matter to the City for a decision before ordering any equipment, materials or before starting any related work.

C. The City shall perform field inspections and note all discrepancies that must be corrected prior to system acceptance.

END OF SECTION – 27 11 00

Appendix A

This list below is intended as a minimum checklist. CM should ensure that the contractor's schedule has built in these components and the necessary buffer period – and associated access restrictions to the communications equipment rooms -- for HAS IT and tenant IT to prepare.1. All communication rooms that will service the area to be opened must be completed. That means a final walkthrough of these areas has been completed. It is not necessary that the entire project achieve substantial completion, but IT cannot install equipment and begin work until the following minimum criteria is met:

a. Space is built out and clean – free from dust/residues.
b. Electrical w/UPS as required.
c. All racks/cabinets installed and mounted. Padlocks eyes have been installed.
d. Grounding bus bar installed and properly tied to main grounding bus bar in MDF
e. HVAC functioning properly and is adequately filtering dust. Humidity is controlled.
f. Door access control is installed (card reader) -or- an approved temporary provision. Card reader access with a blank core installed in all MDF/BDF/IDF doors.
g. Lighting is installed and operational.
h. Cable trays/ladder racks installed and ready to use.
i. Permanent or temporary signage identifying permanent room number.

2. All cabling necessary to operate the areas to be opened is completed.

a. Backbone cabling (copper and fiber) from the applicable communication room(s) is installed, tested, labeled, and approved by the inspector and communications design consultant.
b. Horizontal cabling for all areas to be occupied is installed, tested, labeled, and approved by the inspector and communications design consultant.
c. Copper cross connects and/or fiber jumpers have been installed per the owner/tenant requirements.
d. Cable records and redline drawings for installed cables are submitted and approved PRIOR to putting any active circuits on the new cables. Cable records reflect all installed cables **and** any cross connects or jumper assignments installed by the contractor.
e. All iPatch Panels are programmed and operational.
f. All jumpers and patch cords specified by the contract are transmitted to the owner for use.
g. NOTE: cable labels and permanent room numbers need to match. CM needs to be sure to get design team, airport, IT, and CM / contractor reps together to review permanent room numbers prior to contractor installing cable labels.

3. Move-in buffer period needs to be minimum 6 **weeks** for HAS-IT to install/extend services within the area to be occupied prior to occupation of the facility or spaces. Additional time may be necessary if Tenant IT organization is involved, or if contractor has other systems that must be configured/tested which require HAS-IT resources (i.e. cabling or data network connections). This is frequently the case for PA System, television, radio, Fire Alarm, pay telephone, EFSO (Electronic Fuel Shutoff), access control & CCTV, etc.

4. Once HAS-IT accepts a communications equipment room and begins to install/configure equipment in preparation for hosting live applications, this room becomes a restricted area with access to be controlled by HAS-IT. Contractors must be substantially complete with systems <u>inside</u> the communications equipment room so that access is generally not required. Minor punch list and scheduled testing with escort can be arranged, but access will be very limited.

5. Other IT-related systems that must be operational, tested, and accepted or approved temporary provisions.
    a. PA System
    b. MATV and/or CNN TV (where applicable)
    c. Fire Alarm
    d. MUFIDS
    e. Pay Telephones (where applicable)
    f. EFSO (where applicable)
    g. Access Control & CCTV (note: must be PROGRAMMED, and approved acceptance test walk through by HAS)
    h. Crash phone (where applicable)
    i. Radio system enhancements (where applicable)
    j. Data Network switch installed and configured.

Appendix B

IDF Number:		Date:		
Grounding & Bonding:		**YES**	**NO**	**COMMENTS**
	TGB properly installed			
	Proper grounding conductor installed (6AWG min.)			
	Cable trays properly bonded			
	Equipment Racks, Armored Cables & Cabinets properly bonded			
	Conduit properly bonded			
	Cabling properly bonded			
	Splice Cases properly bonded			
Horizontal Cabling:		**YES**	**NO**	**COMMENTS**
	Routing			
	Cables properly supported			
	Pull tensions properly recorded			
	Sheath damage			
	Bend radius observed			
	Pair twist meets spec			
	Proper termination scheme			
	Cable/jack part number meets spec			
	Plenum vs. PVC			
	Properly dressed in tray			
	Properly dressed in cable management			
	Cables bundled properly			
	Appropriate clearances observed (power)			
	Minimum about of cable exposed at termination			
Backbone Cabling:		**YES**	**NO**	**COMMENTS**
	Fiber strain relief properly applied			

	Routing			
	Cables properly supported			
	Pull tensions properly recorded			
	Sheath damage			
	Bend radius observed			
	Properly dressed in tray			
	Fiber installed in inner duct			
	Properly dressed in termination shelf			
	Any splice cases properly supported			
Room Layout:		**YES**	**NO**	**COMMENTS**
	Room laid out according to project drawings			
	Proper clearances maintained			
	Is the room clean & neat in appearance			
	Liquid carrying pipes within the room			
Pathways:		**YES**	**NO**	**COMMENTS**
	Conduit properly routed & supported			
	Cable Tray properly routed & supported			
	Inner Duct used to route fiber and properly supported			
Labeling:		**YES**	**NO**	**COMMENTS**
	Grounding conductor			
	End-to-End labeling			
	Pair Count on Splice Case			
	Horizontal Cabling			
	Fiber Optic Cabling			
Other:		**YES**	**NO**	**COMMENTS**
	Appropriate fire stop material in place			
	Cabling test results submitted with proper information			
	Climate controlled environment (Temp. &			

	Humidity)			
	Is the room access controlled			
Copper Cabling:				
	Total Pairs (Riser)			
	Pair Counts			
	Termination Type (66, 110, Protectors..)			
	Termination Location			
Fiber Optic Cabling:				
Multimode:				
	Total Strands			
	Termination Type (LC, SC)			
	Termination Location			
Single Mode				
	Total Strands			
	Termination Type (LC, SC)			
	Termination Location			

End of Appendix

SECTION 27 13 00 - BACKBONE AND RISER MEDIA INFRASTRUCTURE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide a Structured Cabling System (SCS) for the purpose of supporting voice, data and video communications at various locations within the Houston Airport System. The Houston Airport System (HAS) has established SYSTIMAX as the standard for cabling infrastructure installations.

1.2 SECTIONS INCLUDES

A. This section includes specifications for the installation of backbone and riser media infrastructure.

B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification sections, apply to the work of this section.

C. Backbone and Riser Media Infrastructure includes but not limited to copper, fiber cable types, connectors, testing requirements, accessories and associated hardware.

1.3 REFERENCES

A. Related Sections: Use these Specifications for all related work not specifically covered in this specification:

1. Section 27 05 26: Telecommunication Grounding and Bonding
2. Section 27 05 43: Exterior Communication Pathways
3. Section 27 05 53: Identification and Labeling of Communication Infrastructure
4. Section 27 11 00: Communication Cabinets and Equipment Rooms
5. Section 27 15 00: Horizontal Media Infrastructure
6. Section 28 13 00: Access Control System
7. Section 28 23 00: Video Surveillance Control and Management System

B. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only.

C. Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean the latest printed edition of each in effect two weeks prior to the date of the Bidding Documents unless the document is shown dated.

D. Conflicts.

1. Between referenced requirements: Comply with the one establishing the more stringent requirements.
2. Between referenced requirements and contract documents: Comply with the one establishing the more stringent requirements.

E. References.

3. ANSI/TIA/EIA-568-D, Commercial Building Telecommunications Wiring Standards

4. ANSI/TIA/EIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces
5. ANSI/TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
6. International Standards Organization/International Electromechanical Commission (ISO/IEC) DIS11801, January 6, 1994
7. Underwriters Laboratories (UL®) Cable Certification and Follow Up Program
8. National Electrical Manufacturers Association (NEMA)
9. American Society for Testing Materials (ASTM)
10. National Electric Code (NEC®) Latest issue
11. National Electrical Safety Code (NESC) Latest issue
12. Institute of Electrical and Electronic Engineers (IEEE)
13. UL Testing Bulletin
14. American National Standards Institute (ANSI) X3T9.5 Requirements for UTP at 100 Mbps
15. SYSTIMAX Structured Cabling Systems, Performance Specifications, Latest Issue
16. SYSTIMAX Structured Cabling Systems, Components Guide, Latest Issue
17. SYSTIMAX Generic Specifications: Fiber Optic Outside Plant Cable, Latest Issue
18. BICSI Telecommunications Distribution Methods Manual (TDMM) Latest issue
19. Rural Utilities Service (RUS) Section 1755

F. All splicing methods, procedures and products shall comply with the following:

20. Rural Utilities Service (RUS) Section 1755
21. National Electrical Safety Code (NESC) Latest issue
22. National Electrical Code (NEC) Latest issue
23. Fiber closures: GR-771-Core
24. Copper splice cases: Bellcore Testing Requirement PUB-55003 (Pressure Tight Splice Closure)
25. UL 1863 classified
26. Applicable local codes, statutes, ordinances, regulations, license requirements.

1.4 SUBMITTALS

A. Qualifications: Demonstrate compliance with requirements of Paragraph 1.05A below.

B. Manufacturers' data, including part numbers, cut sheets and detailed descriptions, for all proposed equipment.to include quantity of spare parts.

C. Cable inventory data shall be submitted for all fiber, copper, and coaxial cabling and termination equipment. Reference Specification 270553 for the Inside and Outside plant spread sheets. Information shall be provided on a CD.

D. Shop Drawings shall be submitted and approved before implementation is started. Shop Drawings to be submitted in accordance with Specification 01340.

E. Record Drawings: Furnish CAD drawings, following format in Section 01340, of completed work including cable numbers. Refer to Specification 270553 for labeling conventions. Contractor's on-site Building Industry Consulting Services International (BICSI) Registered Communications Distribution Designer (RCDD) supervisor shall review, approve and stamp all shop drawings, coordination drawings and record drawings.

F. Include spares list to be approved by HAS IT Project Manager for approval.

G. Cable Testing Reports.
1. Submit Testing Plan prior to beginning cable testing.
2. Submit certified test reports of Contractor-performed tests in accordance with paragraph 3.04. of this document.
3. Electronic versions of the original raw data files and PDF versions of the test reports shall be submitted together and clearly identified with cable identification, reviewed and stamped by the Contractor's on-site RCDD.
4. Test reports shall be reviewed, approved and stamped by the Contractor's on-site RCDD.

H. Product data for all termination and test equipment to be used by Contractor to perform work.
1. Equipment shall be calibrated with traceability to National Institute of Standards and Technology (NIST) requirements.
2. Contractor shall include copy of calibration and certification that equipment calibration meets NIST standards and has been calibrated at least once in the previous calendar year.
3. Test equipment data shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submitting.
4. Refer to 3.04. in this document for test equipment requirements.

I. Submit Technology Implementation Plan in accordance with 1.07 below.

J. Submit Cable Pulling Plan, as follows:
1. Indicate the installed backbone conduit layout in schematic format, including junction boxes and distances between junction boxes.
2. Indicate contents of each conduit.
3. Indicate the cable pulling calculations, conduit fill ratios and actual cable runs and tensions.
4. Cable Pulling Plan shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submittal.
5. Installation of cabling shall not commence prior to approval of the pulling plan and calculations by the Architect/Engineer.

K. Submit installation plan indicating:
1. Equipment and personnel
2. Materials and staging area
3. Start and completion dates
4. Locations, including floor, room and building
5. Installation plan shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submitting.

L. Cable Splicing Submittals
1. Submit fiber fusion splicing method and procedures.
2. Submit schedules of copper and fiber cables to be spliced.
3. Submit copper splicing method and procedures.
4. Submit certification documents for all splicing personnel.
5. Submit cut sheets, showing accurately scaled components, of fiber and copper splice closures, accessories, clamps, brackets, hangers, splice connectors, splice joint assemblies and fittings,
6. Submit manufacturer's data on fiber and copper splice closures including, but not limited to types, materials, finishes, and inside and outside dimensions (cross-sectional properties).

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

C. Maintain temperature of between 64 degrees Fahrenheit and 75 degrees Fahrenheit and between 30 and 55 percent humidity in areas of active electronic system work.

1.6 QUALITY CONTROL

A. Submit written proof that the following experience requirements are being met.
   1. Contractor Qualifications
      a. The contractor shall be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.
      b. Must be supervised on-site by a BICSI RCDD. Must demonstrate knowledge and compliance with all BICSI, TIA/EIA, UL, and NEC methods, standards and codes.
      c. All members of the installation team shall be certified by the manufacturer as having completed the necessary training to complete their part of the installation. Resumes of the entire team shall be provided along with documentation of completed training courses.
      d. The contractor shall provide five references for projects of equivalent scope, type and complexity of work completed within the last five years.
      e. The contractor who is installing the cabling infrastructure shall be a certified and currently registered Commscope/SYSTIMAX Elite Partner capable of issuing a numbered registration certificate for the entire cable system.
      f. The contractor who is installing the cabling infrastructure shall have the following SYSTIMAX iPatch/imVision certifications:
         SP/ND3321 - SYSTIMAX SCS Design & Engineering
         SP/ND3351 - SYSTIMAX MasterClass
         SP/ND3361 - SYSTIMAX SCS Installation and Maintenance
      g. Cable splicing personnel shall have a minimum of five years splicing experience and shall have completed a minimum of five major splicing projects.
   2. Copper cable splicing personnel/technician requirements:
      a. All copper splicing personnel/technicians shall have a minimum of 900 pair in one project splicing experience.
      b. All copper splicing personnel/technicians shall have outside plant (OSP) and inside plant splicing experience.
      c. All copper splicing personnel/technicians shall be familiar with and shall have installed SYSTIMAX splicing modules.
      d. All copper splicing personnel/technicians shall have installed in-line and butt splicing configurations.
      e. All copper splicing personnel/technicians shall have installed OSP, underground, direct buried, aerial, pedestal, and vault splice closures.
   3. Fiber splicing personnel/technicians requirements:
      a. All fiber spicing personnel/technicians shall have a minimum of 144 fibers in one project splicing experience.
      b. All fiber spicing personnel/technicians shall have OSP and inside plant splicing experience.

c. All fiber spicing personnel/technicians shall be familiar and have installed fusion, rotary and mechanical splicing modules.
d. All fiber spicing personnel/technicians shall be familiar and have installed mass fusion splice trays.
e. All fiber spicing personnel/technicians shall be familiar and have installed ribbon fusion and mass fusion splicing.
f. All fiber spicing personnel/technicians shall have installed in-line and butt splicing configurations.
g. All fiber spicing personnel/technicians shall have installed OSP, underground, direct buried, aerial, pedestal, and vault splice closures.

4. Console installers shall be certified by console manufacturer and experienced in the installation of systems of similar complexity.
5. Manufacturer's hardware experience: All components shall be produced by manufacturers who have been regularly engaged in the production of telecommunications cabling components of the types to be installed in this project for a period of five years.

B. Materials and equipment: Equipment shall be rated for continuous operation under the ambient environmental temperature, humidity, and vibration conditions encountered at the installed location. The equipment shall meet the following requirements:
1. Interior controlled environment: 60 to 100 degrees F dry bulb and 20 to 90 percent relative humidity, non-condensing.
2. Interior uncontrolled environment: 0 to 130 degrees F dry bulb and 10 to 95 percent relative humidity, non-condensing.
3. Exterior environments: Minus 30 degrees to 130 degrees F dry bulb, and 10 to 100 percent relative humidity, condensing.
4. Hazardous environment: All system components located in areas where fire or explosion hazards may exist because of flammable gas or vapors, flammable liquids, combustible dust, or ignitable fibers or flying's, shall be rated and installed according to Chapter 5 of the NFPA 70 and as shown.

C. Standard products:
1. Equipment and materials shall be standard products of a manufacturer regularly engaged in the manufacture of telecommunications cabling products and shall be the manufacturer's latest standard design in satisfactory use for at least one year prior to bid opening.
2. Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.

1.7 CONTRACTOR'S DUTIES

A. Contractor's RCDD shall provide all calculations and analysis to support design and engineering decisions as specified in the Submittals section.

B. Provide and pay for all labor, supervision, tools, equipment, test equipment, tests and services/programming to provide and install a complete inside and outside plant fiber and copper infrastructure system. Pay all required sales, gross receipts, and other taxes.

C. Secure and pay for plan check fees, permits, fees, and licenses necessary for the execution of Work as applicable for the project.

D. Give required notices.

E. Comply with all codes, ordinances, regulations, and other legal requirements of public authorities that bear on performance of Work.

1.8 PROCUREMENT

A. Procure equipment specified in this document as dictated by the timeline in Appendix A "Technology Implementation Schedule" in order to ensure that the technology is acquired in a timely fashion, but not outdated by the installation date.

B. Submit a copy of Appendix A "Technology Implementation Schedule" as a part of the equipment submittals required elsewhere in this document. Complete the columns headed "Quantity", "Purchasing Lead Time", "Start Date or Dependent", and "Installation Duration".

C. The "Procurement Lead Time" shall be expressed in days or weeks, and shall include time required for the contractor's personnel to order and receive the material. Substantiation may be required.

D. "Start Date or Dependent" and "Installation Duration" should be an accurate estimate based upon known facts in the project. Substantiation may be required.

E. The Contractor shall not purchase any materials requiring submittals until the owner approves the product submittal and the Technology Implementation Schedule for that material.

F. The Contractor shall not purchase any materials requiring submittals until 6 months prior to installation date is established by the owner as the Purchasing Authorized Date. The Purchasing Authorized Date will be reflected in the "Purch Auth" column of Appendix A as a part of the Submittal Review process.

1.9 MAINTENANCE AND SUPPORT

A. System Assurance: The System Assurance shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that use the ANSI/TIA/EIA 568B or ISO/IEC IS 11801 component and link/channel specifications for cabling, for a twenty-year period.

B. System Certification: Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a numbered certificate, from the manufacturing company, registering the installation.

C. Support Availability: The Contractor shall commit to make available local support for the product and system during the Warranty period.

1.10 EXTENDED WARRANTY

A. The Extended Product Warranty shall meet all manufactures specification to ensure against product defects, that all approved cabling components exceed the specifications of ANSI/TIA/EIA 568B and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of ANSI/TIA/EIA 568B and ISO/IEC IS 11801 for cabling links/channels, that the installation will exceed the loss and bandwidth requirements of ANSI/TIA/EIA 568B and ISO/IEC IS 11801 for fiber links/channels, for a twenty year period. The warranty shall apply to all passive SCS components.

B. The Extended Product Warranty and the System Assurance shall cover the replacement or repair of defective products and labor for the replacement or repair of such defective products.

1.11 DELIVERY AND STORAGE

A. Equipment shall be delivered in original packages with labels intact and identification clearly marked.

B. Equipment shall not be damaged in any way and shall comply with manufacturer's operating specifications.

C. All products shall be purchased not more than 6 months prior to installation.

D. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. Equipment damaged prior to system acceptance shall be replaced at no cost to the City.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to SYSTIMAX SCS and other manufacturers as referenced in this document. However, substitutions for SYSTIMAX products are not permitted.

2.2 GENERAL

A. Provide all cabling, terminating hardware, adapters, and cross-connecting hardware necessary to interconnect all system equipment including equipment located in the Main Distribution Facility (MDF) and the Intermediate Distribution Facilities (IDFs).

B. All Fiber terminations/connectors shall be pigtail fusion splice.

2.3 FIBER OPTIC CABLE GENERAL REQUIREMENTS

A. SYSTIMAX SCS TeraSPEED Singlemode or LazrSPEED 550 50μ Multimode as required.

B. Fiber optic cable shall be certified to meet all parts of EIA-455 and comply with the NEC.
   1. Cable installed in plenums or air-handling spaces shall meet UL 910 and shall be marked OFNP (optical fiber non-conductive plenum) in accordance with the NEC.
   2. Riser cable shall meet UL 1666 and be marked OFNR (optical fiber non-conductive riser) in accordance with the NEC.

C. All fiber optic cable shall utilize the appropriate sheath for the particular application. This shall be in accordance with ANSI/EIA/TIA 568-B standards. Any cable placed in space used as an air return or in any way connected with air handling plenums or building ventilation shall be low-smoke, fire retarding cable, and shall comply with the National Electrical Code Articles 725, 760, and 800. No cabling shall be placed in plenums without written approval from HAS.

D. Outside Plant Fiber Cables.
   1. Stranded loose tube dielectric or armored dry core fiber optic cable shall be utilized for underground conduit, direct buried or aerial applications.

E. Building Fiber Cables.

1. Non-plenum, riser rated cable consisting of multiple fibers, shall have a black, Polyvinyl Chloride (PVC) outer jacket. The cable shall be UL listed and meet the NEC requirements for OFNR.
2. Plenum Fiber rated cable consisting of multiple fibers shall have a Plenum PVC outer jacket. Each group of fibers shall have a color-coded Low Smoke PVC buffer. TeraSPEED shall be yellow and LazrSPEED 550 shall be Aqua. The cable and each subunit shall be UL listed and meet the NEC requirements for OFNP.

F. Preparation for delivery: The fiber optic cable shall be shipped on reels in lengths as specified with a minimum overage of 10 percent.
1. The cable shall be wound on the reel so that unwinding can be done without kinking the cable.
2. Two meters of cable at both ends of the cable shall be accessible for testing.
3. Marking: Each reel shall have a permanent label attached showing length, cable identification number, cable size, cable type, attenuation, bandwidth, and date of manufacture. Labels shall be water resistant and the writing on the labels shall be indelible.
4. Storage: The cable shall have a minimum storage temperature range of minus 40 C to plus 70 C.

G. Unless otherwise specified, all fiber cables not installed in conduit shall be armored cable.

2.4 MULTIMODE FIBER OPTIC CABLE SPECIFICATIONS

A. Manufacturer: SYSTIMAX SCS – LazrSPEED 550 Multimode 50μ Cable.
1. Outdoor Cables: SYSTIMAX Multimode, Stranded Loose Tube Dielectric or Armored Dry core LazrSPEED 550 Outdoor Cable designed for underground conduit, direct buried or aerial applications consisting of multiple multimode 50/125μ fibers.
2. Building Cables: Multimode/non-plenum, SYSTIMAX LazrSPEED 550 Backbone/Riser Rated Cable, consisting of multiple multimode 50/125μ fibers with a PVC outer jacket.
3. Building Cables: Multimode/plenum, SYSTIMAX LazrSPEED 550 Backbone/plenum Rated Cable, consisting of multiple multimode 50/125 μfibers and an Aqua, PVC outer jacket.

2.5 SINGLE MODE FIBER OPTIC CABLE SPECIFICATIONS

A. Manufacturer: SYSTIMAX SCS – TeraSPEED Singlemode cable
1. Outdoor Cables: SYSTIMAX Singlemode, Stranded Loose Tube Dielectric or Armored Dry Core Outdoor Cable designed for underground conduit, direct buried or aerial applications.
2. Building Cables: Singlemode/Non-plenum: TeraSPEED Backbone/Riser Rated Cable consisting of multiple singlemode fibers with a PVC outer jacket.
3. Building Cables: Singlemode/plenum, SYSTIMAX TeraSPEED Backbone/plenum Rated Cable, consisting of multiple singlemode fibers and a yellow, PVC outer jacket.

2.6 FIBER HARDWARE TERMINATION STANDARDS - Real Time Infrastructure Management - Intelligent Fiber Patch Panel

A. SYSTIMAX Solution iPatch Intelligent Fiber Optic Patching System as follows:
1. When install make sure cabinet rails are move back from front door.
2. Make sure there is vertical and horizontal management for the fiber.

Product Number	**Description**
Fiber Shelves (19 inch rack-mountable) and accessories	
760209940	HD-1U
760109470	12-LC-LS-AQ-Pigtails
760109488	12-LC-MM-BG-Pigtails
760109496	12-LC-SM-BL-Pigtails
Product Number	**Description**
760109504	12-LCA-SM-GR-Pigtails
Copper Patch Panels - Cat 6	
760152355	360-iP-1100-E-GS3-1U-24 - 360 iPatch/imVision(enabled) 24 port panel
760152561	360-IPR-1100-E-GS3-1U-24 - 360 iPatch/imVision(ready) 24 port panel
760152579	360-IPR-1100-E-GS3-2U-48 - 360 iPatch/imVision(ready) 48 port panel
Copper Patch Panels - Cat 6A	
760152363	360-iP-1100-E-GS6-1U-24 - 360 iPatch/imVision(enabled) 24 port panel
760152348	360-iP-1100-E-GS6-2U-48 - 360 iPatch/imVision(enabled) 48 port panel
760152587	360-IPR-1100E-GS6-1U-24 – 360 iPatch/imVision (ready) 24 port panel
760152595	360-IPR-1100E-GS6-2U-48 – 360 iPatch/imVision (ready) 48 port panel

2.7 FIBER PATCH CORDS

A. Manufacturer: SYSTIMAX Solutions ONLY

B. The fiber patch cord shall consist of buffered, graded index fiber with a 50 micron core and a 125μ micron cladding for multimode with an Aqua Jacket and a stepped-index 8.3 micron core with a 125μ micron cladding for single mode with a Yellow Jacket. The fiber cladding shall be covered by aramid yarn and a jacket of flame retardant PVC.

C. Singlemode and Multimode Fiber Patch Cord

1. Single mode and Multimode Fiber Patch Cord Part Numbers:

Singlemode, 8.3μ Micron, Duplex, LC to LC, LC to SC and LC/APC to LC/APC	
P7AQ2L9PBB-0000-M3	LC/APC to LC/APC
FDWLCLC42-JXFxxx	OS2 LC to LC (xxx length designator)

D. Patch Cord Quantity. Patch cord spares shall be provided to match fiber strand assignment as shown in the fiber cable schedules in the Drawings. Patch cords shall be various lengths to include but not limited to 3mm, 6mm, 10mm etc.

E. LC type connectors are HAS standard for all patch panel installations. The last 12 strands on each fiber segment will have LC/APC to LC/APC pigtails installed.
   1. When there is a requirement to transmit MATV service over the fiber infrastructure APC type pigtails must be used at. Design must specify APC type fiber jumpers as well. Patch cords shall be various lengths to include but not limited to 3m, 6m, 10m etc. Singlemode LC angled pigtail 12 fiber kit FAWLAUC0C-XMxxx where xxx represents length in meters.

F. Fiber splicing and closures shall be Commscope/SYSTIMAX. The fiber splice module shall meet the following specifications:
   1. Fusion
   2. Joins single mode or multi-mode fibers
   3. Establishes a permanent fusion splice
   4. May be used in OSP and/or premises applications
   5. Accept 250 and 900 micron fibers
   6. Re-enterable, re-arrangable and reusable
   7. Require no polishing
   8. Require no adhesives
   9. No loose parts
   10. Unlimited shelf life

2.8 BACKBONE COPPER CABLE – INSIDE PLANT

A. Manufacturer: SYSTIMAX, unless otherwise noted.

B. Non-plenum Backbone Cable – 24 AWG
   1. Multi-pair insulated with color-coded PVC copper cables shall be used as the vertical riser cables. The cable shall support voice, data, and building service applications. All 50-pair and larger cable shall be conformance tested to meet ANSI/TIA/EIA 568B for Category 3 cables. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation. No cable count larger than 100 pair accepted
      a. 9-57242-1 Product Description 1010A SLT C3 25/24 U/UTP R1000 (25 pair)
      b. 9-57313-1 Product Description 1010A SLT C3 50/24 U/UTP R1000 (50 pair)
      c. 9-57315-1 Product Description 1010A SLT C3 100/24 U/UTP R1000

C. Non-plenum Backbone Cable – 22 AWG
   1. Manufacturer – Superior Essex or submitted and owner-approved equivalent
   2. 22 AWG 100-pair insulated with color-coded PVC copper cables shall be used only transition splices from OSP to inside cable. The ARAM cable shall be routed from the splice closure to the protector panel, as indicated in Drawings.

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D. Plenum Backbone Cable
   1. The plenum cable shall consist of 24-AWG solid-copper conductors insulated with color-coded PVC. All 50-pair and larger cable shall be conformance tested to meet ANSI/TIA/EIA 568B for Category 3 cables. The cable shall be UL® and c (UL®) Listed for Fire Safety and ISO 9001 Certified. The plenum cable shall be available in 25, 50, and 100 pair.

a. MID 107765992 Product Code 2010B WH 25/24 R1000 (25 Pair)
b. MID 107760040 Product Code 2010B WH 50/24 R1000 (50 Pair)
c. MID 107766057 Product Code 2010B WH 100/24 R1000 (100 Pair)

E. The backbone copper cable shall meet or exceed the electrical specifications provided by the manufacture

2.9 BACKBONE COPPER CABLE – OUTSIDE PLANT

A. Manufacturer: Superior Essex or submitted and owner-approved equivalent

B. Superior Essex or submitted and owner-approved equivalent ASP-filled 22 AWG multi-pair copper cables shall be utilized for underground conduit or direct buried applications. The cable shall support voice, low-speed data, and building service applications. The bending radius and pulling strength requirements of all outside plant cables shall be observed during handling and installation. No cable count larger than 200 pair accepted.

C. Protectors (Outside Plant applications):

Product Number	Description	Material ID
331901	Circa 1880NA1/NSC-200: 188-Type, 200-pair protector panel. Input on left side for front of cabinet.	N/A
331902	Circa 1880NA1/NSC-200: 188-Type, 200-pair protector panel. Input on right side for back of cabinet.	N/A
750031	Circa C4B1S: 5-pin solid-state protector module, black shell, 300 volt, sneak current protection and built-in test points.	N/A
4C3S-75	Solid-state protector unit for nonringing circuits (red)	N/A

D. Copper Cable Splice System
1. Copper Splice Systems are defined to include, but not limited to copper splice module, components, closure kits, supports and required accessories to provide a turnkey copper network system.
2. Copper cable to be spliced shall be 22 AWG OSP and 22 AWG inside cable as specified in the previous paragraphs.
3. Splices shall be inline, from underground OSP cable (filled metallic) to indoor cable (air core metallic).
4. Copper Splice Kit
   a. Manufacturer: Preformed Line Products or submitted and owner-approved equivalent.
   b. All splice kit products shall be Commscope/SYSTIMAX Solutions material.
5. Copper Splice Closure Requirements
   a. Manufacturer: Preformed Line Products or submitted and owner-approved equivalent.
   b. Provide an inline, re-enterable copper cable closure.
      1) Metallic stainless steel.
      2) Finish shall be non-corrosive in all intended environments (see Drawings).
   c. Re-enterable without the need for special re-entry kit.

2.10 MULTI-PAIR CABLE TERMINATION HARDWARE

A. 110 Wiring Blocks
1. Manufacturer: SYSTIMAX
2. 110 blocks shall provide for the termination of horizontal, equipment, or tie cables. This high-density modular design shall be compatible with all voice and data circuits. The block shall be Underwriter's Laboratories (UL) listed.
3. Field-terminated, wall-mounted 110 Wiring Block part numbers are as follows:

Product Number	Description	COM code
110 Wiring Blocks With Legs (Small Installations)		
110AB2-100FT	4-pair	107 058 919
110AB2-300FT	4-pair	107 058 943
110 Wiring Block System With Back Panel (Larger Installations)		
110PB2-300FT	4-pair (Station)	107 058 810
110PB2-900FT	4-pair (Station)	107 058 869
110PB2-300FT	5-pair (Riser)	107 058 802
110PB2-900FT	5-pair (Riser)	107 058 851
188 Backboards w/distributing rings for 110 blocks		
188D3	300 pair	107 151 193
188C3	900 pair	107 151 185

4. Field-terminated, rack and cabinet mounted 110 Wiring Block part numbers are as follows:

Product Number	Description	COM code
110 Connector System Mounting Brackets		
110RD2-200-19	(2) 100-Pair Bracket	107 058 919
110 Wiring Block for Wiring Bracket		
110DW2-100	110 100-Pair Wiring Blocks	107 059 909
110 Jumper Troughs		
110B3	110 Troughs	107 831 141

B. Electrical requirements of Copper Termination Equipment per manufactures specification.

C. Wire Managers for Copper Termination Equipment
1. Vertical Wire Manager – Wall-mounted 110 Patch Panel System Backboard
   a. Manufacturer: Chatsworth or submitted and owner-approved equivalent
   b. One on each side
   c. Chatsworth part number(s) are as follows:

Product Number	Description	COM code
Single-Sided Narrow Vertical Cabling Section		
11730-7XX	Vertical Cabling Mgr (Black)	N/A

2. Horizontal Wire Managers –Wall-mounted 110 Patch Panel System Backboard
   a. Manufacturer: SYSTIMAX
   b. Above and below each hardware shelf.
   c. SYSTIMAX part number(s) are as follows:

Product Number	Description	COM code
110 Jumper Troughs		
110B3	110 Troughs	107 831 141

3. Horizontal Wire Managers – Racks and cabinets
   a. Manufacturer: Chatsworth or submitted and owner-approved equivalent
   b. Above and below each equipment shelf
   c. Not required with RJ45 patch panels
   d. Chatsworth part number(s) are as follows:

Product Number	Description	COM code
Horizontal Wire Managers		
11753-719	19" Medium Wire Manager	

D. Hybrid RJ45 to 110 Patch Cords.
1. Manufacturer: SYSTIMAX 119P2PS
2. As required provide Category 5e, Hybrid Patch Cords for each assigned data/voice port on the patch panel. Cords shall RJ45 connector on one end and 110GS on the other end. Cords shall be provided in appropriate lengths to accommodate all tenant voice or specialty ports as shown in detailed drawings. All Category 5e cordage shall be round, and consist of 24-AWG copper, stranded conductors, tightly twisted into individual pair and shall meet or exceed the Category 5e specifications.
3. Hybrid patch cords shall conform to the TIA 568B wiring scheme.
4. Hybrid patch cords shall be provided for each installed port designated as "Tenant Voice or Specialty jack" in the drawings.
5. Hybrid patch cord single pair part numbers are as follows (last 3 digits designates length):

Length	Material ID
8FT	CPC8662-03F-008
10FT	CPC8662-03F-010

6. Hybrid patch cord 2 pair part numbers are as follows (last 3 digits designates length):

Length	Material ID
8FT	CPC3852-03F-008
10FT	CPC3852-03F-010

7. Hybrid patch cord 4 pair part numbers are as follows (last 3 digits designates length):

Length	Material ID
8FT	CPC3812-03F-008
10FT	CPC3812-03F-010

2.11 IDENTIFIERS, LABELS AND LABELING SYSTEM

A. All Identification and Labeling shall follow Specification: 270553–Identification and Labeling of Communication Infrastructure. **Any deviation from the specification must be approved by HAS IT prior to installation.**

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify raceways, boxes, hand holes and maintenance holes are properly installed following Sections 270528, and 270543.

B. All communication media shall be installed in conduit or cable tray unless an alternate method has been approved by HAS/IT Infrastructure.

C. Verify backboards are properly installed.

D. Verify telecommunications grounding system is properly installed and tested following Section 270526.

E. Verify liquid-carrying pipes shall not be installed in or above any IDF/MDF that has active electronic equipment. Do not proceed with installation in affected areas until removed.

3.2 PREPARATION

A. Environmental controlled communication rooms shall maintain temperature of between 64 degrees Fahrenheit and 78 degrees F and between 30 and 55 percent humidity in areas of active electronic system work.

B. Cable Splicing: Exact cable routing, splice enclosure locations, distances, elevations, work space and purpose of splice will be governed by actual field conditions. Contractor shall perform field surveys prior to submitting layout drawings.

C. Contractor's on-site RCDD supervisor shall review, approve and stamp all shop drawings, coordination drawings and record drawings.

3.3 INSTALLATION

A. Install work following drawings, manufacturer's instructions and approved submittal data. The number of cables per run, outlet configuration and other pertinent data are included on the drawings.

B. All installation shall be done in conformance with ANSI/TIA/EIA 568B standards, BICSI methods, Industry standards and SYSTIMAX SCS installation guidelines. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines shall require the Contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the Contractor during the implementation.

C. The SCS installation shall comply with all applicable national and local codes pertaining to low voltage cable system installations.

D. The contractor shall adhere to the installation schedule of the general contractor and shall attend all construction meetings scheduled by the general contractor.

E. Upon structural completion of the communications room(s) and prior to the installation of any communications equipment or supporting devices inside the room, the City Engineer shall consult the Communications Designer in order to:
   1. Perform construction administration activities to compare as-built configuration to the design.
   2. Observe all "not-to-design" compliance issues and issue corrective advisement of actions.
   3. Upon completion of 1 and 2 above, the Communications Designer shall mark with masking tape the general layout of the equipment placement.

F. Cable Splicing
   1. Splicing optical fibers shall be accomplished with the fusion method only; mechanical splices are not allowed.
   2. Copper splicing shall be accomplished using SYSTIMAX modules.

3. Copper splicing shall be done using the fold-back method.
4. All closures and splice cases shall be installed according to the manufacturer's installation procedures.
5. All closures and splice cases shall be "flash tested" to ensure they are properly sealed.
6. All splicing work and splicing hardware shall comply with the following:
   a. Cables shall be neatly routed and properly secured.
   b. Minimum bending radius for fiber and copper cables shall not be exceeded.
   c. Closures shall be properly mounted and secured.
7. All closures, entry and exit cabling shall be labeled per specification 270553, easily visible from the finished floor.

G. The contractor shall perform all required cross connections of the horizontal cable runs to the backbone cable system. The equipment connections to the data systems shall be performed by the vendors installing and/or maintaining those systems.

H. The contractor is responsible for providing a CD with all the cable/patch panel information in the same format that will be accepted for download in HAS's iPatch database **1 month** prior any patching occurs.

I. The contractor is responsible and must perform the following task associated with the iPatch system:
1. Connect iPatch Network Manger (or imVision Controller) to designated port on HAS network switch.
2. Inter-connect iPatch Network Manager to rack managers if applicable.
3. Confirm that all iPatch patch panels are on line.
4. Configure network settings for iPatch Network Manage (or imVision Controller) with IP address, Mask and Gateway.
5. Resolve patching conflicts associated with "Confirm" message on the iPatch Network Manager (or imVision Controller) Display.
6. Resolve conflicts associated with "Alarms" on iPatch Network Manager or imVision Controller.
7. Provide fiber cut sheet depicting fiber port to port or port to equipment connectivity.
8. Provide an excel file compatible with imVision Import Wizard. The file will be used to build rooms, faceplates and jacks in iPatch database.
9. Label all new devices including the iPatch Network Manager according to HAS labeling specs.
10. Label all ports according to HAS labeling specs.
11. Provide floor plans depicting rooms lay out and outlet locations.
12. Confirm iPatch ports are pointing toward the proper end device (iPatch to equipment or iPatch to iPatch connection).

J. The contractor shall provide service loops (slack) for cables terminating in the IDFs. A minimum of 10-foot service loop shall be provided above the access ceiling or cable trays unless specified otherwise. This allows for future changes or expansion without installing new cables.

K. The installation contractor shall be responsible for coordination, testing and problem resolution with the system vendors.

L. Label cable terminations on designation strips per specification 270553. Coordinate numbering with the City's automated cable management system.

M. Labels for backbone/riser cables shall be placed in the following locations: on jack face plates, on cable inside back boxes, conduit pathway, junction boxes, access points, maintenance holes, and hand holes, on cable above the terminations in the IDF and MDF, on patch panels, and every 100 feet when not in conduit. Refer to specification 270553.

N. City inspector or their designated representative shall randomly perform unannounced, on-site reviews during the installation. In addition, this person shall perform a final inspection and a complete review of the test results before the installation is accepted.

O. Upon completion of the installation, Contractor shall prepare as-built documentation of the entire SCS. This documentation shall include:
   1. As-Built Drawings
      a. All drawings shall be provided on a minimum of four (4) USB flash drives in a form compatible with AutoCAD Version 14. A complete set of project plans will be provided to the Contractor on a drive. The Contractor shall modify the drawings by placing the cable information on a separate layer. All of the requested drawings shall be placed on these plans so that all cable routes are to scale and provide accurate information for use in the future when changes are made, and the exact location of cables are required to avoid service interruptions.
      b. A complete diagram of all terminations in the IDFs.
      c. A complete diagram of all copper, fiber, and coax riser cable.
      d. A complete diagram of all copper, fiber, and coax inter-building cable.
      e. Floor plans showing exact cable routings with each outlet clearly marked with cable number.
      f. A complete diagram of all cable tray, conduits and conduit sleeves.
   2. Documentation
      a. All cable inventory data documentation shall be submitted in designated Microsoft Excel 2007 format, or ASCII, comma delimited files with fields in identical order so that data can be incorporated into existing databases.
      b. Documentation on horizontal cable shall include cable number and length of cable.
      c. Documentation on riser cable and inter-building cable shall include cable number, source and destination, type of cable, length of cable and number of pairs or fibers.
      d. Complete cross connect documentation is required. This information will include detailed documentation of all four pairs of each horizontal cable and every pair of all copper riser and inter-building cable and every fiber of fiber optic cable.
   3. As-built Drawings and Documentation shall be reviewed, approved and stamped by Contractor's on-site RCDD.

3.4 POST-INSTALLATION TESTING AND CERTIFICATION

A. Contractor Requirements
   1. Contractor shall provide sufficient skilled labor to complete testing within a reasonable test period.
   2. Contractor shall have a minimum of three years' experience installing and testing structured cabling systems. All installers assigned by the Contractor to the installation shall be certified by the factory to install and test the provided products.
   3. Contractor is responsible for supplying all of the required test equipment used to conduct acceptance tests.
   4. Contractor is responsible for submitting acceptance documentation as defined in 3.04.D below. No cabling installation is considered complete until test results have been completed, submitted and approved as defined in 3.04.D below.
   5. Contractor to insure that the database information for iPatch meets the HAS requirements.

B. Test Procedure
   1. City Engineer reserves the right to be present during any or all testing. Notify City Engineer at least 48 hours prior to beginning test procedures.
   2. Testing shall be of the Basic Link. However, Contractor shall warrant performance based on Channel performance and provide patch cords that meet channel performance.

3. All cabling not tested strictly in accordance with these procedures shall be re-tested at no additional cost to the Owner.
4. Testing of all copper and fiber wiring shall be performed prior to system(s) cutover.
5. 100% of the installed cabling shall be tested. All tests shall pass acceptance criteria defined in 3.05 below.
6. Cable testing shall be performed by a fully charged tester, and the charging unit shall be disconnected during testing.
7. Any pairs not meeting the requirements of the standard shall be brought into compliance by the contractor at no charge to the City. Complete end-to-end test results shall be submitted to the City.

C. Standards Compliance and Test Requirements
1. Copper Cabling shall meet the indicated performance specifications:
   a. Category 3 Riser Cabling – ANSI/TIA/EIA 568B.2 Category 3 Backbone Cabling
2. Fiber Optic Cable shall meet the indicated performance specifications:
   a. Per manufactures specifications and standards.
3. All test equipment used shall meet the performance specifications defined in 3.04.E. below.

D. Cable Test Documentation
1. Test reports shall be submitted in electronic format via a minimum of four (4) USB flash drives and certified by the contractor's RCDD to be a complete and accurate record of cabling installed. Hand-written test reports are not acceptable.
2. Electronic reports are to be submitted with an attached affidavit verifying passing execution of all tests. For large installations (greater than 300 pair copper and/or greater than 72 strand fiber), electronic reports with hardcopy summaries are preferred. Electronic summary reports shall contain the following information on each row of the report: circuit ID, test specification used, cable length, date of test, and pass/fail result.
3. Electronic reports shall be submitted on a minimum of four (4) USB flash drives in PDF format. Electronic reports shall be accompanied by a Certificate signed by an authorized representative of the Contractor warranting the truth and accuracy of the electronic report. Certificate shall reference traceable circuit numbers that match the electronic record.
4. Electronic reports for each cable route shall be submitted together in one submittal. The submittal description shall include the type of test performed, type of cable, and cable ID (including originating and terminating room numbers) of cable tested. Partial or unclear documentation will be returned without reviewing.
5. Test reports shall include the following information for each cabling element tested:
   a. Wiremap results that indicate that 100% of the cabling has been tested for shorts, opens, miswires, splits, polarity reversals, transpositions, presence of AC voltage and end-to-end connectivity.
   b. For Category 3 cabling: Attenuation and NEXT data that indicate the worst-case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 to 16 MHz. Information shall be provided for all pairs or pair combinations and in both directions. Any individual test that fails the relevant performance specification shall be marked as a FAIL.
   c. Length (in meters), propagation delay, and delay skew relative to the relevant limit. Any individual test that fails the relevant performance specification shall be marked as a FAIL.
   d. Cable manufacturer, cable model number/type, and NVP
   e. Tester manufacturer, model, serial number, hardware version, and software version
   f. Circuit ID number and project name
   g. Auto test specification used
   h. Overall pass/fail indication
   i. Date of test

6. Test reports shall be submitted within seven business days of testing.

E. Test Equipment
1. Test equipment used under this contract shall be from manufacturers that have a minimum of 5 years' experience in producing field test equipment. Manufacturers shall be ISO 9001 certified.
   a. Category 6 – Level III tester or owner-approved equivalent.
   b. Category 3 copper backbone/riser – 3M Dynatel 965 DSP Subscriber Loop Analyzer with Far End Device or submitted and owner-approved equivalent.
   c. Fiber Optic – Calibrated and certified OTDR, and optical power meter or submitted and owner-approved equivalent.
2. All test tools of a given type shall be from the same manufacturer and have compatible electronic results output.
3. Test adapter cables shall be approved by the manufacturer of the test equipment. Adapters from other sources are not acceptable.
4. Baseline accuracy of the test equipment shall exceed TIA Level III, as indicated by independent laboratory testing.
5. Test equipment shall be capable of certifying Category 6 links.
6. Test equipment shall have a dynamic range of at least 100 dB to minimize measurement uncertainty.
7. Test equipment shall be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.
8. Test equipment shall include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.
9. Test equipment shall be capable of running individual NEXT, return loss, etc measurements in addition to auto tests. Individual tests increase productivity when diagnosing faults.
10. Test equipment shall include a library of cable types, sorted by major manufacturer.
11. Test equipment shall store at least 1000 Category 6 auto tests in internal memory.
12. Test equipment shall be able to internally group auto tests and cables in project folders for good records management.
13. Test equipment shall include DSP technology for support of advanced measurements.
14. Test equipment shall make swept frequency measurements in compliance with TIA standards.
15. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurement.
16. The Category 3 copper backbone/riser test equipment shall be capable of making frequency sweeps at an impedance of 135 Ohms at the following frequencies (kHz): 20, 30, 50, 69, 90, 110, 138, 276, 400, 600, 800, 1000, and 1100. A far-end device shall be used for all frequencies measurements. The loss at 138kHz shall not exceed -46 dB. The test set shall have the ability to store 100 tests and be able to upload to a PC.
17. The Category 3 copper backbone/riser test equipment shall be able to measure resistance between the following conductors: tip to ring, tip to ground, ring to ground. All measurements shall be greater than 9999 M ohms.

F. Optical Fiber Cable Testing w/ Optical Time Domain Reflectometer (OTDR) and Optical Power Loss Meter
1. Test all lightguide cable prior to the installation of the cable. Assume liability for the replacement of the cable should it be found defective at a later date.
2. All fiber testing shall be performed on all fibers in the completed end-to-end system. Testing shall consist of a bi-directional end-to-end OTDR trace performed per TIA/EIA 455-61and end-to-end in one direction for Optical Power loss meter measurement. The system loss measurements shall

be provided at 850 and 1300 nanometers for multimode fibers and 1310 and 1550 for single mode fibers.

3. Any link not meeting the requirements of the standard shall be brought into compliance by the contractor, at no charge to the City.
4. End point locations.
5. Test direction.
6. Reference power measurement (when not using a power meter with a Relative Power Measurement Mode).
7. Measured attenuation of the link segment.
8. Acceptable link attenuation.
9. Acceptable Attenuation Values shall comply with SYSTIMAX latest version of "Fiber Attenuation Calculation" spread sheet.

3.5 ACCEPTANCE

A. Once all work has been completed, test documentation shall be submitted for approved, and City Engineer is satisfied that all work is in accordance with contract documents, the City Engineer will notify Contractor in writing of formal acceptance of the system.

B. Acceptance Requirements
1. Contractor's RCDD shall warrant in writing that 100% of the installation meets the requirements specified under 3.04. "Standards Compliance & Test Requirements" above.
2. City reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to five percent of the cable plant to confirm documented results. Random re-testing, if performed, shall be at the expense of the City, using standard labor rates. Any failing cabling shall be re-tested and restored to a passing condition at no cost to the City. In the event more than two percent of the cable plant fails during re-test, the entire cable plant shall be re-tested and restored to a passing condition at no additional cost to the Owner.
3. City Engineer may agree to allow certain cabling runs to exceed standardized performance criteria (e.g. length). In this event, such runs shall be explicitly identified and excluded from requirements to pass standardized tests.
4. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and submittal and approval of full documentation as described in 3.04.
5. See Appendix A & B

3.6 DEMOLITION

A. The contractor shall be responsible for maintaining all communications service to areas of the building scheduled to remain in service during the period of renovation.

B. Notify HAS Information Technology (IT) department 30 days prior to the start of demolition work taking place in existing communications rooms. Coordinate removal of equipment and cabling within existing communications rooms with HAS IT.

C. Where removal is indicated in Drawings, remove communications cable from termination point back to originating communications room, MDF or tenant communications room. Coordinate removal at terminating blocks and panels with HAS IT. Coordinate removal of cross-connects and patch cables with HAS IT.

D. Ensure systems and circuits are no longer active before removing and prior to the demolition of existing communications rooms. If active circuits exist at time of scheduled demolition, coordinate with City Engineer to reroute or deactivate circuit(s).

E. Demolition and removal of cabling shall not impact the operation of active systems.

F. Unless otherwise noted, discard all removed cable, patch cables and cross-connects. Except where re-routing of cable is specified in Drawings or by Designer, do not reuse cable.

G. Remove all loose unterminated cabling to source found above ceiling, under floor or in wall.

H. All Demo shall include ALL Abandoned cables shall be removed in accordance with NEC 800.25

3.7 CLEANING

A. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where work has been completed unless designated for storage.

END OF SECTION

APPENDIX A

MDF/IDF Check List

This list is intended as a minimum checklist. CM should ensure that the contractor's schedule has built in these components and the necessary buffer period – and associated access restrictions to the communications equipment rooms -- for HAS IT and tenant IT to prepare.

1. All communication rooms that will service the area to be opened must be completed. That means a final walkthrough of these areas has been completed. It is not necessary that the entire project achieve substantial completion, but IT cannot install equipment and begin work until the following minimum criteria is met:
    a. Space is built out and clean – free from dust/residues.
    b. Electrical w/UPS as required.
    c. All racks/cabinets installed and mounted. Padlocks eyes have been installed.
    d. Grounding bus bar installed and properly tied to main grounding bus bar in MDF
    e. HVAC functioning properly and is adequately filtering dust. Humidity is controlled.
    f. Door access control is installed (card reader) -or- an approved temporary provision. Simple key access is not permissible.
    g. Lighting is installed and operational.
    h. Cable trays/ladder racks installed and ready to use.
    i. Permanent or temporary signage identifying permanent room number.

2. All cabling necessary to operate the areas to be opened is completed.
    a. Backbone cabling (copper and fiber) from the applicable communication room(s) is installed, tested, labeled, and approved by the inspector and communications design consultant.
    b. Horizontal cabling for all areas to be occupied is installed, tested, labeled, and approved by the inspector and communications design consultant.
    c. Copper cross connects and/or fiber jumpers have been installed per the owner/tenant requirements.
    d. Cable records and redline drawings for installed cables are submitted and approved PRIOR to putting any active circuits on the new cables. Cable records reflect all installed cables **and** any cross connects, or jumper assignments installed by the contractor.
    e. All Ipatch Panels are programmed and operational.
    f. All jumpers and patch cords specified by the contract are transmitted to the owner for use.
    g. NOTE: cable labels and permanent room numbers need to match. CM needs to be sure to get design team, airport, IT, and CM / contractor reps together to review permanent room numbers prior to contractor installing cable labels.

3. Move-in buffer period needs to be minimum 6 **weeks** for HAS-IT to install/extend services within the area to be occupied prior to occupation of the facility or spaces. Additional time may be necessary if Tenant IT organization is involved, or if contractor has other systems that must be configured/tested which require HAS-IT resources (i.e. cabling or data network connections). This is frequently the case for PA System, television, radio, Fire Alarm, pay telephone, EFSO, access control & CCTV, etc.

4. Once HAS-IT accepts a communications equipment room and begins to install/configure equipment in preparation for hosting live applications, this room becomes a restricted area with access to be controlled by HAS-IT. Contractors must be substantially complete with systems <u>inside</u> the communications equipment room so that access is generally not required. Minor punch list and scheduled testing with escort can be arranged, but access will be very limited.

5. Other IT-related systems that must be operational, tested, and accepted or approved temporary provisions.
    a. PA System
    b. MATV and/or CNN TV (where applicable)
    c. Fire Alarm
    d. MUFIDS
    e. Pay Telephones (where applicable)
    f. EFSO (where applicable)
    g. Access Control & CCTV (note: must be PROGRAMMED, and approved acceptance test walk through by HAS)
    h. Crash phone (where applicable)
    i. Radio system enhancements (where applicable)
    j. Data Network switch installed and configured.

APPENDIX B

IDF Number:		Date:		
Grounding & Bonding:		**YES**	**NO**	**COMMENTS**
	TGB properly installed			
	Proper grounding conductor installed (6AWG min.)			
	Cable trays properly bonded			
	Equipment Racks & Cabinets properly bonded			
	Conduit properly bonded			
	Cabling properly bonded			
	Splice Cases properly bonded			
Horizontal Cabling:		**YES**	**NO**	**COMMENTS**
	Routing			
	Cables properly supported			
	Pull tensions properly recorded			
	Sheath damage			
	Bend radius observed			
	Pair twist meets spec			
	Proper termination scheme			
	Cable/jack part number meets spec			
	Plenum vs. PVC			
	Properly dressed in tray			
	Properly dressed in cable management			
	Cables bundled properly			
	Appropriate clearances observed (power)			
	Minimum about of cable exposed at termination			
Backbone Cabling:		**YES**	**NO**	**COMMENTS**
	Fiber strain relief properly applied			
	Routing			
	Cables properly supported			
	Pull tensions properly recorded			
	Sheath damage			
	Bend radius observed			
	Properly dressed in tray			

	Fiber installed in inner duct			
	Properly dressed in termination shelf			
	Any splice cases properly supported			
Room Layout:		**YES**	**NO**	**COMMENTS**
	Room laid out according to project drawings			
	Proper clearances maintained			
	Is the room clean & neat in appearance			
	Liquid carrying pipes within the room			
Pathways:		**YES**	**NO**	**COMMENTS**
	Conduit properly routed & supported			
	Cable Tray properly routed & supported			
	Inner Duct used to route fiber and properly supported			
Labeling:		**YES**	**NO**	**COMMENTS**
	Grounding conductor			
	End-to-End labeling			
	Pair Count on Splice Case			
	Horizontal Cabling			
	Fiber Optic Cabling			
Other:		**YES**	**NO**	**COMMENTS**
	Appropriate fire stop material in place			
	Cabling test results submitted with proper information			
	Climate controlled environment (Temp. & Humidity)			
	Is the room access controlled			
Copper Cabling:				
	Total Pairs (Riser)			
	Pair Counts			
	Termination Type (66, 110, Protectors..)			
	Termination Location			

Fiber Optic Cabling:		
Multimode:		
	Total Strands	
	Termination Type (LC, SC)	
	Termination Location	
Single Mode		
	Total Strands	
	Termination Type (LC, SC)	
	Termination Location	

End Of Appendix

SECTION 27 15 00 - HORIZONTAL MEDIA INFRASTRUCTURE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide a Structured Cabling System (SCS) for the purpose of supporting voice, data and video communications at various locations within the Houston Airport System. The Houston Airport System (HAS) has established SYSTIMAX as the standard for cabling infrastructure installations.

B. Related Work:
1. Section 27 05 53: Identification and Labeling of Communication Infrastructure
2. Section 27 11 00: Communication Cabinets and Equipment Rooms
3. Section 27 13 00: Backbone/Riser Media Infrastructure
4. Section 27 05 43: Exterior Communication Pathways
5. Section 27 05 26: Telecommunications Grounding and Bonding

1.2 SUBMITTALS

A. Qualifications: Demonstrate compliance with requirements of Paragraph 1.05A below.

B. Manufacturers' data, including part numbers, cut sheets and detailed descriptions, for all proposed equipment.

C. Cable inventory data shall be submitted for all fiber, copper, and coaxial cabling and termination equipment. Reference Specification 270553 for the Inside and Outside plant spread sheets. Information shall be provided on a CD.

D. Shop Drawings to be submitted and approved before implementation is started. Shop Drawings to be submitted in accordance with Specification 01340.

E. Record Drawings: Furnish CAD drawings, following format in Section 01340, of completed work including cable numbers. Refer to Specification 270553 for labeling conventions. Contractor's on-site Building Industry Consulting Services International (BICSI) Registered Communications Distribution Designer (RCDD) supervisor shall review, approve and stamp all shop drawings, coordination drawings and record drawings.

F. Include spares list to be approved by HAS IT Project Manager for approval.

G. Cable Testing and Reports.
1. Submit Testing Plan prior to beginning cable testing.
2. Submit certified test reports of Contractor-performed tests in accordance with paragraph 3.04. of this document.
3. Electronic and hardcopy versions of test reports shall be submitted together and clearly identified with cable identification. Test results must be in both PDF and original raw format of approved tester.
4. Test reports shall be reviewed, approved and with a stamped cover letter by the Contractor's on-site RCDD.

H. Product data for all termination and test equipment to be used by Contractor to perform work.
   1. Equipment shall be calibrated with traceability to National Institute of Standards and Technology (NIST) requirements.
   2. Contractor shall include copy of calibration and certification that equipment calibration meets NIST standards and has been calibrated at least once in the previous calendar year.
   3. Test equipment data shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submitting.
   4. Refer to 3.04. in this document for test equipment requirements.

I. Submit Technology Implementation Plan in accordance with 1.07 below.

J. Submit Cable Pulling Plan, as follows:
   1. Indicate the installed backbone conduit layout in schematic format, including junction boxes and distances between junction boxes.
   2. Indicate contents of each conduit.
   3. Indicate the cable pulling calculations, conduit fill ratios and actual cable runs and tensions.
   4. Cable Pulling Plan shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submittal.
   5. Installation of cabling shall not commence prior to approval of the pulling plan and calculations by the Architect/Engineer.

K. Submit installation plan indicating:
   1. Equipment and personnel
   2. Materials and staging area
   3. Start and completion dates
   4. Locations, including floor, room and building
   5. Installation plan shall be reviewed, approved and stamped by the Contractor's on-site RCDD prior to submitting.

1.3 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

C. Maintain temperature of between 64 degrees Fahrenheit and 75 degrees Fahrenheit and between 30 and 55 percent humidity in areas of active electronic system work.

1.4 REFERENCES

A. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only.

B. Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean the latest printed edition of each in effect two weeks prior to the date of the Bidding Documents unless the document is shown dated.

C. Conflicts.
1. Between referenced requirements: Comply with the one establishing the more stringent requirements.
2. Between referenced requirements and contract documents: Comply with the one establishing the more stringent requirements.

D. References.
1. ANSI/TIA/EIA-568-D, Commercial Building Telecommunications Wiring Standards
2. ANSI/TIA/EIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces
3. ANSI/TIA/EIA 607-B -Commercial Building Grounding and Bonding Requirements
4. International Standards Organization/International Electromechanical Commission (ISO/IEC) DIS11801, January 6, 1994
5. Underwriters Laboratories (UL®) Cable Certification and Follow Up Program
6. National Electrical Manufacturers Association (NEMA)
7. American Society for Testing Materials (ASTM)
8. National Electric Code (NEC®) Latest Issue
9. National Electrical Safety Code (NESC) Latest Issue
10. Institute of Electrical and Electronic Engineers (IEEE)
11. UL Testing Bulletin
12. American National Standards Institute (ANSI) X3T9.5 Requirements for UTP at 100 Mbps
13. SYSTIMAX Structured Cabling Systems, Performance Specifications, Latest Issue
14. SYSTIMAX Structured Cabling Systems, Components Guide, Latest Issue
15. BICSI Telecommunications Distribution Methods Manual (TDMM) Latest Issue
16. Rural Utilities Service (RUS) Section 1755

1.5 QUALITY CONTROL

A. Submit written proof that the following experience requirements are being met.
1. Contractor Qualifications
   a. The contractor shall be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.
   b. Must be supervised on-site by a BICSI RCDD. Must demonstrate knowledge and compliance with all BICSI, TIA/EIA, UL, and NEC methods, standards and codes.
   c. All members of the installation team shall be certified by the manufacturer as having completed the necessary training to complete their part of the installation. Resumes of the entire team shall be provided along with documentation of completed training courses.
   d. The contractor shall provide five references for projects of equivalent scope, type and complexity of work completed within the last five years.
   e. The contractor who is installing the cabling infrastructure shall be a certified and currently registered Commscope/SYSTIMAX Elite Partner capable of issuing a numbered registration certificate for the entire cable system.
   f. The contractor who is installing the cabling infrastructure shall have the following SYSTIMAX iPatch/imVision certifications:
      SP/ND3360 - SYSTIMAX SCS 360 Solutions
      SP/ND3321 - SYSTIMAX SCS Design & Engineering
      SP/ND3361 - SYSTIMAX SCS Installation and Maintenance

g. Cable splicing personnel shall have a minimum of five years splicing experience and shall have completed a minimum of five major splicing projects.

2. Manufacturer's hardware experience: All components shall be produced by manufacturers who have been regularly engaged in the production of telecommunications cabling components of the types to be installed in this project for a period of five years.

B. Materials and equipment: Equipment shall be rated for continuous operation under the ambient environmental temperature, humidity, and vibration conditions encountered at the installed location. The equipment shall meet the following requirements:

1. Interior controlled environment: 60 to 100 degrees F dry bulb and 20 to 90 percent relative humidity, non-condensing.
2. Interior uncontrolled environment: 0 to 130 degrees F dry bulb and 10 to 95 percent relative humidity, non-condensing.
3. Exterior environments: Minus 30 degrees to 130 degrees F dry bulb, and 10 to 100 percent relative humidity, condensing.
4. Hazardous environment: All system components located in areas where fire or explosion hazards may exist because of flammable gas or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings, shall be rated and installed according to Chapter 5 of the NFPA 70 and as shown.

C. Standard products:

1. Equipment and materials shall be standard products of a manufacturer regularly engaged in the manufacture of telecommunications cabling products and shall be the manufacturer's latest standard design in satisfactory use for at least one year prior to bid opening.
2. Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.

1.6 CONTRACTOR'S DUTIES

A. Contractor's RCDD shall provide all calculations and analysis to support design and engineering decisions as specified in the Submittals section.

B. Provide and pay for all labor, supervision, tools, equipment, test equipment, tests and services/programming to provide and install a complete inside and outside plant fiber and copper infrastructure system. Pay all required sales, gross receipts, and other taxes.

C. Secure and pay for plan check fees, permits, fees, and licenses necessary for the execution of Work as applicable for the project.

D. Give required notices.

E. Comply with all codes, ordinances, regulations, and other legal requirements of public authorities that bear on performance of Work.

1.7 PROCUREMENT

A. Procure equipment specified in this document as dictated by the timeline in Appendix A "Technology Implementation Schedule" in order to ensure that the technology is acquired in a timely fashion, but not outdated by the installation date.

B. Submit a copy of Appendix A "Technology Implementation Schedule" as a part of the equipment submittals required elsewhere in this document. Complete the columns headed "Quantity", "Purchasing Lead Time", "Start Date or Dependent", and "Installation Duration".

C. The "Procurement Lead Time" shall be expressed in days or weeks, and shall include time required for the contractor's personnel to order and receive the material. Substantiation may be required.

D. "Start Date or Dependent" and "Installation Duration" should be an accurate estimate based upon known facts in the project. Substantiation may be required.

E. The Contractor shall not purchase any materials requiring submittals until the owner approves the product submittal and the Technology Implementation Schedule for that material.

F. The Contractor shall not purchase any materials requiring submittals until the date established by the owner as the Purchasing Authorized Date. The Purchasing Authorized Date will be reflected in the "Purch Auth" column of Appendix A as a part of the Submittal Review process.

1.8 MAINTENANCE AND SUPPORT

A. System Assurance: The System Assurance shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that use the ANSI/TIA/EIA 568 or ISO/IEC IS 11801 component and link/channel specifications for cabling, for a twenty five year period.

B. System Certification: Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a numbered certificate, from the manufacturing company, registering the installation.

C. Support Availability: The Contractor shall commit to make available local support for the product and system during the Warranty period.

1.9 EXTENDED WARRANTY

A. The Extended Product Warranty shall meet all manufactures specification to ensure against product defects, that all approved cabling components exceed the specifications of ANSI/TIA/EIA 568 and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of ANSI/TIA/EIA 568 and ISO/IEC IS 11801 for cabling links/channels, that the installation will exceed the loss and bandwidth requirements of ANSI/TIA/EIA 568 and ISO/IEC IS 11801 for fiber links/channels, for a twenty five year period. The warranty shall apply to all passive SCS components.

B. The Extended Product Warranty and the System Assurance shall cover the replacement or repair of defective products and labor for the replacement or repair of such defective products.

1.10 DELIVERY AND STORAGE

A. Equipment shall be delivered in original packages with labels intact and identification clearly marked.

B. Equipment shall not be damaged in any way and shall comply with manufacturer's operating specifications.

C. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. Equipment damaged prior to system acceptance shall be replaced at no cost to the City.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to SYSTIMAX SCS and other manufacturers as referenced in this document. However, substitutions for SYSTIMAX products are not permitted.

2.2 GENERAL

A. Provide all cabling, terminating hardware, adapters, and cross-connecting hardware necessary to interconnect all system equipment including equipment located in the Main Distribution Facility (MDF) and the Intermediate Distribution Facilities (IDFs).

2.3 COPPER CABLE GENERAL REQUIREMENTS

A. Manufacturer Qualifications: ISO 9001 Certified and included in the Underwriters Laboratories LAN Certification and Follow-up Program.

2.04 COPPER HORIZONTAL CABLING

A. Manufacturer: SYSTIMAX SCS XX71 and SYSTIMAX SCS XX91.

B. All horizontal cabling shall meet or exceed the ANSI/EIA/TIA-568 Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components.

C. Cables shall be marked as UL verified with a minimum of Category 6 rating.

D. All horizontal cabling shall be color-coded as follows to differentiate between tenant and owner cabling. All voice circuits will be terminated on patch panels. All horizontal cabling will terminate on patch panels. All tenant and specialty circuits will be cross connected to multi-pair cabling as required.
   1. Green – HAS Data. (This applies to all HAS devices needing data cabling)
      a. IP Cameras
      b. Wireless Access Points(APs) – (Requires two CAT 6A data cables for 802.11ACv2)
      c. Access Control Panels
      d. IP Phones
      e. Etc
   2. Yellow – Tenant Data
   3. Red – Special circuits, including Automated External Defibrillation (AED) Circuits

E. High performance (71 Series) Category 6 UTP, 4 Pair cabling shall be utilized to provide the signal medium from the individual workstation location to the IDF(s) unless denoted otherwise on the drawings. This cabling shall be installed in accordance with the contract drawings and shall adhere to the specifications listed below:
   1. 4 pair UTP
   2. 23 AWG Solid Bare Copper

3. Cable jacket shall comply with NEC Article 800 for use as a plenum cable and shall be UL and c (UL) Listed Type CMP.
4. Cable shall terminate on 8 pin modular jack at each outlet.

F. The high performance Category 6 UTP cable shall be of the traditional round design with mylar separator tape between pairs 2/3 and 1/4. The cable shall support Voice, Analog Baseband Video/Audio, Fax, Modem, Switched-56, T-1, ISDN, RS-232, RS-422, RS-485, 10BASE-T Ethernet, Token Ring, 100Mbps TP-PMD, 100BASE-T Ethernet, 155 Mbps ATM, AES/EBU Digital Audio, 270 Mbps Digital Video, 622 Mbps 64-CAP ATM and emerging high-bandwidth applications, including 1 Gbps Ethernet, gigabit ATM, as well as all 77 channels (550 Mhz , single swept margin) of analog broadband video.

G. The high performance Category 6 cables shall meet or exceed the electrical characteristics set by the manufactures specifications.

H. The high performance Category 6 cable shall be specified to 550 MHz and shall meet the guaranteed swept margin as set by the manufacture.

I. The Category 6 Augmented (6A)/Class EA Unshielded Twisted-Pair (UTP) Cable shall be of round construction, shall contain 4 color coded pairs, and be listed for the environment for which it is being installed (Plenum, Riser, etc.)

J. SYSTIMAX part numbers for Plenum-rated Horizontal Cabling are as follows:

Product Number	Color	MID	Qty per Unit
2071E YEL C6 4	Yellow	700210123	W1000
2071E SGR C6 4	Green	700210164	W1000
2071E RED C6 4	Red	700210263	W1000
2091B GRN C6A	Green	760107219	W1000

K. SYSTIMAX part numbers for Plenum-rated Indoor Outdoor Horizontal Category 6, and 6A Cabling are as follows:

Product Number	Color	MID	Qty per Unit
CS44P-IO BLK C6A	Black	874036404/10	W1000
CS34P-IO BLK C6	Black	874049304/10	W1000

2.5 VIDEO COAXIAL CABLE (MATV)

A. Manufacturer: CommScope or approved equivalent.

B. The shielded, plenum RG-11 cable shall be used where the horizontal run is greater then 350 feet or specified in the Contract Drawings.
1. Shall consist of a 14-AWG solid-copper conductor. The cable shall be UL and (UL) Listed for Fire Safety and ISO 9001 Certified.
2. CommScope part number – 2287K WHRL RG11 QD 1000 4103304/10
3. Must use compression type connectors from IDEAL part number:
   a. IDEAL F connector - #89-011

4. The copper cable shall meet or exceed the electrical specifications set by the manufacture.

C. The Quad shielded, plenum RG-6 cable shall be used as horizontal where specified in the Contract Drawings.
1. Shall consist of a 18-AWG solid-copper conductor. The cable shall be UL and (UL) Listed for Fire Safety and ISO 9001 Certified.
2. CommScope part number – 2227V WHRL RG6 QD 1000 4112704/10
3. Must use compression type connectors from IDEAL part number:
   a. IDEAL F connector - RG6-F-XR-RTQ #92-651
   b. IDEAL BNC connector - RG6-INSITE-BNC #89-048(security camera install only)
4. The copper cable shall meet or exceed the electrical specifications set by the manufacture.

2.6 SECURITY CABLES

A. Manufacturer: CommScope or approved equivalent.

B. Composite Cables: Cable between controlled portals and IFPs shall consist of multiple conductor bundles affixed together via a central spline. The conductor bundles shall consist of the following:
1. 4C, 18 AWG 16/30 STR, shielded
2. 3P, 22 AWG 7/30 STR, shielded
3. 2C, 22A AWG 7/30 STR, shielded
4. 4C, 22 AWG 7/30 STR, shielded
5. The composite access control cable shall be Honey Well Genesis 3295 or approved equivalent.

C. 4 CONDUCTOR CABLE (for use with dry contact devices including door position switches, duress alarm switches, etc.
1. 4 stranded (7 x28) tinned copper conductors
2. Nominal O.D.: .217”
3. Belden 9444 or approved equivalent

2.7 FIBER PATCH CORDS

A. Manufacturer: SYSTIMAX Solutions ONLY. If required see specification 271300.

2.8 COPPER HARDWARE TERMINATION STANDARDS - Real Time Infrastructure Management - Intelligent Patch Panel System

A. All horizontal data cables to terminate on iPatch panel. If a rack manager does not exist in the cabinet one must be added to manage the horizontal infrastructure.

B. SYSTIMAX Solution Fiber Optic Patching System as follows:

Product Number	Description
Fiber Shelves (19 inch rack-mountable) and accessories	
760209940	HD-1U sliding fiber shelf(holds four modules)
760148502	360-LP-STACK-SPT
760231506	HD-1U-SP fixed fiber shelf (holds four modules) when splicing
760109470	12-LC-LS-AQ-Pigtails
760109496	12-LC-SM-BL-Pigtails
760109504	12-LCA-SM-GR-Pigtails
Copper Patch Panels - Cat 6	
760201137	360-iP-1100-E-GS3-1U-24 - 360 iPatch/imVision(enabled) 24 port panel
760201111	360-iP-1100-E-GS3-2U-48 - 360 iPatch/imVision(enabled) 48 port panel
760152561	360-IPR-1100-E-GS3-1U-24 - 360 iPatch/imVision(ready) 24 port panel
760152579	360-IPR-1100-E-GS3-2U-48 - 360 iPatch/imVision(ready) 48 port panel
Copper Patch Panels - Cat 6A	
760201145	360-iP-1100-E-GS6-1U-24 - 360 iPatch/imVision(enabled) 24 port panel
760201129	360-iP-1100-E-GS6-2U-48 - 360 iPatch/imVision(enabled) 48 port panel
760152587	360-IPR-1100E-GS6-1U-24 - 360 iPatch/imVision(Ready) 24 port panel
760152595	360-IPR-1100E-GS6-2U-248 - 360 iPatch/imVision(Ready) 48 port panel

C. Modular Patch Cords
1. Manufacturer: SYSTIMAX SCS-GS8E
2. Provide Category 6, Modular Patch Cords for each installed port designated as “Data” in the Drawings.
3. All cords shall conform to the requirements of ANSI/TIA/EIA 568 Commercial Building Telecommunications Cabling Standard, Horizontal Cabling Section, and be part of the UL® LAN Certification and Follow-up Program. Cords shall be equipped with an 8 pin modular connector on each end and shall conform to the length(s) specified on the detailed drawing. All Category 6 cordage shall be round, and consist of 23-AWG copper, stranded conductors, tightly twisted into individual pairs and shall meet or exceed the electrical specifications set by the manufacture.

4. UTP Patch cord lengths will be deployed as follows:

Length	Location/Application
3 ft	MDF, IDF, Computer Room, and Lab
5 ft	MDF, IDF, Computer Room, and Lab
7 ft	MDF, IDF, Computer Room, and Lab
9 ft	MDF, IDF, Computer Room, Office, Cubicle, or Lab
15 ft	Office, Cubicle, or Lab

5. Copper patch cord part numbers are as follows:

Product Number	Length	Material ID
GS8E-3ft	3FT	CPC3312-xxF003
GS8E-5ft	5FT	CPC3312-xxF005
GS8E-7ft	7FT	CPC3312-xxF007
GS8E-9ft	9FT	CPC3312-xxF009
GS8E-15ft	15FT	CPC3312-xxF015

NOTE: 15 ft. UTP patch cords shall be used at the workstation only.
NOTE: xx represents jacket color field. Order cords based on required colors

D. Hybrid RJ45 to 110 Patch Cords.
1. Manufacturer: SYSTIMAX 119P2PS
2. As required provide Category 6, Hybrid Patch Cords for each assigned data/voice port on the patch panel. Cords shall RJ45 connector on one end and 110GS on the other end. Cords shall be provided in appropriate lengths to accommodate all tenant voice or specialty ports as shown in detailed drawings. All Category 6 cordage shall be round, and consist of 24-AWG copper, stranded conductors, tightly twisted into individual pair and shall meet or exceed the Category 5e specifications.
3. Hybrid patch cords shall conform to the TIA 568B wiring scheme.
4. Hybrid patch cords shall be provided for each installed port designated as “Tenant Voice or Specialty jack” in the drawings.
5. Hybrid patch cord single pair part numbers are as follows(last 3 digits designates length):

Length	Material ID
8FT	CPC8662-03F-008
10FT	CPC8662-03F-010

6. Hybrid patch cord 4 pair part numbers are as follows(last 3 digits designates length):

Length	Material ID
8FT	CPC8312-03F-008
10FT	CPC8312-03F-010

E. Outlets
1. Manufacturer: SYSTIMAX
2. SYSTIMAX MGS400 Modular GigaSpeed Information Outlets - 8 position/8 conductor non-keyed modular outlets for applications up 1 Gbps and ANSI/TIA/EIA 568 compliant for Category 6 transmission requirements and be part of the UL® LAN Certification and Follow-up Program.
3. Outlets shall meet or exceed the following electrical and mechanical specifications set by the manufacture.
4. Standard installations shall utilize orange outlets for data. Dust Cover/Blanks shall match faceplate cover.

5. All IMO's (Interactive Media Outlet) shall have at a minimum 4-data ports at each location unless otherwise specified by the contract documents.
6. SYSTIMAX MGS400 Modular GigaSpeed Information Outlets part numbers are as follows:

Product Numbering	# per pack	Color	Material ID
MGS400-112	1	Orange	700 206 683

7. SYSTIMAX M-Series Modular Faceplates designed for use with M-Series Modular Information Outlets:

Product Numbering	# of ports	# per pack	Color	Material ID
M10L-262	1	1	White	108 258 427
M10LW-262	1 (wall)	1	White	108 258 468
M12L-262	2	1	White	108 168 469
M14L-262	4	1	White	108 168 543

8. SYSTIMAX M-Series Modular Surface Mount Box designed for use with one to four M-Series Modular Information Outlets. May be mounted on a flat surface with screws, Box color shall match wall/furniture surface color:

Product Numbering	# of ports	# per pack	Color	Material ID
M104SMB-262	4	1	White	107 952 459
M104SMB-270	4	1	Gray	107 952 467

2.9 IDENTIFIERS, LABELS AND LABELING SYSTEM

A. All Identification and Labeling shall follow Specification: 270553–Identification and Labeling of Communication Infrastructure. **Any deviation from the specification must be approved by HAS IT prior to installation.**

2.10 CABLE MANAGEMENT

A. Horizontal Manager
   1. Manufacturer: CPI – 30130-719

B. Fiber patch cords
   2. Manufacturer: Panduit – Fiber runner(Applies to all new or expand existing BDF/MDF/Computer room build outs)

2.13 SPECIAL APPLICATIONS SHIELDED TWISTED PAIR SOLUTION

A. Shielded Cable
   1. CommScope Shielded Cable, F/UTP Plenum Rated Category 6A, Black Jacket, 1000ft Length

Product Numbering	# per pack	Color	Material ID
2291B BK 4/23 R1000	1000ft	Black	760171025

B. Shielded Outlets

   1. CommScope Shielded Outlet, Category 6A, F/UTP

Product Numbering	# per pack	Color	Material ID
HGS620	1	Silver (F/UTP)	760152801

* If the HGS620 information outlet is to be used at WAO, the depth of any backboxes must be increased.

C. Shielded Patch Panels

1. CommScope Shielded Panel, 1U, 24 Port, F/UTP Flat. imVision / iPatch system preinstalled, ships with 24 shielded outlets

Product Numbering	# per pack	Color	Material ID
360-iP-MFTP-E-HD6B-1U-24	1	Silver	760201178

D. High Density M-Series Adapter

1. SYSTIMAX High Density M-Series Adapter - White

Product Numbering	# per pack	Color	Material ID
HGS-A-MS-WHITE	1	White	760154187

E. Shielded Patch Cords

1. CommScope Shielded Patch Cords, F/UTP, Black Jacket, RJ45-RJ45, 7ft

Product Numbering	# per pack	Color	Material ID
PCOSP-6AS-BK-07FT (OSP) G10FP-GR-7FT	1	Black Green	CO11192-01F007 CPCZZK1-01F007

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify raceways, boxes, hand holes and maintenance holes are properly installed following Sections 270528, and 270543.

B. All communication media must be installed in conduit or cable tray unless an alternate method has been approved by HAS/IT.

C. Verify horizontal conduit is minimum 1-inch diameter.

D. Verify backboards are properly installed.

E. Verify telecommunications grounding system is properly installed and tested following Section 270526.

F. Verify liquid-carrying pipes are not installed in or above any IDF/MDF that has active electronic equipment. Do not proceed with installation in affected areas until removed.

3.2 PREPARATION

A. Environmental controlled communication rooms shall maintain temperature of between 64 degrees Fahrenheit and 78 degrees F and between 30 and 55 percent humidity in areas of active electronic system work.

B. Cable Splicing: Exact cable routing, splice enclosure locations, distances, elevations, work space and purpose of splice will be governed by actual field conditions. Contractor shall perform field surveys prior to submitting layout drawings.

C. Contractor's on-site RCDD supervisor shall review, approve and stamp all shop drawings, coordination drawings and record drawings.

3.3 INSTALLATION

A. Install work following drawings, manufacturer's instructions and approved submittal data. The number of cables per run, outlet configuration and other pertinent data are included on the drawings.

B. All installation shall be done in conformance with ANSI/TIA/EIA 568 standards, BICSI methods, Industry standards and SYSTIMAX SCS installation guidelines. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines shall require the Contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the Contractor during the implementation.

C. The SCS installation shall comply with all applicable national and local codes pertaining to low voltage cable system installations.

D. The contractor shall adhere to the installation schedule of the general contractor and shall attend all construction meetings scheduled by the general contractor. All low voltage and data cabling shall be complete before ceiling cover.

E. Upon structural completion of the communications room(s) and prior to the installation of any communications equipment or supporting devices inside the room, the HAS IT Representative shall consult the Communications Designer in order to:
   1. Perform construction administration activities to compare as-built configuration to the design.
   2. Observe all "not-to-design" compliance issues and issue corrective advisement of actions.
   3. Upon completion of 1 and 2 above, the Communications Designer shall mark with masking tape the general layout of the equipment placement.

F. All communications conduits shall be identified with color coded orange tape marked "Communications" every 50 feet. Tag conduit termination points (to include J-box locations) with the origination, destination and device name (if applicable) location.

G. Vertical Cabinet Installation
   1. All Cabinets shall be properly positioned, leveled, ganged, anchored, grounded and powered.
   2. All Cabinets shall be populated as noted in drawings with termination hardware, equipment, proper patch cord lengths, and power outlets.
   3. Install and anchor all vertical equipment cabinets to floor following the Drawings and manufacturer's instructions.
   4. All cabinets shall be properly ganged in each bay as shown in the Drawings.
   5. All cabinet doors shall be configured as shown in the Drawings.
   6. All cabinets shall be properly labeled per specification 270553.
   7. After final acceptance of the cabinets, coordinate with Owner to replace key/lock with silver barrel on front and back doors.

H. The contractor shall perform all required cross connections of the horizontal cable runs to the backbone cable system. The equipment connections to the data systems shall be performed by the vendors installing and/or maintaining those systems.

I. The contractor is responsible for providing a CD with all the cable/patch panel information in the same format that will be accepted for download in HAS's iPatch/imVision database **1 month** before any patching is completed.

J. The contractor shall provide service loops (slack) for cables terminating in the IDFs. A 6-foot service loop shall be provided above the access ceiling or cable trays unless specified otherwise. This allows for future changes or expansion without installing new cables.

K. The installation contractor shall be responsible for coordination, testing and problem resolution with the system vendors.

L. HAS IT or their designated representative shall randomly perform unannounced, on-site reviews during the installation. In addition, this person shall perform a final inspection and a complete review of the test results before the installation is accepted.

M. Upon completion of the installation, Contractor shall prepare as-built documentation of the entire SCS. This documentation shall include:
   1. As-Built Drawings
      a. All drawings shall be provided on disk in a form compatible with AutoCAD Version 14. A complete set of project plans will be provided by the Contractor on CD.
      b. A complete diagram of all terminations in the IDFs.
      c. A complete diagram of all copper, fiber, and coax riser cable.
      d. A complete diagram of all copper, fiber, and coax inter-building cable.
      e. Floor plans showing exact cable routings with each outlet clearly marked with cable number.
      f. A complete diagram of all cable tray, conduits and conduit sleeves.
   2. Documentation
      a. All cable inventory data documentation shall be submitted in designated as specified in specification 270553
      b. Documentation on horizontal cable shall include cable number and length of cable.

c. Complete cross connect documentation is required. This information will include detailed documentation of all four pairs of each horizontal cable and every pair of all copper riser and inter-building cable and every fiber of fiber optic cable.

3. As-built Drawings and Documentation shall be reviewed, approved and stamped by Contractor's on-site RCDD.

3.4 POST-INSTALLATION TESTING AND CERTIFICATION

A. Contractor Requirements
1. Contractor shall provide sufficient skilled labor to complete testing within a reasonable test period.
2. Contractor shall have a minimum of three years of experience installing and testing structured cabling systems. All installers assigned by the Contractor to the installation shall be certified by the factory to install and test the provided products.
3. Contractor is responsible for supplying all of the required test equipment used to conduct acceptance tests.
4. Contractor is responsible for submitting acceptance documentation as defined in 3.04.D below. No cabling installation is considered complete until test results have been completed, submitted and approved as defined in 3.04.D below.

B. Test Procedure
1. HAS IT Representative reserves the right to be present during any or all testing. Notify HAS IT Representative at least 48 hours prior to beginning test procedures.
2. Testing shall be of the Permanent Link. However, Contractor shall warrant performance based on Channel performance and provide patch cords that meet channel performance.
3. All cabling not tested strictly in accordance with these procedures shall be re-tested at no additional cost to the Owner.
4. Testing of all copper and fiber wiring shall be performed prior to system(s) cutover.
5. 100% of the installed cabling shall be tested. All tests shall pass acceptance criteria defined in 3.05 below.
6. Cable testing shall be performed by a fully charged tester, and the charging unit shall be disconnected during testing.
7. Any pairs not meeting the requirements of the standard shall be brought into compliance by the contractor at no charge to the City. Complete end-to-end test results shall be submitted to the City.

C. Standards Compliance and Test Requirements
1. Copper Cabling shall meet the indicated performance specifications:
   a. Category 6 Horizontal Cabling shall be tested to the manufactures specification for Category 6 Cabling and SYSTIMAX SCS GigaSpeed System.
   b. Category 6A Horizontal Cabling shall be tested to the manufactures specification for Category 6A Cabling and SYSTIMAX SCS X10D System.
2. All test equipment used shall meet the performance specifications defined in 3.04.

D. Cable Test Documentation
1. Test reports shall be submitted in hardcopy and electronic format and certified by the contractor's RCDD to be a complete and accurate record of cabling installed. Hand-written test reports are not acceptable.
2. Hardcopy reports are to be submitted in labeled three-ring binders with an attached affidavit verifying passing execution of all tests. Hardcopy summary reports shall contain the following information on each row of the report: circuit ID, test specification used, cable length, date of test, and pass/fail result.

3. Electronic reports shall be submitted on CD in PDF format. Electronic reports shall be accompanied by a Certificate signed by an authorized representative of the Contractor warranting the truth and accuracy of the electronic report. Certificate shall reference traceable circuit numbers that match the electronic record.
4. Hardcopy and electronic reports for each cable route shall be submitted together in one submittal. The submittal description shall include the type of test performed, type of cable, and cable ID (including originating and terminating room numbers) of cable tested. Partial or unclear documentation will be returned without reviewing.
5. Test reports shall include the following information for each cabling element tested:
    a. Wiremap results that indicate that 100% of the cabling has been tested for shorts, opens, miswires, splits, polarity reversals, transpositions, presence of AC voltage and end-to-end connectivity.
    b. For Category 6 cabling: Attenuation, NEXT, PSNEXT, Return Loss, ELFEXT, and PSELFEXT data that indicate the worst case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combinations and in both directions when required by the appropriate standards. Any individual test that fails the relevant performance specification shall be marked as a FAIL. Test shall also include mutual capacitance and characteristic impedance.
    c. Length (in feet), propagation delay, and delay skew relative to the relevant limit. Any individual test that fails the relevant performance specification shall be marked as a FAIL.
    d. Cable manufacturer, cable model number/type, and NVP
    e. Tester manufacturer, model, serial number, hardware version, and software version
    f. Circuit ID number and project name
    g. Autotest specification used
    h. Overall pass/fail indication
    i. Date of test
6. Test reports shall be submitted within seven business days of testing.

E. Test Equipment
1. Test equipment used under this contract shall be from manufacturers that have a minimum of 5 years of experience in producing field test equipment. Manufacturers shall be ISO 9001 certified.
    a. Category 6 – At minimum a Level III tester or submitted and owner-approved equivalent.
    b. Refer to spec section 27 13 00 for fiber testing procedures.
2. All test tools of a given type shall be from the same manufacturer, and have compatible electronic results output.
3. Test adapter cables shall be approved by the manufacturer of the test equipment. Adapters from other sources are not acceptable.
4. Baseline accuracy of the test equipment shall exceed TIA Level III, as indicated by independent laboratory testing.
5. Test equipment shall be capable of certifying Category 6 links.
6. Test equipment shall have a dynamic range of at least 100 dB to minimize measurement uncertainty.
7. Test equipment shall be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.
8. Test equipment shall include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.
9. Test equipment shall be capable of running individual NEXT, return loss, etc measurements in addition to autotests. Individual tests increase productivity when diagnosing faults.
10. Test equipment shall include a library of cable types, sorted by major manufacturer.

11. Test equipment shall store at least 250 Category 6 autotests (in full graphic format) in internal memory, with the option for additional storage card via expansion slot.
12. Test equipment shall be able to internally group autotests and cables in project folders for good records management.
13. Test equipment shall include DSP technology for support of advanced measurements.
14. Test equipment shall make swept frequency measurements in compliance with TIA standards.
15. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurement.

3.5 ACCEPTANCE

A. Once all work has been completed, test documentation has been submitted and approved, and HAS IT Representative is satisfied that all work is in accordance with contract documents, the HAS IT Representative will notify Contractor in writing of formal acceptance of the system.

B. Acceptance Requirements
1. Contractor's RCDD shall warrant in writing that 100% of the installation meets the requirements specified under 3.04. "Standards Compliance & Test Requirements" above.
2. HAS IT Representative reserves the right to conduct, using Contractor equipment and labor, a random re-test of up to five percent of the cable plant to confirm documented results. Random re-testing, if performed, shall be at the expense of the City, using standard labor rates. Any failing cabling shall be re-tested and restored to a passing condition at no cost to the City. In the event more than two percent of the cable plant fails during re-test, the entire cable plant shall be re-tested and restored to a passing condition at no additional cost to the Owner.
3. HAS IT Representative may agree to allow certain cabling runs to exceed standardized performance criteria (e.g. length). In this event, such runs shall be explicitly identified and excluded from requirements to pass standardized tests.
4. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and submittal and approval of full documentation as described in 3.04.
5. See Appendix A & B. Acceptance requirements are not limited to these sheets

3.6 DEMOLITION

A. The contractor shall be responsible for maintaining all communications service to areas of the building scheduled to remain in service during the period of renovation.

B. Notify HAS Information Technology (IT) department 30 days prior to the start of demolition work taking place in existing communications rooms. Coordinate removal of equipment and cabling within existing communications rooms with HAS IT.

C. Where removal is indicated in Drawings, remove communications cable from termination point back to originating communications room, MDF or tenant communications room. Coordinate removal at terminating blocks and panels with HAS IT. Coordinate removal of cross-connects and patch cables with HAS IT.

D. Ensure systems and circuits are no longer active before removing and prior to the demolition of existing communications rooms. If active circuits exist at time of scheduled demolition, coordinate with HAS IT Representative to reroute or deactivate circuit(s).

E. Demolition and removal of cabling shall not impact the operation of active systems.

F. Unless otherwise noted, discard all removed cable, patch cables and cross-connects. Except where re-routing of cable is specified in Drawings or by Designer, do not reuse cable.

G. Remove all loose unterminated cabling to source found above ceiling, under floor or in wall.

H. Demo all abandoned cable in accordance with NEC 800.25.

3.7 CLEANING

A. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where Work has been completed unless designated for storage.

END OF SECTION

APPENDIX A

MDF/IDF Check List

This list is intended as a minimum checklist. CM should ensure that the contractor's schedule has built in these components and the necessary buffer period – and associated access restrictions to the communications equipment rooms -- for HAS IT and tenant IT to prepare.

1. All communication rooms that will service the area to be opened must be completed. That means a final walkthrough of these areas has been completed. It is not necessary that the entire project achieve substantial completion, but IT cannot install equipment and begin work until the following minimum criteria is met:
    a. Space is built out and clean – free from dust/residues.
    b. Electrical w/UPS as required.
    c. All racks/cabinets installed and mounted. Padlocks eyes have been installed.
    d. Grounding bus bar installed and properly tied to main grounding bus bar in MDF
    e. HVAC functioning properly and is adequately filtering dust. Humidity is controlled.
    f. Door access control is installed (card reader) -or- an approved temporary provision. Simple key access is not permissible.
    g. Lighting is installed and operational.
    h. Cable trays/ladder racks installed and ready to use.
    i. Permanent or temporary signage identifying permanent room number.

2. All cabling necessary to operate the areas to be opened is completed.
    a. Backbone cabling (copper and fiber) from the applicable communication room(s) is installed, tested, labeled, and approved by the inspector and communications design consultant.
    b. Horizontal cabling for all areas to be occupied is installed, tested, labeled, and approved by the inspector and communications design consultant.
    c. Copper cross connects and/or fiber jumpers have been installed per the owner/tenant requirements.
    d. Cable records and redline drawings for installed cables are submitted and approved PRIOR to putting any active circuits on the new cables. Cable records reflect all installed cables **and** any cross connects or jumper assignments installed by the contractor.
    e. All jumpers and patch cords specified by the contract are transmitted to the owner for use.
    f. NOTE: cable labels and permanent room numbers need to match. CM needs to be sure to get design team, airport, IT, and CM / contractor reps together to review permanent room numbers prior to contractor installing cable labels.

3. Move-in buffer period needs to be minimum 6 **weeks** for HAS-IT to install/extend services within the area to be occupied prior to occupation of the facility or spaces. Additional time may be necessary if Tenant IT organization is involved, or if contractor has other systems that must be configured/tested which require HAS-IT resources (i.e. cabling or data network connections). This is frequently the case for PA System, television, radio, Fire Alarm, pay telephone, EFSO (Electronic Fuel Shutoff), access control & CCTV, etc.

4. Once HAS-IT accepts a communications equipment room and begins to install/configure equipment in preparation for hosting live applications, this room becomes a restricted area with access to be controlled by HAS-IT. Contractors must be substantially complete with systems inside the communications equipment room so that access is generally not required. Minor punch list and scheduled testing with escort can be arranged, but access will be very limited.

5. Other IT-related systems that must be operational, tested, and accepted or approved temporary provisions.
    a. PA System
    b. MATV and/or CNN TV (where applicable)
    c. Fire Alarm
    d. MUFIDS
    e. Pay Telephones (where applicable)
    f. EFSO (where applicable)
    g. Access Control & CCTV (note: must be PROGRAMMED, and approved acceptance test walk through by HAS)
    h. Crash phone (where applicable)
    i. Radio system enhancements (where applicable)
    j. Data Network switch installed and configured.

APPENDIX

B

IDF Number:		**Date:**		
Grounding & Bonding:		**YES**	**NO**	**COMMENTS**
	TGB properly installed			
	Proper grounding conductor installed (6AWG min.)			
	Cable trays properly bonded			
	Equipment Racks, Armored Cables & Cabinets properly bonded			
	Conduit properly bonded			
	Cabling properly bonded			
	Splice Cases properly bonded			
Horizontal Cabling:		**YES**	**NO**	**COMMENTS**
	Routing			
	Cables properly supported			
	Pull tensions properly recorded			
	Sheath damage			
	Bend radius observed			
	Pair twist meets spec			
	Proper termination scheme			
	Cable/jack part number meets spec			
	Plenum vs. PVC			
	Properly dressed in tray			
	Properly dressed in cable management			
	Cables bundled properly			

	Appropriate clearances observed (power)			
	Minimum about of cable exposed at termination			
Backbone Cabling:		**YES**	**NO**	**COMMENTS**
	Fiber strain relief properly applied			
	Routing			
	Cables properly supported			
	Pull tensions properly recorded			
	Sheath damage			
	Bend radius observed			
	Properly dressed in tray			
	Fiber installed in inner duct			
	Properly dressed in termination shelf			
	Any splice cases properly supported			
Room Layout:		**YES**	**NO**	**COMMENTS**
	Room laid out according to project drawings			
	Proper clearances maintained			
	Is the room clean & neat in appearance			
	Liquid carrying pipes within the room			
Pathways:		**YES**	**NO**	**COMMENTS**
	Conduit properly routed & supported			
	Cable Tray properly routed & supported			
	Inner Duct used to route fiber and properly supported			
Labeling:		**YES**	**NO**	**COMMENTS**
	Grounding conductor			
	End-to-End labeling			

	Pair Count on Splice Case			
	Horizontal Cabling			
	Fiber Optic Cabling			
Other:		**YES**	**NO**	**COMMENTS**
	Appropriate fire stop material in place			
	Cabling test results submitted with proper information			
	Climate controlled environment (Temp. & Humidity)			
	Is the room access controlled			
Copper Cabling:				
	Total Pairs (Riser)			
	Pair Counts			
	Termination Type (66, 110, Protectors..)			
	Termination Location			
Fiber Optic Cabling:				
Multimode:				
	Total Strands			
	Termination Type (LC, SC)			
	Termination Location			
Single Mode:				
	Total Strands			
	Termination Type (LC, SC)			
	Termination Location			

End Of Appendix

SECTION 27 40 00

AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 and Division 27 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes: furnishing, installing, testing and documenting audio-visual systems for spaces included by not limited to:
   1. Offices
      a. Displays - Flat screen display
      b. Sources – Owner CATV feed via coax and HDMI wall plate at desk.
      c. Audio – Displays built-in loudspeakers.
      d. Control - Via manufacturers remote.
   2. Discussion Area
      a. Displays - Flat screen display
      b. Sources – Owner CATV feed via coax and HDMI wall plate.
      c. Audio – Displays built-in loudspeakers.
      d. Control – Wall mounted keypad.
   3. Collaboration Room
      a. Displays - Flat screen display
      b. Sources – Owner CATV feed via coax and HDMI at table cubby.
      c. Audio – Displays built-in loudspeakers.
      d. Control – Wall mounted keypad.

B. Audiovisual Systems shall consist of multiple systems with various configurations per the AV Room Type Device Schedules and the design specifications and drawings.

C. These systems include some or all of the following:
   1. Wall mounted, ceiling mounted, and ceiling hung speaker systems.
   2. Mounting of flat screen video displays and projectors.
   3. Audio input/output panels, microphones, wireless microphone systems, mixers, switchers, audio processors and amplifiers.
   4. Video input/output panels, switchers and scalers.
   5. Microphones, mounts and cables.
   6. Programmable audio-visual remote and automated control system and associated support devices for controlling: audio and videos systems, etc.
   7. Floor, wall and desktop connection hubs for audio, video, broadband, LAN, remote control signaling, computer and power connections.
   8. Termination, connector and pull junction boxes.
   9. Flat screen video display mounting systems.
   10. Projector mounting
   11. Wiring and connectors.

1.3 OVERVIEW

A. The work detailed by these specifications and drawings has been specified to meet certain requirements for performance. Some information, such as exact equipment models, layout, wire routing, additional conduit and power requirements, etc. has been omitted. It shall be the responsibility of the Contractor to translate these specifications and drawings into a complete design package containing all necessary elements for a complete turnkey installation including all material, labor, warranties, shipping and permits.

B. General elements of the work shall consist of, but not limited to, the following:
   1. Procure all permits and license required to complete this installation.
   2. Submission of Part 3.14 Pricing Forms for all equipment, materials and labor.
   3. Attend pre-construction/pre-submittal meeting with Owner and Consultant to review design package for the Audio-Video Systems.
   4. Prepare schedule of work.
   5. Submittal preparation and processing prior to ordering equipment.
   6. Attend submittal review meeting.
   7. Provide materials necessary to complete the Audio-Video Systems.
   8. Perform camera pre-installation sign-off walk through with Owner and Consultant.
   9. Provide continuous on-site supervision of the installation technicians. On-site supervision shall include: daily supervision of the work, updating work site progress drawings to reflect changes and installation details, preparing weekly progress reports and attendance at site coordination meetings as directed by the Owner and Consultant.
   10. Provide all miscellaneous hardware including cable management devices, termination cabinets, wire and cable labeling materials, fasteners, hangers and brackets as required.
   11. Provide all materials, equipment, labor and all other incidental material, tools, appliances and transportation as required for a complete and functional audio-video system (AVS) as described herein and supplementary drawings.
   12. Coordinate receipt of Owner furnished equipment.
   13. Perform installation according to contract documents and manufacturers recommendations.
   14. Protect new facilities finishes and equipment.
   15. Maintain construction materials and refuse within the area of work.
   16. Clean the work area at the end of each day.
   17. Provide system software and programming and other materials necessary for the Audio-Video Systems to function by standard industry practices.
   18. Program Audio-Video Systems and load with user define text and specified operations per design specifications and drawings.
   19. Provide web control for all programmed interfaces and room systems.
   20. All touch panel and internet controls must have “User interface” (Basic functionality) and Lockable / password “Admin user interface” (Advance functionality). Coordinate all programming with Owner and Consultant for approval.
   21. Provide (2) non-substantial final programming changes for all systems within warranty period after acceptance date.
   22. Perform initial testing, programming and adjustments with written reports.
   23. Make final adjustments, calibrations and programming modifications as directed by the Owner and Consultant.
   24. Demonstrate all systems for final acceptance.
   25. Preparation of O&M manuals and as-built documents for Owner’s use.
   26. Providing training for Owner’s staff, facility personnel and technical staff.
   27. Providing warranty service for a period of one year from acceptance date.

28. Provide extended system support.

1.4 DEFINITIONS

A. AVS: Audiovisual System.

B. OWNER: Houston Airport Systems (HAS) as described herein and in supplementary drawings.

C. OFE: Owner Furnished Equipment.

D. OFOI: Owner Furnished Owner Installed.

E. OFCI: Owner Furnished Contractor Installed.

F. CFCI: Contractor Furnished Contractor Installed.

G. CONTRACTOR: Contractor or subcontractor providing and installing the Audiovisual System.

H. PROJECT: HAS IDO Building Standards Space Fit-Out.

I. PROVIDE: Furnish, install, commission, test and warrant.

J. WORK: Action required furnishing, installing, commissioning, testing and warranting the Audio-Visual Systems.

K. COMPONENT: Any individual item of equipment or material which is an element of the Audio-Visual Infrastructure System.

L. ZONE: Separate parallel signal path with independent processing and alternate program capabilities.

M. AGC: Automatic gain control.

N. CCD: Charge-coupled device.

O. CTS: Certified Technology Specialist.

P. DSP: Digital Sound Processor

Q. FSD: Flat Screen Display.

R. MPEG: Moving Picture Experts Group.

S. NTSC: National Television System Committee.

T. UPS: Uninterruptible power supply.

U. PoE: Power over Ethernet

1.5 PERFORMANCE REQUIREMENTS

A. These specialized AVS systems are designed to efficiently support the Owner's various facilities and activity areas in a manner, which can be proficiently managed by the staff. Work shall include the complete turnkey installation and commissioning of these systems per the following specifications and drawings.

1.6 SUBMITTALS

A. Contractor's on-site CTS supervisor shall review, approve and sign off all submittal documents.

B. Provide documentation as outlined in quality assurance. Submit all supervisor and installation team members resume(s) and manufacture certification certificates.

C. Product Data:
   1. List all system components including manufacturer and model number. List to be alphabetical by manufacturer and then model.
   2. Manufacturer's literature sheets for all materials and equipment, including warranty information, recommended preventative maintenance and spare part inventory recommendations. Literature containing more than one device shall be clearly marked to delineate item(s) included in the Work. Literature to be alphabetical by manufacturer and then model.
   3. Clearly indicate any substitutions.
   4. Clearly indicate color or special finishes.
   5. Correlate products with part 2 of this Specification.

D. Pricing Forms: Contractor shall submit completed pricing form that includes an itemized listing of all equipment, materials and labor required for the installation of the system as specified herein for Change Order pricing. The listing shall contain: item description, item model number, quantity, unit cost and extended labor, material and installation cost required to provide a complete and functional system.

E. Programming:
   1. Provide and coordinate with the Owner all possible control functionalities based on project drawing and specifications.
   2. Provide web control for all programmed interfaces and room systems
   3. Provide screen shots / templates and a narrative description of all "User Interfaces" and "Admin Interfaces" functionality. Contractor must have written approval of control lay-out and functionality prior to installation of programming. Provide Owner with a full functioning control system.

F. Shop Drawings:
   1. Contractor's on-site CTS supervisor shall review, approve and sign off all shop drawings, coordination drawings As Built Drawings documents.
   2. Reproducing Contract Documents for shop drawing is not acceptable.
   3. Shop drawings to include the following:
      a. Drawing legend sheet describing all symbols used on the drawings.
      b. Floor plans with all devices and wiring raceway depicted.
      c. Wire runs with tags for type, gauge, quantities and cable identifiers.
      d. System riser diagram indicating all field devices, riser paths and room designations.
      e. Block diagram for each system showing all equipment and signal pathways.
      f. Point schedules defining interconnection of all inputs and outputs for all equipment

including data connections and other systems with cable identifiers.
g. Elevations of equipment racks and teaching consoles.
h. Fabrication shop drawings for all custom components.
i. Diagrams for power, signal, control wiring and grounding.
j. Include plans, elevations, sections, details, and attachments to other work.

G. Coordination Drawings: Reflected ceiling plans, drawn to scale, with ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings are shown and coordinated, using input from installers of the items involved. Provide similar elevation drawings for wall-mounted items.

H. An implementation schedule listing dates for audiovisual equipment installations. See appendix A. The dates of audiovisual equipment installations shall be in accordance with dates for installation of the various special systems and users. It is incumbent upon the audiovisual implementers to include the dates for special system and user installs into the schedule.

I. Samples: Provide as requested for colors and texture coordination.

J. Partial submittals shall not be acceptable without prior approval by Owner. Product data, shop drawings and coordination drawings must be submitted at the same time.

K. No portion of the work shall commence, or equipment ordered until the Owner has approved the submittals.

L. The Contractor shall not be relieved from any contract-required responsibility by the Owner's approval of submittals.

M. Nothing in the specification shall relieve Contractor of system package design responsibility, including, but not limited to, all equipment furnished under this Contract. The Contractor is, in all cases, solely responsible for the performance of the delivered AVS, and for furnishing complete system documentation for each and every part of the system.

N. Extended AVS Support.
1. Provide pricing for AVS hardware and software support including necessary reconfiguration and data base changes for years 2 through 5.

O. Resubmitting.
1. Make corrections or changes in Submittals as required by the Consultant’s stamped instructions and attached comments and resubmit.
2. Identify changes on resubmittals by clouding. Only indicated changes will be reviewed when resubmitted.
3. Added drawings shall be clearly identified.
4. Contractor shall be responsible for project delays caused by rejected submittals.
5. Consultant shall be compensated for additional services for submittals rejected more than twice. The amount of such compensation shall be incorporated by change order and withheld from the Contractor‘s Application for Payment.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:
1. The Contractor performing the installation shall have a minimum of 5 years experience in

the installation of AVS systems of similar size and scope.

2. An AVIXA CTS-I shall supervise and approve all on-site work as a recognized member of the Contractor's installation team. All installation team members must demonstrate knowledge and compliance with all AVIXA, TIA, UL, and NEC methods, standards and codes. Submit resumes of the entire team and completed training courses and certifications.
3. All members of the installation team must be certified by the manufacturer as having completed the necessary training to complete their part of the installation.
4. Owner's representative may make such investigations as deemed necessary to determine that the Contractor is responsive, responsible and qualified in the area of work contemplated by the Contract. In this regard, the Contractor shall furnish to the Owner such information as requested for this purpose. Information and data may include (but not necessarily be limited to): Date of organization and/or incorporation and number of years engaged in this business under present firm's names; list of major equipment owned by the company; list of principal personnel who will be involved in the execution of this contract with the experience and qualifications of each person.
5. Contractor shall have local in-house engineering and project management capability consistent with the requirements of this project. The Contractor shall provide a project manager that shall be the same individual throughout the project and shall be the person responsible for system programming, preparation of Operation and Maintenance Manuals, Training, Programs, Schedules and Test Protocols, documentation of system testing, maintenance of record drawings and coordination and scheduling of all labor.
6. Contractor shall be or have direct relations through their subcontractors, an authorized manufacturer's representative for all products they furnish or install.
7. Contractor shall have a local organization capable of providing maintenance and service for the specified system. Facility shall be no more than 100 miles from Owner's site.
8. Contractor shall be capable of providing emergency service on a 24-hour, 7 days a week basis.

B. Conflicts:
   1. In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify in writing to Consultant of any such occurrences before the purchasing of any equipment, materials and/or installation. The Consultant will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to: design changes, equipment, materials and/or installation changes. In any event, Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications.

C. The Contractor shall provide all materials, equipment and installation in compliance with the latest applicable standards from ANSI, ASTM, FCC, IEEE, NCTA, NEC, NEMA, NFPA, REA, TIA/EIA, and UL including but not limited to:
   1. American National Standards Institute (ANSI).
   2. ANSI T1.404 (DS3) and CATV Applications.
   3. American Society for Testing and Materials (ASTM).
   4. American with Disabilities Act (ADA).
   5. EIA/TIA-569 Standard, Commercial Building Standard for Telecommunications Pathways and Spaces.
   6. EIA/TIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
   7. National Cable Television Association (NCTA).
   8. NCTA-02 NCTA Recommended Practices for Measurements on Cable Television Systems.

9. National Electrical Code (NEC) (Latest revision and pertinent addendums).
   a. Article 250, Grounding.
   b. Article 300, Part A. Wiring Method.
   c. Article 310, Conductors for General Wiring.
   d. Article 800, Communication Systems.
10. National Fire Protection Association (NFPA) Publications (Latest revisions and pertinent addendums).
11. Underwriters Laboratories (UL).

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. NECA 1 Good Workmanship in Electrical Contracting.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: System components shall be equipped and rated for the environments where installed.

B. Environmental Conditions.
   1. Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
   2. Interior, Controlled Environment: System components installed in conditioned interior environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F (2 to 50 deg C) dry bulb and 20 to 90 percent relative humidity, non-condensing.
   3. Interior, Uncontrolled Environment: System components installed in non-conditioned interior environments shall be rated for continuous operation in ambient conditions of 0 to 122 deg F (minus 18 to plus 50 deg C) dry bulb and 20 to 90 percent relative humidity, non-condensing.
   4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F (minus 34 to plus 50 deg C)] dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) and snow cover up to 24 inches (610 mm) thick.

1.9 PROJECT COORDINATION AND PLAN

A. Contractor shall submit a project plan detailing the steps and associated timeframe to meet the General Contractor's schedule requirements. Project plan should include benchmarks for items such as regular project meetings, equipment order and delivery, installations, configuration and calibrations, testing and burn-in, training, substantial completion notification, testing and final acceptance.

B. Contractor assumes total responsibility for coordinating with building trades or other parties as may be identified by the General Contractor.

C. Coordinate size and location of conduit systems, back boxes, and provisions for electrical power to equipment of this Section.

D. The Contractor must obtain written permission from the General Contractor prior to routing and/or installing cable, equipment or service through the facility.

E. Contractor shall prepare the installation schedule to coordinate sequencing, dependencies and priorities of the system installation including work by other trades.

1.10 COMMISSIONING

A. Provide system commissioning and commission report.

B. Commissioning of systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Agent. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure.

C. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans.

PART 2 – PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

1. AMX
2. Biamp
3. BSS
4. C2G
5. Chief
6. Clear-One
7. Crown
8. Dell
9. Denon
10. Dalite
11. Draper
12. Electro-Voice
13. Elmo
14. Ergotron
15. Extron
16. FSR Inc.
17. Furman
18. Gepco
19. JBL
20. JVC
21. Lab.Gruppen
22. Liberty Wire and Cable
23. Listen Technologies
24. Middle Atlantic Products
25. Mersive
26. NEC
27. Neutrik
28. Peerless
29. Premier
30. Presonus
31. QSC
32. Radio Design Labs
33. Rane
34. Raxxess
35. RCI
36. Shure
37. SurgeX
38. Tascam
39. Tripp Lite
40. Vaddio
41. West Penn Wire
42. Wiremold

2.1 AUDIO VISUAL PROGRAMMING

A. Audiovisual Control System to be composed of a Control manufacturer and software. Provide necessary cables, connector and other components as required for the systems to function per the drawings and specifications.

B. Coordinate with owner to develop basis for control system GUI “look and feel” for all A/V room types.

C. Final programming A/V source code to remain property of Owner. Provide copies of all A/V room types compiled and uncompiled source code, to Owner and Control Manufacturer for backup and future reference as part of the Final Acceptance.

2.2 KEYPAD CONTROLLERS

A. Approved products:

1. AMX
   a. MCP-108
2. Or approved equal

2.3 VIDEO EXTENDERS

A. Approved products:

1. AMX
   a. DX-TX-DWP-4K
   b. DX-RX
2. Or approved equal

2.4 VIDEO INPUT PLATES

A. Approved products:

1. Liberty
   a. PC-G1791-E-P
      1) Verify color with architect.
2. Or approved equal

2.5 FLAT PANEL DISPLAYS (FPD)

A. Minimum Requirements

1. HDMI
2. VGA w/3.5mm
3. RS-232

4. 1920x1080p
5. NTSC Tuner
6. Built-in Loudspeakers
7. Ethernet Connectivity

B. Approved products (Size by plans):

1. NEC
   a. E-Series
2. No alternates allowed.

2.6 FLAT SCREEN DISPLAY MOUNTS

A. Requirements:

1. Tilting wall mount for 55” & smaller displays. Unless noted otherwise. Mount with display shall be ADA compliant.
2. Articulating wall mount for 60” & larger displays.

B. Approved manufacturers:

1. Chief
2. Premier
3. Peerless
4. Or approved equal

2.7 POWER PROTECTION

A. Required at all display and equipment locations.

B. Approved products for racks and lecterns:
1. Middle Atlantic PD-915R-SP
2. Furman M-8Lx
3. Surge-X SX-1115 RL
4. Or approved equal

C. Approved products for displays:
1. Middle Atlantic PD-215
2. Furman AC-215A
3. Surge-X SX-DS-154
4. Or approved equal

2.8 TABLE CUBBIES

A. Approved products:
1. AMX

a. HPX-600
b. Provide accessories per schematics.
c. Confirm finish options with owner.

2. Or approved equal

2.9 PATCH CABLES

A. Provide types and quantities per drawings and schedules.

B. Minimum 10’ length cables.

C. Lectern, Desk, etc. must reach furthest point of surface.

D. Approved Manufactures:

1. Liberty
2. C2G
3. Extron

2.10 FLOOR BOXES

A. Approved products:
1. FSR
a. FL-500P-8
2. Or approved equal
3. EC to provide and install box, conduit, pour pan, lid and any other required accessories for box installation. Audiovisual contractor to provide inserts and connectivity plates.

2.11 CABLES

A. Provide types and quantities per drawings and schedules.

B. Conductor Sizing:

1. Insulation shall be rated for a minimum of 300 volts.
2. Wire types and minimum sizes:
a. 70 Volt Speaker Cable - 16 AWG, twisted, stranded CL2/CL2P.
b. Low Impedance Speaker Cable – minimum 12 AWG, twisted, stranded CL2/CL2P.
c. Microphone Level Cable - 22 AWG, with 22 AWG drain wire, shielded, twisted, stranded CL2/CL2P.
d. Line Level Cable - 22 AWG, with 22 AWG drain wire, shielded, twisted, stranded CL2/CL2P.
e. Low Voltage Control Cable - 18 AWG twisted, stranded CL2/CL2P.
f. CAT6 – Per 27 15 00 specifications.
g. HDBaseT – Per device manufacturer requirements.

C. Minimum acceptable AVS systems wiring performance standards shall be as follows:

1. Speaker cable - Per ANSI WC57 standard test.
2. Network CAT6 - Per 27 15 00 specifications.
3. RS 232 - Per ANSI/ WC66 standard test.
4. Line level shielded audio cable - Per ANSI WC66 standard test.
5. Microphone level shielded audio cable - Per ANSI WC66 standard test.
6. Video coax cable - Per ANSI/TIA/EIA–TSB-67standard test.
7. Multi-conductor control cable - Per ANSI WC57 standard test.

D. Approved manufacturers:

1. West Penn Wire
2. Belden
3. Liberty

2.12 CABLE CONNECTORS

A. Approved manufacturers:

1. West Penn Wire
2. Belden
3. Liberty

PART 3 – EXECUTION

3.1 CONSTRUCTION MEETINGS

A. The Consultant and/or Owner will hold regular construction meetings to review the installation schedule. It is mandatory that the Contractor's project manager attend each meeting.

3.2 SITE INSPECTION

A. Continuously verify that the site conditions are in agreement with the Contract Documents and the AVS design. Notify Owner's representative immediately of conditions that affect the performance of the installed system.

B. Coordinate any required work that is not specified in the Contract Documents.

3.3 COORDINATION

A. Adequate conduit and back boxes are provided for the specified system installation.

B. Adequate power has been provided for the specified system installation.

C. Verify mounting location of all devices with Owner prior to installation.

3.4 GENERAL

A. The Contractor shall be responsible for providing all wire and cable as required for complete and operational system.

B. All cables must be continuous runs from device location to the final point of termination. No mid run cable splices will be allowed.

C. Make connections and splices with solderless devices that are mechanically and electrically secure in accordance with manufacturer's recommendations.

D. The cable installation techniques shall be such that the mechanical and communications characteristics of the cables are not degraded at the time of installation. Any special environmental requirements for equipment shall be specified.

E. The Contractor shall not place wiring in the same conduit or raceway with wire for electrical power distribution.

F. Connectors to all devices in system shall be protected against moisture. Approval of the method shall not relieve the Contractor of full responsibility for proper application and workmanship of the materials in the manner specifically approved. All connector threads shall be treated with an approved silicone lubricant.

G. The Contractor shall be responsible for providing approved grounds for all AVS system equipment per the manufactures recommendations. The Contractor shall also be responsible for ensuring ground continuity by properly bonding all appropriate cabling, closures, cabinets, service boxes, and framework. All ground connections shall consist of minimum 6 AWG copper wires and shall be supplied from an approved building ground and bonded to the main electrical ground. Contractor must notify the Owner prior to making any changes in submitted system design and/or installation.

H. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

I. Splices, Taps, and Terminations: For power and control wiring, use numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

J. Grounding: Provide independent-signal circuit grounding per practices published by the manufacturer.

3.5 IDENTIFICATION, LABELING AND DOCUMENTATION

A. The Contractor shall label all termination devices, panels, enclosures and equipment rooms. The Contractor will mark each unit with permanently attached markings that will not impair the

equipment or present a hazard to maintenance personnel.

B. Place wire identification numbers ¼" on each end of all conductors and or connectors by using sleeve type heat shrinkable markers. Install markers to be readable from left to right or top to bottom. Wire numbers shall be computer printed (Brady TLS2200 with Permasleeve cable marking labels or equivalent). Handwritten labels are not acceptable.

C. Mark all spare conductors.

D. Contractor to maintain a progress set of design documents on the Project site. These documents shall be updated daily to reflect the current condition of the work and available for review by the Consultant and Owner when requested.

E. If changes occur prior to acceptance testing altering the documentation previously furnished. The Contractor shall formally update and reissue the relevant documentation to the Consultant and Owner.

F. Consultant and Owner will review all documentation for accuracy and completeness and may reject substandard submittals.

G. The Contractor shall establish and maintain complete system documentation, including documentation procedures, operational information, configuration information and drawings. Documentation shall include the following:
   1. Floor plan drawings indicating device locations, unique system point numbers with device legends indicating manufacturers and model numbers for each device.
   2. The unique system point number of a device shall identify either through the software or hardwire connection, the specific device or group of devices associated with the unique point number in the system.
   3. Floor plan drawings indicating conduit and wire routing and junction box locations.
   4. Wire routing shall include cable identification and terminal strip numbers.
   5. Mounting details for all equipment and hardware.
   6. Functional block diagrams for each system.
   7. Wiring details showing rack elevations, equipment wiring and terminations and inter-rack wiring.

3.6 FIELD QUALITY CONTROL

A. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.

B. Pre-testing: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements.

C. Test Schedule: Schedule tests after pre-testing has been successfully completed and system has been in normal functional operation for at least 14 days. Provide a minimum of 10 days' notice of test schedule.

D. Operational Tests: Perform operational system tests to verify that system complies with Specifications. Include all modes of system operation. Test equipment for proper operation in all functional modes.

E. Remove and replace malfunctioning items and retest as specified above.

F. Record test results for each piece of equipment.

G. Re-test: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.7 ADJUSTING

A. Programming
   1. Coordinate with Owner to develop basis and admin for control system GUI "look and feel" for all A/V room types. but not limited to:
      a. Security numeric keypad per user type.
      b. Basic user functionality (No more than 3-4 button pushes to complete task).
      c. Admin functionality (Hidden independent device switching, control, gain control, status review etc.).
      d. GUI, Layout (Prepare proper lay-out and color contrast for color blind users)
   2. Coordinate and verify all AV programming with Owner and or Owner representative prior to installation.
   3. Final programming A/V source code to remain property of Owner. Provided copies of all A/V room types compiled and uncompiled source code, to Owner for backup and future reference as part of the Final Acceptance.
   4. Owner may use AV control system up to warranty period of (1) year after substantial completion Contractor must provide the Owner (2) non-substantial programming changes to any aspect of the AV control systems including, but not limited to:
      a. Touch Panels
      b. Key Pads
      c. Functionality
      d. Control
      e. Lay-out
      f. Added equipment
   5. Stand-alone displays must be programmed with auto-sync functionality.
   6. All AV systems must be fully functional and be considered a turn-key solution by the completion date of the project.

B. Speaker Systems
   1. Balance all room speaker dB levels.
   2. Equalize speaker systems flat from 80 Hz to 2 KHz with a 2dB per octave roll-off thereafter. Program a high pass filter at 60Hz with 12dB per octave roll off and a low pass filter 15 KHz with 12 dB per octave roll off.
   3. Use a minimum of three measurement locations in the system's intended coverage area to calibrate the system response.
   4. Verify system gain and amplifier levels.
   5. Verify speaker polarity
   6. Adjust appropriate speaker delays.
   7. Set and adjust limiters.
   8. Contractor shall provide for calibration of the system:
      a. Sound analyzer (SmartLive, TEF SoundLab, Meyer's SIM or equivalent) with trained operator for adjusting and verifying delay timing, cabinet aim and equalization.
      b. Suitable calibrated microphone.

c. The Contractor shall coordinate this testing and calibration. It is anticipated that this work will take 1 hour per room. It will be necessary to have a quiet room during these times.

C. Contractor to record all measurements, settings and adjustment for inclusion in the O&M manuals.
1. Adjust limit switches on electric operated projection screens.
2. Adjust back focus on all video cameras.

D. Occupancy Adjustments: When requested within 12 months following the of date of Substantial Completion, provide on-site assistance in adjusting systems to suit actual occupied conditions and to optimize performance of the installed equipment. Tasks shall include, but are not limited to, the following:
1. Check cable connections.
2. Check proper operation of equipment.
3. Adjust all presets; consult Owner's personnel.
4. Recommend changes to the AVS to improve Owner' utilization of the system.
5. Provide a written report of adjustments and recommendations.

3.8 TRAINING

A. AVS training shall be provided for the operator/user and technical staff. Operator/user training shall minimally consist of two (2), 1-hour sessions per room type. Technical operation and maintenance training session shall minimally consist of two (2), 1-hour sessions per room type. Training sessions to be coordinated with the Owner and scheduled throughout the 1-year warranty period.

B. A complete operation and maintenance manuals and preliminary as-built drawings shall be delivered to the Owner one week prior to the training sessions.

C. Operator/user training shall minimally consist of:
1. Provide custom system specific printed reference material for each trainee that documents and explains in layman's terms:
a. System block diagram.
b. Laminated, basic user guide per room. One (1) copy for each room and One (1) spare for each room type.
c. Normal day-to-day operation.
d. Operator selectable features.

D. Technical Operations and Maintenance training shall consist of:
1. The technical explanation shall be sufficiently thorough that: staff personnel shall be able to make any programming changes required, analyze malfunctions and make equipment substitutions or bypasses necessary to maintain system operation except for the malfunctioning equipment or circuits.
2. Provide printed reference material for each trainee that documents and explains in technical terms:
a. System block diagram with technical features.
b. Technical operation, adjustments and programming.
c. System features and programming.
d. Review of as-built drawings.

e. Provide a hands-on training with Q & A session.

3.9 WARRANTY

A. The Contractor shall warrant the system for parts and labor for one (1) year. Warranty commences at the time of substantial project completion and acceptance by Owner. Nothing shall be construed to limit this obligation to a shorter period.

B. Warranty service shall be rendered on-site by request of Owner to repair or replace any defective materials, equipment and workmanship without cost to the Owner, unless the Owner has previously given the Contractor a written acceptance of such condition.

C. The Owner shall give prompt notice of the defect(s) either verbally or in writing to Contractor.

D. Perform preventative maintenance during the warranty period, which includes:

1. Cleaning and inspection of all devices every 6 months.

2. Clean and vacuum console and rack equipment every 6 months.

3. Testing of all room functions.

E. Service technician performing service / warranty work shall check-in and out with Owner for each visit.

F. Provide a written report to Owner documenting any work performed during the warranty period within 24 hours of such event. Report shall detail work performed, equipment repaired or replaced, etc.

G. Provide loner equipment that is equivalent to the malfunction equipment for any equipment that is not field repairable.

H. Repair or Replacement Service.
1. Repair or replacement service during the warranty period shall be performed during normal business hours and with a 24 hour response time.
2. Emergency repair or replacement service during the warranty period shall be performed 7 days a week, 24 hours a day and with a 1 hour response time.
3. If the Contractor cannot restore system operation during the warranty period within 2 business days of the system failure, the Owner reserves the right to require the Contractor to provide on-site manufacturer's service technicians at no additional cost.
4. The Owner reserves the right to expand or add to the system during the warranty period using firm(s) other than the Contractor for such expansion without affecting the Contractor's responsibilities, provided the expansion is performed by an authorized dealer for the affected equipment.

3.10 SUBSTANTIAL COMPLETION

A. Work must meet the following requirements to qualify for the Owner's consideration of Substantial Completion:
1. All AVS devices shall be fully installed, powered, online and fully operational.
2. All sub-system interfaces must be complete and operational.

3. All training complete.
4. Owner may utilize the system for its designed intent.

B. Contractor will provide a list of remaining work items and approximate completion date.

C. Contractor will certify in writing that all remaining work is minor in nature and will be completed in less than 30 days.

3.11 TESTING REQUIREMENTS

A. The Contractor shall perform sample tests in the presence of the Consultant and Owner. Performing the testing procedures specified herein assures that the communication cabling and system electronics meets the performance characteristics specified.

B. All testing shall comply with EIA/TIA Standards and that of the equipment manufacturers. If testing indicates that the performance characteristics are not met, the test shall be failed test and any other test that may be affected by the modification and/or repair shall be rerun and verified.

C. Test equipment will be provided by the Contractor to test and to certify the 100% operational condition of all materials and equipment.

D. The Contractor shall prepare and submit all test procedures and data forms for the pre-installation, post installation and subsystem test to Owner. The test procedures shall have Owner approval before the tests.

3.12 SYSTEM CHECK OUT AND VERIFICATION

A. Verify continuity of cabling between field devices and controllers.

B. Commission all devices from field to front end.

C. Contractor supplied "As Built" Drawings shall show conduit routing.

D. Review all as-built documentation and Operation and Maintenance manuals with Owner. Revise and reissue as required.

E. Provide as-built documentation in hard copy, PDF and AutoCAD formats.

F. Demonstrate proper sequences of operation for all devices.

G. Contractor shall provide programming code, spreadsheet of room inventory (including but not limited to: location, model description, serial number and value) to owner via (2) USB drives.

3.13 FINAL ACCEPTANCE OF SYSTEMS

A. Each area of construction completed and submitted as complete shall meet the following criteria under testing:
1. System must meet all specifications as described in these instructions.
2. Operational prints, manuals, signal logs, and as built prints must be furnished.

3. Visual testing and signal verification will be conducted at random locations to determine that equipment performs satisfactorily.

B. Specifications set forth for construction of the system have been devised in order to insure system compatibility and performance. Compliance to these specifications will be determined during periodic observances of construction. Repeated failure to comply with the specification will be considered before the initial acceptance phase of the plant commences.

C. Within ten days receipt of the final acceptance notice, the Owner's representatives shall schedule and perform the final inspection. When the work is found acceptable under the contract documents and the contract is fully performed, declare the project complete.

3.14 PRICING FORMS

A. In addition to all other required bid forms, Contractor shall prepare and present to Owner and Owner’s representative pricing based on the requirements of 27 40 00.

B. Pricing shall include the list of equipment and labor in tabular form by room type and include; part number, item description, unit price, number of units, extended price and totals. The pricing shall breakdown the material and labor in the categories.

C. Contractor shall provide Service Agreement pricing levels for terms of 1, 2 and 3 years. Breakout service pricing levels by response times of within 1 hour, 24 hours or more than 24 hours.

END OF SECTION 27 40 00

APPENDIX A

TECHNOLOGY IMPLEMENTATION SCHEDULE (EXAMPLE)

	(from Designer)		(Contractor Submittal)				(Submittal Response)		
	Product Description	Spec. Ref.	Qty.	Procurement Lead Time	Start Date or Dependent	Installation Duration	Submittal Approved	Purch. Auth.	Remarks
1	AMX MCP-108	2.2							
2	AMX DX-TX-DWP-4K	2.3							
3	AMX DX-RX	2.3							
4	Liberty PC-G1791-E-P	2.4							
5	NEC E-Series	2.5							
6	AMX HPX-600	2.8							

SECTION 28 13 00 ACCESS CONTROL SYSTEM

PART 1 - - GENERAL

1.1 PROJECT SCOPE SUMMARY

A. Perform all work, coordination, systems integration, engineering design, and testing, and shall provide all products required in order to ensure a fully operative system and proper installation of equipment. System operability and proper installation shall be verified via completion of the acceptance test plan.

B. Provide all system documentation and submittals.

C. Provide warranty and maintenance support as specified.

D. Provide and pay for all labor, materials, and equipment.

E. Secure and pay for plan check fees, permits, fees, and licenses necessary for execution of Work as applicable for the project.

F. Give required notices.

G. Comply with all codes, ordinances, regulations, and other legal requirements of public authorities that bear on performance of Work.

1.2 SECTIONS INCLUDES

A. This section includes specification for the installation of the Access Control System.

B. Provide all required software, hardware, programming and integration as specified herein to produce complete and operational access control and alarm monitoring functions for Federal Inspection Services (FIS) Renovation and Expansion

C. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification sections, apply to the work of this section.

D. These Specifications may include components that are not required. Use drawings to determine the quantities to be installed. Include in the original bid, all equipment, software, cabling, connectors, transformers, relays, etc., whether specified here or not, such that said bid fulfills the intent of these Specifications and renders these systems functional and fully operational.

1.3 REFERENCES

A. Related Sections: The references and standards listed herein shall be considered part of this specification. Bidder and Contractor shall conform to the following references and standards:
   1. Section 270526: Telecommunication Grounding and Bonding

2. Section 270528: Interior Communication Pathways
3. Section 270553: Identification and Labeling of Communication Infrastructure
4. Section 271100: Communication Cabinets and Equipment Rooms
5. Section 271300: Backbone and Riser Media Infrastructure
6. Section 271500: Horizontal Media Infrastructure
7. Section 272100: Data Communication Network Equipment
8. Section 272200: PC, Laptop, Servers and Equipment
9. Section 275113: Audio Communication System
10. Section 281300: Access Control System
11. Section 232300: Video Surveillance Control and Management System

B. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only.

C. Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean the latest printed edition of each in effect at the date of contract unless the document is shown dated.

D. Conflicts.
1. Between referenced requirements: Comply with the one establishing the more stringent requirements.
2. Between reference requirements and contract documents: Comply with the one establishing the more stringent requirements.

E. References:
1. National Electrical Manufacturers Association (NEMA)
2. American Society for Testing Materials (ASTM)
3. National Electric Code (NEC)
4. Institute of Electrical and Electronic Engineers (IEEE)
5. UL Testing Bulletin

E. Definitions:
1. *ANSI* – American National Standards Institute
2. *EIA* – Electronics Industries Alliance
3. *IEEE* – Institute of Electrical and Electronic Engineers
4. *ISO* – International Organization for Standardization
5. M*ulti-path* – The possible multiple routes of a single source of RF energy due to reflection, refraction, or diffraction.
6. *NEC* – National Electrical Code
7. *NEMA* – National Electrical Manufacturing Association
8. *UL* – Underwriter's Laboratories

F. Conflicts:
1. Between reference requirements and contract documents: Comply with the one establishing the more stringent requirements.

1.4 SUBMITTALS

A. Qualifications: Demonstrate compliance with requirements of Paragraph 1.05 below.

B. Submit manufacturer's technical data for each product provided.

C. Shop Drawings for Exit Lane Breach Control System

D. Panel wiring diagrams by organized by IDF

E. Preliminary Permit Drawings in prior to submission to the City of Houston permitting office.

F. Submit HAS provided card reader software programming work sheet for each card reader a minimum of two weeks prior to cut-over of the respective card reader.

G. Submit technical and operations manuals.
1. Manuals shall describe function, operation, and programmable parameters for each device to be installed.
2. Manuals shall include required maintenance to be performed.
3. Manuals shall describe function, operation, and programmable parameters for each card and port for each device to be installed.
4. Manuals shall include required maintenance to be performed.
5. Manuals shall be suitable for the training of future personnel by the City, and for use as a reference by currently employed personnel in performing work assignments.

H. List of HAS naming conventions for logical devices and Card reader (i.e. Facility (C), Geo (N), Level (1) = CNE-1001).and associated devices

I. AOC Security Schedule in Excel (See Exhibit A) Test Equipment Calibration Certificates

J. Test results

K. Spare parts list and quantities (10% of all replaceable components/devices, minimum 1 unit)

L. Warranty list with equipment make, model, serial number, commission date, warranty start date, and, warranty end date. Also include RMA Procedure and contact information for warranty claims.

M. Schedule of Unit Price Values

N. As-builts to include but not limited to HAS' naming conventions, card readers, cameras, door numbers per layer, per floor. Submitted in latest Auto-CAD version.

1.5 QUALITY CONTROL

A. Contractor Qualifications:
1. The contractor shall be certified by the manufacturer of the products to be installed, adhere to the engineering, installation and testing procedures, and utilize the authorized manufacturer components and distribution channels in provisioning this Project.

2. All members of the installation team shall be factory certified by the manufacturer(s) as having completed the necessary training to complete their part of the installation. Written confirmation of such certification by manufacturer(s) shall be submitted to the Owner if requested.
3. Contractor shall provide five references for projects completed within the last five years of approved equivalent scope, type and complexity.

B. Equipment and materials supplied shall be a standard product of manufacturers regularly engaged in the manufacture and installation of access control systems and shall be the manufacturer's latest standard design. Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components. Electrically powered equipment shall be UL approved. Electronic equipment shall meet the requirements of CFR 47 Part 15.

C. All hardware, software, firmware, and/or operating system requirements given are the minimum requirements. The Contractor's product shall meet or exceed these requirements. The product selected shall meet the operational, functional, and performance requirements specified herein. Additionally, due to the rapid advancement and antiquation of technology related products, the supplied product shall be the "contemporary technical equivalent" of that specified. "Contemporary technical equivalent" shall be based on a comparison of technology at the time of publication of specification to the technology at the time of the first product submittal. Final product approval is at the sole discretion of the City.

D. HAS retains the right to access and inspect all work during the entire duration of the project and any items that do not adhere to the standards, reference, contract, bid, or project documents will be corrected immediately at the expense of the contractor.

1.6 WARRANTY

A. Warrant all equipment and work for a period of not less than one year following formal notice of substantial completion or commencement of beneficial use. The warranty shall ensure that the installed equipment will conform to its description and any applicable specifications and shall be of good quality for the known purpose for which it is intended. The warranty shall allow for replacement or repair at the discretion of the City Engineer and shall include all upgrades for firmware and/or operating systems.

B. Software Licenses
1. Required software licenses shall be identified and supplied by the Contractor.
2. All software licenses and warranties shall be registered in the name of Houston Airport System.

1.7 PROCUREMENT

A. Procure equipment specified in this document in order to ensure that the technology is acquired in a timely fashion, but not outdated by the installation date.

B. The Contractor shall not purchase any materials requiring submittals until the City Engineer approves the submittal for that material and the Technology Implementation Schedule.

C. All products shall be purchased not earlier than 6 months prior to installation.

1.8 DOOR PERMITTING

A. Contractor is responsible for submitting permit drawings for approval by the City of Houston permitting office.

B. Contractor is responsible for coordinating the final inspection with the City of Houston permitting office.

C. Contractor is responsible for all fees and materials required for door permitting.

D. Contractor shall notify Engineer if door configuration is not code compliant.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. All products shall be procured not earlier than 6 months prior to installation as required to ensure delivery of current technology. Contractor shall warrant that all products will be supported by the contractor and manufacturer for a minimum of two years following acceptance by the Owner.

B. Unless otherwise noted, all materials and equipment shall be new, of the type, capacity, and quality specified and free from defects. Material shall bear the label of or be listed by the Underwriters' Laboratories (U.L.) unless of a type for which label or listing service is not provided.

C. All equipment listed in this specification may not be required. It is the Contractors responsibility to determine exact equipment and quantities from the contract drawings.

D. For compatibility and ease of installation, materials shall be of same brand or manufacturer throughout for each class of material or equipment, wherever possible.

E. All enclosures for all equipment shall be of metal throughout the system unless noted otherwise.

2.2 INTELLIGENT FIELD PANELS (IFP's):

A. The Intelligent Field Panel shall be connected to the security host, by means of a TCP/IP network. It shall respond to commands from the host. Each IFP shall connect into the TCP/IP network through an Ethernet HUB. The IFP shall forward to the host information regarding access, status and alarms, which the IFP has gathered from the readers and sensor devices that the IFP controls. The IFP shall meet or exceed the following functional requirements: Each IFP shall be identifiable from the central host by means of a unique IP address. IFPs and associated modules and components shall be manufactured by Honeywell, no substitution.

B. The IFP shall operate normally as an online device.

C. In its offline mode, the IFP shall be able to save (buffer) 35,000 badge transactions.

D. When the IFP returns to online mode from its stand-alone (offline) mode of operation, the transactions it stored shall be transmitted to the host during the subsequent polling sequences. Such transmission shall not impede current transaction processing. Historical activity must be differentiated from current activity.

E. Any portal controlled by the IFP shall be capable of being opened or closed by the issuance of a command from the host.

F. Each IFP shall be capable of supporting up to 32 card readers for badge access.

G. The IFP shall support readers, which utilize HAS compatible smart card technology.

H. Time shall be generated locally at each IFP, and the local time shall be capable of being updated for accuracy from a host master clock at any time.

I. The IFP shall be in current factory production.

J. The IFP shall include power backup in the form of re-chargeable batteries. In the event of an AC power failure, the battery backup shall protect any data or software stored in the memory of the IFP for not less than 1 hour.

K. The IFP shall be installed with capacity to connect one additional card reader for each 3 card readers installed.

L. Operation from 2 to +43 degrees Celsius, at up to 85% non-condensing relative humidity.

M. Provide each IFP with an enclosure. Enclosures shall be rack mounted if it is determined that this configuration would result in a more reliable, simple to service, and less costly system. Remote mounting of these devices is also approved. Provide each enclosure with an integral tamper alarm switch.

N. The IFP shall be capable of maintaining a database of badge holders, badge holder PINs (user definable) and their privileges. During degrade mode, the IFP will continue to grant appropriate accesses for individuals based on this database and shall not degrade the access selection rules. IFPs are to be capable of maintaining at least 100,000 badge holders.

O. The IFP shall communicate via an Ethernet TCP/IP or RS232 communication data interface.

P. Provide the intelligent controller with an Ethernet daughter board, a 3MB memory expansion module and a daisy-chain harness.

Q. COMPONENT MODELS:
1. Intelligent Field Panels PW7K1IC
2. Enclosure PW5K1ENC2
3. Enclosure power supply PW7KPSU120
4. Dual Reader Module PW7K1R2
5. Input Module PW7K1IN
6. Output relay Module PW7K1OUT
7. Daisy-chain harness PW5K1DCC

2.3 CARD READERS:

A. Provide HID iCLASS Elite Compatible Contactless Smart Card readers, NO EXCEPTIONS, as shown on the drawings. Card readers shall be "single-package" type, combining controller, electronics and antenna in one package, in the following configurations:

B. RK40 - Contactless Smart Card Reader with Keypad, Wall Mounting (Single-Gang Mounting Applications) Provide “single-gang” mounting style contactless smart card readers for wall mounting, Vehicle Stanchions and Pedestals, and where shown on plans.

C. Titan FPUS Multi Authentication Biometric Reader. Wall Mounting (Single-Gang Mounting Applications) Provide “single-gang” mounting style contactless smart card readers for wall mounting, Vehicle Stanchions and Pedestals, and where shown on plans.
   a. Enhancement Kit Thermal Infrared (TIR) Sensor With Thermographic Camera For Detecting Elevated Body Temperatures (EBT).

2.4 DOOR POSITION SWITCHES

A. Recessed Door Position Switch
   1. Construction - totally encapsulated brushed housing.
   2. Life Expectancy - Greater than 10,000,000 cycles.
   3. Gap distance - 5/8" or greater for contacts on pedestrian doors; 2" or greater for overhead doors.
   4. UL listing - UL listed 634 for use with security systems.
   5. The door position switch shall be recessed, normally closed, with a wide gap.
   6. Sentrol 1078W or Department of Aviation approved equivalent substitute.
   7. Provide DPDT switches on TSA area Access Controlled doors.

B. Overhead Door Position Switch
   1. Construction: Aluminum
   2. Contact Configuration: N.O, SPDT
   3. Environmental Specifications: Hermetically Sealed Reed Switch Encapsulated in Polyurethane
   4. Lead Type: 3/16 Armored (A) Stainless Steel Cable with Wire Leads
   5. Sentrol 2200 Series or Department of Aviation approved equivalent substitute.

C. Surface Mounted Door Position Switch
   1. Construction: Aluminum
   2. Electrical Configuration: SPDT
   3. Lead Type: 3’ 3/16” Armored Cable
   4. Sentrol 2500 Series or Department of Aviation approved equivalent substitute

2.5 ELECTRIC LOCKS

A. Electrified Mortise Lock:
   1. Replaceable breakaway spindle.
   2. Solid stainless steel 1.5” deadbolt with 1” throw.

3. Reversible handing without disassembly (lock case is not required to be opening in order to reverse).
4. Universal lock chassis.
5. Free-wheeling lever to resist force when locked.
6. Independent heavy-duty spring cage for level support.
7. Interchangeable core compatible with master keying, grand master keying and construction keying. Furnish core that is compatible with existing HAS Master cores (Best Series V Core).
8. Furnish with ADA compliant lever set that is consistent with building standards.
9. Lockset shall include request-to-exit feature and fail secure design.
10. Furnish with switch for monitoring of the retractor crank. Switch to be activated when rotation of the lever rotates the retractor hub.
11. Inside lever must allow immediate egress.
12. Electric Lock: Best Model 45 or Department of Aviation approved equivalent.

B. Electric Strikes
13. Stainless Steel ANSI size Faceplate
14. Frame Type - Hollow Metal or Aluminum
15. Corrosion - Resistant case and moving parts
    Tamper Strength Test - 1700 lbs (765kg)
16. Cycle Test 500,000 cycles
17. Keeper Depth - 5/8” Maximum Latch Projection possible with 1/8” Door/Frame Clearance - 3/4"
18. Strike Depth 1.50" Overall
19. Handed - When ordering indicate RH or LH
20. ANSI/BHMA A 156.5 (1-1/4" x 4-7/8"), fits cutout Specification A 115.1 (with slight jamb modification)
21. Keeper Opening 3/8" below center line
22. Electric Stike: ROFU or approved Department of Aviation approved equal.

C. Electric Power Transfer:
1. The electrical power transfer shall provide a means of transferring electrical power from a door frame to the edge of a swinging door. Provide with the following minimum features:
2. The unit shall be completely concealed when the door is in the closed position.
3. The unit shall provide access for up ten (10) 24 AWG wires, up to1 amp at 24VDC with a maximum surge of 16 amps.
4. The unit shall be UL listed for use on fire doors.
5. Stanley APEX2000 Series or Department of Aviation approved equal. Electrified hinges shall not be acceptable.
6. Electrified hinges shall not be acceptable.

D. Electrified Panic Hardware:
1. The panic hardware shall be suitable for emergency/fire exit and provide optional delayed-egress functionality. The unit shall include the following minimum features/functions:
7. The unit shall be permit connection to the fire alarm system for immediate release upon alarm condition.

8. All controls, auxiliary locking, local alarm and remote signaling output shall be self contained inside the unit.
9. The unit shall be installed with an electric mortise lock when electric locking is required.
10. The unit shall provide a request-to-exit feature to detect when someone attempts to exit. The feature will active when a force of less than 15 pounds is applied.
11. An option shall be included so that alarming does not occur for a period 2 seconds pf pressure on the unit to avoid nuisance alarming. This shall be a selectable feature capable of being turned off for immediate alarming.
12. The unit shall be installed with a minimum of three relays. One relay shall be tied into an external audible alarm. One relay shall be tied into an external visual alarm and one relay shall be spare.
13. The unit shall include a key switch for alarm reset, arm or disarm.
14. The delay time shall be a programmable feature from 0 to 60 seconds as defined by the user.
15. Von Duprin CHEXIT #9975L-F0E0 or Department of Aviation approved equivalent substitute.

2.5 LOCK POWER SUPPLIES

A. Rack Mounted Power Supply: Provide 24VDC power supply

1. 12 amp @ 12VDC and/or 24VDC output.
2. 2.0 amp max. current per output.
3. Sixteen (16) fuse protected non-power limited outputs.
4. 115VAC 50/60Hz. Input Normally closed [NC] or normally open [NO] dry contact inputs (switch selectable).
5. Individually selectable, Mag Lock/Strike (Fail-Safe, Fail-Secure) solid state fuse protected power outputs.
6. Fire Alarm disconnect (latching with reset or non-latching) is individually selectable for any or all of the outputs.
7. Fire Alarm disconnect input options:
   a. Normally open [NO] or normally closed [NC] dry contact input.
   b. Polarity reversal input from FACP signaling circuit.
8. Remote reset capability for latching Fire Alarm Interface mode
9. Filtered and electronically regulated outputs.
10. Short circuit and thermal overload protection.
11. Removable terminal blocks with locking screw flange.
12. 3-wire line cord.
13. Illuminated master power switch.
14. Built-in charger for sealed lead acid or gel type batteries.
15. Zero voltage drop upon transfer to battery backup.
16. Automatic switch over to stand-by battery when AC fails.
17. AC fail, low battery and battery presence supervision.
18. Individual output status LEDs located on the front panel.
19. Lifetime warranty
20. Modular 2U standard EIA 19” rack mount chassis.
21. Dimensions: 3.25”H x 19.125” W x 8.5” D.
22. Allow 1/2U space on top and bottom of the unit for ventilation.

2.6 REQUEST-TO-EXIT DEVICE:

A. UL listed

B. Complies with current City of Houston Building Codes.

C. 2 5/8" Red Mushroom Button mounted to single gang backbox

D. Momentary DPST switch contacts

E. ASSA ABLOY Model TS-21R Series or approved equivalent.

F. Motion Detector, Honeywell IS310WH

2.7 DURESS ALARM SWITCH

A. SPDT switch in surface mounted plastic housing

B. Switch remains activated until reset with key

C. Honeywell Model 269R or approved equivalent

2.8 POLE MOUNTED STROBE / SOUNDER

A. Federal Signal LP7 – Blue Lens

2.9 BLUE PULL STATION

A. Security Door Controls – 492 Emergency Door Release or approved equal.

2.10 L-SERIES WALL-MOUNTABLE HORN STROBE

A. The horn strobe shall be a System Sensor L-Series Model P2WL-P listed to UL 1971 and UL 464 and shall be approved for fire protective service. The horn strobe shall be wired as a primary signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.

B.

2.11 COMPOSITE SECURITY CABLE:

A. Cable between controlled portals and IFPs shall consist of multiple conductor bundles affixed together via a central spline. The conductor bundles shall consist of the following:
   1. 4C, 18 AWG 16/30 STR, shielded
   2. 3P, 22 AWG 7/30 STR, shielded
   3. 2C, 22A AWG 7/30 STR, shielded
   4. 4C, 22 AWG 7/30 STR, shielded

B. The composite access control cable shall be Genesis 3295 or approved equivalent for cables up to 150 feet in length.

C. Cables between controlled portals and IFPs with lengths from 150 to 240 feet shall include an additional one (1) 16 AWG 2/C Shielded CMP-CL2P, Genesis 3225 by contractor used for lock power.

D. Cables between controlled portals and IFPs between 240' and 400' shall include an additional (1) 12 AWG 2/C STR Shielded CMP-CL2P Genesis 3225 by contractor.

2.12 STRANDED PLENUM RATED CABLE:

A. Cable between controlled portals, sounders and IFPs shall consist of multiple conductor:
1. 4C, 18 AWG STR, shielded

2.13 EXIT LANE BREACH CONTROL (ELBC) SYSTEM:

A. The System detects wrong way motion of a person or object entering an airport exit lane. It consists of 2 detection zones. The Pre-Alarm zone starts at the end of the exit lane near the non-sterile side doors in the exit lane and the Alarm -Zone is contiguous to the Pre-Alarm zone in the exit lane. The Pre-Alarm zone will warn passengers that a person or object is entering a prohibited area. The Alarm-Zone notifies the passengers in the exit lane and the System operator that a person or object is in violation of the exit lane activity. The system consists of the following components

1. Central Control Rack: providing video analytics and storage, operator and system notifications for two separate exit paths.

2. Field Devices: 2 detection Cameras and 2 surveillance Cameras and 2 speaker strobes per lane.

3. Remote Command Terminal: Located in and adjacent TSA Podium for viewing and control of System.

4. Ancillary System Inputs and Outputs: Interface with Access Controlled Lane Doors via the Access Control System to allow for System On, Alarm Reset, System Bypass and other functions.; provide video streaming outputs for integration in the Owner's Video Management System.

B. Basis of Design: Extended View ExitSentry by CheckVideo

PART 3- **EXECUTION**

3.1 INSTALLATION

A. Install components in accordance with contract drawings, manufacturer's instructions and approved submittal data.

B. System installation and construction methods shall conform to the requirements of the Federal Communications Commission.

C. Install all system components including furnished equipment, and appurtenances in accordance with the manufacturer's instructions, and adjustments required for a complete and operable system.

D. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

E. Coordinate with Owner to obtain inspection and approval of all cable raceway prior to installation of cable

F. Install all power supplies in locations easily assessable for maintenance or replacement

3.2 PRODUCT HANDLING

A. The Contractor shall be responsible for any and all loss or damage in the shipment and delivery of all material until transfer of title to the City.

3.3 HARDWARE INSTALLATION

A. Unless otherwise specified herein, or shown on the drawings, provide electrified mortise locks, electric strikes or electrified panic hardware. Provide electromagnetic locks only upon receipt of written authorization from HAS.

B. Unless otherwise specified herein, or shown on the drawings, provide end-of-line resistor packs at field device (door position switched, tamper switches, duress alarm switches, etc.) contacts as required for continuous supervision of field device cable. Resistor packs shall be located to maximize cable supervision. Resistor packs shall be configured to produce discreet annunciation of open and short conditions.

C. The Contractor shall take all steps necessary to ensure that all public areas remain clear or are properly marked during installation or maintenance.

D. The contractor shall place materials only in those locations that have been previously approved. The City Engineer shall approve any other locations, in writing.

3.4 CONFIGURATIONS

A. Definitions of the alarm status signals are:
1. Authorized Card – Valid card has been presented. Central System logs event and approves unlock.
2. Undefined Card – A card that is not in the system has been presented (used to detect lost or stolen cards). Central System logs event and disapproves unlock and reports alarm event.
3. Invalid Area – Card has been presented at a reader that is not a part of the readers assigned to that card. Central System logs event and disapproves unlock and reports alarm event.

4. Invalid Time Period – Card has been presented at a time that is not defined in the system as a valid time assigned to that card. Central System logs event and disapproves unlock and reports alarm event.
5. Expired Card – Card that is presented has been programmed to be inactive after a specific date. Central System logs event and disapproves unlock and reports alarm event.
6. Inactive Card – Card that is programmed in the system as inactive is presented. Central System logs event and disapproves unlock and reports alarm event.
7. Door Held Open Alarm – A door is held open longer than the programmed time. Alarm event is sent to Central System.
8. Forced Door Alarm – A door that has been opened without presenting a valid card or PIN code and received an unlock command. Alarm event is sent to Central System.
9. Door Restore – The door has been closed and condition has returned to normal and event is sent to Central System.
10. Duress Alarm – Duress Button is pressed
11. AED Alarm – AED Cabinet is opened
12. Video Intrusion Warning Alarm – VMS triggered Alarm Event
13. Video Intrusion Violation Alarm – VMS triggered Alarm Event

B. Install each configuration listed below found on drawings with the appropriate functional description and alarm/status signals.
1. Double door electric panic hardware with REX, EPT, door contacts and removable mullion: Reader Entry; Free Exit.
2. Double door electric panic hardware with REX, EPT, door contacts and removable mullion: Reader Entry; Security Horn/Strobe or Reader Exit.
3. Double door electric panic hardware with REX, EPT, door contacts and removable mullion: No Entry; Free Exit.
4. Single door, electric mortise with REX, EPT and door contact: Reader Entry; Free Exit.
5. Single door, electric mortise with REX, EPT and door contact: Reader Entry; Reader Exit.
6. Double door, fixed leaf with auto latches, electric mortise with REX, EPT and door contacts: Reader Entry; Free Exit.
7. Single door, electric panic with REX, EPT and door contact: Reader Entry; Free Exit.
8. Single door, electric panic with REX, EPT and door contact: Reader Entry; Security Horn/Strobe Exit
9. Single Cage door, electric mortise with REX, EPT and door contact: Reader Entry; Free Exit.
10. Automatic Overhead Door with Key-switch and surface-mounted door position: Reader Entry; Reader Exit.
11. Single door, electromagnetic lock, door contacts: Reader Entry; Exit REX Button/ Blue Pull Station Exit.
12. Single door, electromagnetic lock, door contacts: Reader Entry; Reader/ Blue Pull Station Exit.
13. Double door, electromagnetic lock, door contacts: Reader Entry; Exit REX Button/ Blue Pull Station Exit.
14. Double door, electromagnetic lock, door contacts: Reader Entry; Reader/ Blue Pull Station Exit.
15. Single door, delayed electric panic with REX, EPT and door contact: No Entry; Security Horn/Strobe Exit

16. Double door, electromagnetic lock, door contacts, EPT, REX Exit Device: Reader Entry; Exit Device REX/ Blue Pull Station Exit.
17. Double door, door contacts, mechanical exit hardware, Security horn/strobe, REX, EPT.
18. Double door, door contacts, mechanical exit hardware with REX, EPT.
19. Double door, door contacts.
20. Single door, door contacts
21. Baggage Start Stop with BHS interface
22. Baggage Security Door Monitor with BHS interface
23. Access hatch door contacts
24. Camera Pole mounted Strobe /Sounder trigger by VMS Alarm Event

3.5 SYSTEM STARTUP

A. The Contractor shall not apply power to the system until after:
   1. System and components have been installed and inspected in accordance with the manufacturer's installation instructions.
   2. A visual inspection of the system components has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
   3. System wiring has been tested and verified as correctly connected as indicated.
   4. All system grounding and transient protection systems have been verified as properly installed and connected, as indicated.
   5. The City Engineer and the HAS Representative have approved the installation.

B. Satisfaction of the above requirements shall not relieve the contractor of responsibility for incorrect installations, defective equipment items, or collateral damage as a result of contractor’s deficient work/defective equipment.

3.6 ACCEPTANCE TESTING

A. The contractor shall develop and execute an onsite acceptance-testing program.

B. The Contractor shall coordinate with HAS Technology the input of GIS Locations for all devices into the ArcGIS System used by HAS. The contractor shall reference the HAS ArcGIS Device Location Spreadsheet “Exhibit B” as a reference for the data needed for each device installed.

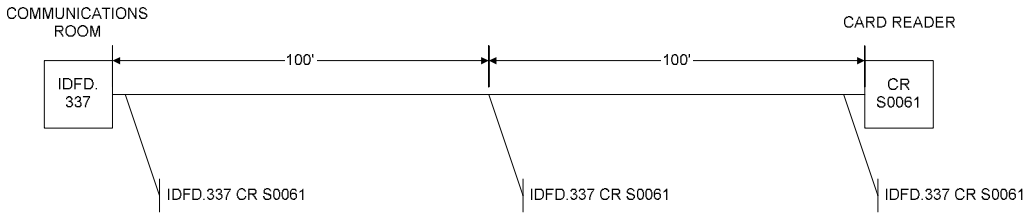
C. The plan shall address all requirements identified in this specification and test all contractor supplied cabling and hardware components. The plan shall follow accepted industry testing practices and have a method of independent verification described.

D. Any specified item that does not satisfy the requirements of this specification shall be replaced, upgraded, or added by the contractor as necessary to correct the noted deficiencies. After correction of a noted deficiency, re-testing shall be performed to verify the effectiveness of the corrective action.

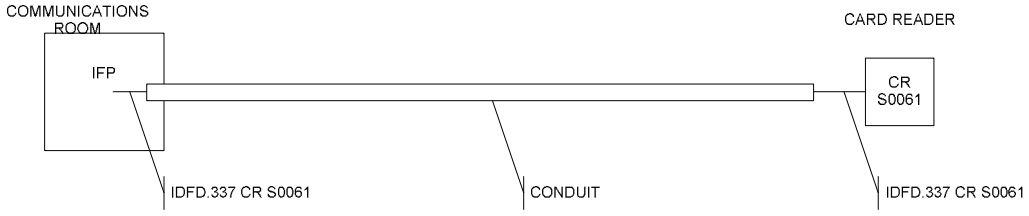
3.7 IDENTIFIERS, LABELS AND LABELING SYSTEM

A. Label each card reader on the card reader spacer. Label shall be permanently engraved on a lexan back plate. The label shall include the card reader number. Coordinate with HAS for sample.

CABLE AND CONDUIT LABELING:



CONDUIT LABELING



CABLE LABELING

LABEL CABLE INSIDE OF IFP, WHERE IT CONNECTS TO CARD READER, AND WHEN NOT IN CONDUIT

3.8 RECORD DRAWINGS

A. Site Prints: Maintain a set of clearly marked black-line prints of the Construction Documents at the job site which shall be used for recording the work details, final size, location, interrelation, and similar items of all work under this Division. This set of Construction Documents shall be corrected daily as the work progresses and shall clearly indicate all changes to suit field conditions, changes made by "Field Order" or "Change Order," accurate dimensions of all buried or concealed work. Precise locations of all concealed work, locations of all concealed boxes, controls and devices and any deviations from the work shall be referenced by at least two permanent structure points.

B. Upon completion of work, incorporate into AutoCAD (Version. 2014) all marks from site prints and produce two bound sets of draft Record Drawings for use and verification during acceptance testing. The draft Record Drawings shall utilize the latest Architectural background drawings and shall incorporate all modified drawings as outlined in Article 1.04 of this Section, or any other drawings which were developed during the installation process. Any changes to the required Record Drawings as a result of acceptance testing shall be redlined on these sets as required. As-builts to include but not limited to HAS' naming conventions, card readers, cameras, door numbers per layer, per floor. Submitted in latest Auto-CAD version.

C. Upon completion of acceptance testing, incorporate into CAD files (Version. 2014) all marks from the site prints, including any revisions made to the drawings outlined in Section 1.04

(Submittals) of this Section. Produce one set of clean Record Drawings on vellum and a minimum of four (4) USB flash drives as a complete set of Record Drawings.

EXHIBIT A
TBD

ITEM NO	CARD READER ID	CARD READER NAME	ASSOC CCTV ID	AC CABLE TERMINATION LOCATION	MOUNT DETAIL	CARD READER TYPE	DOOR HARDWARE SET	PROWATCH PANEL ID	PANEL POSITION	COMMENTS	CARD TYPE	DOOR #	DWG#	CLEARANCE CODE	SECURITY PRIORITY	FLOOR LEVEL	PORTAL TYPE	PORTAL NAME	DEVICE ID (PROWATCH)	ROOM LOCATION	CCTV ID (MAXPRO) PRIMARY	LOCATION DESCRIPTION	CCTV ID (MAXPRO) ALTERNATES	NOTES

EXHIBIT B

HAS ArcGIS Device Location Spreadsheet

Device ID	Address	Latitude	Longitude	Tags	Building	Floor	Room	Long Description Comment	INFOR Asset ID	Airport	Associated Camera	Device Type

END OF SECTION 28 1300

SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Notification appliances.
5. Device guards.
6. Remote annunciator.
7. Graphic annunciator.
8. Addressable interface device.
9. Digital alarm communicator transmitter.
10. Network communications.
11. System printer.
12. Connection and reporting to existing facility fire alarm system.

B. Related Requirements:

1. Section 260519 “Low-Voltage Electrical Power Conductors and Cables” for cables and conductors for fire-alarm system.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

F. VESDA: Very Early Smoke-Detection Apparatus.

G. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:

1. Control Voltage: Listed and labeled for use in remote-control, signaling, and power limited circuits supplied by a Class 2 or Class 3 power supply having rated output not greater than 150 V and 5 A, allowing use of alternate wiring methods complying with NFPA 70, Article 725.
2. Low Voltage: Listed and labeled for use in circuits supplied by a Class 1 or other power supply having rated output not greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Part I.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.

C. General Submittal Requirements:

1. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; Level III minimum.
    c. Licensed or certified by authorities having jurisdiction.

2. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Seismic Qualification Data: Certificates, for fire-alarm control unit, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
g. Record copy of site-specific software.
h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

i. Manufacturer's required maintenance related to system warranty requirements.
j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
3. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
4. Keys and Tools: One extra set for access to locked or tamper-proofed components.
5. Audible and Visual Notification Appliances: Two of each type installed.
6. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
7. Filters for Air-Sampling Detectors: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

B. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units require for this Project.

C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

D. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

E. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

F. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

1.9 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, the existing Honeywell system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and voice/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Smoke detectors.
3. Duct smoke detectors.
4. Carbon monoxide detectors.
5. Automatic sprinkler system water flow.
6. Fire-extinguishing system operation.
7. Fire standpipe system.
8. Dry system pressure flow switch.
9. Fire pump running.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances**,** including voice evacuation notices.
2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
3. FACP shall flash common alarm indicator and emit sound. Acknowledging must silence audible and change flashing alarm to steady.
4. Transmit an alarm signal to the remote alarm receiving station.
5. Deactivate heating, ventilating, and air-conditioning equipment over 2000 CFM serving the zone in alarm.
6. Record events in the system memory.
7. Record events by the system printer.
8. Indicate device in alarm on the graphic annunciator.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe sprinkler system.
3. Fire pump running.
4. Fire-pump loss of power.
5. Fire-pump power phase reversal.
6. Independent fire-detection and -suppression systems.
7. User disabling of zones or individual devices.
8. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit.
3. Record the event on system printer.
4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
5. Transmit system status to building management system.
6. Display system status on graphic annunciator.

2.3 FIRE-ALARM CONTROL UNIT

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Gamewell - FCI by Honeywell.
2. Notifier.
3. Siemens Industry, Inc.; Fire Safety Division.
4. SimplexGrinnell LP.

B. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

    a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
    b. Include a real-time clock for time annotation of events on the event recorder and printer.
    c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
    d. The FACP shall be listed for connection to a central-station signaling system service.
    e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
    f. Connect to existing FACP.

2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.
4. The control unit(s) shall not be capable of being reset until all alarm conditions have been cleared.

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, three line(s) of 40 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class A.
2. Pathway Survivability: Level 1.
3. Serial Interfaces:

    a. One dedicated RS 485 port for central-station operation using point ID DACT.
    b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
    c. One RS 232 port for PC configuration.
    d. One RS 232 port for VESDA HLI connection.
    e. One RS 232 port for voice evacuation interface.

E. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

F. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

I. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control unit.

1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.

    a. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
    b. Programmable tone and message sequence selection.
    c. Standard digitally recorded messages for "Evacuation" and "All Clear."
    d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.

2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

J. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also, print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

K. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals and digital alarm communicator transmitters shall be powered by integral 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

L. Secondary Power: integral 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

M. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. Manufacturers: subject to compliance with requirements of this specification, including FM Global Approval, provide products by one of the following or approved equals:
1. AMSECO – A Potter Brand.
2. Bosch Security Systems.
3. Copper Wheelock.
4. Faraday.

5. Federal Signal Corporation.
6. Fike Corporation.
7. Fire-Lite Alarms.
8. GAMEWELL.
9. GE UTC Fire& Security; A United Technologies Company.
10. Keltron Corporation.
11. Mircom Technologies, Ltd.
12. Notifier.
13. Siemens Industry, Inc.; Fire Safety Division.
14. Silent Knight.
15. SimplexGrinnell LP.
16. System Sensor.

B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
4. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bosch Security Systems.
2. Faraday.
3. Fenwal Protection Systems; A UTC Fire & Security Company.
4. Fire-Lite Alarms.
5. GAMEWELL.
6. GE UTC Fire & Security; A United Technologies Company.
7. Gentex Corporation.
8. Harrington Signal, Inc.
9. Keltron Corporation.
10. Mircom Technologies, Ltd.
11. Notifier.
12. Siemens Industry, Inc.; Fire Safety Division.
13. Silent Knight.
14. SimplexGrinnell LP.
15. System Sensor.

B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four or two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
    a. Rate-of-rise temperature characteristic of combination smoke detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    b. Fixed-temperature sensing characteristic of combination smoke detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
    c. Multiple levels of detection sensitivity for each sensor.
    d. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.

5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.6 NOTIFICATION APPLIANCES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cooper Wheelock.
2. Federal Signal Corporation.
3. GE UTC Fire & Security; A United Technologies Company.
4. Gentex Corporation.
5. Harrington Signal, Inc.
6. Keltron Corporation.
7. Mircom Technologies, Ltd.
8. Siemens Industry, Inc.; Fire Safety Division.
9. SimplexGrinnell LP.
10. System Sensor.

B. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

C. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

D. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

E. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

F. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.

1. Rated Light Output:
   a. 15/30/75/110 cd, selectable in the field.
   b. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white.

G. Voice/Tone Notification Appliances:

1. Comply with UL 1480.
2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. High-Range Units: Rated 2 to 15 W.
4. Low-Range Units: Rated 1 to 2 W.
5. Mounting: Ceiling mounted unless otherwise indicted on design drawings. Wall-mounted appliances shall be no less than 90 inches above the finished floor, and not less than 6 inches below the finished ceiling.
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

H. Addressable Relay Modules:

1. Provide address-setting means on the module. Store an internal identifying code for control panel use to identify the module type.
2. Allow the control panel to switch the relay contacts on command.
3. Have a minimum of two normally open and two normally closed contacts available for field wiring.
4. Listed for controlling HVAC fan motor controllers.

2.7 GRAPHIC ANNUNCIATOR

A. Graphic Annunciator Panel: Mounted in an aluminum frame with nonglare, minimum 3/16-inch- thick, clear acrylic cover over graphic representation of the facility. Detector locations shall be represented by red LED lamps. Normal system operation shall be indicated by a lighted, green LED. Trouble and supervisory alarms shall be represented by an amber LED.

1. Comply with UL 864.
2. Operating voltage shall be 24-V dc provided by a local 24-V power supply provided with the annunciator.
3. Include built-in voltage regulation, reverse polarity protection, RS 232/422 serial communications, and a lamp test switch.
4. Semiflush mounted in a NEMA 250, Type 1 cabinet, with key lock and no exposed screws or hinges.
5. Graphic representation of the facility shall be a CAD drawing and each detector shall be represented by an LED in its actual location. CAD drawing shall be at 1/8-inch per foot scale or larger.
6. The LED representing a detector shall flash two times per second while detector is an alarm.

B. Graphic Annunciator Workstation: PC-based, with fire-alarm annunciator software with historical logging, report generation, and a graphic interface showing all alarm points in the system. PC with operating system software, minimum 64 GB hard drive, 21 inches digital display monitor, with wireless keyboard and mouse.

2.8 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.9 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.11 NETWORK COMMUNICATIONS

A. Provide network communications for fire-alarm system to interface with existing fire alarm system according to fire-alarm manufacturer's written requirements.

B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.

C. Provide integration gateway using BACnet or Modbus for connection to building automation system.

2.12 SYSTEM PRINTER

A. Printer shall be listed and labeled as an integral part of fire-alarm system.

2.13 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by device manufacturer.
2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.

C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

D. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

E. Smoke Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
5. HVAC: Locate detectors not closer than 60 inches from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

F. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

H. Air-Sampling Smoke Detectors: If using multiple pipe runs, the runs shall be pneumatically balanced.

I. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

3.3 PATHWAYS

A. Pathways above recessed ceilings and in non-accessible locations may be routed exposed.
1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.

B. Pathways shall be installed in EMT.

C. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
1. Smoke dampers in air ducts of designated HVAC duct systems.
2. Alarm-initiating connection to elevator recall system and components.
3. Supervisory connections at valve supervisory switches.
4. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
5. Supervisory connections at elevator shunt-trip breaker.
6. Data communication circuits for connection to building management system.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals.

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

A. Field tests shall be witnesses by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 284621.11