



NOTICE OF ADDENDUM

Addendum #5

January 12, 2020

Montebello Elementary | Middle School

GMP-2

Addition & Renovations

2020 East 32nd Street
Baltimore, MD 21218

Summary of Changes/Clarifications – ADDENDUM No. 5

Attention All Trade Packages:

In order for your bid to be accepted all bidders must submit their bid on the Designated bid form, “00300 Bid Form” found in CAM Constructions Bid Manual. This bid form has also been posted on BuildingConnected for your convenience, identified by data file “00-MEMS GMP2 00300 Bid Form”.

Added Specifications:

1. None

Revision to Specifications:

1. Section 31200 Earth Moving
2. Section 116800 Play Field Equipment & Structures
3. Section 230900 Instrumentation & Control for HVAC
4. Section 238239.13 Cabinet Unit Heaters
5. Section 238239.16 Propeller Unit Heaters
6. Section 238239.19 Wall & Ceiling Unit Heaters
7. Section 211313 Wet Pipe Sprinkler Systems
8. Section 221423 Storm Drainage Piping Specialties
9. Section 224000 Plumbing Fixtures
10. Section 224213.13 Commercial Water Closets
11. Section 260501 General Electrical Requirements
12. Section 260526 Grounding and Bonding for Electrical Systems
13. Section 260533 Raceways and Boxes for Electrical Systems
14. Section 262816 Enclosed Switches and Circuit Breakers
15. Section 262913 Enclosed Controllers
16. Section 274100 Audio Visual and Sound Systems
17. Section 283112 Public Safety Distributed Antenna Systems



Unit Price Schedule 3.1 Per Section 012200 Unit Prices revise as follows

1. Delete Division 22 Plumbing Unit Prices
2. Delete Division 23 HVAC Unit Prices
3. Unit prices for Electrical/Communications to be revised in future addendum.

Scope Clarifications:

1. **Trade Package 4A:** Reference CAM's Bid manual trade contractor 4A scope item 21. Replace scope item 21 to read include 240 manhours hours of a general labor for overall job site clean up to be directed by the project superintendent. This labor is addition to the required trade contractor's daily clean-up of their own trade package scope of work. A line item for this work shall be established on the requisition.
2. **Trade Package 9A:** Reference CAM's Bid manual trade contractor 9A scope item 13. Replace scope item 13 to read include 416 manhours hours of a general labor for overall job site clean up to be directed by the project superintendent. This labor is addition to the required trade contractor's daily clean-up of their own trade package scope of work. A line item for this work shall be established on the requisition.
3. **Trade Package 22A:** Reference CAM's Bid manual trade contractor 22A scope item 16. Replace scope item 16 to read include 416 manhours hours of a general labor for overall job site clean up to be directed by the project superintendent. This labor is addition to the required trade contractor's daily clean-up of their own trade package scope of work. A line item for this work shall be established on the requisition.
4. **Trade Package 26B:** Reference CAM's Bid manual trade contractor 26B scope item 15. Replace scope item 15 to read include 416 manhours hours of a general labor for overall job site clean up to be directed by the project superintendent. This labor is addition to the required trade contractor's daily clean-up of their own trade package scope of work. A line item for this work shall be established on the requisition.
5. **Trade Package 6A:** Furnish and install 21 temporary 10 lb ABC Fire extinguishers at the direction of the CM. This work is to include the re-certification and/or replacement after 1 year. In addition, include 10 additional fire extinguishers for replacement due to use, damage, theft or failure.
6. **Trade Package 6A:** Furnish and Install wood blocking for wall mounted 75" Onscreen Interactive Display boards (M) and TV's (M1) at locations as identified on the Secondary IT Drawings. This blocking is to include 3/4" FRT plywood blocking at a minimum area of 4'x6' depending on stud layout to support wall mounted bracket. Final configuration and location to be coordinated with 27A Trade Contractor.



Trade Package Alternates:

Alternate 1 Trade Package 22A: Provide the following changes to Domestic Water Piping Section 221116 and associated valves Section 220523 General Valves for Plumbing

221116 Domestic Water Piping

ALL Above Ground piping:

- CPVC less than 2-1/2": Schedule 40; socket fittings; and solvent-cemented joints.
- CPVC 2-1/2" and larger: Schedule 80, socket fittings and solvent-cemented joints
- CPVC pipes and fittings are compatible with chlorine, chloramine and chlorine dioxide disinfection methods at all levels safe for human consumption and significantly above those levels.
- Comply with NSF 61 for potable domestic water piping and components.
- All solvent cements used, to conform to ASTM D-2564, listed by NSF for potable use applications.
- All insulation materials shall be chemically compatible with CPVC. Piping shall be wrapped with insulation.

220523 General Duty Valves for Plumbing

All Ball valves for domestic water CPVC 1 pc ball valves

Alternate 2 Trade Package 22A: Provide the following changes to Storm Drainage Piping Section 221413 and Sanitary Waste and Vent Section 221316

Sch 40 PVC DWV for above and below grade piping

- PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
- PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
- Solvent Cement and Adhesive Primer: a. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- All insulation materials shall be chemically compatible with PVC. Above grade piping shall be wrapped with insulation.
- Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

Alternate 1 Trade Package 26B: Eliminate conduit and related boxes for DAS system. Maintain only boxes and conduit in IT closets and exposed ceiling spaces and provide sleeves through walls and roof as required.

Questions From Trade Contractors and Responses:

1. Specification Section 27-41-00 states a 75” OneScreen Interactive Display is to be installed within each classroom. Plan TSD6.2 details an “M” faceplate at the PR location with an EPSON ELP846 Wall Bracket.
 - a. Is this “M” location and Wall Bracket needed if we are to install a 75” Interactive Display?
 - b. Shouldn’t the “M” locations on plans actually be “PR” locations?

R1. BCPS recently changed their specifications for the classrooms. The OneScreen Interactive Display is required for the M symbol locations as there is no longer a PR location defined. The M location will now interface with the Extron plenum vault and not the wall vault. Contractor should provide the wall mount bracket to support the OneScreen on the wall.

2. Plan TSD4.B: Is the projector shown on the stage part of the IT Technology Section? Specification Section 27-41-00 does not mention this projector. If this projector is to be included, we will need the following information:
 - a. Make and model of Projector
 - b. Type and dimensions of Heavy Duty Cage

R2. This is actually a requirement for the primary technology package. The projector shown on the TSD plans will be removed on next drawing issuance.

3. Please reference specification 116800, Section 1.5 (B), which states that all equipment must be accompanied by a “Made in the USA Statement”. Is it possible to remove this requirement as it will eliminate some other playground equipment manufacturer alternates if we are required to provide Made in the USA equipment?

R3. “Made in the USA Statement” has been removed from the specification.

4. Are playground equipment substitution requirements noted in specification 116800, Section 1.7, required to be submitted prior to the bid due date or is this a post bid requirement?

R4. Substitution Requests shall be submitted post-bid. Please note that all of the same requirements noted in both the specs and the plans must be met for a substitution to be accepted. The Substitution must meet or exceed the products that are currently specified.

5. Please reference specification section 321816.13 issued with Amendment 1, please confirm that the poured in place rubber surfacing should be an IPEMA Certified product.

R5. Of the five Standards that IPEMA certifies, only two apply to this project, both of which are included in the spec 321816.13, section 1.8.B, therefore adding the IPEMA Certified Product requirement would be redundant and is not necessary.

6. It appears the specification section 283111 has been omitted from the bid documents, this is for the Fire Alarm Systems and will be needed to bid.

R6. Added via addendum

7. Need specification for Metal Shelving this was not included.

R7. Refer to spec section 101000 Specialty Building Products.

8. Spec 260501-3.6-A states that the general electrical warranty is 3 years from substantial completion. This is not industry standard and will increase cost significantly. Can the general electrical warranty term be verified?

R8. 2-year warranty.

9. 260519-3.3-H states all exterior circuits shall contain an extra #10 ground wire. To be clear, for a 20A 1P 277V circuit, we would have (1) hot, (1) neutral and (2) grounds?

R9. Correct

10. 260533-3.1-A-5 states outdoor boxes and enclosures above ground are to be N4X. Is N3R acceptable for this application?

R10. NEMA 3R is acceptable

Same question when this appears in other division 26 specification sections.

R10. NEMA 3R is acceptable

11. What bid package is responsible to provide IT and AV racks/cabinets?

R11. TSD provides Active and Passive Data Racks

R11. Package 1 provides Intercom, CCTV, and AV Racks

R11. DAS contractor provides the DAS rack.

12. 283111 is missing from the volume 3 specifications. Please issue this in a future addendum.

R12. Included in Addendum #4

13. After a quick review, I have a question regarding Line Item 25C Salad Counter. This doesn't appear to be tagged on the plan K-101 but I believe it may be behind the cashier stand 25E. Also, on this same item 25C, it seems that the written spec for the mechanical cold pan is missing.

R13. Yes, Item 25C Salad Counter is behind the cashier stand, Item 25E. The written spec calls for Eagle #DCS3-CFURN-S-SEP-MOD cold food unit with refrigerated mechanical cold pan. Refer to Section 114000, Page 114000-49 for information.

14. Looking over the drawing list on CS.2, there are several Mechanical and (1) Plumbing drawing that are listed but not in the drawing set. MD1.1 thru MD1.8 & P4.2

R14. P4.2 issued in Addendum. See Demo plans issued by CAM from previous Phase 1 demo

15. The TSD Classroom Division 274100 specifications mention Plenum Vault and Wall Vault systems. Please confirm which system should be quoted.

R15. The One Screen Interactive Display will be used for this school so specify the plenum vault.

16. The TSD Classroom Division 274100 specifications list HDMI and RGB inputs on the wall plates. The BCPS standard has changed to dual HDMI inputs. Please confirm we should bid dual HDMI inputs.

R16. Yes wall plate with dual HDMI inputs is correct.

17. TSD Division 274100 page 7, C.1 says Wall Vault. Same page C.1.d. says Plenum Vault.

R17. See above..

18. TSD Division 274100 page 7, C.1.e.i. lists the HDMI/RGB wall plate.

R18. See above.

19. Identify type of termination for tile on outside corners and top of wainscot. Bullnose or Schluter. Also clarify the extent of tile on any given wall where sink or toilets due not run the full extent of the wall scheduled to be tiled (i.e. bathroom 005 sink wall).

R19. Info called out in the specification section 093000. The extents are called out on drawings I7.5 through I7.8 finish plans.

20. Specs 233113-3.10.B.1.e and 3.10.C.1.e state to line the first 5' of supply and return from FCUs. Detail 36 on Drawing M7.4 states to line the first 10'. Which is correct? Also, does the liner only apply to the straight section of duct connecting to the FCU, or do branch lines that fall within the first 5'/10' also need to be lined?

R20. Provide liner for first five (5) feet of straight duct section from FCU. This shall be clarified in Addendum #4. Branch lines that fall with-in the first five (5) feet shall be lined as well.

21. Details #1 (drawing M7.1) and #33 (drawing M7.3) show diffuser plenums being externally insulated with no internal liner. Air Device Schedule and Linear Diffuser Schedule on drawing M9.2 have notes stating diffuser plenums are to be lined. Please clarify if the diffuser plenums are to lined, insulated, or both. If liner is required, please advise if a perf inner wall is also required.

R21. All diffuser plenums shall be lined. All lined duct shall have perf inner wall. Detail #1 shall be revised under this Addendum.

22. Spec 233113-3.10.H.6 states to line all Stage, Gym, and Cafeteria duct in its entirety. Please clarify if we are to line only the duct within these rooms, or do we also line the complete duct system all the way to the connection to the air handling units in the mechanical rooms.

R22. Complete duct system shall be lined.

23. Detail #11 (drawing M7.1) notes 2" sound lined, 18 gauge transfer duct. Please confirm if 18 gauge duct is required, or is it acceptable to use standard SMACNA gauges (18 gauge seems excessive for this application).

R23. 18 gauge is not required. Provide 22 gauge for transfer air ducts. Detail #11 shall be revised under this Addendum.

24. The Specifications list Concord Elevator as a Manufacturer for the Unenclosed Wheel Chair Lift. Concord Elevator was purchased by Savaria. We want to bid a MultiLift by Savaria to meet the requirements outlined in the specifications. Will this be allowed?

R24. Yes Acceptable

25. Drawing A2.8 and A4.3 both indicate side-brace, side fold basketball backstops for the (4) side court basketball hoops but Section 114800, paragraph 2.3.F. specifies only front-braced, forward front-braced backstops. Can you confirm that #3107 front-braced, forward fold backstops are to be provided for the (2) main court basketball backstops and #3109 side-braced, side fold backstops are to be provided for the (4) side court basketball backstops?

R25. Side courts to be side braced and side fold, corrected in Addendum #4.

26. Drawing A2.8 indicates a scoreboard that is 10'-0" wide by 4'-0" high (similar to [Daktronics model #BB-2125-13](#)) but Section 114800, paragraph 2.9.A. specifies a [Daktronics model #BB-2103-13](#) scoreboard, which is 6'-0" wide by 8'-0" high. Can you confirm which style scoreboard should be provided, a BB-2125-13 as shown on the drawings or a BB-2103-13 as specified?

R26. Refer to spec section for scoreboard size.

27. Drawing A4.3, Gym Accessories Legend, Tag G3 for the basketball backstops mentions "maintain P.I.A.A. clearances" and we are unfamiliar with this requirement. Can more details on P.I.A.A. clearances be required, it seems to be a Pennsylvania requirement?

R27. Revised per Addendum #4.

28. Drawing A4.3, Gym Accessories Legend, Tag G14 for the gym equipment touch screen controller is shown in (2) locations but drawing E1.5 shows only (1) touch screen controller location. Can you confirm how many touch screen controllers should be provided, (1) or (2)?

R28. Two are required – one at each side of curtain. Electrical Trade contractor include and coordinate with equipment trade contractor for second location

29. Drawing A4.3 shows the main court basketball lines offset of the main court volleyball lines. Can you confirm this is desired or should the (2) courts share a center line?

R29. Dimensions on A4.3 indicate the volleyball court is to be centered on the main basketball court. Need clarification on where the main court lines are showing off center? Location of divider curtain and side courts will be revised in Addendum #4.

30. Drawing E1.5 shown only (1) twist lock plug for each of the (6) basketball backstops but (2) twist lock plugs will be required, one for the electric winch and one for the electric height adjuster on each basketball backstop. Can you confirm that (2) twist lock plugs should be provided for each basketball backstop?

R30. A separate twist lock receptacle will need to be provided with the height adjuster, with same requirements as motorized backstop.

31. Hanger supports shown on FP5.1 are not typical for fire protection systems. Can typical tear drop loop hangers and rod be used?

R31. Detail was revised to show the adjustable swivel hanger.

32. In reference to Spec 211313-Wet Pipe Sprinkler Systems Section 2.3 calls for ASTM A312 (Stainless Steel) pipe and fittings Sections 2.5-2.7 call for stainless steel valves Can this requirement for stainless steel piping and valves be removed as they are not typical in fire sprinkler systems and be replaced with the piping requirements listed in Spec 211316-Dry Pipe Sprinkler Systems, Section 2.4- • All piping 2" or less in diameter shall be ASTM A53 (Type E Grade B) or A795 (Type E Grade A), Schedule 40 black steel. • All piping 2½" or larger in diameter shall be ASTM A135 or A795 (Type E Grade A), Schedule 10 black steel.

R32. Please see revised specifications.

33. The Elevation Legend on page A2.3 note number 5 references a, "metal clad window system". Please confirm there are not any wood windows clad with aluminum on the project, and that all windows are aluminum per section 085113.

R33. Confirmed

34. . Sections 084113 and 085113 list different finishes at storefront and windows. Is this correct or should they be the same finish?

R34. We can select finishes in shop drawing submittals.

35. On sheet C610 the sewer line is labelled as 6" DiP but the profile on sheet C611 the sewer line is labelled as SDR-35 (PVC). Which one is required?

R35. Use SDR-35 PVC shall be used for most of the network. DIP will be used for the sewer line from existing building. Approximate DIP length will be 100'. Updated drawings will be provided in this addendum.

36. On sheet C611 there structures labelled 174 through 177. What are these structures?

R36. Updated sewer profile will be provided. Cleanouts will be needed at each bend. See this addendum drawings

37. On sheet C613 there is a detail for concrete encasement of a sewer line. I don't not see where concrete encasement is called on C610 or C611. Where is the concrete encasement required.

R37. Ignore detail, it will be removed following addendum

38. On sheet C613 there is a detail for an inside drop connection. I don't not see where an inside drop connection is called on C610 or C611.

R38. Grease trap will be required.

39. Please provide a profile for sewer line from the connection to the existing sewer from auditorium/gym to the proposed sewer main.

R39. See this addendum. Reference Plumbing drawings.

40. Scope #29 reads “Provide all storm, sanitary and water utilities complete” Please confirm the grease trap is in the 31A scope.

R40. Grease trap will be required.

41. Please provide a detail for the grease trap shown on C610.

R41. Grease trap detail is provided in plumbing plans. Grease trap to be furnished and installed by 22A Trade Contractor. Reference Addendum 4 Item 7 in Q&A

42. On sheet C620 west of the existing building there is a note that reads “Connect Playground Underdrain to Proposed Storm Drain” that has a line drawn to an existing manhole. There is no playground underdrain in that area. Please confirm note is a mistake.

R42. Underdrain will be detailed and installed by the playground trade contractor 11E. Please coordinate and attach underdrain to the proposed storm drain network. Reference scope item 39 of Trade package 31A.

43. Please provide a structure schedule for both the sewer and the sewer.

R43. Schedules have been provided in previous addendum.

44. Please clarify what type of trench drain is required per plan C620/C624(- for example ACO and a model number)?

R44. Please use NEENAH R-4999CX TYPE P or approve equal. C620 was updated.

45. Please clarify what the **unit of measure** is for UNIT Price UP-31A-4 temporary access road ? For example per sy, per each, etc?

R45. Please use SY.

46. Please clarify if RC-6 is acceptable material for “engineered fill” as mentioned per unit price 31A-#2 and #3? If RC-6 is unacceptable material for engineered fill, please clarify what is required for “engineered fill”?

R46. Typically RC-6 is acceptable, however all fills must be approved by the geotechnical engineer.

47. Division 274100 13.b spec lists the speaker model EV SX100 on page 5 for the Gym. The line drawing and ceiling plans both show the Extron ceiling speakers. Please confirm we are to quote just the ceiling speakers in the Gym.

R47. ESP – Correct, only ceiling speakers. The EVSX100+ should be revised to an Extron SF 10C Subwoofer

48. TSD 274133.10 spec 2.2 they list a Teleprompter and a character generator but there is no brand or model given for either one. Are we supposed to provide those and if so what brands and models? Also, what about Mobile Production?

R48. Not Required

49. The TSD drawing TSD 6.2 detail 10 shows an Epson projector wall mount for the M location. The TSD spec and the drawing T5.2 show this as a flat screen. Please confirm the M locations should all be flat screens.

R49. M locations are the OneScreen Interactive Displays and the M1 locations refer to the Vizio 42” displays. Refer to TSD specifications 274100 for part numbers. Also Extron plenum vaults should be used with the OneScreen displays.

50. The drawing T5.4 detail 3 SP Pathway says 6 speakers in a cluster. That same drawing on detail 1 shows 4 speakers and the floor pan drawing T1.5 shows 4 wall mounted speakers. Please confirm we are to quote 4 wall mount speakers.

R50. ESP – Four wall-mounted speaker should be provided.

51. The TSD drawing TSD 4.B detail 1 Gym ceiling plan shows 6 circles with “IR” in them. The legend says these are Sound Enhancement IR receivers but it does not appear there is a Classroom Sound Enhancement system in the Gym. The T series drawings show an Auxiliary sound system that uses RF wireless mics instead of IR. Please confirm these IR receivers in the Gym are not part of the audiovisual scope.

R51. Yes, this is a mistake. Please remove requirements for devices.

52. Regarding Addendum #4 RFI responses 19 and 24: We see that all aluminum doors and associated hardware are to be included in the 8C package. These responses though reference, "Kolbe" doors which seem to be aluminum clad wood doors. Is this type of door included in the specifications? Which bid package should pick up these doors (assuming that 8C is responsible for their frames and all glass)?

R52. To be included in Bid Package 08C Aluminum Entrances, Storefront and Glazing

53. Drawing Sheet FA0.1 asks for red-painted conduit for the DAS cabling and NEMA1 junction boxes for the splitters.

a. Will the conduit and junction boxes be provided by the Electrical Contractors or should this be included in the DAS Contractor's scope?

R53. Conduit and boxes provided and installed by 26B trade Contractor

b. If the WSP and PS DAS systems are separate, does the WSP cabling need to be in conduit?

R53. Not sure what is meant by WSP cabling. The documents produced by A2ESG are for the fire alarm and public safety distributed antenna systems and both systems require separate conduit raceway systems for their wiring.

54. Drawing Sheet FA1.1 to FA1.4 shows DAS antennas on the floor plans. Is this design to be followed as is or can we provide a lower-cost solution that also exceeds the performance criteria?

R54. A2ESG Response: A2ESG has no objection to considering for a lower cost solution so long as cabling is installed in conduit and meets or exceeds the performance criteria needs to satisfy the local authority having jurisdiction. Please see General Public Safety Distributed Antenna System Note #8.

55. Specification 280006 Part 1.1: asks for one system to support both WSP and PS DAS. Can we propose an alternate lower cost solution with separate PS and WSP DAS systems?

R55. Provide as specified

56. Specification 280006 Part 2.6 D: Can alternate components, that have been used in this jurisdiction before, be used in place of the specified manufacturers?

R56. Provide as specified



Design Team Addendum:

Addendum 4 Dated January 8, 2020

No Change to Bid Schedule

Bid Date: January 28, 2021 at 5:00PM

Site Visit: December 29, 2020 and January 5, 2021 at 9:00AM-12:00PM

RFI's Due: January 14, 2021 at 4:00PM

Expected Start: March 1, 2021

Expected Finish: August 1, 2022

End of Addendum



**Crabtree, Rohrbaugh & Associates
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ADDENDUM NO. 4

ADDENDUM NO. 4

January 08, 2021

**MONTEBELLO ELEMENTARY/MIDDLE SCHOOL
CRA PROJECT NO. 3356**

**TO: ALL PROSPECTIVE BIDDERS AND OTHER RECIPIENTS OF CONTRACT DRAWINGS &
SPECIFICATIONS**

NOTE: This Addendum is hereby made a part of the Contract Document, which will be the basis of the Contract. This Addendum is issued to modify and/or correct the original 90% Contract Documents dated November 16, 2020. Attach this Addendum to your Contract Documents. Receipt of this Addendum must be acknowledged on the Bid Form. Failure to do so may subject the Bidder to disqualification.

Crabtree, Rohrbaugh & Associates

CIVIL SPECIFICATIONS

SECTION 31200 – EARTH MOVING:

1. **REMOVE** Section 2.1.C: “, except under the building slab”

LANDSCAPE SPECIFICATIONS

SECTION 116800 – PLAY FIELD EQUIPMENT AND STRUCTURES:

1. **REMOVE** Section 1.5.B.1.a.3: “LEED Recycled Fraction percentage (must meet or exceed 31%).
2. **REMOVE** Section 1.5.B.1.b.1: “Made in the USA Statement (must be 100% for all fabrication, rotomolding, welding, and painting on all standard products)”

MECHANICAL SPECIFICATIONS

SECTION 230900 – INSTRUMENTATION AND CONTROL FOR HVAC

1. **ADD** section 1.2D sub section 9 to read” 9. Provide all equipment, materials, labor, programming, etc. as required to fully integrate the building controls systems to the Baltimore City Public Schools Johnson Controls Inc. (JCI) head end Energy Management System.”

SECTION 238239.13 – CABINET UNIT HEATERS

1. **ADD** “Raywall” to list of acceptable manufacturers under section 2.1A

SECTION 238239.16 – PROPELLER UNIT HEATERS

1. **ADD** “Raywall” to list of acceptable manufacturers under section 2.1A

SECTION 238239.19 – WALL AND CEILING UNIT HEATERS

1. **ADD** “Raywall” to list of acceptable manufacturers under section 2.1B

PLUMBING and FIRE PROTECTION SPECIFICATIONS

SECTION 211313 - WET PIPE SPRINKLER SYSTEMS

1. **ADD** revised specification section in its entirety

SECTION 221123 - DOMESTIC WATER PUMPS

1. **ADD** revised specification section in its entirety

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

1. **ADD** revised specification section in its entirety

SECTION 224000 - PLUMBING FIXTURES

1. **ADD** revised specification section in its entirety

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

1. **ADD** revised specification section in its entirety

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ELECTRICAL SPECIFICATIONS

SECTION 260501 PARAGRAPH 3.6 GUARANTEE:

1. **REVISE** Section A.1 to “two (2) years”.

SECTION 260526 PARAGRAPH 2.4.B CONNECTORS:

1. **ADD** “equivalent to cadweld”.

SECTION 260533 PARAGRAPH 3.1 RACEWAY APPLICATION:

1. **REVISE** Section A.5 to “NEMA 3R”.
2. **REVISE** Section B.3 to “EMT”.

SECTION 262816 PARAGRAPH 3.2 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

1. **REVISE** Section A.2 to “NEMA 3R”.

SECTION 262913 PARAGRAPH 2.3 ENCLOSURES

1. **REVISE** Section A.2 to “NEMA 3R”.

TECHNOLOGY SPECIFICATIONS

274100 – AUDIO VISUAL AND SOUND SYSTEMS

1. **REVISE** 2.1, B., 13, b to an Extron SF 10C Subwoofer.

PUBLIC SAFETY DISTRIBUTED ANTENNA SYSTEM SPECIFICATIONS

SECTION 283112- PUBLIC SAFETY DISTRIBUTED ANTENNA SYSTEM

1. Revised footer to correct specification section number.

LANDSCAPE DRAWINGS

DRAWING L200 - SITE FURNISHING AND HARDSCAPE DETAILS REFERENCE PLAN

1. **ADD** retaining / division wall detail call out for circular planter in front of main entrance.

DRAWING L202 - SITE FURNISHING AND HARDSCAPE DETAILS

1. **REVISE** Planter Wall detail (detail 5) reinforcement
2. **ADD** top soil call out on Planter Wall detail (detail 5)

DRAWING L204 – L206 - SITE FURNISHING AND HARDSCAPE DETAILS

1. **REVISE** Amphitheater Seat Wall and Stair section’s / detail’s reinforcement

DRAWING L207 - MONUMENT SIGN DETAIL

1. **REMOVE** Monument Sign reinforcement shown within detail elevation. See detail sections for specified reinforcement.

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DRAWING L301 - PROPOSED LANDSCAPE PLAN

1. **REVISE** landscape plans

DRAWING L310 - PROPOSED NOTE AND DETAILS

1. **REVISE** plant schedule

ARCHITECTURAL DRAWINGS

DRAWING A1.3 – BASEMENT FLOOR PLAN – UNIT A & B

1. **REVISE** Dimension in Pantry 009.

DRAWING A1.4 – FIRST FLOOR PLAN- UNIT A

1. **ADD** 6'-0"W x 4'-8"H x 12"D Display case.

DRAWING A1.6 – FIRST FLOOR PLAN – UNIT A

1. **REVISE** dimension at Electric Closet 107.

DRAWING A1.8 – SECOND FLOOR PLAN- UNIT A

1. **ADD** 6'-0"W x 4'-8"H x 12"D Display case.

DRAWING A1.9 – SECOND FLOOR PLAN – UNIT B

1. **ADD** Existing catwalk ladder.

DRAWING A1.10 – OVERALL ROOF PLAN

1. View 1 – Roof line **CLARIFICATION**.

DRAWING A1.15 – FIRST FLOOR REFLECTED CEILING PLAN – UNIT B

1. **ADD** Catwalk access panel.

DRAWING A3.6 – WALL SECTIONS

1. View 2 – **REVISE** section and notes.

DRAWING A4.1 – LARGE SCALE TOILET PLANS

1. **ADD** Note #9 to 'General Notes'.

DRAWING A4.2 – LARGE SCALE TOILET PLANS

1. **ADD** Note #9 to 'General Notes'.
2. View A – **REVISE** note.

DRAWING A6.4 – DOOR SCHEDULE

1. **REVISE** Hardware number for door OCB-A.

DRAWING A6.5 – DOOR SCHEDULE

1. **REVISE** Door width of 107.

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MECHANICAL DRAWINGS

DRAWING M1.5 – FIRST FLOOR PLAN – UNIT ‘B’

1. **REVISE** location of ACCU—5 to be shifted south, parallel to building by roughly 6’-0” such that the end of the north end of the unit is in line with south end of generator.

DRAWING M1.5A - FIRST FLOOR PLAN – UNIT ‘B’ - PIPING

1. **REVISE** location of ACCU—5 to be shifted south, parallel to building by roughly 6’-0” such that the end of the north end of the unit is in line with south end of generator. Shift associated refrigerant piping and conduit as well.

DRAWING M7.1 – MECHANICAL AIR DISTRIBUTION DETAILS

1. **REVISE** detail #1 typical supply air device installation detail. Diffuser plenum box shall be internally lined. Refer to reissued sheet for additional information.
2. **REVISE** detail #11 typical transfer air duct detail from 18 Ga to 22 Ga duct. Refer to reissued sheet for additional information.

DRAWING M7.4 – DUCTWORK, EQUIPMENT & SUPPORT DETAILS

1. **REVISE** detail #36 typical horizontal FCU mounting detail. Revise minimum amount of lined ductwork on FCU supply and return from 10’-0” to 5’-0”.

PLUMBING DRAWINGS

DRAWING P1.1 – FOUNDATION PLAN-NEW WORK-PLUMBING

1. **ADD** revised drawing in its entirety.
2. Added notes and sizes.

DRAWING P1.3 – BASEMENT FLOOR PLAN-NEW WORK-PLUMBING

1. **ADD** revised drawing in its entirety.
2. Added notes and vent pipe.

DRAWING P1.5 – GROUND FLOOR PLAN-NEW WORK-PLUMBING

1. **ADD** revised drawing in its entirety.
2. Added gas pipe in corridor OCH near.

DRAWING P1.7 – FIRST FLOOR PLAN-NEW WORK-PLUMBING

1. **ADD** revised drawing in its entirety.
2. Added gas pipe.
3. Added Drawing note number 8.

DRAWING P1.8 – SECOND FLOOR PLAN-NEW WORK-PLUMBING

1. **ADD** revised drawing in its entirety.
2. Modify vent pipe near girls toilet.

DRAWING P1.9 – SECOND FLOOR PLAN-NEW WORK-PLUMBING

1. **ADD** revised drawing in its entirety.
2. Added notes to AHU-6 and gas pipe.

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DRAWING P1.11 – ROOF PLAN-NEW WORK-PLUMBING

1. **ADD** revised drawing in its entirety.
2. Added gas pipe for MAU-1 and RTU-1.
3. Added Drawing notes number 6 ,7 and 8.

DRAWING P4.1 – PART PLANS-NEW WORK-PLUMBING

1. **ADD** revised drawing in its entirety.
2. Domestic water booster triplex pump added.
3. Added notes and drawings.
4. Revised notes and drawings.

DRAWING P4.2 – PART PLANS-NEW WORK-PLUMBING

1. **ADD** revised drawing in its entirety.
2. Changed P# to fixtures in toilet rooms.

DRAWING P4.3 – PART PLANS-NEW WORK-PLUMBING

1. **ADD** revised drawing in its entirety.
2. Changed P-X to the associated P-#.

DRAWING P4.4 – PART PLANS-NEW WORK-PLUMBING

1. **ADD** revised drawing in its entirety.
2. Added the MBH to AHU-5.

DRAWING P4.5 – PART PLANS-NEW WORK-PLUMBING

1. **ADD** revised drawing in its entirety.
2. Revised note 17.
3. Added Drawing notes number 29.

DRAWING P4.6 – PART PLANS-NEW WORK-PLUMBING

1. **ADD** revised drawing in its entirety.
2. Revised health room plumbing chase piping.

DRAWING P5.1 – PLUMBING DETAILS

1. **ADD** revised drawing in its entirety.
2. Corrected Typo
3. Added note.

DRAWING P5.2 – DETAILS

1. **ADD** revised drawing in its entirety.
2. Corrected size on grease interceptor.
3. Added note.

DRAWING P5.3 –PLUMBING DETAILS

1. **ADD** revised drawing in its entirety.
2. Added designations on detail.

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DRAWING P6.1 –PLUMBING RISER DIAGRAMS

1. **ADD** revised drawing in its entirety.
2. Added pipe sizes.

DRAWING P6.2 –SANITARY RISER DIAGRAMS

1. **ADD** revised drawing in its entirety.
2. Added/adjust pipe sizes.
3. Revised layout to accommodate floor plan changes.
4. Added room designations.

DRAWING P6.3 –SANITARY RISER DIAGRAMS

1. **ADD** revised drawing in its entirety.
2. Added/adjust pipe sizes.
3. Revised layout to accommodate floor plan changes.
4. Added room designations.

DRAWING P6.4 –SANITARY RISER DIAGRAMS

1. **ADD** revised drawing in its entirety.
2. Added/adjust pipe sizes.
3. Revised layout to accommodate floor plan changes.
4. Added room designations.

DRAWING P6.5 –SANITARY RISER DIAGRAMS

1. **ADD** revised drawing in its entirety.
2. Added/adjust pipe sizes.
3. Revised layout to accommodate floor plan changes.
4. Added room designations.

DRAWING P6.6 –SANITARY RISER DIAGRAMS

1. **ADD** revised drawing in its entirety.
2. Added/adjust pipe sizes.

DRAWING P6.12 –PLUMBING RISER DIAGRAMS

1. **ADD** revised drawing in its entirety.
2. Added/adjust pipe sizes to relocation of connection gas riser diagram.

DRAWING P7.1 –PLUMBING SCHEDULES

1. **ADD** revised drawing in its entirety.
2. Added P-1C.
3. Deleted P-12.

DRAWING P7.2 –PLUMBING SCHEDULES

1. **ADD** revised drawing in its entirety.
2. Domestic water booster triplex pump schedule added.

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FIRE PROTECTION DRAWINGS

DRAWING FP1.1 – BASEMENT FLOOR PLAN UNIT A-NEW WORK-FIRE PROTECTION

1. **ADD** revised drawing in its entirety.
2. Revised piping at chase.
3. Revised fire protection piping to accommodate domestic piping and HVAC.

DRAWING FP1.2 – GROUND FLOOR PLAN UNIT ‘A’-NEW WORK-FIRE PROTECTION

1. **ADD** revised drawing in its entirety.
2. Revised fire protection piping to accommodate domestic piping and HVAC.

DRAWING FP1.3 – GROUND FLOOR PLAN UNIT ‘B’-NEW WORK-FIRE PROTECTION

1. **ADD** revised drawing in its entirety.
2. Revised piping near stairwell D.
3. Revised piping at chase near stairwell C.

DRAWING FP1.4 – FIRST FLOOR PLAN UNIT ‘A’-NEW WORK-FIRE PROTECTION

1. **ADD** revised drawing in its entirety.
2. Revised fire protection piping to accommodate domestic piping and HVAC.
3. Added Drawing note number 7.

DRAWING FP1.5 – FIRST FLOOR PLAN UNIT ‘B’-NEW WORK-FIRE PROTECTION

1. **ADD** revised drawing in its entirety.
2. Revised piping near stairwell D.
3. Revised piping at chase near stairwell C.

DRAWING FP1.6 – SECOND FLOOR PLAN UNIT ‘A’-NEW WORK-FIRE PROTECTION

1. **ADD** revised drawing in its entirety.
2. Revised fire protection piping to accommodate domestic piping and HVAC.

DRAWING FP1.7 – SECOND FLOOR PLAN UNIT ‘B’-NEW WORK-FIRE PROTECTION

1. **ADD** revised drawing in its entirety.
2. Revised piping at chase near stairwell C.

DRAWING FP1.8 – ROOF PLAN-UNIT ‘A’-NEW WORK-FIRE PROTECTION

1. **ADD** revised drawing in its entirety.
2. Added Drawing note number 2.

DRAWING FP5.1 – FIRE PROTECTION DETAILS

1. **ADD** revised drawing in its entirety.
2. Revised “TYPICAL PIPE HANGER SUPPORTS” detail.

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ELECTRICAL DRAWINGS

DRAWING E1.1 - BASEMENT FLOOR PLAN UNIT 'A' – ELECTRICAL

1. **REVISE** location of “A1” drop in Mechanical Room 0015 as indicated in reissued sheet.
2. **REVISE** receptacle layout in Community Room 0014 per the revised furniture layout, as indicated in reissued sheet.
3. **ADD** Booster Pump in Building Service 008.

DRAWING E1.5 - FIRST FLOOR PLAN UNIT 'B' – ELECTRICAL

1. **ADD** additional twist lock receptacle for electrical height adjuster at each basketball hoop, and include drawing notes #1, 2, 5 with added receptacle.
2. **REVISE** location of ACCU-5 as indicated on reissued sheet.

DRAWING E2.0 – LIGHT FIXTURE SCHEDULE

1. **DRAWING E2.0 – LIGHT FIXTURE SCHEDULE**
2. **REVISE** type ‘C’ series luminaires to surface mount and lumen variations.

DRAWING E2.3 - GROUND FLOOR PLAN UNIT 'B' - LIGHTING

1. **REVISE** type ‘C’ series luminaires at Cafeteria to surface mount.
2. **ADD** Exit Signage at Corridor OCB (outside of Cafeteria).

DRAWING E4.1 - PART PLAN – KITCHEN – ELECTRICAL

1. **ADD** Detail for “Cord Reel Ceiling Support” as indicated on reissued sheet.

DRAWING E5.1 - SCHEMATIC POWER RISER DIAGRAM

1. **REVISE** Primary circuit breaker for TCBA to “225A”, TCGB to “60A”, for TE2RBA, TE2RGB to “90A”, and TRGB to “150A”
2. **REVISE** circuit breaker MSB-4 serving Panelboard LGB to 100A, and connect via (4) #1 + #8GW – 1-1/2”C.
3. **REVISE** circuit breaker MSB-5 serving Panelboard MGB to 700A, and connect via 2 sets of (4) 500kmcil + #1/0GW – 3”C
4. **ADD** Drawing Note #6 for use of aluminum feeders, as indicated.
5. **ADD** Drawing Notes #6 and #14 to ATS-1, and ATS-2 from the generator docking station.

DRAWING E7.1 - PANELBOARD SCHEDULES

1. **ADD** twelve (12), 1P-20A spare circuit breakers to Panelboard C1A; four (4), 1P-20A spare circuit breakers to Panelboard CBA; and four (4), 1P-20A spare circuit breakers to Panelboard CGB;

DRAWING E7.2 - PANELBOARD SCHEDULES

1. **REVISE** circuit breaker E2LGB-7,9,11 to 125A, and connect via (4) #1 + #6GW – 1-1/2”C.
2. **REVISE** Mains Rating of Panelboard E2LGB to “150A”, and MCB Rating to “125A”
3. **ADD** twelve (12), 1P-20A spare circuit breakers to Panelboard E1LBA, E1RBA, E2LBA, E1LGB, E1RGB, and E2LGB

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DRAWING E7.3 - PANELBOARD SCHEDULES

1. **ADD** twelve (12), 1P-20A spare circuit breakers to Panelboard E1LBA
2. **ADD** three (3), 1P-20A spare circuit breakers to Panelboard E2RBA
3. **ADD** three (3), 1P-20A spare circuit breakers to Panelboard E2RGB
4. **ADD** twelve (12), 1P-20A spare circuit breakers to Panelboard KP
5. **ADD** twelve (12), 1P-20A spare circuit breakers to Panelboard KR

DRAWING E7.4 - PANELBOARD SCHEDULES

1. **REVISE** Mains Rating of Panelboard LGB to “225A”, and MCB Rating to “100A”
2. **REVISE** circuit breaker LGB-2,4,6 to “60A”
3. **ADD** twelve (12), 1P-20A spare circuit breakers to Panelboard LGB, M1A
4. **ADD** circuit breaker MBA-74,76,78; 3P-70A for Booster Pump

DRAWING E7.5 - PANELBOARD SCHEDULES

1. **REVISE** Neutral rating of Panelboard RGB to “100%”
2. **REVISE** circuit RBA-1,3,5 to read “Panelboard R1A”.
3. **ADD** twelve (12), 1P-20A spare circuit breakers to Panelboard R1A, RBA, RGB

DRAWING E7.6 – MECHANICAL EQUIPMENT CONNECTION SCHEDULES

1. **ADD** Booster pump schedule and associated note #12, as indicated on reissued sheet.

TECHNOLOGY DRAWINGS

DRAWING T5.4 – CAFÉ AV SYSTEM

1. **REVISE** Detail 3 Speaker detail to wall-mounted.

END OF ADDENDUM No. 04

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ATTACHMENTS

This addendum includes the following attachments:

SPECIFICATIONS:

116800	PLAY FIELD EQUIPMENT AND STRUCTURES
260501	GENERAL ELECTRICAL REQUIREMENTS
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
262816	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
262913	ENCLOSED CONTROLLERS
211313	WET PIPE SPRINKLER SYSTEMS
221123	DOMESTIC WATER PUMPS
283112	PUBLIC SAFETY DISTRIBUTED ANTENNA SYSTEM
221423	STORM DRAINAGE PIPING SPECIALTIES
224000	PLUMBING FIXTURES
224213.13	COMMERCIAL WATER CLOSETS
274100	AUDIO VISUAL AND SOUND SYSTEMS
312000	EARTH MOVING

DRAWINGS:

L200	SITE FURNISHING AND HARDSCAPE DETAILS REFERENCE PLAN
L202	SITE FURNISHING AND HARDSCAPE DETAILS
L204	SITE FURNISHING AND HARDSCAPE DETAILS
L205	SITE FURNISHING AND HARDSCAPE DETAILS
L206	SITE FURNISHING AND HARDSCAPE DETAILS
L207	MONUMENT SIGN DETAIL
L301	PROPOSED LANDSCAPE PLAN
L310	PROPOSED NOTE AND DETAILS
A1.3	BASEMENT FLOOR PLAN – UNIT A & B
A1.4	GROUND FLOOR PLAN – UNIT A
A1.6	FIRST FLOOR PLAN – UNIT A
A1.8	SECOND FLOOR PLAN – UNIT A
A1.9	SECOND FLOOR PLAN – UNIT B
A1.10	OVERALL ROOF PLAN
A1.15	FIRST FLOOR REFLECTED CEILING PLAN – UNIT B
A3.6	WALL SECTIONS
A4.1	LARGE SCALE TOILET PLANS
A4.2	LARGE SCALE TOILET PLANS
A6.4	DOOR SCHEDULE
A6.5	DOOR SCHEDULE
M7.1	MECHANICAL AIR DISTRIBUTION DETAILS
FP1.1	BASEMENT FLOOR PLAN UNIT 'A'-NEW WORK-FIRE PROTECTION
FP1.2	GROUND FLOOR PLAN UNIT 'A'-NEW WORK-FIRE PROTECTION
FP1.3	GROUND FLOOR PLAN UNIT 'B'-NEW WORK-FIRE PROTECTION
FP1.4	FIRST FLOOR PLAN UNIT 'A'-NEW WORK-FIRE PROTECTION

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FP1.5 FIRST FLOOR PLAN UNIT 'B'-NEW WORK-FIRE PROTECTION
FP1.6 SECOND FLOOR PLAN UNIT 'A'-NEW WORK-FIRE PROTECTION
FP1.7 SECOND FLOOR PLAN UNIT 'B'-NEW WORK-FIRE PROTECTION
FP1.8 ROOF PLAN-UNIT 'A'-NEW WORK-FIRE PROTECTION
FP5.1 FIRE PROTECTION DETAILS
P1.1 FOUNDATION FLOOR PLAN-NEW WORK-PLUMBING
P1.3 BASEMENT FLOOR PLAN-NEW WORK-PLUMBING
P1.5 GROUND FLOOR PLAN-NEW WORK-PLUMBING
P1.7 FIRST FLOOR PLAN-NEW WORK-PLUMBING
P1.8 SECOND FLOOR PLAN-NEW WORK-PLUMBING
P1.9 SECOND FLOOR PLAN-NEW WORK-PLUMBING
P1.11 ROOF PLAN-NEW WORK-PLUMBING
P4.1 PART PLANS-NEW WORK-PLUMBING
P4.2 PART PLANS-NEW WORK-PLUMBING
P4.3 PART PLANS-NEW WORK-PLUMBING
P4.4 PART PLANS-NEW WORK-PLUMBING
P4.5 PART PLANS-NEW WORK-PLUMBING
P4.6 PART PLANS-NEW WORK-PLUMBING
P5.1 PLUMBING DETAILS
P5.2 DETAILS
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P6.2 SANITARY RISER DIAGRAMS
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P6.4 SANITARY RISER DIAGRAMS
P6.5 SANITARY RISER DIAGRAMS
P6.6 SANITARY RISER DIAGRAMS
P6.12 PLUMBING RISER DIAGRAMS
P7.1 PLUMBING SCHEDULES
P7.2 PLUMBING SCHEDULES
E1.1 BASEMENT FLOOR PLAN UNIT 'A' – ELECTRICAL
E1.5 FIRST FLOOR PLAN UNIT 'B' – ELECTRICAL
E2.0 LIGHT FIXTURE SCHEDULE
E2.3 GROUND FLOOR PLAN UNIT 'B' - LIGHTING
E4.1 PART PLAN – KITCHEN – ELECTRICAL
E5.1 SCHEMATIC POWER RISER DIAGRAM
E7.1 PANELBOARD SCHEDULES
E7.2 PANELBOARD SCHEDULES
E7.3 PANELBOARD SCHEDULES
E7.4 PANELBOARD SCHEDULES
E7.5 PANELBOARD SCHEDULES
E7.6 MECHANICAL EQUIPMENT CONNECTION SCHEDULES
T5.4 CAFÉ AV SYSTEM

SECTION 116800 - PLAY FIELD EQUIPMENT AND STRUCTURES

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. Division 32 Section "Playground Protective Surfacing" for play surfacing and associated sub-base.

1.2 SUMMARY

- A. Section includes freestanding and composite playground equipment.
- B. Related Codes and Guideline:
 - 1. ASTM F 1487: Standard Consumer Safety Performance Specifications for Playground Equipment for Public Use
 - 2. U.S. Consumer Product Safety Commission
 - 3. Department of Justice 2010 Standard for Accessible Design

1.3 DEFINITIONS

- A. Definitions in ASTM F 1487 apply to Work of this Section.
- B. Fall Height: According to ASTM F 1487, "the vertical distance between a designated play surface and the protective surfacing beneath it."
- C. HDPE: high-density polyethylene
- D. IPEMA: International Play Equipment Manufacturers Association.
- E. Use Zone: According to ASTM F 1487, the "area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from of exiting the equipment."
- F. GFRC: Glass Fiber Reinforced Concrete

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated Accessibility of Surface Systems: According to ASTM F 1951
- B. Sustainable Design Submittal:
 - 1. Product Data:
 - a. Total weight of recycled content recovered or diverted from solid waste stream including:
 - 1) Total recycled content (must meet or exceed 35%)
 - 2) Total post-consumer recycled content (must exceed 20%)
 - ~~3) LEED Recycled Fraction percentage (must meet or exceed 31%)~~
 - b. Environmental Statement indicating CO2 offsetting efforts and calculations for the specific playground design.
 - ~~1) Made in the USA Statement (must be 100% for all fabrication, rotomolding, welding, and painting on all standard products)~~
 - 2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 - 3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
- C. Shop Drawings: For each type of playground equipment.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include fall heights and use zones for playground equipment, coordinated with the critical-height values of protective surfacing specified in Section 321816.13 "Playground Protective Surfacing."
- D. Samples for Initial Selection: For each type of exposed finish.
 - 1. Manufacturer's color chart and chips.
 - 2. Include single samples of playground equipment and accessories involving color selection
- E. Samples for Verification: For each type of exposed finish on the following products:
 - 1. Include Samples of accessories to verify color and finish selection.
 - 2. Posts and Rails: Minimum 6 inches long.
 - 3. Platforms: Minimum 6 inches square.
 - 4. Molded Plastic: Minimum 3 inches square.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involving:
 - 1. Extents of surfacing systems and use zones for equipment.
 - 2. Critical heights for playground surfacing and fall heights for equipment.
- B. Qualification Data: For Installer and manufacturer.
- C. Product Certificates: Product Certificates: For each type of playground equipment from manufacturer indicating IPEMA and ASTM F1487 Compliance
- D. Playground Benefit Evaluation/Analysis Report: An evaluation of each type of playground component and structure performed by a licensed/registered occupational therapist who specializes in the play environments and childhood development.
- E. Material Certificates: For the following items:
 - 1. Shop finishes.
 - 2. Wood-Preservative Treatment: Include certification by treating plant that states type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - 3. Recycles Plastic Content
- F. Field quality-control reports.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of playground equipment.
- H. Sample Warranty: Standard warranty as provided by manufacturer.

1.7 SUBSTITUTIONS

- A. All proposed substitutions for playground equipment must be submitted to the landscape architect for review and approval. Sufficient documentation shall be provided with each component that adequately demonstrates that the proposed substitution meets or exceeds the specified playground equipment. This includes, but is not limited to, 3D renderings showing color and application on the site with accurate site features (topography, adjacent surfaces, walls, playground surfacing, etc.), 2D plan drawings showing layout of equipment on the site including use zones and all aforementioned site features, a detailed list and description of the playground components, warranty information for each item, a detailed Developmental Benefits analysis specific to the design and per 1.6.D of this specification.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: An order-specific maintenance kit shall be provided for each structure order. The kit will include a notebook or packet with a second set of installation documents and order-specific maintenance documentation with recommendations on how often to inspect, what to look for and what to do to keep the equipment in like-new condition. The kit also includes touch-up primer, appropriate color touch-up paint, sandpaper, appropriate color touch-up PVC and additional installation tools for the tamperproof fasteners.
- B. Warranty information

1.9 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.
 - 2. A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
 - 3. Provide playground equipment and play structure components bearing the IPEMA Certification Seal.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- D. Safety Standards: Provide playground equipment complying with or exceeding requirements in ASTM F 1487.
- E. Preinstallation Conference: Conduct a preinstallation conference at project site.

1.10 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within a specific warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

B. Warranty Period:

1. Playworld Systems, Inc.:

- a. **LIMITED LIFETIME WARRANTY** On all steel and aluminum deck support posts, stainless steel hardware, clamps, deck hangers, post caps, and cast aluminum parts, except as otherwise specified below
- b. **25-YEAR LIMITED WARRANTY** On all Spring Mates® aluminum castings.
- c. **15-YEAR LIMITED WARRANTY** On all perforated steel decks and stairs, steel rails, stationary weldments, rotationally-molded and sheet plastic components, recycled plastic lumber, roof panels, and stainless steel slides, except as otherwise specified below by product family type.
- d. **10-YEAR LIMITED WARRANTY** On all fiberglass signage, accessible swing seats, Fun Centers™, FirstPlay™ play structures, pre-cast PolyFiberCrete® or reinforced concrete products, Timber Stacks™ Robinia timbers and galvanized hardware, Hat Shade fabric and components, Shade Canopy fabric and components, Hypar Shade fabric and components, and Shadesure and Colourshade FR fabrics. (Note Exception: Limited Five (5) Year Warranty on fabrics in colors Red, Yellow, Electric Purple, Zesty Lime, Cinnamon, and Olive.).
- e. **5-YEAR LIMITED WARRANTY** On all Steel reinforced cable net and rope fittings and connections (Note Exception: Warranty does not cover normal wear and tear such as fraying or fading of cable coating), PlaySimple® play structures, DropZone Tower™, LiveWire Zip Line™, AeroGlider™, Border Timbers™, flex treads, wood and polycarbonate panels, Eco-Armor coating and PVC coating (against cracking and peeling), site amenities (i.e. benches, tables, litter receptacles, and bike racks), GFRP (Glass Fiber Reinforced Polymer) products, and motion/moving play components and parts.
- f. **3-YEAR LIMITED WARRANTY** On all steel coil and C springs, flat webbing nets (excluding normal wear and tear), electronic panel speakers, sound chips, and circuit boards.
- g. **1-YEAR LIMITED WARRANTY** On all NEOS®, electronic based play products, swing chain, swing clevises, swing galvanized attachment hardware, molded rubber bumpers, handholds, swing seats, and any other materials or custom products not covered above. (*For NEOS only, an extended 3-year warranty is available for purchase, providing 4 years of cumulative coverage.)
- h. This warranty does not include any cosmetic issues or wear and tear from normal use. It is valid only if the play structures and/or equipment are erected to conform with Playworld Systems, Inc.'s installation instructions and maintained according to the maintenance procedures furnished by Playworld Systems, Inc.

2. Percussion Play Ltd.:

- a. **Limited Twenty Five (25) Year Warranty** - on metalwork used in the supporting structure of stands and frames against structural failure caused by deterioration due to exposure to weather or by defective materials or defective workmanship.
- b. **Limited Ten (10) Year Warranty** – on timber, composite, aluminum and stainless steel components (includes notes and fixings) against structural failure caused by deterioration due to exposure to weather or by defective materials or defective workmanship.
- c. **Limited Two (2) Year Warranty** – on mallets and components used in the initiation of percussive sound on our instruments and associated fastening hardware, on fastening hardware associated with notes.
- d. Limited Warranties do not include fading of colors, damage due to excessive wear and tear, vandalism, or negligence.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Playground Equipment Manufacturer and Contact information:

- 1. Playworld Systems, Inc. (via Playground Specialists Inc.)
 - a. Playground Specialists, Inc.
29 Apples Church Rd,
Thurmont, MD 21788
ph (800)385-0075
Contact: Eric Black
e-mail: Eric@playspec.com
cell: 301-748-6702
- 2. Percussion Play Ltd. (via Playground Specialists Inc.)
 - a. Playground Specialists, Inc.
29 Apples Church Rd,
Thurmont, MD 21788
ph (800)385-0075
Contact: Eric Black
e-mail: Eric@playspec.com
cell: 301-748-6702
- 3. Approved Equal

B. Source Limitations: Obtain playground equipment from single source from single manufacturer.

C. All playground equipment and components shall have the IPEMA Certification Seal.

2.2 PERFORMANCE REQUIREMENTS

- A. Safety Standard: Provide playground equipment according to ASTM F 1487 and U.S. Consumer Product Safety Commission and local playground safety guidelines.

2.3 PLAYGROUND EQUIPMENT & STRUCTURES

- A. Composite and Freestanding Play Structure: Assembled from a manufacturer's products.
1. Basis of Design Manufacturer: Subject to compliance with requirements, provide all products and associated accessories as indicated below.
 2. Products: All products are subject to compliance with requirements
 3. Equipment - The project numbers listed below is representative of the modular play equipment only. All items listed under Independent Items must be ordered separately.:
 - a. 2-5 Year Old (Grades: Pre-K to K) (**Playground Specialists, Inc. Project # P062920-17D**)
 - 1) Modular Playscapes:
 - a) (4) 3.50in x 88in Steel Post with Cap (Product No. ZZCH0356)
 - b) (1) Tic-Tac-Toe Activity Wall (Product No. ZZCH4350)
 - c) (1) Driver Panel (Product No. ZZCH4387)
 - d) (1) Four-The-Win Insert (Product No. ZZUN4676)
 - e) (1) Slide & Solve Insert (Product No. ZZUN4678)
 - f) (1) Playcube – Ground Level (Product No. ZZUN8727)
 - 2) Independent Items:
 - a) (1) Spin Cup (Product No. ZZXX0065)
 - b) (3) Butterfly Climbers (Product No. ZZXX0480)
 - c) (2) Spring Rider Footer Frame (Product No. ZZXX0495)
 - d) (1) Turtle Spring Mate (Product No. ZZXX0741)
 - e) (1) Duck Spring Mate (Product No. ZZXX0721)
 - f) (1) Playhouse (Product No. ZZXX0882)
 - g) (2) Garden Sensory Panel (Product No. ZZXX0888)
 - 3) Musical Equipment:
 - a) (1) Medium Congas (Product No. N/A)
 - b) (1) Harmony Bells (Product No. N/A)
 - c) (1) Cadenza (Product No. N/A)
 - d) (1) Harmony Flowers (Product No. N/A)
 - b. 2-12 Year Old (Grades: 1-2) (**Playground Specialists, Inc. Project # P062920-14C**)
 - 1) Modular Playscapes:

- a) (6) 3.5 in. OD x 124 in. Steel Post with Riveted Cap (Product No. ZZCH0018)
 - b) (1) Full Hex Coated Deck Assembly (Product No. ZZCH0619)
 - c) (1) Transfer Station (36 in. Deck) (Product No. ZZCH2006)
 - d) (1) Approach Step for Transfer Station (Product No. ZZUN2019)
 - e) (1) Glide Slide (36 in. Deck) (Product No. ZZCH3127)
 - f) (1) 90 Degree Glide Slide (36 in. Deck) (Product No. ZZCH3129)
 - g) (1) Find The Way Home Panel (Product No. ZZCH4318)
 - h) (1) Accessible Driving Panel (Product No. ZZCH4406)
 - i) (1) Solar Climber (36 in. & 30 in. Deck) (Product No. ZZCH7657)
 - j) (1) Beanstalk Climber (36 in. Deck) (Product No. ZZCH8100)
 - k) (1) Playcube – Ground Level (Product No. ZZUN8727)
 - l) (1) 8 in. Bell (Post Mount) (Product No. ZZCH4557)
 - m) (1) 10 in. Bell (Post Mount) (Product No. ZZCH4559)
- 2) Independent Items:
- a) (2) Spin Cup (Product No. ZZXX0065)
 - b) (1) Cosmic Warp (Product No. ZZXX0401)
 - c) (1) Cozy Cocoon – Spinning (Product No. ZZXX0483)
 - d) (1) Chatterry (Product No. ZZXX0887)
- c. 5-12 Year Old (Grades: 3-5) (**Playground Specialists, Inc. Project # P062920-12D**)
- 1) Modular Playscapes:
- a) (4) 3.5 in. OD x 124 in. Steel Post with Riveted Cap (Product No. ZZCH0018)
 - b) (2) 3.5 in. OD x 148 in. Steel Post with Riveted Cap (Product No. ZZCH0038)
 - c) (2) 3.5 in. OD x 172 in. Steel Post with Riveted Cap (Product No. ZZCH0058)
 - d) (2) 3.5 in. OD x 200 in. Steel Post with Riveted Cap (Product No. ZZCH0076)
 - e) (2) Square Coated Deck Assembly (Product No. ZZCH0616)
 - f) (1) Double Slide Coated Deck Assembly (Product No. ZZCH0636)
 - g) (1) Transfer Station with Tall Guardrail (36 in. Deck) (Product No. ZZCH2007)
 - h) (1) Approach Step for Transfer Station (Product No. ZZUN2019)
 - i) (1) Slither Slide 2.0 Balcony Entry / Exit (Product No. ZZCH3216)
 - j) (1) Nuvo 36 in. Double Slide (Product No. ZZCH3538)
 - k) (1) Slither Slide 2.0 (Straight Section) (Product No. ZZUN3207)
 - l) (3) Slither Slide 2.0 (Right 120° Section) (Product No. ZZUN3217)
 - m) (1) Slither Slide 2.0 Support Leg 5 ft.-6 in. (Product No. ZZUN3247)
 - n) (1) Slither Slide 2.0 Support Leg 2 ft.-6 in. (Product No. ZZUN3256)
 - o) (1) Accessible Driver Panel (Product No. ZZCH4406)

- p) (1) Storefront Panel (Product No. ZZCH4646)
- q) (1) Oval Insert Panel (Deck Mount) (Product No. ZZCH4807)
- r) (1) Oval Bubble Panel Replacement Insert (Product No. ZZUN4796)
- s) (1) Geo Barrier (Product No. ZZCH4496)
- t) (2) 24 in. Deck to Deck Climber (Product No. ZZCH6190)
- u) (1) 7 ft. Tower Climber (Product No. ZZCH7169)
- v) (1) Hopscotch Climber (60 in. Deck) (Product No. ZZCH8270)
- w) (3) Playcube – Ground Level (Product No. ZZUN8727)
- x) (1) Playcube – Above Ground – 3 Sided Connection (Product No. ZZUN8747)
- y) (1) 8 in. Bell (Post Mount) (Product No. ZZCH4557)
- z) (1) 10 in. Bell (Post Mount) (Product No. ZZCH4559)
- aa) (1) Bell Panel (Product No. ZZCH4588)
- bb) (1) 24 in. Stepped Platform (Deck to Deck) (ZZCH9170)

2) Independent Items:

- a) (2) Spin Cups (Product No. ZZXX0065)
- b) (1) Unity Rockr (Product No. ZZXX0193)
- c) (1) Unity Dome (Product No. ZZXX0366)
- d) (1) Overdrive (Product No. ZZXX0150)

- 4. Colors: As chosen by Owner / Owner’s Representative from full range of Manufacturer’s material colors.
 - a. Recommended colors shall include green, brown, tan/cream, orange, and grey.
- 5. Arrangement: As indicated on Drawings and per manufacturer’s recommendations.

2.4 FABRICATION

- A. Provide sizes, strengths, thicknesses, wall thickness, and weights of components as required to comply with requirements in ASTM F 1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structures, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required for equipment indicated.
- B. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing with cross-section profile and dimensions as required. Unless otherwise indicated, provide each pipe or tubing main-frame member with manufacturer's standard drainable bottom plate or support flange. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

- C. Composite Frame: Fabricate main-frame upright support posts from metal and plastic. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.
- D. Play Surfaces: Manufacturer's standard elevated drainable decks, platforms, landings, walkways, ramps, and similar transitional play surfaces, designed to withstand loads; Fabricate units in modular sizes and shapes to form assembled play surfaces indicated by manufacturer.
- E. Protective Barriers: Fabricate according to ASTM F 1487. Extend barriers to height above the protected elevated surface according to requirements for use by age group indicated. Fabricate from one or more of the following:
 - 1. Welded-metal pipe or tubing with vertical bars.
 - 2. Steel sheet with openings for vision and ventilation.
 - 3. Metal-pipe or -tubing frame with wire-mesh infill panels.
 - 4. Opaque plastic panels with openings.
 - 5. Vertical wood balusters with metal pipe or tubing or wood frame.
 - 6. Wood panels with openings for vision and ventilation.
- F. Guardrails: Provide guardrails configured to completely surround the protected area, except for access openings. Fabricate from welded metal pipe or tubing. Extend guardrails according to requirements for use by age group indicated.
- G. Handrails: Welded metal pipe or tubing, maximum OD between 0.95 and 1.55 inches.
 - 1. Provide handrails at heights to comply with requirements for use by age group indicated according to ASTM F 1487.
- H. Roofs and Canopies: Designed to discourage and minimize climbing by users.
 - 1. Fabricated from metal, metal-pipe or -tubing-framed welded wire, opaque plastic, or polyethylene.
- I. Signs: Manufacturer designated signs and graphics, fabricated from opaque plastic with graphics molded in, attached to fence, freestanding and upright support posts, or directly to play equipment.
 - 1. Text: Minimum informational content according to ASTM F 1487.
 - 2. Colors: Minimum two different colors, as selected and approved by Owner / Owner's Representative from manufacturer's standard colors.

2.5 MATERIALS

- A. Aluminum: Material, alloy, and temper recommended by manufacturer for type of use and finish indicated.

- B. Steel: Material types, alloys, and forms recommended by manufacturer for type of use and finish indicated, hot-dip galvanized.
 - C. Stainless-Steel Sheet: Type 304; finished on exposed faces with No. 2B finish.
 - D. Plywood: PS 1, Exterior grade; smooth surfaced with rounded edges; preservative treated after fabrication.
 - E. Opaque Plastics: Color impregnated, UV stabilized, and mold resistant.
 - F. Transparent Plastic: Abrasion-resistant, UV-stabilized polycarbonate sheet; colors as designated, not less than 3/16 inch thick.
 - G. Suspension Chain and Fittings: ASTM A 467/A 467M, Class CS, 4/0 or 5/0, welded-straight-link coil chain; [hot-dip galvanized or zinc plated; with commercial-quality, hot-dip galvanized or zinc-plated steel connectors and swing or ring hangers.
 - H. Suspension Cable: Manufacturer's standard hot-dip galvanized zinc-plated or PVC-coated cable; with commercial-quality, hot-dip galvanized or zinc-plated steel connectors and swing or ring hangers.
 - I. Iron Castings and Hangers: Malleable iron, ASTM A 47/A 47M, Grade 32510, hot-dip galvanized.
 - J. Post Caps: Cast aluminum or color-impregnated, UV-stabilized, mold-resistant polyethylene or polypropylene color to match posts.
 - K. Platform Clamps and Hangers: Cast aluminum or zinc-plated steel, not less than 0.105-inch-nominal thickness.
 - L. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a vandal-resistant design.
 - M. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or zinc-plated steel and iron, or stainless steel; permanently capped; and theft resistant.
- 2.6 CAST-IN-PLACE CONCRETE
- A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight concrete with minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch-maximum-size aggregate.

2.7 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils medium gloss. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
- B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 80 mils. Comply with coating manufacturer's written instructions for pretreatment and application.

2.8 IRON AND STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for pretreatment, applying, and baking.
- B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 100 mils. Comply with coating manufacturer's written instructions for pretreatment and application.

2.9 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

2.10 HARDWARE PACKAGES

- A. All shipments shall include individual component-specific hardware packages. Each hardware package shall be labeled with the part number, description, a component diagram showing the appropriate component, package weight, a bar code linking the hardware package to the job number, assembler's name, date and time the package was assembled, work center number and work order number.

2.11 INSTALLATION DOCUMENTATION

- A. All shipments shall include a notebook or packet of order-specific, step by-step instructions for assembly of each component, including equipment assembly diagrams, estimated hours for assembly, footing dimensions, concrete quantity for direct bury components, fall height information, area required information and detailed material specifications.

2.12 PACKING LIST

- A. All shipments shall include a packing list for each skid/container, specifying the part numbers and quantities on each skid or within each container.

2.13 PACKAGING

- A. All components shall be individually wrapped or bulk wrapped and placed on skids (pallets) then shrink-wrapped to provide protection during shipment. Small parts and hardware packages will be placed in crates for shipment. Other components shall be individually wrapped or bulk wrapped to provide protection during shipment

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading required for placing playground equipment and protective surfacing is completed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Manufacturer shall inspect each piece of installed equipment twice within the first year of use.

3.2 PREPARATION

- A. Verify location of playground perimeter and pathways. Verify that playground layout and equipment locations comply with requirements of each type and component of equipment.

3.3 INSTALLATION

- A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.
 - 1. Maximum Equipment Height: Coordinate installed fall heights of equipment with finished elevations and critical-height values of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within

required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

- B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.
- C. Post Set on Subgrade: Level bearing surfaces with drainage fill to required elevation.
- D. Post Set with Concrete Footing: Comply with Section 033000 "Cast-in-Place Concrete" and ACI 301 for measuring, batching, mixing, transporting, forming, and placing concrete.
 - 1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.
 - a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
 - 2. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.
 - 3. Finishing Footings: Smooth top, and shape to shed water.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
 - 1. Engage a factory-authorized service representative to perform inspection and testing for each playground component, assembly, and equipment installation, including connections, according to ASTM F 1487.
- C. Playground equipment items will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Notify Architect and Owner 48 hours in advance of date(s) and time(s) of testing and inspection.

END OF SECTION 116800

SECTION 116800 - PLAY FIELD EQUIPMENT AND STRUCTURES

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. Division 32 Section "Playground Protective Surfacing" for play surfacing and associated sub-base.

1.2 SUMMARY

- A. Section includes freestanding and composite playground equipment.
- B. Related Codes and Guideline:
 - 1. ASTM F 1487: Standard Consumer Safety Performance Specifications for Playground Equipment for Public Use
 - 2. U.S. Consumer Product Safety Commission
 - 3. Department of Justice 2010 Standard for Accessible Design

1.3 DEFINITIONS

- A. Definitions in ASTM F 1487 apply to Work of this Section.
- B. Fall Height: According to ASTM F 1487, "the vertical distance between a designated play surface and the protective surfacing beneath it."
- C. HDPE: high-density polyethylene
- D. IPEMA: International Play Equipment Manufacturers Association.
- E. Use Zone: According to ASTM F 1487, the "area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from of exiting the equipment."
- F. GFRC: Glass Fiber Reinforced Concrete

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated Accessibility of Surface Systems: According to ASTM F 1951
- B. Sustainable Design Submittal:
 - 1. Product Data:
 - a. Total weight of recycled content recovered or diverted from solid waste stream including:
 - 1) Total recycled content (must meet or exceed 35%)
 - 2) Total post-consumer recycled content (must exceed 20%)
 - ~~3) LEED Recycled Fraction percentage (must meet or exceed 31%)~~
 - b. Environmental Statement indicating CO2 offsetting efforts and calculations for the specific playground design.
 - ~~1) Made in the USA Statement (must be 100% for all fabrication, rotomolding, welding, and painting on all standard products)~~
 - 2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 - 3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
- C. Shop Drawings: For each type of playground equipment.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include fall heights and use zones for playground equipment, coordinated with the critical-height values of protective surfacing specified in Section 321816.13 "Playground Protective Surfacing."
- D. Samples for Initial Selection: For each type of exposed finish.
 - 1. Manufacturer's color chart and chips.
 - 2. Include single samples of playground equipment and accessories involving color selection
- E. Samples for Verification: For each type of exposed finish on the following products:
 - 1. Include Samples of accessories to verify color and finish selection.
 - 2. Posts and Rails: Minimum 6 inches long.
 - 3. Platforms: Minimum 6 inches square.
 - 4. Molded Plastic: Minimum 3 inches square.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involving:
 - 1. Extents of surfacing systems and use zones for equipment.
 - 2. Critical heights for playground surfacing and fall heights for equipment.
- B. Qualification Data: For Installer and manufacturer.
- C. Product Certificates: Product Certificates: For each type of playground equipment from manufacturer indicating IPEMA and ASTM F1487 Compliance
- D. Playground Benefit Evaluation/Analysis Report: An evaluation of each type of playground component and structure performed by a licensed/registered occupational therapist who specializes in the play environments and childhood development.
- E. Material Certificates: For the following items:
 - 1. Shop finishes.
 - 2. Wood-Preservative Treatment: Include certification by treating plant that states type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - 3. Recycles Plastic Content
- F. Field quality-control reports.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of playground equipment.
- H. Sample Warranty: Standard warranty as provided by manufacturer.

1.7 SUBSTITUTIONS

- A. All proposed substitutions for playground equipment must be submitted to the landscape architect for review and approval. Sufficient documentation shall be provided with each component that adequately demonstrates that the proposed substitution meets or exceeds the specified playground equipment. This includes, but is not limited to, 3D renderings showing color and application on the site with accurate site features (topography, adjacent surfaces, walls, playground surfacing, etc.), 2D plan drawings showing layout of equipment on the site including use zones and all aforementioned site features, a detailed list and description of the playground components, warranty information for each item, a detailed Developmental Benefits analysis specific to the design and per 1.6.D of this specification.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: An order-specific maintenance kit shall be provided for each structure order. The kit will include a notebook or packet with a second set of installation documents and order-specific maintenance documentation with recommendations on how often to inspect, what to look for and what to do to keep the equipment in like-new condition. The kit also includes touch-up primer, appropriate color touch-up paint, sandpaper, appropriate color touch-up PVC and additional installation tools for the tamperproof fasteners.
- B. Warranty information

1.9 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.
 - 2. A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
 - 3. Provide playground equipment and play structure components bearing the IPEMA Certification Seal.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- D. Safety Standards: Provide playground equipment complying with or exceeding requirements in ASTM F 1487.
- E. Preinstallation Conference: Conduct a preinstallation conference at project site.

1.10 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within a specific warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

B. Warranty Period:

1. Playworld Systems, Inc.:

- a. **LIMITED LIFETIME WARRANTY** On all steel and aluminum deck support posts, stainless steel hardware, clamps, deck hangers, post caps, and cast aluminum parts, except as otherwise specified below
- b. **25-YEAR LIMITED WARRANTY** On all Spring Mates® aluminum castings.
- c. **15-YEAR LIMITED WARRANTY** On all perforated steel decks and stairs, steel rails, stationary weldments, rotationally-molded and sheet plastic components, recycled plastic lumber, roof panels, and stainless steel slides, except as otherwise specified below by product family type.
- d. **10-YEAR LIMITED WARRANTY** On all fiberglass signage, accessible swing seats, Fun Centers™, FirstPlay™ play structures, pre-cast PolyFiberCrete® or reinforced concrete products, Timber Stacks™ Robinia timbers and galvanized hardware, Hat Shade fabric and components, Shade Canopy fabric and components, Hypar Shade fabric and components, and Shadesure and Colourshade FR fabrics. (Note Exception: Limited Five (5) Year Warranty on fabrics in colors Red, Yellow, Electric Purple, Zesty Lime, Cinnamon, and Olive.).
- e. **5-YEAR LIMITED WARRANTY** On all Steel reinforced cable net and rope fittings and connections (Note Exception: Warranty does not cover normal wear and tear such as fraying or fading of cable coating), PlaySimple® play structures, DropZone Tower™, LiveWire Zip Line™, AeroGlider™, Border Timbers™, flex treads, wood and polycarbonate panels, Eco-Armor coating and PVC coating (against cracking and peeling), site amenities (i.e. benches, tables, litter receptacles, and bike racks), GFRP (Glass Fiber Reinforced Polymer) products, and motion/moving play components and parts.
- f. **3-YEAR LIMITED WARRANTY** On all steel coil and C springs, flat webbing nets (excluding normal wear and tear), electronic panel speakers, sound chips, and circuit boards.
- g. **1-YEAR LIMITED WARRANTY** On all NEOS®, electronic based play products, swing chain, swing clevises, swing galvanized attachment hardware, molded rubber bumpers, handholds, swing seats, and any other materials or custom products not covered above. (*For NEOS only, an extended 3-year warranty is available for purchase, providing 4 years of cumulative coverage.)
- h. This warranty does not include any cosmetic issues or wear and tear from normal use. It is valid only if the play structures and/or equipment are erected to conform with Playworld Systems, Inc.'s installation instructions and maintained according to the maintenance procedures furnished by Playworld Systems, Inc.

2. Percussion Play Ltd.:

- a. **Limited Twenty Five (25) Year Warranty** - on metalwork used in the supporting structure of stands and frames against structural failure caused by deterioration due to exposure to weather or by defective materials or defective workmanship.
- b. **Limited Ten (10) Year Warranty** – on timber, composite, aluminum and stainless steel components (includes notes and fixings) against structural failure caused by deterioration due to exposure to weather or by defective materials or defective workmanship.
- c. **Limited Two (2) Year Warranty** – on mallets and components used in the initiation of percussive sound on our instruments and associated fastening hardware, on fastening hardware associated with notes.
- d. Limited Warranties do not include fading of colors, damage due to excessive wear and tear, vandalism, or negligence.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Playground Equipment Manufacturer and Contact information:

1. Playworld Systems, Inc. (via Playground Specialists Inc.)
 - a. Playground Specialists, Inc.
29 Apples Church Rd,
Thurmont, MD 21788
ph (800)385-0075
Contact: Eric Black
e-mail: Eric@playspec.com
cell: 301-748-6702
2. Percussion Play Ltd. (via Playground Specialists Inc.)
 - a. Playground Specialists, Inc.
29 Apples Church Rd,
Thurmont, MD 21788
ph (800)385-0075
Contact: Eric Black
e-mail: Eric@playspec.com
cell: 301-748-6702
3. Approved Equal

B. Source Limitations: Obtain playground equipment from single source from single manufacturer.

C. All playground equipment and components shall have the IPEMA Certification Seal.

2.2 PERFORMANCE REQUIREMENTS

- A. Safety Standard: Provide playground equipment according to ASTM F 1487 and U.S. Consumer Product Safety Commission and local playground safety guidelines.

2.3 PLAYGROUND EQUIPMENT & STRUCTURES

- A. Composite and Freestanding Play Structure: Assembled from a manufacturer's products.
 - 1. Basis of Design Manufacturer: Subject to compliance with requirements, provide all products and associated accessories as indicated below.
 - 2. Products: All products are subject to compliance with requirements
 - 3. Equipment - The project numbers listed below is representative of the modular play equipment only. All items listed under Independent Items must be ordered separately.:
 - a. 2-5 Year Old (Grades: Pre-K to K) (**Playground Specialists, Inc. Project # P062920-17D**)
 - 1) Modular Playscapes:
 - a) (4) 3.50in x 88in Steel Post with Cap (Product No. ZZCH0356)
 - b) (1) Tic-Tac-Toe Activity Wall (Product No. ZZCH4350)
 - c) (1) Driver Panel (Product No. ZZCH4387)
 - d) (1) Four-The-Win Insert (Product No. ZZUN4676)
 - e) (1) Slide & Solve Insert (Product No. ZZUN4678)
 - f) (1) Playcube – Ground Level (Product No. ZZUN8727)
 - 2) Independent Items:
 - a) (1) Spin Cup (Product No. ZZXX0065)
 - b) (3) Butterfly Climbers (Product No. ZZXX0480)
 - c) (2) Spring Rider Footer Frame (Product No. ZZXX0495)
 - d) (1) Turtle Spring Mate (Product No. ZZXX0741)
 - e) (1) Duck Spring Mate (Product No. ZZXX0721)
 - f) (1) Playhouse (Product No. ZZXX0882)
 - g) (2) Garden Sensory Panel (Product No. ZZXX0888)
 - 3) Musical Equipment:
 - a) (1) Medium Congas (Product No. N/A)
 - b) (1) Harmony Bells (Product No. N/A)
 - c) (1) Cadenza (Product No. N/A)
 - d) (1) Harmony Flowers (Product No. N/A)
 - b. 2-12 Year Old (Grades: 1-2) (**Playground Specialists, Inc. Project # P062920-14C**)
 - 1) Modular Playscapes:

- a) (6) 3.5 in. OD x 124 in. Steel Post with Riveted Cap (Product No. ZZCH0018)
 - b) (1) Full Hex Coated Deck Assembly (Product No. ZZCH0619)
 - c) (1) Transfer Station (36 in. Deck) (Product No. ZZCH2006)
 - d) (1) Approach Step for Transfer Station (Product No. ZZUN2019)
 - e) (1) Glide Slide (36 in. Deck) (Product No. ZZCH3127)
 - f) (1) 90 Degree Glide Slide (36 in. Deck) (Product No. ZZCH3129)
 - g) (1) Find The Way Home Panel (Product No. ZZCH4318)
 - h) (1) Accessible Driving Panel (Product No. ZZCH4406)
 - i) (1) Solar Climber (36 in. & 30 in. Deck) (Product No. ZZCH7657)
 - j) (1) Beanstalk Climber (36 in. Deck) (Product No. ZZCH8100)
 - k) (1) Playcube – Ground Level (Product No. ZZUN8727)
 - l) (1) 8 in. Bell (Post Mount) (Product No. ZZCH4557)
 - m) (1) 10 in. Bell (Post Mount) (Product No. ZZCH4559)
- 2) Independent Items:
- a) (2) Spin Cup (Product No. ZZXX0065)
 - b) (1) Cosmic Warp (Product No. ZZXX0401)
 - c) (1) Cozy Cocoon – Spinning (Product No. ZZXX0483)
 - d) (1) Chatterry (Product No. ZZXX0887)
- c. 5-12 Year Old (Grades: 3-5) (**Playground Specialists, Inc. Project # P062920-12D**)
- 1) Modular Playscapes:
- a) (4) 3.5 in. OD x 124 in. Steel Post with Riveted Cap (Product No. ZZCH0018)
 - b) (2) 3.5 in. OD x 148 in. Steel Post with Riveted Cap (Product No. ZZCH0038)
 - c) (2) 3.5 in. OD x 172 in. Steel Post with Riveted Cap (Product No. ZZCH0058)
 - d) (2) 3.5 in. OD x 200 in. Steel Post with Riveted Cap (Product No. ZZCH0076)
 - e) (2) Square Coated Deck Assembly (Product No. ZZCH0616)
 - f) (1) Double Slide Coated Deck Assembly (Product No. ZZCH0636)
 - g) (1) Transfer Station with Tall Guardrail (36 in. Deck) (Product No. ZZCH2007)
 - h) (1) Approach Step for Transfer Station (Product No. ZZUN2019)
 - i) (1) Slither Slide 2.0 Balcony Entry / Exit (Product No. ZZCH3216)
 - j) (1) Nuvo 36 in. Double Slide (Product No. ZZCH3538)
 - k) (1) Slither Slide 2.0 (Straight Section) (Product No. ZZUN3207)
 - l) (3) Slither Slide 2.0 (Right 120° Section) (Product No. ZZUN3217)
 - m) (1) Slither Slide 2.0 Support Leg 5 ft.-6 in. (Product No. ZZUN3247)
 - n) (1) Slither Slide 2.0 Support Leg 2 ft.-6 in. (Product No. ZZUN3256)
 - o) (1) Accessible Driver Panel (Product No. ZZCH4406)

- p) (1) Storefront Panel (Product No. ZZCH4646)
- q) (1) Oval Insert Panel (Deck Mount) (Product No. ZZCH4807)
- r) (1) Oval Bubble Panel Replacement Insert (Product No. ZZUN4796)
- s) (1) Geo Barrier (Product No. ZZCH4496)
- t) (2) 24 in. Deck to Deck Climber (Product No. ZZCH6190)
- u) (1) 7 ft. Tower Climber (Product No. ZZCH7169)
- v) (1) Hopscotch Climber (60 in. Deck) (Product No. ZZCH8270)
- w) (3) Playcube – Ground Level (Product No. ZZUN8727)
- x) (1) Playcube – Above Ground – 3 Sided Connection (Product No. ZZUN8747)
- y) (1) 8 in. Bell (Post Mount) (Product No. ZZCH4557)
- z) (1) 10 in. Bell (Post Mount) (Product No. ZZCH4559)
- aa) (1) Bell Panel (Product No. ZZCH4588)
- bb) (1) 24 in. Stepped Platform (Deck to Deck) (ZZCH9170)

2) Independent Items:

- a) (2) Spin Cups (Product No. ZZXX0065)
- b) (1) Unity Rockr (Product No. ZZXX0193)
- c) (1) Unity Dome (Product No. ZZXX0366)
- d) (1) Overdrive (Product No. ZZXX0150)

- 4. Colors: As chosen by Owner / Owner’s Representative from full range of Manufacturer’s material colors.
 - a. Recommended colors shall include green, brown, tan/cream, orange, and grey.
- 5. Arrangement: As indicated on Drawings and per manufacturer’s recommendations.

2.4 FABRICATION

- A. Provide sizes, strengths, thicknesses, wall thickness, and weights of components as required to comply with requirements in ASTM F 1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structures, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required for equipment indicated.
- B. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing with cross-section profile and dimensions as required. Unless otherwise indicated, provide each pipe or tubing main-frame member with manufacturer's standard drainable bottom plate or support flange. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

- C. Composite Frame: Fabricate main-frame upright support posts from metal and plastic. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.
- D. Play Surfaces: Manufacturer's standard elevated drainable decks, platforms, landings, walkways, ramps, and similar transitional play surfaces, designed to withstand loads; Fabricate units in modular sizes and shapes to form assembled play surfaces indicated by manufacturer.
- E. Protective Barriers: Fabricate according to ASTM F 1487. Extend barriers to height above the protected elevated surface according to requirements for use by age group indicated. Fabricate from one or more of the following:
 - 1. Welded-metal pipe or tubing with vertical bars.
 - 2. Steel sheet with openings for vision and ventilation.
 - 3. Metal-pipe or -tubing frame with wire-mesh infill panels.
 - 4. Opaque plastic panels with openings.
 - 5. Vertical wood balusters with metal pipe or tubing or wood frame.
 - 6. Wood panels with openings for vision and ventilation.
- F. Guardrails: Provide guardrails configured to completely surround the protected area, except for access openings. Fabricate from welded metal pipe or tubing. Extend guardrails according to requirements for use by age group indicated.
- G. Handrails: Welded metal pipe or tubing, maximum OD between 0.95 and 1.55 inches.
 - 1. Provide handrails at heights to comply with requirements for use by age group indicated according to ASTM F 1487.
- H. Roofs and Canopies: Designed to discourage and minimize climbing by users.
 - 1. Fabricated from metal, metal-pipe or -tubing-framed welded wire, opaque plastic, or polyethylene.
- I. Signs: Manufacturer designated signs and graphics, fabricated from opaque plastic with graphics molded in, attached to fence, freestanding and upright support posts, or directly to play equipment.
 - 1. Text: Minimum informational content according to ASTM F 1487.
 - 2. Colors: Minimum two different colors, as selected and approved by Owner / Owner's Representative from manufacturer's standard colors.

2.5 MATERIALS

- A. Aluminum: Material, alloy, and temper recommended by manufacturer for type of use and finish indicated.

- B. Steel: Material types, alloys, and forms recommended by manufacturer for type of use and finish indicated, hot-dip galvanized.
 - C. Stainless-Steel Sheet: Type 304; finished on exposed faces with No. 2B finish.
 - D. Plywood: PS 1, Exterior grade; smooth surfaced with rounded edges; preservative treated after fabrication.
 - E. Opaque Plastics: Color impregnated, UV stabilized, and mold resistant.
 - F. Transparent Plastic: Abrasion-resistant, UV-stabilized polycarbonate sheet; colors as designated, not less than 3/16 inch thick.
 - G. Suspension Chain and Fittings: ASTM A 467/A 467M, Class CS, 4/0 or 5/0, welded-straight-link coil chain; [hot-dip galvanized or zinc plated; with commercial-quality, hot-dip galvanized or zinc-plated steel connectors and swing or ring hangers.
 - H. Suspension Cable: Manufacturer's standard hot-dip galvanized zinc-plated or PVC-coated cable; with commercial-quality, hot-dip galvanized or zinc-plated steel connectors and swing or ring hangers.
 - I. Iron Castings and Hangers: Malleable iron, ASTM A 47/A 47M, Grade 32510, hot-dip galvanized.
 - J. Post Caps: Cast aluminum or color-impregnated, UV-stabilized, mold-resistant polyethylene or polypropylene color to match posts.
 - K. Platform Clamps and Hangers: Cast aluminum or zinc-plated steel, not less than 0.105-inch-nominal thickness.
 - L. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a vandal-resistant design.
 - M. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or zinc-plated steel and iron, or stainless steel; permanently capped; and theft resistant.
- 2.6 CAST-IN-PLACE CONCRETE
- A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight concrete with minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch-maximum-size aggregate.

2.7 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils medium gloss. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
- B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 80 mils. Comply with coating manufacturer's written instructions for pretreatment and application.

2.8 IRON AND STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for pretreatment, applying, and baking.
- B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 100 mils. Comply with coating manufacturer's written instructions for pretreatment and application.

2.9 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

2.10 HARDWARE PACKAGES

- A. All shipments shall include individual component-specific hardware packages. Each hardware package shall be labeled with the part number, description, a component diagram showing the appropriate component, package weight, a bar code linking the hardware package to the job number, assembler's name, date and time the package was assembled, work center number and work order number.

2.11 INSTALLATION DOCUMENTATION

- A. All shipments shall include a notebook or packet of order-specific, step by-step instructions for assembly of each component, including equipment assembly diagrams, estimated hours for assembly, footing dimensions, concrete quantity for direct bury components, fall height information, area required information and detailed material specifications.

2.12 PACKING LIST

- A. All shipments shall include a packing list for each skid/container, specifying the part numbers and quantities on each skid or within each container.

2.13 PACKAGING

- A. All components shall be individually wrapped or bulk wrapped and placed on skids (pallets) then shrink-wrapped to provide protection during shipment. Small parts and hardware packages will be placed in crates for shipment. Other components shall be individually wrapped or bulk wrapped to provide protection during shipment

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading required for placing playground equipment and protective surfacing is completed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Manufacturer shall inspect each piece of installed equipment twice within the first year of use.

3.2 PREPARATION

- A. Verify location of playground perimeter and pathways. Verify that playground layout and equipment locations comply with requirements of each type and component of equipment.

3.3 INSTALLATION

- A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.
 - 1. Maximum Equipment Height: Coordinate installed fall heights of equipment with finished elevations and critical-height values of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within

required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

- B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.
- C. Post Set on Subgrade: Level bearing surfaces with drainage fill to required elevation.
- D. Post Set with Concrete Footing: Comply with Section 033000 "Cast-in-Place Concrete" and ACI 301 for measuring, batching, mixing, transporting, forming, and placing concrete.
 - 1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.
 - a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
 - 2. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.
 - 3. Finishing Footings: Smooth top, and shape to shed water.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
 - 1. Engage a factory-authorized service representative to perform inspection and testing for each playground component, assembly, and equipment installation, including connections, according to ASTM F 1487.
- C. Playground equipment items will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Notify Architect and Owner 48 hours in advance of date(s) and time(s) of testing and inspection.

END OF SECTION 116800

SECTION 211313-WET PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division Specification Sections, as applicable, shall apply to work under Divisions 21 and 22.

1.2 SUMMARY

- A. The work under this Section of the Specification shall include the furnishing of labor, materials and equipment for the installation of complete system to provide continuous and satisfactory service.
- B. This Specification establishes the minimum technical requirements for the materials, design, installation and certification of automatic fire sprinkler systems.
- C. The work of this Specification includes wet-pipe sprinkler systems, as defined by NFPA 13. These systems are herein referred to as, the system.
- D. System, installation, testing and certification:
 - 1. A licensed sprinkler contractor, who is now or has been engaged in the installation of automatic sprinkler systems for the past five years, shall install the system. Completed installation to be inspected by a NICET Level IV technician before hydrostatic test is performed.
 - 2. Installation, testing and certification of the system are to be done in accordance with applicable NFPA Standards and the *International Building Code*.
 - 3. The Installing Contractor shall possess a Class IIIc sprinkler license issued by the State of Maryland.
- E. Furnish and install devices, material, and equipment including, but not limited to, the following:
 - 1. Piping and valves,
 - 2. Pipe supports, anchors, and hangers,
 - 3. Pipe sleeves and appropriate fire stopping products for system piping passing through walls, floors, and ceilings,
 - 4. Sprinklers and sprinkler guards,
 - 5. Spare sprinklers, cabinets and wrench for each type of sprinkler,
 - 6. Other operational spare parts, spare parts cabinets, and special maintenance and repair tools as required,
 - 7. Water flow indicating switches,
 - 8. Valve supervisory switches,
 - 9. Test and drain assemblies,
 - 10. Pressure relief valves,

11. Fire department connection (Reuse existing fire department connection unless it does not meet current codes then it will need to be replaced),
12. Backflow preventer (BFP) assembly,
13. BFP test header,
14. Pressure gauges,
15. Equipment identification signs and labels for fire protection equipment.

- F. Provide installed systems that are complete, including incidental items, which are essential, but which may not be expressly described by this Specification.

1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.
- B. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device.

1.4 SYSTEM DESCRIPTIONS

A. General

1. Furnish and install (as applicable) all fire protection systems to the Codes and Standards.
2. Locate sprinklers and valves so that damage to, interference with, ore obstruction of equipment, objects and passageways is avoided.
3. Install all fire suppression systems so that no interference exist between the fire protection piping and equipment, and systems or equipment designed and installed by others.
4. Install pipe supports, anchors, and hangers in accordance with NFPA 13.

B. Sprinkler System

1. Modify/Provide/Extend automatic wet-pipe sprinkler system throughout the renovated portions of the building. Coordination of the sprinkler system with new layout and existing conditions shall be the responsibility of the installing contractor.
2. Except where indicated otherwise on shop drawings, sprinkler piping in areas with suspended ceilings shall be concealed.
3. Except where indicated otherwise on shop drawings, use standard orifice K-5.6 or K-8.0, ordinary temperature rated, quick response, fusible link type upright, pendent and horizontal sidewall sprinklers.
4. Contractor is responsible for generating final fabrication and as-built drawings.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.
 2. Sprinkler system shall be submitted to the Architect for review after governmental and regulatory agency approvals have been obtained. Approval agencies shall include the local fire department and the State Fire Marshal's office. No installation of the system shall be made until approval is obtained.
 3. System may be hydraulically designed. Computer readout sheets shall be submitted as required for approval and permit purposes.
- C. Submittals are to be made in accordance with the applicable NFPA Standards and this Specification.
- D. Submit fabrication/coordination drawings and equipment submittals to the Owner for approval.
- E. Acceptance by AHJ
1. The acceptance of the AHJ. It is the Contractor's responsibility to obtain approval from the AHJ of the shop drawings, and design information.
 2. All approved shop drawings are to bear the stamp of acceptance of the AHJ.
 3. The Contractor is responsible for preparing responses to all AHJ comments during the sprinkler permit review process. After the permit for the sprinkler system has been issued, it is the Installing Contractor's responsibility to obtain acceptance of the installation by the AHJ.
- F. Contractor Documents
1. Shop drawings and hydraulic calculations shall be in accordance with NFPA 13.
Contractor is responsible for the following:
 - a. Submit hydraulic calculations, clearly labeled, for system or remote area.
 - b. Indicate hydraulic calculation reference points, detailed pipe layout, sizes, hangers and supports, components, and accessories.
Provide a legend defining all symbols, notations, and abbreviations used on all drawings. Symbolism is to comply with latest edition of NFPA 170, *Fire Safety and Emergency Symbols*.
 - c. All shop drawings shall be prepared on drawings of uniform size and quality.
- G. Fabrication/Coordination Drawings and Equipment Submittals
1. Fabrication/coordination drawings and equipment submittals shall be prepared by the Installing Contractor in electronic (PDF) format and shall include the following:
 - a. Required and recommended spare parts lists; include both operational and start-up spares.
 - b. Fabrication/coordination drawings showing pipe cut lengths, fittings, contractor pipe designations, etc. as required by the Contractor to coordinate the installation with field conditions.
 - c. Manufacturer's data sheets for all equipment to be provided. All equipment shall be provided in bound booklet form and include a complete bill of materials. Where more than one component, finish, etc., is indicated on a particular data sheet, the specific item provided shall be clearly identified by highlighting or clouding the specific item.
 - d. List of special tools.
 - e. Hydrostatic test procedures.

- f. Acceptance test procedures.

H. Project Record Documents

- 1. Installing Contractor shall provide the following:
 - a. Provide verification that the systems installed have been tested and meet or exceed the requirements of the applicable NFPA Standards and this Specification.
 - b. Hydrostatic test results.
 - c. Test and certification reports as required by NFPA 13.
 - d. Record actual locations of sprinklers and all deviations of installed sprinkler piping from the approved shop drawings. Indicate drain and test locations.
 - e. Upon completion of the work (within two weeks) the record (“As-Built”) set of prints shall be used by the Contractor to prepare complete, accurate final record drawings reflecting any and all changes and deviations made to the fire sprinkler system. "Red-Lined" shop drawings are not acceptable.
 - f. Upon completion of the work, the Contractor shall submit an electronic (PDF) copy of updated record drawings to the Owner for review and acceptance.
 - g. After review and acceptance, the Contractor shall provide contractor record drawings on USB drive in AutoCAD version as required by Owner.

I. Operation and Maintenance Data

- 1. Prepare and submit two (2) complete operation and maintenance (O&M) manuals in three-ring binders. O&M manuals shall include the following information:
 - a. Complete set of “As-Built” drawings in electronic (PDF) format on USB flash drive.
 - b. Comprehensive operation description of all systems.
 - c. Names, addresses, and phone numbers of all equipment suppliers and installers.
 - d. Equipment guarantees.
 - e. Comprehensive preventative maintenance, service and programming instructions.
 - f. Test and certification reports as required by NFPA 13 showing approval from the AHJ.
 - g. Hydrostatic test results.
 - h. Product data sheets for all installed sprinkler system equipment.
 - i. A copy of the latest edition of NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
 - j. A DVD copy of the demonstration session(s).

1.6 INFORMATIONAL SUBMITTAL

- A. Provide informational submittals in Operation and Maintenance Manuals in addition to action submittals and section 017823 “Operation and Maintenance Data”.
- B. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 PROJECT 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 Owner no fewer than seven days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Owner's written permission.

1.8 INFORMATION AVAILABLE TO BIDDERS

- A. This Article and the following flow test data and water supply calculations are made available for the bidder's convenience and are not part of the Contract Documents and do not relieve the bidders from performing their own investigation to determine the accuracy of the information.
 1. Flow Test Data-Shown on FP0.1.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Engage a qualified professional contractor to design wet-pipe sprinkler system.
- B. Provide only devices, equipment and materials that are Underwriters' Laboratories (UL) listed or Factory Mutual (FM) Global approved for the use intended, unless otherwise noted.
- C. Not all materials or components described below are necessarily used in the systems specified.
- D. All equipment of a similar type shall be of the same manufacturer.
- E. Asbestos and asbestos containing materials are not acceptable or permitted.
- F. All system components shall be listed for a maximum working pressure of 175 psi. All fittings shall have a minimum working pressure of 175.
- G. Sprinkler system design shall be approved by authorities having jurisdiction.

2.2 SPRINKLERS

- A. No O-Rings shall be permitted in the sprinkler head. Glass bulb sprinklers shall not be used.
- 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. Viking Corporation
 2. Reliable Automatic Sprinkler Co., Inc.
 3. Tyco Fire & Building Products LP.
 4. Victaulic Company.
- C. Sprinkler Guards:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - d. Viking Corporation.
2. Standard: UL 199.
 3. Type: Wire cage with fastening device for attaching to sprinkler.
 4. Provide FM Approved or UL Listed sprinkler guards to protect automatic sprinklers where physical damage to the sprinkler head can occur.
- D. Suspended Ceiling Type: Unless otherwise noted below, sprinklers installed in areas with suspended ceilings shall meet the following criteria:
1. Type: Semi-recessed pendent type with matching push-on escutcheon plate (where applicable). All sprinklers within a particular compartment shall have the same spray pattern characteristics.
 2. Finish: Chrome plated brass
 3. Escutcheon Plate Finish: Match sprinkler head finish.
 4. Operating Element: Quick response, fusible link type, temperature rated for specific area hazard. Note, standard response sprinklers shall be used where quick response sprinklers are prohibited by their listing.
 5. Nominal K-factor: 5.6 or 8.0.
- E. Exposed Area Type: Sprinklers installed in areas without finished ceilings or in areas with exposed piping shall meet the following criteria:
1. Type: Standard upright or pendent. Refer to contract drawings for sprinkler types.
 2. All sprinklers within the same compartment shall have the same spray pattern characteristics.
 3. Finish: Rough brass
 4. Operation Element: Quick response, fusible link type, temperature rated for specific area hazard. Note, standard response sprinklers shall be used where quick response sprinklers are prohibited by their listing.
 5. Nominal K-factor: 8.0.
- F. Horizontal Sidewall Sprinklers: Horizontal sidewall sprinklers shall meet the following criteria:
1. Type: Horizontal sidewall sprinklers shall be listed for use in light and ordinary hazard occupancies. All sprinklers within the same compartment shall have the same spray pattern characteristics.
 2. Finish: Chrome plated brass
 3. Escutcheon Plate Finish: Match sprinkler head finish.
 4. Operation Element: Quick response, fusible link type, temperature rated for specific area hazard.
 5. Nominal K-factor: 5.6.

2.3 PIPING

- A. Piping shall be as per NFPA 13.

- B. All piping 2” or less in diameter shall be ASTM A53 (Type E Grade B) or A795 (Type E Grade A), Schedule 40 Black Steel.
- C. All piping 2½” or larger be ASTM A135 or A795 (Type E Grade A), Schedule 10 Black Steel.

2.4 FITTINGS

- A. All piping 2” or less in diameter shall be joined by threaded fittings. Threaded fittings shall conform per NFPA 13.
- B. All piping 2½” or larger in diameter shall be joined by roll-grooved fittings. All components for grooved fittings shall be from the same manufacturer.
- C. Manufacturers: Victaulic, Tyco, or approved equal.
- D. For grooved fittings that require a specified bolt torque requirement, written documentation (tags, etc.) shall be affixed at each fitting in the field indicating the bolt torque applied such that it can be verified fittings were installed in accordance with manufacturer’s specified bolt torque. A protocol for documentation shall be submitted as part of the equipment submittal required by Section 1.5.E.
- E. Use of Mechanical-T fittings is not permitted for use on fire sprinkler system piping.
- F. Branch piping shall be connected to mains via welded threads or welded steel couplings.
- G. Ground-joint unions shall not be used.
- H. Plain-end fittings which incorporate a locking-lug, rotating retainer lug, or quarter-turn retainer lug shall not be used.
- I. Press-fit fittings shall not be used.
- J. Flexible sprinkler hose fittings are not permitted.
- K. All fittings shall be listed and installed in accordance with NFPA 13 and the manufacturer’s instructions.

2.5 CONTROL VALVES

- A. OS&Y (gate) valves:
 1. Shall have a 175-psi (12.1 Bar) working pressure.
 2. Valves 2” and smaller: UL 262, stainless steel with threaded ends, solid wedge, OS&Y type with rising stem.
 3. Valves 2½” and larger: Stainless steel, taper wedge, OS&Y type with rising stem. Include replaceable, wedge facing rings and flanged ends complying with ANSI B16.1 (Class 125).
 4. Stainless steel butterfly valves shall have internal gear operator handwheel, stainless steel valve stem and be provided with a position indicator. Valves shall have factory provided grooved ends complying with ANSI/AWWA C606. All valves shall have a 175-psi

working pressure and be provided with integral valve supervisory switches suitable for final connection to the building fire alarm system.

5. Acceptable Manufacturers:
 - a. Milwaukee Valve Company,
 - b. Kennedy,
 - c. Victaulic.

2.6 CHECK VALVES

- A. Provide stainless steel swing check valves and bolt cap with disc with flanged ends.
- B. Minimum pressure rating of check valves shall be 250 psi.
- C. Check valves shall be Listed per UL 313 and installed in accordance with the manufacturer's instructions.

2.7 SPECIALTY VALVES

- A. Globe valves: Stainless Steel.
- B. Ball valves: Stainless Steel.

2.8 TEST AND DRAIN ASSEMBLIES

- A. Test and drain valve assemblies shall be UL listed and FM approved.
- B. Test and drain valve assemblies shall be operated by opening one handle only.

2.9 PRESSURE RELIEF VALVES

- A. Provide UL listed pressure relief valves.
- B. Valves shall have a stainless steel body with stainless steel spring.
- C. Valves shall be 1/2" and factory rated at 175 psi.

2.10 VALVE SUPERVISORY SWITCHES

- A. Provide valve supervisory switch with dual SPDT (Form C) contacts for sprinkler system water supply, riser, or zone control valves.
- B. Provide housing with red enamel finish, 1/2-inch conduit entrance, and necessary accessories for attachment of the switch to the valve.
- C. Removal of switch cover shall cause the supervisory initiating device to operate.

2.11 WATER FLOW INDICATING SWITCHES

- A. Provide UL listed vane type water flow alarm devices suitable for final connection to the building fire alarm system for each sprinkler zone.
- B. Each water flow switch shall be factory wired with two sets of alarm contacts, capable of being monitored by two separate fire alarm circuits.
- C. Vane type water flow switches shall be provided with a field adjustable retard of between 0-60 seconds. Retard shall be initially set at 20 seconds. Switches shall be capable of detecting flows of at least 5 gpm.

2.12 FIRE DEPARTMENT CONNECTION (FDC)

- A. Confirm if existing FDC needs to be replaced to meet current codes.
- B. Confirm with fire department for FDC configuration. Provide Storz FDC for wall mounting meeting the following criteria:
 - a. Body Material of FDC shall be forged aluminum.
 - b. Provide locking 4-in. Storz inlet x 4-in. Female NPT outlet.
 - c. Provide Storz cap with securing chain; forged aluminum with powder coat finish.
 - d. Provide rectangular, brass, wall type escutcheon plate.
 - e. Body Style: 30° angle pattern.
 - f. Number of Inlets: One.
 - g. Escutcheon Plate Marking: Similar to "AUTO SPRK".
 - h. Finish: Powder coat.
 - i. Manufacturer: Guardian Fire Equipment, Inc. Model 6625, or approved equal.
 - j. Confirm with fire department configuration.
 - k. FDC to have locking caps P/N 3041.

2.13 BACKFLOW PREVENTER (BFP) ASSEMBLY

- A. Confirm if existing needs to be replaced to meet current codes.
- B. Provide UL listed and/or FM approved double-check backflow preventer assembly and meeting the following criteria:
 - 1. Type: Horizontal assembly; consisting of two independently operated check valves, two shutoff valves, and four test cocks.
 - 2. Finish: 300 Series (Schedule 40) stainless steel.
 - 3. Manufacturer: The backflow preventer assembly shall be the AMES Colt Series C200 or AMES Model 2000SS, or approved equivalent.
 - 4. Shutoff Valves: UL/FM outside steam and yoke (OS&Y) resilient seated gate valves.

2.14 BFP TEST HEADER

- A. Provide flush-type test header for the BFP for wall mounting meeting the following criteria:

1. Body Material of BFP test header shall be corrosion-resistant metal.
2. Provide rectangular, brass, wall-type escutcheon plate.
3. Body Style: Horizontal.
4. Number of Inlets: Two.
5. Inlet Size: 4-in. x 2½ in. x 2½ in.
6. Hydrant outlet snoots: 2½ in. female NPT 2½ in. male NPT threaded with caps and chains.
7. Gate valves: N.R.S. loose bonnet (2½ in. female NPT x 2½ in. male hose thread).
8. Escutcheon Plate Marking: Similar to “ BFP Test Header”.
9. Finish: Cast Brass.

2.15 SPARE SPRINKLER CABINET

- A. Provide a spare sprinkler cabinet(s) located adjacent to the main system riser. Two (2) sprinkler wrenches for each type of sprinkler installed shall also be provided.
 1. Manufacturer: Viking Model 01724A (six sprinkler capacity) and/or 01725A (12 sprinkler capacity), or approved equal.
- B. Provide six (6) spare sprinklers for each style and temperature installed.
- C. Provide a 24x18-in. detailed framed drawing showing the building sprinkler zones and locations of all test valve assemblies, fastened to the wall in the sprinkler room directly adjacent to the main system riser(s).

2.16 PRESSURE GAUGES

- A. Phosphor bronze bourdon tube type with 4½-inch diameter case, 0 - 250-psig range, aluminum white coated dials, brass, case, glass crystal, and ¼” male connection. Gauge shall capable of being readjusted with a hydraulic testing unit.
- B. Pressure gauges shall be equipped with a shut-off valve and drain for servicing.
- C. Pressure gauges shall be UL 393 listed.

2.17 IDENTIFICATION SIGNS AND LABELS

- A. Provide an identification sign or label for all devices furnished under this Section that require operation. Clearly inscribe all pertinent function and operating information and instructions on the sign. Example of device requiring such labels include: ‘shut-off’.
- B. Signs or labels are to be durable for the specified environmental conditions (metal, i.e., nonferrous or stainless steel, or plastic) and permanently attached (banding strap or screws) in a conspicuous place on or adjacent to each piece of equipment. Attachment by self-tapping screws is not acceptable.
- C. Provide signs or labels which have red letters on a white background or white letters on a red background.

- D. Valve identification signs shall be a minimum 6-in. wide by 2-in. high.
- E. FDC identification sign
 - 1. Provide an 18-in. by 12-in. (minimum) sign with letters that read 'FDC' at least 6-in. in height on exterior wall above FDC that is clearly visible.
 - 2. Sign shall have a red background with white lettering.
- F. Provide hydraulic design information signs at each set of zone valves. Signs shall be comply with NFPA 13.
- G. Escutcheons – Shall be provided for all piping passing through walls and finished ceilings. Escutcheons shall completely conceal the annular space between the pipe and the surface penetrated, including any required firestopping material.

2.18 PIPE HANGERS AND SUPPORTS

- A. Piping shall be adequately supported from the building structure by listed ferrous hanger assemblies installed in accordance with NFPA 13. Hanger components attached to the building structure or piping shall be UL listed.
- B. All hangers shall be securely attached to the building structure. In no case shall hangers be supported by roof deck or other hanger systems, such as those supporting mechanical or electrical systems. Hangers shall allow for proper expansion and contraction of building structural elements and the sprinkler piping.
- C. Pipe hangers shall be heavy pattern black malleable iron and approved for use on fire protection systems.
- D. Powder driven fasteners are not permitted.
- E. Provide surge restraint as required by NFPA 13 where system-working pressure exceeds 100 psi.
- F. All hanger rods shall be installed plumb.

2.19 FABRICATION

- A. Sprinkler piping may be shop-fabricated in accordance with the requirements of NFPA 13.
- B. Either screwed or grooved fittings may be utilized, in accordance with the requirements of the appropriated NFPA standard, and with the requirements of this Specification.
- C. Screwed pipe lengths are to contain the minimum number of fittings and connections practicable.
- D. Pipe may be welded at the Installing Contractor's discretion. Conduct field shop fabrication only outside of the plant buildings, and away from hazardous locations. Establish an acceptable fabrication shop location with the Owner. Obtain permission and a welding permit from the Owner prior to final welding of pipe. Provide a fire watch outfitted with fire hose and

extinguisher during all welding operations. Provide welding procedures for review and approval by Engineer.

- E. All welding methods shall comply with NFPA 13.
- F. Maximum length of welded section of pipe is 20 feet.

PART 3 - EXECUTION

3.1 GENERAL

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Coordinate with all other trades prior to installation and existing conditions.
- C. Sprinkler shall be an automatic wet pipe system complete with piping, sprinkler heads, valves, accessories, hangers, etc.
- D. Do not route any sprinkler system piping through the rooms containing electrical equipment.
- E. All equipment and materials in accordance with manufacturer's instructions and the requirements of the applicable NFPA Code or Standard.
- F. Piping locations shall be coordinated and field measured to ensure proper fit.
- G. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.
- H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PIPING – GENERAL

- A. Install piping in accordance with NFPA 13 for sprinkler systems. All piping shall be pitched to drain to the main drain valve without the use of auxiliary drain connections.
- B. Place pipe runs to minimize obstruction to other work.
- C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient as required for drainage.
- D. Install piping to conserve building space, and not interfere with use of space and other work.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Install pipes, valves, and fittings, requiring maintenance or replacement with unions or flanged connections and isolating valves to permit easy removal.

- G. Avoid interferences with all other piping, cable trays, and equipment that is installed, or will be installed, in the protected area.
- H. Die cut screw joints with full-cut standard taper pipe threads.

3.3 PIPING - DRAIN LINES

- A. Slope piping and arrange systems to drain at low points.
- B. All system zone valve drains or main drains shall be piped through an exterior wall directly to the outside of the building.

3.4 HANGERS AND SUPPORTS

- A. All hangers shall be securely supported from walls, beams, columns, and slabs using approved structural attachments. In no case shall hangers be supported by other hanger systems, such as those supporting mechanical or electrical systems. Hangers shall allow for proper expansion and contraction of building structural elements and the sprinkler piping.
- B. In situations where approved attachments cannot be used, alternative attachments or substructure assemblies must receive approval prior to installation. Prior approval must be given for any cutting or drilling of building structural steel. Damage to the structure through welding, cutting, or drilling will not be permitted if it reduces the structure's strength to a point below the established safety factor for said structure. Approvals may only be granted by the Architect or Structural Engineer. Any additional structural steel required to properly support piping or equipment shall be furnished and installed under this contract. Piping shall be supported to maintain grading and pitching of lines, to prevent vibration, and to secure piping in place. In no case shall hangers or supports use performed metal roof or floor deck as a means of support.
- C. Trapeze hangers shall be used where needed. Only Schedule 40 piping shall be used as the pipe span.

3.5 VALVES

- A. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.
- B. Provide a chain operator for manual sprinkler system control valves, which are more than seven feet from floor or platforms.
- C. Provide OS&Y valves for shut-off or zone valves.
- D. Tighten valve glands as the pipelines are erected. Install additional valve gland packing rings if necessary to provide a seal and ensure tight working conditions after valves are placed in service.

3.6 PENETRATIONS

- A. Do not penetrate building structural members unless indicated. Do not cut, drill, burn, or weld to structural members without prior approval of the Owner.
- B. Provide core drilling for penetrations in masonry walls and floors.
- C. Seal pipe penetrations with a UL classified through-penetration system to maintain the fire and/or smoke resistance rating of the assembly penetrated.

3.7 ACCESS PANELS

- A. Provide 24-in. by 24-in. access panels for any concealed valves located above gypsum ceilings.

3.8 BACKFLOW PREVENTER

- A. Install backflow preventer at a maximum of 42-in. above finished floor and provide 12-in. clearance on all sides for access.

3.9 SPRINKLER INSTALLATIONS

- A. Install sprinklers in the centerline of the ceiling tiles for 2' x 2' tiles.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers supplied from heated space.
- C. Sprinkler head and escutcheon shall be U.L. listed as a single assembly.

3.10 PIPE SLEEVES

- A. All pipes passing entirely through walls, floors, roofs, and partitions shall be provided with sleeves. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs and partitions. Provide one inch minimum clearance on all sides between the exterior surface of the piping and the interior wall of the sleeve or core-drilled hole.
- B. Sleeves in masonry and concrete walls and floors shall be Schedule 40 black steel pipe, set flush with finished floors or walls. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.
- C. Sleeves in other than masonry and concrete wall, floors and roofs shall be 26 gauge galvanized steel sheet, set flush with finished surfaces.
- D. Seal the space of the sleeve or core-drilled hole with UL listed fill, void or cavity material in accordance with the Specification Section Division 7, "Fire Stopping" when penetrating fire and smoke rated walls, barriers and partitions. Seal the space around pipe sleeves in non-rated penetrations with non-shrinking caulk or grout as needed for the partition type. Refer to the Code Data Sheets for the walls and partition locations.

3.11 SYSTEM IDENTIFICATION

- A. All exposed sprinkler piping shall be painted RED #9903. Color based upon Duron "Dura Clad" (Alkyd Gloss Enamel Modified with Urethane) Industrial Maintenance Finishes.
- B. All concealed piping over 2-1/2" and equipment shall be marked for ease of identification.
- C. Marking shall be done using stencils or commercially available wraparound pipe identification signs applied to clean, smooth surfaces.
- D. All lettering shall be not less than 1/2" in height and shall have sharply contrasted background for ease of identification.
- E. All piping shall be marked to identify direction of waterflow and the system it is serving.
- F. Marking shall be located to be clearly visible from the floor when looking above ceilings and shall be spaced every 20 feet and at all changes in direction.
- G. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- H. Identify system components, wiring, cabling, and terminals.
- I. Once painting work is completed, product identification stenciling and tagging shall be performed.

3.12 CONNECTIONS

- A. Connect to specialty valves, specialties and accessories.
- B. Connect water supplies to sprinkler systems. Include backflow preventers.
- C. Electrical Connections: Power wiring is specified in Division 16.
- D. Connect alarm devices to fire alarm system.

3.13 ACCEPTANCE TESTING

- A. General
 - 1. After all system components and associated piping are installed, notify the Owner, in writing, that the systems are ready for inspection.
 - 2. Participate in a "walk-through" inspection of all fire protection systems with the Owner, and others as requested or required by the Owner. The intent of the "walk-through" is to obtain agreement from all parties that systems are ready for functional testing.
 - 3. Perform hydrostatic tests and certification only after successful inspection and functional testing of all fire protection systems are completed and necessary corrective action has been taken. Acceptance tests are to be witnessed by the AHJ, and the Owner. Installing Contractor shall provide a minimum of 72 hours advance notice of the pending tests to

- the Owner to permit scheduling of required personnel and to prevent any disruptions to any other on-site activities.
4. Prior to final system acceptance tests, prepare written instructions outlining all tests to be conducted and how tests are to be performed. At the time of tests inform all witnessing personnel of the following:
 - a. Purpose of Test
 - b. Test Procedures
 - c. Anticipated Results
 5. Decision by witnessing personnel not to witness field acceptance tests or inspections does not relieve the Installing Contractor from full responsibility for the quality and correctness of the work.
 6. Conduct all acceptance tests and certification in accordance with the referenced NFPA Standards and the manufacturer's instructions, where applicable.
 7. Upon successful completion of tests, furnish a complete record of all tests and results to the Owner. Complete and provide to the Owner all forms and reports described in the applicable NFPA standards.
 8. Replace parts, which are furnished under this Subcontract and found to be defective and not mechanically abused (as determined by the Owner) at no cost to the Owner.

B. Water Systems

1. Perform acceptance tests, certification and approval in accordance with the applicable NFPA standards and the manufacturer's instructions, where applicable.
2. After installation, hydrostatically test all piping at 200 psi or 50 psi above the maximum system working pressure (whichever is greater) as required by NFPA 13.
3. Functionally test all valves and manual operating devices.
4. Provide protective covers for equipment that could be damaged by water during testing.
5. Provide protection of adjacent areas that may be exposed to or damaged by water discharged during testing.
6. After tests are completed, remove all covers and clean up any water produced by the test(s) if required by the Installing Contractor.

C. Acceptance

1. Any portion of the work or equipment, or accessories failing to meet the requirements of this Specification as determined by the Owner is to be promptly modified, repaired or replaced, as necessary, by the responsible party. The costs of such work and the cost of any further tests or inspections to show such compliance will be at no additional cost to the Owner.
2. If after the tests, the Owner is convinced that the installed equipment clearly meets the capability and performance guarantees, and that it is otherwise in accordance with this Specification, the equipment and installation will be accepted.
3. Upon final acceptance by the Owner, the Installing Contractor shall provide the Owner with a final bound copy of the following:
 - a. "As-Built" (record) drawings.
 - b. All operation and maintenance manuals.
 - c. Warranties on all equipment.

3.14 ADJUSTING AND CLEANING

- A. Flush entire piping system of foreign matter. Flushing procedures found in NFPA 13 are to be used in flushing the system. Minimum flushing velocity is to be 10 feet per second.
- B. Restore, to its original condition, any completed construction or construction work in progress which is not part of the work of this Specification and which is damaged during installation. All such damaged areas, which are repaired, are subject to the Owner's acceptance.
- C. Finishing and Painting
 - 1. Furnish only manufacturer's standard shop finish on all components.
 - 2. Unless noted below, all exposed sprinkler pipe shall be painted red.
- D. Cleaning and Closures
 - 1. Clean all internal and external surfaces of the equipment. Remove all mill scale, loose metal particles, weld splatter, slag, dirt, and other foreign matter. Remove all burrs and ease all sharp edges.
 - 2. Seal all openings against entry of paint, water, dirt, and debris during painting, shipment and storage and field handling.
 - 3. Clean dirt and debris from sprinklers. Replace sprinklers having paint other than factory finish with new sprinklers. Cleaning and reuse of painted sprinklers is prohibited.

3.15 DEMONSTRATIONS AND TRAINING

- A. Provide the services of a qualified representative to demonstrate the fire sprinkler system.
- B. At a minimum, demonstration sessions shall include the following activities:
 - 1. Instruct the Owner or designated personnel in the operation, maintenance, lubrication, and adjustment of the systems and equipment.
 - 2. On-site instruction provided by the manufacturer's technical representative for each type of equipment, including performance of the recommended preventative maintenance procedures for that equipment.
 - 3. Approved O&M manuals shall be made available within 10 working days of any demonstration.

END OF SECTION 211313

SECTION 221123-DOMESTIC WATER PUMPS

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. In-line pump(s).
 - 2. Domestic Water Booster Pumps

1.3 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- 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. All wetted surfaces must comply with NSF61. All components in contact with the water stream shall also comply with NSF 372 and COMAR 09.20.01.03 provisions of “Maryland Plumbing Act.”
- C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 - PRODUCTS

2.1 IN-LINE PUMP

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Taco
 - 2. Armstrong Pumps Inc.
 - 3. Bell & Gossett Domestic Pump; ITT Corporation.
 - 4. Grundfos Pumps Corp.
 - 5. Or approved equal.
- B. Description: Factory-assembled and -tested, in-line, lead free, pump. Compact, high velocity performance. Quiet efficiency operation. Self-lubricating and no mechanical seal.
- C. Pump Construction:
 - 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
 - 2. Casing: Bronze or stainless steel, with threaded or companion-flange connections.
 - 3. Motor: Single speed, unless otherwise indicated.

2.2 DOMESTIC WATER BOOSTER PUMP

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Grundfos Pumps Corp
 - 2. Armstrong Pumps Inc.
 - 3. Bell & Gossett Domestic Pump; ITT Corporation.
 - 4. Or approved equal
- B. VARIABLE SPEED PACKAGED PUMPING SYSTEM WITH INTEGRATED VARIABLE FREQUENCY DRIVE MOTORS
 - 1. Furnish and install a pre-fabricated and tested variable speed packaged pumping system to maintain constant water delivery pressure.
 - 2. The packaged pump system shall be a standard product of a single pump manufacturer. The entire pump system including pumps and pump logic controller, shall be designed, built, and tested by the same manufacturer.

3. The complete packaged water booster pump system shall be certified and listed by UL (Category QCZJ – Packaged Pumping Systems) for conformance to U.S. and Canadian Standards.
4. The complete packaged pumping system shall be NSF372 Listed for drinking water and low lead requirements.

C. PUMPS

1. The pumps shall be NSF 372 Listed for drinking water.
2. The pumps shall be of the end-suction horizontal multi-stage design with the discharge vertical on the centerline of the pump.
3. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.
4. Cast Iron Horizontal End-suction Multi-Stage Pumps (12mm or 16mm shaft, Nominal flow from 10 to 130 gallons per minute) shall have the following features:
 - a. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement with a Stop Ring and Nord-lock® washer or similar, which makes it possible to disassemble the pump from the pump side.
 - b. The suction/discharge shall have internal pipe thread (NPT) connections as determined by the pump station manufacturer.
 - c. 3. On the top of the inlet part should be a priming plug to allow the pump to be nearly completely filled with the liquid to be pumped.
 - d. 4. On the lower side of the inlet part should be a drain plug.
 - e. 5. Pump Construction.
 - 1) Inlet Part, Discharge Part: Cast iron (Class 30)
 - 2) Impellers, chambers: 304 Stainless Steel
 - 3) Shaft: 431 Stainless Steel
 - 4) Spacing Pipe: 316 Stainless Steel
 - 5) O-rings: EPDM
 - f. The shaft seal shall be an o-ring seal with fixed driver type with the following features:
 - 1) Retainer and Driver for Seal Ring: 304 or 316 Stainless Steel
 - 2) Spring: 304 or 316 Stainless Steel
 - 3) Stationary Seal: Silicon Carbide (Graphite Imbedded)
 - 4) Rotating Seal: Silicon Carbide (Graphite Imbedded)
 - 5) O-rings: EPDM
 - g. AISI 304 or 316 Stainless Steel End-suction Horizontal Multi-Stage Pumps Nominal flow from 10 to 130 gallons per minute) shall have the following features:
 - 1) The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement with a Stop Ring and Nord-lock® washer or similar, which makes it possible to disassemble the pump from the pump side.
 - 2) The suction/discharge shall have internal pipe thread (NPT) connections as determined by the pump station manufacturer.
 - 3) On the upper area of the flange should be a priming port to allow the pump to be nearly completely filled with the liquid to be pumped.
 - 4) On the bottom side of the pump sleeve should be a drain hole
 - 5) Pump Construction.

- a) Flange: Cast Iron
- b) Impellers, Chambers, Sleeve: 304 or 316 Stainless Steel
- c) Shaft: 304 or 316 Stainless Steel
- d) Spacing Pipe: 316 Stainless Steel
- e) O-rings: EPDM
- f) The shaft seal shall be an o-ring seal with fixed driver type with the following features:
- g) Retainer and Driver for Seal Ring: 304 or 316 Stainless Steel
- h) Spring: 304 or 316 Stainless Steel
- i) Stationary Seal: Silicon Carbide (Graphite Imbedded)
- j) Rotating Seal: Silicon Carbide (Graphite Imbedded)
- k) O-rings: EPDM

D. INTEGRATED VARIABLE FREQUENCY DRIVE MOTORS

1. Each motor shall be of the Integrated Variable Frequency Drive design consisting of a motor and a Variable Frequency Drive (VFD) built and tested as one unit by the same manufacturer.
2. The VFD shall be of the PWM (Pulse Width Modulation) design using current IGBT (Insulated Gate Bipolar Transistor) technology.
3. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of motor. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump control and to eliminate the need for motor de-rating.
4. The VFD shall utilize an energy optimization algorithm to minimize energy consumption. The output voltage shall be adjusted in response to the load, independent of speed.
5. The VFD shall automatically reduce the switching frequency and/or the output voltage and frequency to the motor during periods of sustained ambient temperatures that are higher than the normal operating range. The switching frequency shall be reduced before motor speed is reduced.
6. An integral RFI filter shall be standard in the VFD.
7. The VFD shall have a minimum of two skip frequency bands which can be field adjustable.
8. The VFD shall have internal solid-state overload protection designed to trip within the range of 125-150% of rated current.
9. The integrated VFD motor shall include protection against input transients, phase imbalance, loss of AC line phase, over-voltage, under-voltage, VFD over-temperature, and motor over-temperature. Three-phase integrated VFD motors shall be capable of providing full output voltage and frequency with a voltage imbalance of up to 10%.
10. The integrated VFD motor shall have, as a minimum, the following input/output capabilities:
 - a. Speed Reference Signal: 0-10 VDC, 4-20mA
 - b. Digital remote on/off
 - c. Fault Signal Relay (NC or NO)
 - d. Fieldbus communication port (RS485)
11. The motor shall be Totally Enclosed Fan Cooled (TEFC) with a standard NEMA C-Face, Class F insulation with a temperature rise no higher than Class B.
12. The cooling design of the motor and VFD shall be such that a Class B motor temperature rise is not exceeded at full rated load and speed at a minimum switching frequency of 9.0 kHz.

13. Motor drive end bearings shall be adequately sized so that the minimum L10 bearing life is 17,500 hours at the minimum allowable continuous flow rate for the pump at full rated speed.

E. PUMP SYSTEM CONTROLLER

1. The pump system controller shall be a standard product developed and supported by the pump manufacturer.
2. The controller shall be microprocessor based capable of having software changes and updates via personal computer (notebook). The controller shall be designed specifically for control of parallel connect pumps in constant pressure applications.
3. The controller shall provide internal galvanic isolation to all digital and analog inputs as well as all fieldbus connections.
4. The controller shall display the following as status readings from a single display on the controller (this display shall be the default):
 - a. Current value of the control parameter, (typically discharge pressure)
 - b. Alarm indication (if any)
 - c.
5. The controller shall have as a minimum the following hardware inputs and outputs:
 - a. Two analog inputs (4-20mA or 0-10VDC)
 - b. Two digital inputs
 - c. Two digital outputs
 - d. Three PTC connections for motor monitoring
 - e. Field Service connection to PC for advanced programming and data logging
6. Pump system programming (field adjustable) shall include as a minimum the following:
 - a. Current setpoint
 - b. Pump control Off/Auto
 - c. System control On/Off
 - d. Alarm reset
7. Pump system programming (field Service connection to PC for advanced programming) shall include as a minimum the following:
 - a. Water shortage protection (analog or digital)
 - b. Transducer Settings (Suction and Discharge Analog supply/range)
 - c. PI Controller (Proportional gain and Integral time) settings
 - d. High system pressure indication and shut-down
 - e. Low system pressure indication and shut-down
 - f. Low suction pressure/level shutdown (via digital contact)
 - g. Low suction pressure/level warning (via analog signal)
 - h. Low suction pressure/level shutdown (via analog signal)
 - i. Flow meter settings (if used, analog signal)
8. The controller shall be capable of receiving a remote analog set-point (4-20mA or 0-10 VDC) as well as a remote system on/off (digital) signal.
9. The pump system controller shall be mounted in a UL Type 3R rated enclosure. A self-certified NEMA enclosure rating shall not be considered equal. The entire control panel shall

be UL 508 listed as an assembly. The control panel shall include a main disconnect, circuit breakers for each pump and the control circuit and control relays for alarm functions.

Control panel options shall include:

Emergency/Normal Operation Switches, located on front of panel.

- a. The controller shall be capable of receiving a redundant sensor input to function as a backup to the primary sensor (typically discharge pressure).
- b. The controller shall have the ability to communicate common field-bus protocols, (BACnet, Modbus, Profibus, and LON), via optional communication expansion card installed inside controller.

F. SEQUENCE OF OPERATION

1. The system controller shall operate equal capacity variable speed pumps to maintain a constant discharge pressure (system set-point). The system controller shall receive an analog signal [4-20mA] from the factory installed pressure transducer on the discharge manifold, indicating the actual system pressure. As flow demand increases the pump speed shall be increased to maintain the system set-point pressure. When the operating pump(s) reach 97% of full speed (adjustable), an additional pump will be started and will increase speed until the system set-point is achieved. When the system pressure is equal to the system set-point all pumps in operation shall reach equal operating speeds. As flow demand decreases the pump speed shall be reduced while system set-point pressure is maintained. When all pumps in operation are running at low speed the system controller shall switch off pumps when fewer pumps are able to maintain system demand.
2. The system controller shall be capable of switching pumps on and off to satisfy system demand without the use of flow switches, motor current monitors or temperature measuring devices.
3. All pumps in the system shall alternate automatically based on demand, time and fault. If flow demand is continuous (no flow shut-down does not occur), the system controller shall have the capability to alternate the pumps every 24 hours, every 48 hours or once per week. The interval and actual time of the pump change-over shall be field adjustable.

G. LOW FLOW STOP FUNCTION

1. The system controller shall be capable of stopping pumps during periods of low-flow or zero-flow without wasting water or adding unwanted heat to the liquid. Temperature based no flow shut-down methods that have the potential to waste water and add unwanted temperature rise to the pumping fluid are not acceptable.
2. Standard Low Flow Stop and Energy Saving Mode
If a low or no flow shut-down is required (periods of low or zero demand) a bladder type diaphragm tank shall be installed with a pre-charge pressure of 70% of system set-point. The tank shall be piped to the discharge manifold or system piping downstream of the pump system. When only one pump is in operation the system controller shall be capable of detecting low flow (less than 10% of pump nominal flow) without the use of additional flow sensing devices. When a low flow is detected, the system controller shall increase pump speed until the discharge pressure reaches the stop pressure (system set-point plus 50% of programmed on/off band). The pump shall remain off until the discharge pressure reaches the start pressure (system set-point minus 50% of programmed on/off band). Upon low flow shut-down a pump shall be restarted in one of the following two ways:

- a. Low Flow Restart: If the drop in pressure is slow when the start pressure is reached (indicating the flow is still low), the pump shall start and the speed shall again be increased until the stop pressure is reached and the pump shall again be switched off.
- b. Normal Flow Restart: If the drop in pressure is fast (indicating the flow is greater than 10% of pump nominal flow) the pump shall start and the speed shall be increased until the system pressure reaches the system set-point.

H. SYSTEM CONSTRUCTION

1. Suction and discharge manifold construction shall be in way that ensures minimal pressure drops, minimize potential for corrosion, and prevents bacteria growth at intersection of piping into the manifold. Manifold construction that includes sharp edge transitions or interconnecting piping protruding into manifold is not acceptable. Manifold construction shall be such that water stagnation can not exist in manifold during operation to prevent bacteria growth inside manifold.
2. The suction and discharge manifolds shall be constructed of 316 stainless steel. Manifold connection sizes shall be as follows:

3 inch and smaller: Male NPT threaded
4 inch ANSI Class 150 rotating flanges
3. Pump Isolation valves shall be provided on the suction and discharge of each pump. Isolation valve sizes 2 inch and smaller shall be nickel plated brass full port ball valves. Isolation valve sizes 3 inch and larger shall be a full lug style butterfly valve. The valve disk shall be of stainless steel. The valve seat material shall be EPDM and the body shall be cast iron, coated internally and externally with fusion-bonded epoxy.
4. A spring-loaded non-slam type check valve shall be installed on the discharge of each pump. The valve shall be a wafer style type fitted between two flanges. The head loss through the check valve shall not exceed 5 psi at the pump design capacity. Check valves 1-1/2" and smaller shall have a POM composite body and poppet, a stainless steel spring with EPDM or NBR seats. Check valves 2" and larger shall have a body material of stainless steel or epoxy coated iron (fusion bonded) with an EPDM or NBR resilient seat. Spring material shall be stainless steel. Disk shall be of stainless steel or leadless bronze.
5. For systems that require a diaphragm tank, a connection of no smaller than 3/4" shall be provided on the discharge manifold.
6. A pressure transducer shall be factory installed on the discharge manifold (or field installed as specified on plans). A factory installed pressure switch on the suction manifold for water shortage protection. Pressure transducers shall be made of 316 stainless steel. Transducer accuracy shall be +/- 1.0% full scale with hysteresis and repeatability of no greater than 0.1% full scale. The output signal shall be 4-20 mA with a supply voltage range of 9-32 VDC.
7. A bourdon tube pressure gauge, 2.5 inch diameter, shall be placed on the suction and discharge manifolds. The gauge shall be liquid filled and have copper alloy internal parts in a stainless steel case. Gauge accuracy shall be 2/1/2 %. The gauge shall be capable of a pressure of 30% above its maximum span without requiring recalibration.
8. The base frame shall be constructed of corrosion resistant 304 stainless steel. Rubber vibration dampers shall be fitted between each pumps and baseframe to minimize vibration.

I. TESTING

1. The entire pump station shall be factory tested for functionality. Functionality testing shall include the following parameters: Dry Run Protection, Minimum Pressure and Maximum Pressure alarms (where applicable), Setpoint Operation, and Motor Rotation.
2. The system shall undergo a factory hydrostatic test at the end of the production cycle. The system shall be filled with water and pressurized to 1.5 times the nameplate maximum pressure. Systems with 150# flange connections shall be tested at 350 psig, and systems with 300# flange connections shall be tested at 450 psig. The pressure shall be maintained for a minimum of 15 minutes with no leakage (slight leakage around pump(s) mechanical seal is acceptable) prior to shipment.

J. WARRANTY

1. The warranty period shall be a non-prorated period of 24 months from date of installation, not to exceed 30 months from date of manufacture.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install in-line pump with shaft horizontal unless otherwise indicated.
 1. Comply with requirements for hangers and supports specified in Division 23 Section "Hangers and Supports for Mechanical Piping and equipment."
- C. Pump must be designed for vertical mount if placed vertically,
- D. Install thermostats in hot-water return piping.

3.3 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
- D. Comply with Division 26 Sections for electrical connections, and wiring methods.

3.4 IDENTIFICATION

- A. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.5 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 6. Start motor.
 - 7. Open discharge valve slowly.
 - 8. Adjust temperature settings on thermostats.
 - 9. Adjust timer settings.

3.6 ADJUSTING

- A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated, or as recommended by manufacturer.

END OF SECTION 221123

SECTION 221423-STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to the work under Divisions 22 and 23.

1.2 SUMMARY

- A. Section Includes the following storm drainage piping specialties:
 1. Downspout boot adapter.
 2. Roof Drains.
 3. Cleanouts.
 4. Backwater Valves

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.5 COORDINATION

- A. Coordinate size and location of architectural downspouts.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

- A. Downspout Boot Adapters
 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products by one of the following:
 - a. Neehan R-4927
 - b. Zurn Plumbing Products Group; Specification Drainage Operation.
Barry Foundry
 2. Description: cast-iron soil pipe.
 3. Size: Coordinate size with architectural downspout and connecting round pipe. Match to existing.

B. Roof Drain And Overflow Drains

1. Main roof drain and overflow drains shall have a cast iron body with low silhouette polypropylene dome secured to be vandal resistant, sump receiver, combination flashing clamp/gravel guards and adjustable extension collar. Overflow drain shall have 2” high internal water dam.
 - a. Zurn – ZC 100
 - b. J. R. Smith 1011-U-CID, inside caulk joint
 - c. Josam
2. Roof and overflow drain outlet connection and the first pipe joint connection shall be cast iron hub and spigot with lead and oakum joint seals.
3. Install clevis hanger within 12” of the first 90 degree elbow, below the roof and overflow drains.
4. Roof drains located in canopies only shall have a side pipe connection in three locations. Coordinate and confirm connections arrangements prior to purchasing.

C. Downspout Nozzles

1. Downspout Nozzles shall be nickel bronze construction with, stainless steel screen, decorative wall flange and goose-bill spout. Provide factory optional finish as selected by the Architect. Downspout nozzles shall be of the size and quantity indicated on the drawings. Downspout nozzles in exterior walls for secondary overflow roof drainage discharge above grade.
 - a. Zurn- Z199 SS
 - b. J. R. Smith
 - c. Josam
 - d.

D. Area Drains

1. Area drains shall have a cast iron body with rotatable square promenade frame with seepage openings, frame clamps, Nickel Bronze top, Deck extension, Vandal proof secured top, heavy duty heel proof duresist grate and sediment bucket.
 - a. Zurn – ZN 150
 - b. J. R. Smith
 - c. Josam
2. Coordinate and confirm connections arrangements and pipe sizes prior to purchasing.

2.2 CLEANOUTS

A. Exposed Cast Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products by one of the following:
 - a. Zurn Plumbing Products Group; Specification Drainage Operation.
 - b. Josam Company; Josam Div.
 - c. MIFAB, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
2. Standard: ASME A112.36.2M fr cast iron for cleanout test tee.

3. Size: Same as connected drainage piping.
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersink, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. Oatey.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M, for threaded, adjustable housing cleanouts.
3. Size: Same as connected branch.
4. Body or Ferrule Material: Cast iron
5. Closure: Brass plug with tapered threads
6. Adjustable Housing Material: Cast iron with threads.
7. Frame and Cover Material and Finish: Nickel-bronze, copper alloy Frame and Cover
Shape: Preferably Round
8. Top-Loading Classification: Medium Duty.
9. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
10. Standard: ASME A112.3.1.
11. Size: Same as connected branch.

C. Cast-Iron Wall Cleanouts :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M,. Include wall access.
3. Size: Same as connected drainage piping.
4. Body Material: as required to match connected piping.
5. Closure: Countersunk brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.

2.3 BACKWATER VALVES

A. Cast-Iron, Horizontal Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.14.1, for backwater valves.
3. Size: Same as connected piping.
4. Body Material: Cast iron.
5. Cover: Cast iron with bolted access check valve.
6. End Connections: Hub and spigot.
7. Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
8. Extension: ASTM A 74, Service class; full-size, cast-iron soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install downspout boot adapters, connect to sheet metal downspouts and piping.
- B. Install downspout boots adapters at grade with top no more than 18 inches above grade or otherwise indicated. Secure to building wall.
- C. Install cleanouts. Cleanouts in walls must be within 2" of the finished wall or it must be extended to within 2" of the finished wall.
- D. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.
 1. Install roof-drain flashing collar or flange so there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 2. Position roof drains for easy access and maintenance.
 3. Install drains per manufacturer's requirements.
- E. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
 1. The same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical riser.
- F. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- G. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- H. Install horizontal backwater valves in floor with cover flush with floor.
- I. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- J. Install cast-iron downspout boots with top of hub 12 inches above floor/grade, or as indicated otherwise.
- K. Install downspout discharge nozzles at exposed bottom of conductors where they spill onto grade.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.4 TESTING

- A. Perform water tests on roof drain assemblies, including leader piping, and on gutter assemblies and scuppers. Plug roof drain bowl, and using 3/4 inch garden hose, fill sump area and bowl with water. Perform visual inspection below roof decking after thirty minutes. Then run water into the drainage components for thirty minutes. Inspect all drainage components for leakage and repair as required. If repair is needed to fix leaks, this shall be performed at no cost to owner.

END OF SECTION 221423

SECTION 224000-PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division Specification Sections, as applicable, shall apply to this section.

1.2 SUMMARY

- A. The work this Section of the Specification shall include the furnishing of labor, materials and equipment for the installation of complete system to provide continuous and satisfactory service.
- B. This Section includes the following conventional plumbing fixtures and related components:
 - 1. Sinks.
 - 2. Showers
 - 3. Service Sinks
 - 4. Clothes Washer Wall Box
 - 5. Can Washer
 - 6. Urinal

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.

- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, flow-control rates, diagram power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
- B. 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.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act" for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Solid-Surface-Material Sinks: ANSI/ICPA SS-1.

I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Faucets: ASME A112.18.1.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Engineered Brass Co.
- b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
- c. McGuire Manufacturing Co., Inc.
- d. Plumberex Specialty Products Inc.
- e. TCI Products.
- f. TRUEBRO, Inc.
- g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold- water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. TRUEBRO, Inc.

3. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

2.2 PLUMBING FIXTURES

A. Mounting Heights of Fixtures

1. To provide for the physically disabled, plumbing fixtures shall be provided for their use at a mounting height suitable for the disabled as set forth by the Federal Government. Fixtures for special uses need not meet this requirement. Fixture mounting heights are generally indicated on the drawings.
 2. Hot water and drain piping accessible to a wheelchair patient shall be suitably protected against high temperature by molded vinyl piping covers with access to shut-off valves, trap cleanout, etc. Insulation shall have out of sight fastening system, tie bands are not approved. Covers shall be Truebro 105/102.
- B. Hot and cold water connections to fixtures shall be provided with a stop valve. Stop valves, risers, etc. shall be commercial/institutional grade as manufactured by Brass Craft, Chicago, Engineered Systems or McGuire.
- C. Provide water temperature limiting device conforming ASSE 1070 as required by code.
- D. Provide metal supports necessary to adequately and substantially hang and set fixtures, supports must be floor mounted and anchored to the floor, no exceptions. Supports shall be Zurn, Josam or J. R. Smith and suitable for the wall thickness and piping arrangements shown.
- E. For sinks and fixtures specified under other Divisions or other contracts and not provided with faucets, tailpieces, traps, and stop valves; provide necessary fittings and completely connect the sinks and fixtures.
- F. Plumbing fixtures shall be caulked at wall and floor with silicone caulking material of same color as the fixture.
- G. All plumbing fixture trim is to have vandal resistant fittings and fasteners.
- H. Fixtures shall be as follows:
1. P-1A,P-1B, P-1C WATER CLOSET
 - a. See specification section 224213.13 Water Closet
 2. P-2A, P-2B, P-2C, P-2D, P-2E, LAVATORY
 - a. See specification section 224216.13 Lavatory
 3. P-3A SINK
 - a. Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 16 x 16 x 10 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - b. Model
 - 1) Elkay DLKQ202210
 - 2) Approved equal
 - c. Faucet – Concealed widespread faucet dual 2-5/8” lever handles, 11” Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439C
 - 2) Approved equal
 - d. Drain - stainless steel drain with removable grid strainer and tailpiece.
 - 1) Elkay LK99
 - 2) Approved equal

4. P-3B CLASSROOM SINK
 - a. ADA, Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 13-1/2 x 16 x 5-1/2 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - 1) Model
 - a) Elkay DRKAD222055
 - b) Approved equal
 - b. Faucet – Concealed widespread faucet dual 4” lever handles, 11” Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439BHC
 - 2) Approved equal
 - 3) Bubbler – Vandal resistant ADA Lead free bubbler. Comply with ANSI/NSF 61. Adjustable flow regulator and self -closing push bottom activator. Confirm mounting location with architectural drawings prior to purchase and installation.
 - a) Elkay LKSSVR1141A
 - b) Approved Equal
 - c. Drain - stainless steel drain with removable grid strainer and offset tailpiece.
 - 1) Elkay LK35
 - 2) Approved equal
 - d. Deck Mount Swivel-Type, Plumbed Eyewash Unit:
 - 1) Basis of Design Product: Subject to compliance with requirements, provide Bradley Model: S19-270 or comparable product by one of the following:
 - a) a. Acorn Safety; a division of Acorn Engineering Company.
 - b) b. Haws Corporation.
 - 2) Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - 3) Supply Piping: NPS 1/2 (DN 15) chrome-plated brass with flow regulator and stay-open control valve.
 - 4) Control-Valve Actuator: Movement of spray-head assembly to position over sink.
 - 5) Control Spray-Head Assembly: Two spray heads with offset piping.
 - 6) Mounting: Deck next to sink.
 - 7) Provide emergency thermostatic mixing valve Bradley S19-2000
 - 8) Confirm right or left hand mount with architectural drawings prior to purchase and installation.
5. P-3C CLASSROOM SINK
 - a. ADA, Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 13-1/2 x 16 x 5-1/2 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - 1) Model
 - a) Elkay DRKAD222055
 - b) Approved equal
 - b. Faucet – Concealed widespread faucet dual 4” lever handles, 11” Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439BHC
 - 2) Approved equal

- c. Bubbler – Vandal resistant ADA Lead free bubbler. Comply with ANSI/NSF 61. Adjustable flow regulator and self -closing push bottom activator. Confirm mounting location with architectural drawings prior to purchase and installation.
 - 1) Elkay LKSSVR1141A
 - 2) Approved Equal
 - d. Drain - stainless steel drain with removable grid strainer and offset tailpiece.
 - 1) Elkay LK35
 - 2) Approved equal
6. P-3D SINK (ART)
- a. ADA, Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 18 x 14 x 4-7/8 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - 1) Model
 - a) Elkay Iradq221950
 - b) Approved equal
 - b. Faucet – Concealed widespread faucet dual 4” lever handles, 11” Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439BHC
 - 2) Approved equal
 - c. Drain - stainless steel drain with removable grid strainer and offset tailpiece.
 - 1) Elkay LK99
 - 2) Approved equal
 - d. Provide a top access solids trap with removable stainless steel bucket and chrome plated brass or steel wall flange, Zurn Z-1180.
7. P-3E SINK (ART)
- a. Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 16 x 16 x 7-5/8 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - b. Model
 - 1) Elkay LR2022
 - 2) Approved equal
 - c. Faucet – Concealed widespread faucet dual 2-5/8” lever handles, 11” Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439C
 - 2) Approved equal
 - d. Drain - stainless steel drain with removable grid strainer and tailpiece.
 - 1) Elkay LK99
 - 2) Approved equal
 - e. Provide a top access solids trap with removable stainless steel bucket and chrome plated brass or steel wall flange, Zurn Z-1180.
8. P-3F SINK (SCIENCE)
- a. Provide drop in epoxy resin sink. Sink bowl is 18x15x5 with corner drain. Mount sink in counter furnished under another division.
 - b. Model
 - 1) Chemtops/Durcon model A25
 - 2) Approved equal

- c. Faucet – ADA, Polished chrome-plated double laboratory faucet with integral shank, quarter turn ceramic disc cartridges and a 6" centerline rigid gooseneck spout with vacuum breaker. Unit is furnished with a serrated nozzle, vandal-resistant 2 1/2" color-coded metal lever handles, mounting hardware and stainless steel flex connection hoses. Vandal resistant .5 gpm aerator.
 - 1) Zurn Z82601-6M
 - 2) Approved equal
 - d. Drain Outlet- Propylene.
 - 1) Chemtops/Durcon model OUTL-S03R
 - 2) Approved equal
 - e. Overflow Drain Outlet- Propylene.
 - 1) Chemtops/Durcon model OVRP-OE
 - 2) Approved equal
 - f. Sink Strainer Cap- Propylene.
 - 1) Chemtops/Durcon model STRN-BH-001
 - 2) Approved equal
 - g. Sink Stopper- Rubber.
 - 1) Chemtops/Durcon model STPR-02P
 - 2) Approved equal
 - h. Provide point of use PHX Cartridge Acid Neutralization system includes industrial strength glass filled polypropylene body with a 1-1/2" compression fitting inlet and 1-1/2 No Hum outlet, removable upper neutralization chamber and lower sediment collection chamber. Cartridge has a maximum flow of 8 gpm. System media, a mix of non-hazardous solid alkali non resin materials to neutralize acids in a self-contained system. Piping from sink to Acid Neutralization system shall be acid resistance such as HP PVDF.
9. P-3G SINK (SCIENCE)
- a. Provide drop in epoxy resin sink. Sink bowl is 18x15x5 with corner drain. Mount sink in counter furnished under another division.
 - b. Model
 - 1) Chemtops/Durcon model A25
 - 2) Approved equal
 - c. Faucet – ADA, Polished chrome-plated double laboratory faucet with integral shank, quarter turn ceramic disc cartridges and a 6" centerline rigid gooseneck spout with vacuum breaker. Unit is furnished with a serrated nozzle, vandal-resistant 2 1/2" color-coded metal lever handles, mounting hardware and stainless steel flex connection hoses. Vandal resistant .5 gpm aerator.
 - 1) Zurn Z82601-6M
 - 2) Approved equal
 - d. Drain Outlet- Propylene.
 - 1) Chemtops/Durcon model OUTL-S03R
 - 2) Approved equal
 - e. Overflow Drain Outlet- Propylene.
 - 1) Chemtops/Durcon model OVRP-OE
 - 2) Approved equal
 - f. Sink Strainer Cap- Propylene.
 - 1) Chemtops/Durcon model STRN-BH-001
 - 2) Approved equal
 - g. Sink Stopper- Rubber.
 - 1) Chemtops/Durcon model STPR-02P

- 2) Approved equal
 - h. Deck Mount Swivel-Type, Plumbed Eyewash Unit:
 - 1) Basis of Design Product: Subject to compliance with requirements, provide Bradley Model: S19-270 or comparable product by one of the following:
 - a) a. Acorn Safety; a division of Acorn Engineering Company.
 - b) b. Haws Corporation.
 - 2) Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - 3) Supply Piping: NPS 1/2 (DN 15) chrome-plated brass with flow regulator and stay-open control valve.
 - 4) Control-Valve Actuator: Movement of spray-head assembly to position over sink.
 - 5) Control Spray-Head Assembly: Two spray heads with offset piping.
 - 6) Mounting: Deck next to sink.
 - 7) Provide emergency thermostatic mixing valve Bradley S19-2000
 - 8) Confirm right or left hand mount with architectural drawings prior to purchase and installation.
 - i. Provide point of use PHX Cartridge Acid Neutralization system includes industrial strength glass filled polypropylene body with a 1-1/2" compression fitting inlet and 1-1/2 No Hum outlet, removable upper neutralization chamber and lower sediment collection chamber. Cartridge has a maximum flow of 8 gpm. System media, a mix of non-hazardous solid alkali non resin materials to neutralize acids in a self-contained system. Piping from sink to Acid Neutralization system shall be acid resistance such as HP PVDF.
10. P-3H SINK (SCIENCE)
- a. Provide drop in epoxy resin sink. Sink bowl is 18x15x7-1/2 with corner drain. Mount sink in counter furnished under another division.
 - b. Model
 - 1) Chemtops/Durcon model D25
 - 2) Approved equal
 - c. Faucet – Polished chrome-plated double laboratory faucet with integral shank, quarter turn ceramic disc cartridges and a 6" centerline rigid gooseneck spout with vacuum breaker. Unit is furnished with a serrated nozzle, vandal-resistant 2 1/2" color-coded metal lever handles, mounting hardware and stainless steel flex connection hoses. Vandal resistant .5 gpm aerator.
 - 1) Zurn Z82601-6M
 - 2) Approved equal
 - d. Drain Outlet- Propylene.
 - 1) Chemtops/Durcon model OUTL-S03R
 - 2) Approved equal
 - e. Overflow Drain Outlet- Propylene.
 - 1) Chemtops/Durcon model OVRP-OE
 - 2) Approved equal
 - f. Sink Strainer Cap- Propylene.
 - 1) Chemtops/Durcon model STRN-BH-001
 - 2) Approved equal
 - g. Sink Stopper- Rubber.
 - 1) Chemtops/Durcon model STPR-02P
 - 2) Approved equal

- h. Provide point of use PHX Cartridge Acid Neutralization system includes industrial strength glass filled polypropylene body with a 1-1/2" compression fitting inlet and 1-1/2 No Hum outlet, removable upper neutralization chamber and lower sediment collection chamber. Cartridge has a maximum flow of 8 gpm. System media, a mix of non-hazardous solid alkali non resin materials to neutralize acids in a self-contained system. Piping from sink to Acid Neutralization system shall be acid resistance such as HP PVDF.
11. P-3J SINK
- a. ADA, Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 13-1/2 x 16 x 5-1/2 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - 1) Model
 - a) Elkay DRKAD222055
 - b) Approved equal
 - b. Faucet – Concealed widespread faucet dual 4" lever handles, 11" Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439BHC
 - 2) Approved equal
 - c. Drain - stainless steel drain with removable grid strainer and offset tailpiece.
 - 1) Elkay LK35
 - 2) Approved equal
12. P-3K SINK
- a. ADA, Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 13-1/2 x 16 x 5-1/2 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - 1) Model
 - a) Elkay DRKAD222055
 - b) Approved equal
 - b. Faucet – Concealed widespread faucet dual 4" lever handles, 11" Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439BHC
 - 2) Approved equal
 - c. Drain - stainless steel drain with removable grid strainer and offset tailpiece.
 - 1) Elkay LKD35
 - 2) Approved equal
13. P-3L SINK (DOUBLE)
- a. ADA, Double compartments 18 gauge, type 304 stainless steel, drop in sink. Each sink bowl shall be 12 x 12 x 6-1/2 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - 1) Model
 - a) Elkay LRAD291865PD
 - b) Approved equal
 - b. Faucet – Concealed widespread faucet dual 4" lever handles, 11" Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.

- 1) Elkay LKD2439BHC
 - 2) Approved equal
 - c. Drain - stainless steel drain with removable grid strainer and offset tailpiece.
 - 1) Elkay LKDS99
 - 2) Approved equal

- 14. P-4 SHOWER
 - a. Enclosure provided under Architectural Division.
 - b. Shower Valve –Pressure Balance, ADA.
 - 1) Bradley Equa-Flo
 - 2) Approved equal
 - c. Shower System Faucet/kit- lever handle, single control, Pressure balancing valve, 36” slide bar, 59” metal shower hose. Faceplate and vacuum breaker shall be chrome plated. FloWise showerhead shall be 3-function, ADA compliant and limited to 1.5 GPM.
 - 1) Model
 - a) American Standard 1662SG.211
 - b) Approved equal
 - d. Drain 2” outlet – cast iron adjustable nickel bronze 8 inch round strainer.
 - 1) Zurn Z415B
 - 2) J. R. Smith

- 15. P-5 SERVICE SINK
 - a. 36 x 24 inch molded stone basin with 10 inch high sides, cast-in strainer, stainless steel caps on curbs.
 - 1) Model
 - a) Fiat - MSB-3624
 - b) Stern Williams
 - b. Faucet - wall mounted with vacuum breaker, integral stops, adjustable wall brace, pail hook, and hose end.
 - 1) Fiat - 830-AA
 - 2) Stern Williams
 - c. Hose and Hose Bracket - heavy duty hose with chrome coupling and stainless steel bracket with rubber grip.
 - 1) Fiat - 832-AA
 - 2) Stern Williams
 - d. Mop Hanger - stainless steel bracket with 3 rubber grips.
 - 1) Fiat - 889-CC
 - 2) Stern Williams
 - e. Silicone Sealant
 - 1) Fiat - 833-AA
 - 2) Stern Williams

- 16. P-6 DOMESTIC CLOTHES WASHER
 - a. Provided by owner or under another division of the specification. Provide connections only and make connection under division 22.
 - b. Washing machine standpipe box.
 - 1) Provide washing machine standpipe box suitable for flush mounting. Box shall be constructed of galvanized steel with lead free domestic valve and overflow guard. Valves shall comply with ASME A112.18.1.

- 2) Provide “Duo-Cloz” ball valve assembly with hose ends to control hot and cold water supplies with a single lever. Provide vacuum breakers on hot and cold water supplies.
 - 3) Standpipe box shall be Guy Gray model BB200TS or Symmons W602.
17. P-7 DOMESTIC CLOTHES DRYER
- a. Provided by owner or under another division of the specification.
18. P-8 WATER COOLER
- a. See specification section 224700 Drinking Fountains and Water Coolers
19. P-9 WATER COOLER AND BOTTLE FILL
- a. See specification section 224700 Drinking Fountains and Water Coolers
20. P-10 CAN WASHER
- a. Square cast iron can wash drain with acid resisting interior, double drainage flange with weepholes, bottom outlet, removable sediment bucket, bronze spray nozzle assembly and nikaloy rim and light-duty nikaloy secured grate. Provide vandal proof screws, prime adapter water supply control box.
 - 1) Josam series 49870a
 - b. Dual temperature remote supply box of 304 stainless steel. Includes ½” compression valves, vacuum breaker and screwdriver stops. Door provided with cam and cylinder lock.
 - 1) Josam (-98)
21. P-11 URINAL
- a. White vitreous china, syphon jet action, wall hung urinal and 3/4" top spud. Provide with the appropriate carrier system to accommodate the piping arrangement and wall cavity restrictions. Provide heights as indicated on architectural and ADA compliant.
 - 1) Model
 - a) American Standard - WashbrookFlowise - 6590.001
 - b. Flush Valve:
 - 1) Manufacturer:
 - a) Royal 186
 - 2) Standard: ASSE 1037.
 - 3) Hard wired sensor with override button and transformer
 - 4) Features: Include integral check stop and backflow-prevention device.
 - 5) 11-1/2” Exposed Flushometer-Valve Finish: Chrome plated.
 - 6) Style: Exposed.
 - 7) Consumption: .125 gal. per flush.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install wall-mounting fixtures with tubular waste piping attached to supports.
- C. Install counter-mounting fixtures in and attached to casework.
- D. Install fixtures level and plumb according to roughing-in drawings.
- E. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- F. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- G. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- H. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- I. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- J. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- K. Provide and install water temperature limiting devices as required by code.
- L. Install per manufacturer's requirements.
- M. Install traps on fixture outlets.
- N. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- O. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 224213.13-COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division Specification Sections, as applicable, shall apply to this section.

1.2 SUMMARY

- A. Section includes:
 - 1. Water closets.
 - 2. Flush valves.
 - 3. Toilet seats.
 - 4. Fixture supports.
- B. The work under this Section of the Specification shall include the furnishing of labor, materials and equipment for the installation of complete system to provide continuous and satisfactory service.
- C. Related Sections
 - 1. Division 10 Section “Toilet and Bath Accessories”
 - 2. Division 22 Section “Domestic Water Piping Specialties”.
 - 3. Section 224216.13 “Commercial Lavatories.”

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 water closets.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Provide informational submittals in Operation and Maintenance Manuals in addition to action submittals and section 017823 “Operation and Maintenance Data”.
- B. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WATER CLOSETS

- A. P-1A Water Closet: Floor mounted, back outlet, top spud. ADA Compliant.
1. Manufacturers: Subject to compliance with requirements, provide products by Zurn or comparable product of one of the following:
 - a. Model
 - 1) Zurn Z-5645-BWL
 - 2) Kohler
 - 3) Sloan
 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: ADA Compliant (16-3/4" to top of bowl).
 - f. Rim Contour: Universal/Elongated.
 - g. Water Consumption: Dual 1.6/1.1 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
 - i. Color: White
 3. Flushometer Valve:
 - a. Manufacturer:
 - 1) Sloan WES 111
 - b. ADA Compliant
 - c. Standard: ASSE 1037.
 - d. Features: Include integral check stop and backflow-prevention device, Antimicrobial coating on handle
 - e. Exposed Flushometer-Valve Finish: Chrome plated.
 - f. Style: Exposed.
 - g. Consumption: High Efficiency, dual 1.6/1.1 gal. per flush.
 4. Toilet Seat:
 - a. Manufacturer: Olsonite #95
 - b. Standard: IAPMO/ANSI Z124.5.
 - c. Material: Plastic.
 - d. Type: Commercial (Heavy Duty).
 - e. Shape: Elongated rim, open front without cover.
 - f. Hinge: Self Sustaining Concealed check.
 - g. Hinge Material: Stainless steel posts and Pintles.
 - h. Color: White.
 5. Support:
 - a. Standard: ASME A112.6.1M.
 - b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space. Floor mounted supports shall be provided, NO Exceptions.
 - c. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

- B. P-1B Water Closet: Floor mounted, back outlet, top spud. Youth Standard/ADA Compliant.
1. Manufacturers: Subject to compliance with requirements, provide products by Zurn or comparable product of one of the following:
 - a. Model
 - 1) Zurn Z-5635-BWL
 - 2) Kohler
 - 3) Sloan
 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: ADA Compliant (14" to top of bowl).
 - f. Rim Contour: Universal/Elongated.
 - g. Water Consumption: Dual 1.6/1.1 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
 - i. Color: White
 3. Flushometer Valve:
 - a. Manufacturer:
 - 1) Sloan WES 111
 - b. ADA Compliant
 - c. Standard: ASSE 1037.
 - d. Features: Include integral check stop and backflow-prevention device, Antimicrobial coating on handle
 - e. Exposed Flushometer-Valve Finish: Chrome plated.
 - f. Style: Exposed.
 - g. Consumption: High Efficiency, dual 1.6/1.1 gal. per flush.
 4. Toilet Seat:
 - a. Manufacturer: Olsonite #95
 - b. Standard: IAPMO/ANSI Z124.5.
 - c. Material: Plastic.
 - d. Type: Commercial (Heavy Duty).
 - e. Shape: Elongated rim, open front without cover.
 - f. Hinge: Self Sustaining Concealed check.
 - g. Hinge Material: Stainless steel posts and Pintles.
 - h. Color: White.
 5. Support:
 - a. Standard: ASME A112.6.1M.
 - b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space. Floor mounted supports shall be provided, NO Exceptions.
 - c. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.
- C. P-1C Water Closet: Floor mounted, bottom outlet, top spud. ADA Compliant.
1. Manufacturers: Subject to compliance with requirements, provide products by American Standard or comparable product of one of the following:
 - a. Model
 - 1) American Standard Baby DeVoro 2282.001

- 2) Kohler
 - 3) Sloan
 - 4) Zurn
2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: ADA Compliant (10.25" to top of bowl).
 - f. Rim Contour: Universal/Elongated.
 - g. Water Consumption: Dual 1.6/1.1 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
 - i. Color: White
 3. Flushometer Valve:
 - a. Manufacturer:
 - 1) Sloan WES 111
 - b. ADA Compliant
 - c. Standard: ASSE 1037.
 - d. Features: Include integral check stop and backflow-prevention device, Antimicrobial coating on handle
 - e. Exposed Flushometer-Valve Finish: Chrome plated.
 - f. Style: Exposed.
 - g. Consumption: High Efficiency, dual 1.6/1.1 gal. per flush.
 4. Toilet Seat:
 - a. Manufacturer: Olsonite #95
 - b. Standard: IAPMO/ANSI Z124.5.
 - c. Material: Plastic.
 - d. Type: Commercial (Heavy Duty).
 - e. Shape: Elongated rim, open front without cover.
 - f. Hinge: Self Sustaining Concealed check.
 - g. Hinge Material: Stainless steel posts and Pintles.
 - h. Color: White.
 5. Support:
 - a. Standard: ASME A112.6.1M.
 - b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space. Floor mounted supports shall be provided, NO Exceptions.
 - c. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

2.2 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.3 INSTALLATION

- A. Water-Closet Installation:
 - 1. Install level and plumb according to roughing-in drawings.
- B. Flush-Valve Installation:
 - 1. Install flush-valve, water-supply fitting on each supply to each water closet.
 - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
- C. Install toilet seats on water closets.
- D. No offset toilet flanges allowed.
- E. Wall Flange and Escutcheon Installation:
 - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
 - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
- F. Joint sealing:
 - 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 - 2. Match sealant color to water-closet color.
 - 3. Comply with sealant requirements specified in Section 079200 “Joint Sealants.”

2.4 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 “Domestic Water Piping.”
- C. Comply with soil and waste piping requirements specified in Section 221316 “Sanitary Waste and Vent Piping.”
- D. Compression valves are not permitted on domestic water.
- E. Where installing piping adjacent to water closets, allow space for service and maintenance.

2.5 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flush valves to produce proper flow.

2.6 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers’ recommended cleaning methods and materials.

- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 260501- GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

- A. Provide all labor, materials, equipment and services necessary for and incidental to the complete installation and operation of all electrical work.
- B. All work under this Division is subject to the General Conditions and Special Requirements for the entire contract.
- C. Unless otherwise specified, all shop drawings and submissions required under Division 26 shall be made to, and acceptances and approvals made by, the ENGINEER.
- D. Conform to the requirements of all rules, regulations, and codes of local, state, and federal authorities having jurisdiction. Conform to the National Electrical Code and all NECA – National Electrical Installation Standards (NEIS).
- E. Perform the work in a first-class, substantial, and workmanlike manner. Any materials installed which do not present an orderly and neat workmanlike appearance shall be removed and replaced when so directed by the Engineer, at the Contractor's expense.
- F. Coordinate the work of all trades.
- G. Arrange conduit, wiring, equipment, and other work generally as shown, providing proper clearances and access. Carefully examine all contract drawings and fit the work in each location without substantial alteration. Where departures are proposed because of field conditions or other causes, prepare and submit detailed drawings for approval in accordance with "Submittals" specified below. The right is reserved to make reasonable changes in location of equipment, conduit, and wiring up to the time of rough-in or fabrication.
- H. The contract drawings are generally diagrammatic and all offsets, bends, fittings, and accessories are not necessarily shown. Provide all such items as may be required to fit the work to the conditions.
- I. Be responsible for all construction means, methods, techniques, procedures, and phasing sequences used in the work. Furnish all tools, equipment and materials necessary to properly perform the work in a first class, substantial, and workmanlike manner, in accordance with the full intent and meaning of the Contract Documents.
- J. The Contractor shall provide other work and services not otherwise included in the Contract Documents that are customarily forwarded in accordance with generally-accepted construction practices.

1.2 PERMITS, INSPECTIONS, AND FEES:

- A. The Contractor shall obtain and pay for all charges and fees, and deliver all permits, licenses, certificates of inspection, etc., required by the authorities having jurisdiction. Deliver inspection, approval, and other certificates to the Owner prior to final acceptance of the work.
- B. File necessary plans, prepare documents, give proper notices, and obtain necessary approvals.
- C. Permits and fees shall comply with the General Requirements of the Specification.
- D. The Owner will pay for the building permit.
- E. Notify Inspection Authorities to schedule inspections of work. All work shall be subject to field inspections.
- F. Notify Architect in advance of scheduled inspections.
- G. An electrical foreman, superintendent or other supervisor shall be in attendance for all scheduled inspections.
- H. The Contractor shall provide an electrical certificate from an independent electrical inspection agency approved by the Owner and the State Fire Marshal. The Contractor shall submit certificate prior to final payment invoice. The Contractor shall pay all fees, including filing fees.

1.3 ELECTRICAL WORK UNDER OTHER DIVISIONS:

- A. Mechanical Equipment and Systems
 - 1. In general, power wiring and motor starting equipment for mechanical equipment and systems are furnished and installed under Electrical Division 26.
 - 2. Certain mechanical units contain starters, contacts, transformers, fuses, wiring, etc., required for fans, pumps, etc., furnished with the equipment from the factory. When this equipment is supplied from the factory, the Contractor must supply power circuit(s) to the unit and a disconnecting means. Coordinate with Contractor so that one, and only one, set of starters, fuses, switches, etc., is provided and installed.
 - 3. In general, control and interlock equipment for HVAC systems (including associated wiring, conduit, transformers, relays, contacts, etc.) is furnished under Mechanical Divisions. Contractor shall install and connect all such equipment as necessary.
 - 4. Controls, wiring, conduit, transformers, etc., for smoke, fire, and motor-operated dampers are provided by Mechanical Contractor. Electrical shall install and connect all such equipment.
- B. Architectural Equipment: In general, any electrically operated or controlled equipment furnished under architectural divisions shall be supplied with control wiring, transformers, contacts, etc. Contractor shall provide power circuits to such equipment and install all electrical control equipment related thereto.
- C. Carefully review the contract documents and coordinate the electrical work under the various Divisions.

1.4 CONTRACTOR QUALIFICATION:

- A. Any Contractor performing work under this Division shall be fully qualified and acceptable to the Engineer. Submit the following evidence for approval:
 - 1. A list of not less than five (5) comparable projects that the Contractor completed.
 - 2. Letters of reference from not less than three (3) registered professional engineers, contractors, or building owners, explaining Contractor proficiency, quality of work, or other attribute on projects of similar size or substance.
 - 3. Membership in trade or professional organization where required.
 - 4. Copy of Master Electrician’s License.
- B. Contractor is any individual, partnership, corporation, or firm performing work by Contract or subcontract on this project. Corporations should be in Good Standing with the State.
- C. Acceptance of a subcontractor will not relieve the Contractor of any contractual requirements or his responsibility to supervise and coordinate the various trades.
- D. Supervisory Qualifications: The electrical work on the project shall be under the direct supervision of a licensed Master Electrician.
- E. Qualifications of Installers:
 - 1. For the actual fabrication, installation, and testing of the work, the Contractor shall use only thoroughly trained, experienced, and certified journeyman who are completely familiar with the requirements of this work and with the installation recommendations of the manufacturers of the specified items.
 - 2. The Electrical Installer shall utilize a full-time project foreman in charge of all electrical work. This person shall be fully qualified and experienced in such work and shall be available, on site, at all times during Construction. All problems, questions, coordination, etc., relating to electrical work shall take place through this person to the Architect.
- F. Qualifications of Video Tape Technician: For videotaping specified in “Operating Instructions”, the Contractor shall provide the services of persons skilled in videotape production and editing.

1.5 FIRE SAFE MATERIALS:

- A. Unless otherwise indicated, materials and equipment shall conform to UL, NFPA, or ASTM Standards for Fire Safety with Smoke and Fire Hazard Rating not exceeding flame spread of 25 and smoke developed of 50.

1.6 REFERENCED STANDARDS, CODES, ORDINANCES AND SPECIFICATIONS

- A. Specifications, Codes and Standards listed below are included as part of this specification, latest edition.

ADA	Americans with Disabilities Act

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
IBC	International Building Code
CABO	Council of American Building Officials
FM	Factory Mutual
IEEE	Institute of Electrical and Electronics Engineers
MOSHA	Maryland Occupational Safety & Health Administration
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety & Health Administration
UL	Underwriters Laboratories

- B. All electrical equipment and materials shall comply with the Codes and Standards listed in the latest edition of IEEE Standard 241, *Electric Power Systems in Commercial Buildings*, Chapter 1, Section 1.6, entitled “Codes and Standards”.
- C. Comply with all Codes applicable to the work:
1. Bidders shall inform themselves of all local and state codes and regulations.
 2. In case of conflict between Contract Documents and governing Codes, the most stringent shall take precedence. Where, in any specific case, different sections of any applicable codes or when Drawings and Specifications specify different materials, methods of Construction, or other requirements, the most restrictive shall govern.
 3. Where Contract Documents exceed minimum Code requirements, and are permitted under the Code, the Contract Documents take precedence and shall govern.
 4. No extra payment will be allowed for work or changes required by local Code enforcement authorities.

- D. Underwriters Laboratories Labels shall apply to all materials and devices, etc., except specified items not covered by existing UL Standards.
- E. Conflicts with applicable regulations:
 - 1. Resolve at Contractor's expense.
 - 2. Prepare and submit details of alternate construction:
 - a. Acceptable solution of conflict.
 - b. List of substitute materials:
For approval of inspecting authorities.
For approval of Engineer.
- F. Comply with all NECA's National Electrical Installation Standards (NEIS), including NECA 1-2000 "Standard Practices for Good Workmanship in Electrical Contracting".

1.7 INTERPRETATION OF DOCUMENTS

- A. Any discrepancies between Drawings, Specifications, Drawings and Specifications, or within Drawing and Specifications shall be promptly brought to the attention of the Owner during the bidding period. No allowance shall subsequently be made to the Contractor by reason of his failure to have brought said discrepancies to the attention of the Owner during the bidding period or of any error on the Contractor's part.
- B. The locations of products shown on Drawings are approximate. The Contractor shall place the devices to eliminate all interference with above-ceiling ducts, piping, etc. Where any doubt exists, the exact location shall be determined by the Owner and Architect.
- C. All general trades and existing conditions shall be checked before installing any outlets, power wiring, etc.
- D. Equipment sizes shown on the Drawings are estimated. Before installing any wire or conduit, the Contractor shall obtain the exact equipment requirements and install wire, conduit, or other item of the correct size for the equipment actually installed. However, wire and conduit sizes shown on the Drawings shall be taken as a minimum and shall not be reduced without written approval from the Architect/Engineer.
- E. Where variances occur between the drawings and specifications or within either document itself, the item or arrangement of better quality, greater quality, or higher cost shall be included in the Contract Price. The Engineer will decide on the item and manner in which the work shall be installed.
- F. Contract Drawings are generally diagrammatic and all offsets, fittings, transitions, and accessories are not necessarily shown. Furnish and install all such items as may be required to fit the work to the conditions encountered. Arrange conduits, equipment, and other work generally as shown on the Contract Drawings, providing proper clearance and access. Where departures are proposed because of field conditions or other causes, prepare and submit detailed Shop Drawings for approval in accordance with "submittals" specified below. The right

is reserved to make reasonable changes in location of equipment, piping, and ductwork, up to the time of rough-in or fabrication.

- G. Work not specifically outlined, but reasonably incidental to the completion of the work, shall be included without additional compensation from the Owner.

1.8 CUTTING AND PATCHING

- A. The cutting of walls, floors, partitions, etc., for the passage and/or accommodation of conduits, etc., the closing of superfluous openings and the removal of all debris caused by said work under this contract shall be performed by and at the expense of the Electrical Contractor.
- B. No cutting of any structure or finishes shall be done until the condition requiring such cutting has been examined and approved by the Architect.
- C. All surfaces disturbed as a result of such cutting shall be restored under this division to match original work and all materials used for any patching, mending or finishing must conform to the class of materials originally installed.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material and equipment installed as a part of the permanent installation shall be new, unless otherwise indicated or specified, and shall be approved by the Underwriters' Laboratories, Inc., for installation in each particular case where standards have been established.
- B. Where material or equipment is identified by proprietary name, model number, and/or manufacturer, furnish the named item or equivalent thereof, subject to acceptance.
- C. Material submissions shall conform to requirements outlined in SUBMITTALS, REVIEW, AND ACCEPTANCE.
- D. The suitability of named item only has been verified. Where more than one Manufacturer is named, only the first named Manufacturer has been verified as suitable alternate. Manufacturers and items other than the first named shall be equal or better in quality and performance to that of specified items, and must be suitable for available space, required arrangement, and application. Submit all data necessary to determine suitability of alternate manufacturers for review. Provide a list company proposed and specified products and performance on the first page of the submittal. Failure to clearly identify differences will result in the submittal being returned as "Revise and Resubmit". The Contractor, by providing other than the first named Manufacturer, assumes responsibility for all necessary adjustments and modifications necessary for a satisfactory installation.
- E. The Contractor shall only submit those manufacturers indicated in the Specification. Proposed manufacturers other than those indicated will not be considered unless the specific item

indicates “or as approved equal”. Submit all data necessary to determine suitability of substituted items for approval. Failure to do so will result in a “Revise and Resubmit” response.

- F. All items of equipment furnished shall have a service record of at least five (5) years.

2.2 SUBSTITUTIONS

- A. Substituted items or items other than those named shall be equal or better in quality and performance and must be suitable for the available space, required arrangement, and application. Submit any and all data necessary to determine the suitability of substituted items. The Contractor shall be responsible for correct application, placement, and installation of substituted equipment. Cost savings data shall also be submitted with submittal data for substituted items. Total cost savings or a per-unit saving to the Owner shall be clearly indicated. If a substituted item is accepted, all cost savings shall be returned to the Owner as a credit.
- B. Substitutions will not be permitted for specific items of material or equipment where specifically indicated.
- C. For substituted items, clearly list on the first page of the submittal all differences (i.e. paragraph-by-paragraph, performance differences, physical differences, etc.) between the specified item and the proposed item. The Contractor shall be responsible for corrective action (or replacement with the specified item) while maintaining the specification requirements if differences have not been clearly indicated in the submittal.
- D. Where the Contractor proposes to use an item of equipment or application other than that specified or detailed on the Drawings, which requires any redesign of the structure, partitions, foundation, HVAC, piping, wiring, or any other part of the mechanical, electrical, or architectural layout, all such redesign and all new drawings and detailing required thereafter shall be prepared by the Contractor at his own expense for review by the Owner representative, Architect and Engineer before any such work is implemented.
- E. All Contractor-proposed changes and revisions shall be at the Contractor’s risk and expense. The Contractor shall fully coordinate all revisions, substitutions and changes with other trades. The Contractor shall provide all necessary provisions, including HVAC, ventilation, foundations, access, etc., for a complete, code compliant, and fully functional installation.
- F. Where the Contractor elects to submit a substitution for equipment or materials, he shall:
 - 1. Submit Shop Drawings that show complete compliance to each statement or requirement of the Specifications.
 - 2. Submit certified test data from an independent testing laboratory for each product.
 - 3. Submit one complete working sample of the equipment or materials to be furnished. In cases involving large or heavy items of equipment, the Owner may waive the requirement to submit the sample.
- G. Failure to comply with the above-required submissions shall constitute an automatic rejection of the substitution.

2.3 SUBMITTALS, REVIEW, AND ACCEPTANCE

A. General:

1. The equipment, material, installation, workmanship, arrangement of work, final instruction, and final documentation is subject to review and acceptance. No substitution will be permitted after acceptance of equipment or materials except where such substitution is considered by the Engineer to be in the best interest of the Owner. Submit for review in clear and legible form the following documents:
 - a. Material and Equipment List
 - b. Descriptive Data
 - c. Shop Drawings
 - d. Installation and Coordination Drawings
 - e. Contractor As-Built Drawings
 - f. Owner Instructions and Manuals
 - g. Construction Phasing and Outage Schedule
2. Prepare all submittals specifically for this project and stamp each submittal in a form indicating that the documents have been Contractor reviewed, are complete, and are in compliance with the requirements of the plans and specifications. Each submittal item shall be clearly identified and numbered. Each submittal shall contain a complete schedule of Manufacturer's part numbers and quantity listings of all supplied components. Each proposed item shall be highlighted and tagged with a star, an arrow, etc., including all options and accessories.
3. Coordinate the installation requirements and any mechanical requirements for the equipment submitted. Submittals will be reviewed for general compliance with design concept in accordance with the contract documents. The Contractor is responsible for the correctness of all submittals. Reviews will not verify dimensions, quantities, or other details.
4. Identify all submittals, indicating the intended application, location, or service of the submitted item. Refer to specification sections or paragraphs where applicable. Clearly indicate the exact type, model number, size, and special features of the proposed item. Clearly list on the first page of the Submittal all differences between the specified item and the proposed item. The Contractor shall be responsible for corrective action (or replacement with the specified item) while maintaining the specification requirements, if differences have not been clearly indicated in the submittal. Submittals of a general nature will not be acceptable.
5. Submit actual operating conditions or characteristics for all equipment where required capacities are indicated. Factory order forms showing only required capacities will not be acceptable. Indicate all options used to meet the specifications. It is not the responsibility of the Engineer or Owner to make selections of factory options other than colors. Submittals lacking proper selection of factory options or special features required by the specification shall be RETURNED WITHOUT REVIEW.
6. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted.
7. Documents of general form indicating options shall be clearly marked to show what is specifically proposed for this project.
8. Submittals NOT IN COMPLIANCE with the requirements of this section will be RETURNED WITHOUT REVIEW.

- B. Material, Equipment, Manufacturer and Subcontractor List: Within 30 calendar days after the award of contract, submit a complete MATERIAL, EQUIPMENT, MANUFACTURER AND SUBCONTRACTOR LIST for preliminary review. List all proposed materials and equipment, the associated proposed Manufacturer, and any proposed subcontractors. After the receipt of reviewed Material and Equipment List, submit complete Shop Drawings for approval. List all materials and equipment, indicating manufacturer, type, class, model, curves, and other general identifying information. Submittals shall be specific for each building as contained in the individual building Specifications and Drawings.
- C. Upon approval of the List of Materials, the Contractor shall prepare a complete Master Submittal Register, listing all products and materials that will be submitted for approval. Items shall be listed by referenced specification paragraph in ascending order. This master list shall be included with each submittal, updated to reflect the status of approval for each item, and shall highlight the items pertaining to the submittal. A suggested Submittal Register Format is shown below:

SUBMITTAL REGISTER					
Item/Material	Ref'd Spec. Paragraph	Specified or Substitute	Submittal Date	Status	Remarks

- D. No Shop Drawing Submittals will be considered for approval until the complete List of Subcontractors and the complete List of Materials/Manufacturers and Equipment have been approved.
- E. Descriptive Data: After acceptance of the MATERIAL and EQUIPMENT LIST, submit additional DESCRIPTIVE DATA for all items. Data shall consist of specifications, data sheets, samples, capacity ratings, performance curves, operating characteristics, catalog cuts, dimensional drawings, installation instructions, and any other information necessary to indicate complete compliance with the contract documents. Where several ratings or sizes are shown or available, clearly indicate the exact size or rating relating to the particular device being proposed.
- F. Submit complete descriptive data for all items. Data shall consist of Specifications, data sheets, samples, capacity ratings, performance curves, operating characteristics, catalog cuts, dimensional drawings, wiring diagrams, specific electrical/wiring requirements and connections including control and interlock wiring, installation instructions, and any other information necessary to indicate complete compliance with the Contract Documents. Edit submittal data specifically for application to this project.

- G. Shop Drawings shall be submitted and approved for all materials and equipment prior to installation. If any material and/or equipment is installed prior to receipt by the Contractor of approved Shop Drawings, the Contractor is liable for its replacement at no additional cost to the Owner.
- H. Data submitted shall include information on all materials and equipment to demonstrate compliance with the Contract Drawings and Specifications. Where installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.
- I. Any deviation of submitted material or equipment from the Contract Drawings or Specifications shall be clearly marked in red ink on Submittals, and itemized in a transmittal letter, in order to receive consideration for approval.
- J. Approval of material or equipment submittals containing deviations not specifically identified by Contractor shall not relieve the Contractor from compliance with specified requirements.
- K. Thoroughly review and stamp all submittals to indicate compliance with Contract requirements prior to submission. Coordinate installation requirements and any electrical requirements for equipment submitted. Contractor shall be responsible for correctness of all submittals.
- L. Submittals will be reviewed for general compliance with design concept in accordance with Contract Documents, but dimensions, quantities, or other details will not be verified.
- M. Increase, by the quantity listed below, the number of electrical related Shop Drawings, product data, and samples submitted, to allow for required distribution plus two copies of each submittal required, which will be retained by the Electrical Consulting Engineer.
 - 1. Shop Drawings - Initial Submittal: 1 additional blue- or black-line print.
 - 2. Shop Drawings - Final Submittal: 1 additional blue- or black-line print.
 - 3. Product Data: 1 additional copy of each item.
- N. Additional copies may be required by individual sections of these Specifications.
- O. Shop Drawings (include but not limited to):
 - 1. Prepare and submit SHOP DRAWINGS AND/OR DIAGRAMS for all specially fabricated items, modifications to standard items, specially designed systems where detailed design is not shown on the contract drawings, or where the proposed installation differs from that shown on the contract drawings.
 - 2. Shop drawings shall include plans, elevations, sections, mounting details of component parts, point to point interconnection diagrams, elementary diagrams, single line diagrams, and any other drawings necessary to show the fabrication and connection of the complete item or system.
 - 3. Shop drawings shall be provided for, but not limited to the following items:

Analysis and Coordination Study

Automatic Transfer Switches
Ballasts
Basic Electrical Materials
Cable - 600 volt
Cable – Medium Voltage
Cable Tray
Circuit Breakers
Conduit and Surface Raceway
Contractor and Subcontractor Qualifications
Controllers & Control Devices
Cord Reels
Disconnects
Electrical Connection Coordination Schedule
Engine/Generator
Equipment Connections
Equipment Pads
Excavation and Backfill
Fire Alarm Systems
Firestopping
Fuses
Ground Conductors, Rods
Ground Connection to Underground Water Pipe
Identification System
Innerduct
Lamps
Lighting Control Equipment
Lighting Fixtures
Low Voltage Fuses
Material and Equipment List
Motor Starters
Occupancy Sensors
Outlet Boxes
PA System
Panelboards
Receptacles
Record and Information Booklet
Safety Switches
Schedule of Values
Sleeves, Hangers, Supports
Sound Systems
Special Systems
Submittal Schedule
Surge Protection Devices
Switchboards
Tests and Reports
Transformers
Underground Cable
Wiring Devices

Wiring Diagrams

- P. The Contractor, additionally, shall submit for approval any other shop drawings as required by the Architect. No item listed above shall be delivered to the site, or installed, until approved. After the proposed materials have been approved, no substitution will be permitted except where approved by the Engineer.
- Q. The Contractor shall prepare and submit a Detail Schedule of Values indicating the Contract costs for the major work items. The Contractor shall provide additional detail and information as requested by the Engineer.
- R. The Contractor shall prepare and submit a complete Submittal Schedule. The Schedule shall include a listing of all Submittals, Shop Drawings, and Coordination Drawings.
- S. The Contractor shall review and coordinate with all other not order major electrical gear that serves HVAC and plumbing motors until all HVAC and plumbing equipment with motors have been reviewed. Additionally, the Contractor shall review all mechanical and plumbing submittals for coordination items (disconnect switch, capacitors, etc.) prior to the Mechanical Contractor submitting products for review.

2.4 INSTALLATION AND COORDINATION DRAWINGS:

- A. Prepare, submit, and use composite installation and coordination drawings to assure proper coordination and installation of the work. Drawings shall include, but not be limited to the following:
 - 1. Telecommunication Rooms indicating data rack assemblies, panels, etc.
 - 2. Electrical Rooms indicating switchboard assemblies, transformers, equipment pads, panels, etc.
 - 3. Mechanical Equipment Rooms, including panels, transformers, starters, equipment, etc.
 - 4. Cable tray, light fixtures.
- B. Draw plans to a scale not less than 1/4 inch equals one foot. Include plans of the proposed work, showing all equipment, major elements, conduit, and wiring in the areas involved. Fully dimension all work, horizontally and vertically. Show coordination with other work including piping, ductwork and other mechanical work, walls, doors, ceilings, columns, beams, joists, and other architectural and structural work.
- C. Identify all equipment and devices on wiring diagrams. Where field connections are shown to factory-wired terminals, furnish manufacturer's literature showing internal wiring.
- D. Prepare, submit, and use scaled layout drawings indicating dimensions, clearances, and actual equipment dimensions. Layout drawing shall include, but not be limited to the following:
 - 1. Pad-mounted equipment and equipment connections.
 - 2. Underground conduits, ductbanks, manholes, handholes, and building penetrations.
- E. The Electrical Contractor shall develop and prepare an AutoCAD or Revit coordination model for the entire building to be used in conjunction with the mechanical, plumbing, structural and architectural model for coordination purposes. Model shall include major above ground feeders (2" and larger) cable trays, light fixtures, etc.

- F. The Mechanical Contractor shall schedule bi-weekly Coordination Drawing Reviews with the Owner, Mechanical Engineer, and all associated subcontractors, including but not limited to the following:
1. Mechanical Contractor
 2. Finishes Contractor
 3. Sheet Metal Contractor
 4. Sprinkler Contractor
 5. Electrical Contractor
 6. Plumbing Contractor
 7. Owner/Architect/Engineer
 8. Commissioning Agent
 9. Note: A Foreman or Project Manager responsible for Decision-Making of each company shall attend all Coordination Meetings.
- G. The purpose of these meetings is to coordinate proposed installations of systems and equipment, including clearances, routing, penetrations, as well as to review potential conflicts. The Mechanical Contractor shall base preliminary equipment sizes and connections on proposed products and the final coordination drawing for review shall reflect approved/reviewed products. Coordination Meetings shall be held at the Contractor's Field Office.

2.5 RECORD DRAWINGS:

- A. As the work progresses, record on a set of white prints the installed locations, sizes of electric feeders, equipment, etc. Upon completion of the work, submit one (1) complete set of white prints with "As-Built" information neatly recorded thereon in red ink. Use other colors to distinguish between variations in separate categories of the work. Note related change-order numbers where applicable. Provide electronic copies to the owner and architect at the completion of the project.
- B. Write step-by-step detailed instructions for turn-on, turn-off, seasonal changeover, and periodic checks of all systems and equipment. Include all precautions and warnings.
- C. Prepare a list of the manufacturers of all major equipment, their local service representative and procedures for obtaining service.
- D. Post one (1) copy of all instructions, lists, charts, and diagrams at the equipment or where indicated, mounted under glass or approved plastic cover.
- E. Furnish to the Owner two (2) copies of the Manufacturer's installation and operations instructions, and an electronic copy. Include replacement parts lists where applicable. Also include copies of all posted instructions, lists and charts. Assemble the material in one or more heavy duty 8- 1/2" x 11" loose leaf binders with tab separators. Submit for approval before final delivery. Binder shall be labeled on spine and on cover with Project Name.
- F. Deliver all instruction materials to the Owner prior to the formal instruction period.

- G. Deliver two (2) complete sets of all approved submittals to the Owner for filing, including electronic copies.
- H. Prepare record documents in accordance with the requirements in the specifications. In addition to the requirements specified, indicate installed conditions for:
 - 1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and circuit breaker size and arrangements.
 - 2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 3. Approved Substitutions, Contract Modifications, and actual equipment and materials installed.
- I. The Contractor shall keep at the site at all times during construction, one set of up-to-date Contract prints for the express purpose of showing any and all changes made during construction. The Contractor shall make the prints showing each change and shall incorporate all changes in "Record/As-Built Drawings" to be submitted to the Engineer upon completion of the project.
- J. The Contractor shall show proof of up-to-date record drawings to the Owner prior to submitting monthly invoice.
- K. The Contractor shall conform to all drawings, including all revisions, addendums, alternates, change orders, deletions, existing conditions, and as-built conditions without extra cost to the Owner.

2.6 DEMONSTRATION AND OPERATING INSTRUCTIONS

- A. Furnish the necessary technicians, skilled workers, and helpers to operate the electrical systems and equipment of the entire project. The Contractor shall provide a minimum of three 2-hour sessions of system demonstration and operation for each system including, but not limited to: lighting controls, switchboards, generator, transfer switches.
- B. Where specified in technical sections, provide longer periods required for specialized equipment.
- C. Contractor shall provide start-up of all systems in an orderly, organized, and coordinated manner to ensure that all systems are functioning as designed. The Contractor shall provide a detailed start-up, testing, and demonstration plan for all systems in a coordinated manner that is documented in writing at least 45 days prior to system start-up. Start-up, testing and demonstration plans shall include detailed point-by-point checklists that clearly show that systems are, in fact, functioning as designed. Instruct the Owner or designated personnel in operation, maintenance, lubrication, and adjustment of systems and equipment.
- D. The Operating and Maintenance Manual shall be available at the time of the instructions, for use by Instructors and Owner personnel.

- E. Videotape each instruction session, including both the sessions specified above and added sessions required in technical sections for specialized equipment. Provide one complete set of DVD video disks with each Operating and Maintenance Manual.
- F. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and Engineer. All operation training and demonstrations shall be complete prior to Owner acceptance of any given system.

PART 3 - EXECUTION

3.1 EXAMINATION OF SITE, SURVEYS, AND MEASUREMENTS:

- A. Examine the site, determine all conditions and circumstances under which the work must be performed, and make all necessary allowances for same. No additional cost to the Owner shall be permitted for Contractor's failure to do so.
- B. Examine the site and observe the conditions under which the work will be done or other circumstances which will affect the contemplated work. No allowance will be made subsequently in this connection for any error or negligence on the Contractor's part.
- C. The Contractor shall base all measurements, both horizontal and vertical, from established benchmarks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.
- D. Any discovery of discrepancy between actual measurements and those indicated which prevents following good practice or the intent of the Drawings and Specifications shall be brought to the attention of the Owner's Representative. Work shall not proceed until receiving instructions from the Owner's Representative.
- E. The Contractor shall follow Drawings in laying out the work and check Drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, the Owner's Representative shall be notified before proceeding with the installation.
- F. To prevent conflict with the work of other trades and for proper execution of the work, the Contractor, as directed by the Architect/Engineer, shall make the necessary modifications in the layout as needed, at no extra charge to the Owner.
- G. The Contractor shall be solely responsible for the proper arrangement of his conduit and equipment.
- H. The Engineer shall make all final decisions as to any conditions that require the changing of any work.
- I. The Contractor shall have competent supervision on the site at all times to lay out, check, coordinate, and supervise the installation of all electrical work and be responsible for the

accuracy thereof. He shall plan the installation of all electrical work, giving consideration to the work of other trades, to prevent interference.

- J. The Contractor shall determine the location, size, etc., of all chases, sleeve openings, etc., required for the proper installation of the electrical work and see that such are provided. All chases, sleeves, openings, etc., shall be set prior to erection of new work to prevent delay in the progress of other work or trades.
- K. Conditions and/or situations that prevent the proper installation of any equipment or item where shown on the Drawings shall be called to the attention of the Engineer for instructions.
- L. The Contractor shall have equipment shipped or fabricated in sections of suitable size for entering the building and being removed from the finished building in the future, if necessary.
- M. The Contractor shall fully investigate all peculiarities and space limitations for all materials and equipment.
- N. Outlet, pull, and junction boxes and other appliances that require operation, examination, adjustment, servicing or maintenance shall be readily accessible.
- O. The Contractor shall take all field measurements necessary for this work and shall assume responsibility for their accuracy.
- P. The Contractor shall coordinate the electrical work with all other sub-contractors. All work shall be so arranged that there will be no delay in the proper installation and completion of any part or parts of electrical equipment. All electrical work shall be installed in proper sequence with other trades without any unnecessary delay.
- Q. The Drawings are to some extent diagrammatic and indicate the general arrangement of the equipment, the runs of conduit, and the manner of connection.
- R. The Contractor shall confer with all sub-contractors engaged in the construction of the project, regarding the work that may, in any way, affect his installation. Whenever interference occurs, before installing any of the work in question, the Contractor shall consult with all sub-contractors and shall come to an agreement with them as to the exact location and level of his conduit parts of his equipment.
- S. The Contractor shall be responsible for determining exact property lines and area of work. The Contractor shall not install any equipment or conduits outside of the property lines and/or area of work without written direction from the Owner. Any work indicated diagrammatically on the Contract Documents to be installed beyond the property lines and/or area of work shall be verified with the Owner prior to installation.

3.2 GENERAL RESPONSIBILITIES:

- A. The Contractor shall be responsible for systems and related damages possible, and shall hold harmless the Owner, the Architect and his consultants from malfunction of systems and

equipment installed under this Contract as defined by the applicable state laws pertaining to real property for the period of time as defined by such laws.

- B. It is the intent of these Specifications to fully cover without exception all required labor and materials so that the finished work will be delivered to the Owner in a complete and satisfactory working installation. Excavation, wiring, distribution, etc., shall be performed in compliance with the Contract Documents.
- C. Work not specifically outlined, but reasonably incidental to the completion of the work, shall be included without additional compensation from the Owner.
- D. Conflicting points in the Specifications or on the Drawings shall be called to the attention of the Architect prior to the execution of the Contract.

3.3 STORAGE AND PROTECTION OF EQUIPMENT

- A. All electrical equipment to be used in the construction shall be properly stored and protected against the elements. All equipment shall be stored under cover, and shall not be stored at the construction site on the ground, in mud, water, snow, rain, sleet or dust. Large diameter cables may be stored on reels with weatherproof materials. Such weatherproof materials shall be heavy-duty, securely fastened and made impervious to the elements.
- B. Conventional electrical construction materials such as building wire, outlet and junction boxes, wiring devices, conduit, lighting fixtures, fittings, etc., shall be stored in construction buildings, covered trailers or portable covered warehouses. Any equipment subject to damage or corrosion from excessive moisture shall be stored in dry, heated areas. Any equipment containing plastic or material subject to damage caused by excessive heat or sunlight shall be stored to prevent such damage. This includes plastic ducts and lenses.
- C. Switchboard, motor controllers, panelboards, breakers, emergency lighting, and supervisory equipment, if delivered to the construction site before the building is under cover, shall be warehoused and protected as follows: All gear and equipment shall be covered and protected from the elements and other damage and shall be stored in a clean, dry, heated atmosphere, under cover.
- D. All gear and equipment delivered to the construction site after the building is under cover shall be protected as described above and in addition shall be provided with auxiliary heat to prevent condensation damage. The gear shall also be protected against damage caused by installation of any building systems and equipment; or damage caused by carelessness of workmen who are installing equipment connected to or adjacent to the above electrical equipment.
- E. Equipment damaged as a result of the above conditions shall be properly repaired at the Contractor's expense or shall be replaced at the Contractor's expense, if, in the opinion of the Engineer the equipment has been damaged to such an extent it cannot operate properly after repairs are made.

- F. All electrical enclosures exposed to construction damages such as paint spots, spackling or plaster spatter, grout splashes, waterproofing compound, tar spots or runs and pipe covering compound splashes, shall be completely covered and protected against damage.
- G. In the event leakage into the building of any foreign material or fluid occurs or may occur, the Contractor shall take all steps as described above to protect any and all equipment.
- H. After connections to electrical equipment are complete and the equipment is ready for operation, all construction debris shall be removed from all enclosures. Such debris includes dust, dirt, wire clippings, tape and insulation removed in order to make the connection.

3.4 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate electrical systems, equipment, materials, and installation with landscape/irrigation contractor(s).
 - 2. Verify all dimensions by field measurements.
 - 3. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
 - 4. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components where installed exposed in finished spaces.
 - 5. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. All equipment and disconnects shall maintain proper working space to conform to NEC.
 - 6. Install systems, materials, and equipment giving right-of-way priority to systems that require installation at a specified slope.
 - 7. Arrange for chases, slots and openings in other building components during progress of construction, to allow for electrical installation.
 - 8. Space, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work.

3.5 SUPERVISION AND COORDINATION:

- A. Provide complete supervision, direction, scheduling and coordination of all work under the contract, including that of subcontractors, using full attention and the best skill. Be responsible for all work and make all subcontractors, suppliers and manufacturers fully aware of all requirements of the contract.
- B. Coordinate the rough-in of all work performed under Mechanical & Electrical Divisions.

- C. The Contractor shall coordinate all electrical rough-ins with approved shop drawings and coordination drawings. Any rough-in installed without complete coordination shall be at the Contractor's risk and expense.
- D. Coordinate the installation of all necessary rough-in of work, sleeves, anchors and supports for conduit, wiring, and other work performed under Divisions Mechanical and Electrical Divisions.
- E. Coordinate the spacing and arrangement of lighting fixtures, diffusers, grilles and access panels in ceilings to establish a symmetrical pattern.
- F. Where a discrepancy exists within the Specifications or drawings or between the Specifications and Drawings, the more stringent (or costly) requirement shall apply until a clarification can be obtained from the Engineer. Failure to clarify such discrepancies with the Engineer will not relieve the Contractor of the responsibility of conforming to the requirements of the Contract.
- G. Failure of the Contractor to obtain a full and complete set of Contract Documents (either before or after bidding) will not relieve the Contractor of the responsibility of complying with the intent of the Contract Documents.
- H. To insure proper electrical coordination between the electrical components supplied under the Electrical Divisions and the equipment supplied under the Mechanical Divisions, a schedule shall be submitted, prior to start of work and prior to fabrication of panels and/or gear which power is fed from, for review by the Engineer with the following column headings:

1. Equip. or Item	2. HP or KVA	3. Voltage and Phase	4. Power Factor	5. Capacitor	6. Motor Starter	7. Discon.	8. Controls	9. Remarks
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Description of Column Headings:

1. List all the approved equipment furnished under Mechanical Division that requires electrical connections and designate the equipment as it appears in the Mechanical Divisions. Indicate the quantity, if more than one, in parentheses of identical equipment being supplied.
2. Indicate the supplied horsepower of the equipment listed under Column No. 1. If equipment listed has more than one motor, indicate each motor and its respective horsepower. Indicate the kVA rating for all other equipment requiring an electrical connection, unless the electrical connection is for a control circuit only.
3. Indicate the voltage and phase requirements for equipment listed under Column No. 1. If more than one electrical circuit or voltage is required for the listed equipment, it shall be so indicated. Indicate wiring required for connection, including all phase, neutral, and ground conductors.
4. Indicate the power factor rating for all motors listed under Column No. 2
5. Where a capacitor is to be provided, indicate specification it is supplied under and indicate the KVAR size for any capacitor provided under Division 26.

6. Where a motor starter is required, indicate the specification division it is supplied under and the type of motor starter; across-the-line, reversible, variable speed, two speed-single winding, etc. Indicate In Column No. 9 if the motor starter provided under Division 26 is not compatible with the motor specified.
 7. Where a disconnect switch is required by the National Electric Code or by the contract documents for the equipment listed under Column No. 1, indicate under which Division the disconnect switch is supplied.
 8. Indicate the Division under which the controls for the equipment listed under Column No. 1 are provided.
 9. Indicate any discrepancies between what is indicated in the contract documents and what is actually being provided.
- I. The Contractor shall fully coordinate the electrical connections to all equipment prior to installations, with the approved Shop Drawings and the trades involved. Coordination shall include voltage, phases, quantity and size of wiring, device sizes, terminations, rough-in work, and other coordination for a complete installation.
- J. Coordinate Division 26 work with all trades.
- K. Install work with proper clearances and access. Carefully examine all contract drawings and fit the work in each location without substantial alteration. Where departures are proposed or required, submit detailed drawings for acceptance. The right is reserved to make reasonable changes in location of equipment, conduit and wiring up to the time of rough-in or fabrication.
- L. Coordinate light switch locations with door swings prior to rough-in. No switches permitted behind doors.
- M. Coordinate electrical work with architectural items and equipment. Typical equipment refers to, but is not limited to, the following:
1. Countertops, Casework and Cabinets.
 2. Fume and Exhaust Hoods.
 3. Kitchen equipment.
 4. Do not install outlets, switches, etc., behind casework, cabinets, etc.
 5. Data, phone, and other low voltage system outlets shall be mounted above the counter tops to match power outlets in the same areas.
 6. Coordinate counter top outlets with drilling of casework/counters.
 7. Coordinate surface raceways and outlets above and below counters with approved casework shop drawings to avoid conflicts with sinks and other appurtenances.
 8. Verify lab/kitchen equipment nameplates and connection requirements prior to rough-in.
 9. Shop equipment connections, including busways.
- N. This Contractor shall make all system connections required to equipment furnished and installed under other divisions. Connections shall be complete in all respects to render this equipment functional to its fullest intent. The Contractor shall make all system connections required to equipment furnished under other Divisions. Circuits shall be extended to all equipment which is

incidental to, but not necessarily shown, for equipment specified under other divisions such as magnetic flow meters, ATC panels, liquid level controls, leak detection systems, etc. Connections shall be complete in all respects to render this equipment functional to its fullest extent. Coordinate quantity, locations and power requirement for all items with the mechanical, plumbing and general trades contractors.

- O. It shall be the responsibility of the Contractor to obtain complete instructions for connections.

3.6 GUARANTEE:

- A. Guarantee obligations shall be as hereinbefore specified in the GENERAL AND SPECIAL CONDITIONS of these specifications, except as follows:
 - 1. Guarantee the complete electrical system free from all mechanical and electrical defects for the period of **two (2) (Addendum No. 4)** years beginning from the day of substantial completion of the work by the Architect. Refer to the Alternates specification section for additional years of guarantee. In all cases (base bid or alternates) specific equipment or materials warranties shall be guaranteed as stated hereinafter or as indicated on the drawings.
 - 2. Also, during the guarantee period, be responsible for the proper adjustments of all systems, equipment and apparatus installed by the Contractor and do all work necessary to ensure efficient and proper functioning of the systems and equipment.
 - 3. Upon receipt of notice from the Owner of failure of any part of the electrical installation during the guarantee period, new replacement parts shall be furnished and installed promptly at no cost.
 - 4. Warranty From the Manufacturer: Contractor shall obtain all warranty papers and records from the Original Equipment Manufacturer according to their warranty policy and deliver the same to the Owner. Contractor shall fulfill all the Original Manufacturer's requirements to validate the warranty as offered by the Original Equipment Manufacturer.
- B. Provide 24-hour service for any and all warranty problems experience in the operation of the equipment provided.
- C. Any equipment or system in need of warranty work whether during regular hours or on an emergency basis, shall be immediately serviced and repaired. The warranty work and guarantee shall include all parts and labor and shall be furnished at no cost to the Owner.
- D. The Contractor shall guarantee to make good any and all defects in his work, exclusive of lamps, which may develop due to defective workmanship or materials, within three years from the date of final acceptance of the work by the Owner.
- E. In addition to the warranty and correction of work obligations contained in the General and supplementary Conditions, correct the work of the system as embraced by the Specification, free from Mechanical and Electrical defects for the warranty period beginning from the day of acceptance of the building by the Architect for the beneficial use of the Owner.

- F. During the warranty period, take responsibility for the proper adjustments of systems, equipment and apparatus installed and perform work necessary to ensure the efficient and proper functioning of the systems and equipment.
- G. Certain items of equipment hereinafter specified shall be guaranteed for a longer time than the general warranty period. These guarantees shall be strictly adhered to and the Contractor shall be responsible for service or replacement required in connection with guarantee of these items. These guarantees shall commence on the same date as the final acceptance by the Architect.
- H. Submission of a bid proposal for this Project warrants that the Contractor has reviewed the Contract Documents and has found them free from ambiguities and sufficient for the construction and proper operation of systems installed for this project. If discrepancies are found, have them clarified by Addendum.
- I. It is possible that certain areas of the building or certain systems will be accepted at a time different than as specified. The date of acceptance by the Architect for beneficial use of the Owner for these building areas or systems will be adjusted accordingly.

3.7 SCHEDULING OF WORK:

- A. The Contractor shall not be permitted to do any work in any area of any occupied building during normal hours, except in areas specifically assigned.
- B. Coordination of work by the Contractor is essential such that power outages are kept to a minimum in quantity and duration. All required outages shall be approved by the Owner for optimum time scheduling. Written notice of not less than 15 calendar days shall precede all power outages. Utility disruptions during normal school hours are prohibited.

3.8 TEMPORARY FACILITIES:

- A. General: Refer to the Division 1 Sections for general requirements on temporary facilities.
- B. Description: Furnish and install the necessary metering and distribution equipment or an adequate, 3-phase, 4 wire temporary service and all temporary wiring, including step-down or step-up dry-type transformers. Exact requirements for temporary service will be determined by the Contractor. Temporary wiring shall follow specification requirements regarding workmanship, proper overcurrent protection, as well as conductor ampacity limits.
- C. The Contractor's attention is directed to the Occupational Safety and Health Act, Americans with Disabilities Act and NEC requirements for electrical work on construction sites.
- D. Materials: Lights at each floor in each stair. At least one light outlet per 1200 square feet on each floor, exclusive of stairs.
 - 1. One 20-ampere circuit for each 7500 square feet of gross floor area per floor to which various trades may attach their cords.

2. One temporary 220v power online in corridor (each elevator lobby) including connections to saws, fireproofing equipment and wood sanding equipment, if required.
 3. Power for testing and operating of elevators.
 4. Temporary lighting for stripping forms for all floors below grade.
 5. Power for crane operation.
- E. Installation: Temporary lighting shall provide minimum foot candle levels for construction as follows:

AREA	FOOT CANDLE LEVEL
General construction area lighting, corridors, hallways and exit ways.	10
Electrical equipment rooms, active storerooms, shops, locker and dressing areas	10

- F. The Contractor shall pay for all material and labor to provide and maintain temporary service.
- G. The Contractor shall obtain and shall pay for temporary electrical service for construction power.
- H. Provide all underground and/or overhead equipment, transformers, overcurrent devices, wires, connections, etc., for obtaining power from utility company lines.
- I. Remove all temporary power installations and connections after permanent power is established and/or prior to completion of the project.
- J. Contractor responsible for any and all temporary utility power connection fees.

3.9 DEMONSTRATION:

- A. As a part of this contract, the Contractor shall provide for the services of equipment manufacturers or their established representatives to demonstrate to selected maintenance personnel the correct operation, safety and maintenance of all electrical equipment under this contract.

3.10 PAINTING AND FINISHES:

- A. Provide protective finishes on all materials and equipment. Use coated or corrosion-resistant materials, hardware and fittings throughout the work. Paint bare, untreated ferrous surfaces with rust-inhibiting paint. All exterior components including supports, hangers, nuts, bolts, washers, vibration isolators, etc., shall be galvanized or stainless steel.
- B. Clean surfaces prior to application of coatings, paint, or other finishes.

- C. Provide factory-applied finishes where specified. Unless otherwise indicated factory-applied paints shall be baked enamel with proper pre-treatment.
- D. Protect all finishes and restore any finishes damaged as a result of work under Division 26 to their original condition.
- E. The preceding requirements apply to all work, whether exposed or concealed.
- F. Remove all construction marking and writing from exposed equipment, conduit, and building surfaces. Do not paint manufacturer's labels or tags.
- G. All exposed conduit, etc., shall be painted, except in electrical rooms, mechanical rooms, storage rooms, and crawl spaces. Colors shall be selected by the Architect and conform to ANSI Standards.
- H. Submit color of factory-finished equipment for approval prior to ordering.

3.11 PROTECTION OF WORK:

- A. Protect work, material and equipment from weather and construction operations before and after installation. Properly store and handle all materials and equipment.
- B. Cover temporary openings in conduit and equipment to prevent the entrance of water, dirt, debris, or other foreign matter.
- C. Cover or otherwise protect all finishes.
- D. Replace damaged materials, devices, finishes and equipment.

3.12 OPERATION OF EQUIPMENT:

- A. Clean all systems and equipment prior to initial operation for testing, retesting, or other purposes. Set, adjust, and test all equipment in accordance with manufacturer's instructions. Do not operate equipment unless all proper safety devices or controls are operational. Provide all maintenance and service for equipment that is authorized for operation during construction.
- B. Where specified, or otherwise required, provide the services of the manufacturer's factory-trained servicemen or technicians to start up the equipment.
- C. Do not use electrical systems for temporary services during construction unless authorized in writing by the Owner. Where such authorization is granted, temporary use of equipment shall in no way limit or otherwise affect warranties or guaranty period of the work.
- D. Upon completion of work, clean and restore all equipment to new conditions; replace expendable items such as filters.

3.13 TESTING AND ADJUSTMENT

- A. Perform all tests which are specified or required to demonstrate that the work is installed and operating properly. Where formal tests are required, give proper notices and perform all necessary preliminary tests to assure that the work is complete and ready for final test.
- B. Adjust all systems, equipment and controls to operate in a safe, efficient and stable manner.
- C. On all circuits, 600 volts or less, provide circuits that are free from ground faults, short circuits and open circuits.
- D. Other tests of a specific nature for special equipment shall be as specified under the respective equipment.

3.14 IDENTIFICATIONS, ELECTRICAL DIAGRAMS AND OPERATING INSTRUCTIONS:

- A. Contractor shall submit for approval schematic diagrams of each electrical system installed in the building. Diagrams shall indicate device location, service, type, make, model number and the identification number of each device in the particular system. Following approval by all authorities, the diagrams shall be framed, mounted under glass and hung in each Main Equipment Room where directed. Contractor shall deliver the tracing or sepia from which the diagrams were reproduced to the Owner.
- B. All equipment shall be plainly tagged.
- C. All items of equipment, including motor starters, panels, etc., shall be furnished with white letters and numbers on black plastic identification plates or aluminum letters and numbers on black engraved aluminum identification plates. Lettering shall be a minimum of 1/4" high. Identification plates shall be securely affixed to each piece of equipment, starters, panels, etc., by screws or adhesive (Tuff-Bond #TB2 or as approved equal). Pressure sensitive tape backing is prohibited.
- D. Provide three (3) copies and electronic copies of operating and maintenance instructions for all principal items of equipment furnished. This material shall be bound as a volume of the "Record and Information Booklet" as hereinafter specified.
- E. Provide at least 24 hours of straight time instruction to the operating personnel. This instruction period shall consist of not less than three (3) consecutive 8-hour days. Time of instruction shall be designated by the Owner. Provide two DVD/Digital copies of all instructional periods/demonstrations.

3.15 RECORD DRAWINGS AND SPECIFICATIONS:

- A. Upon completion of the Electrical installations, the Contractor shall deliver to the Engineer one complete set of prints of the Electrical Contract Drawings which shall be legibly marked in red pencil to show all Addenda, approved Shop Drawings, Change Orders, changes and departures of the installation as compared with the original design. They shall be suitable for use in preparation of Record Drawings. Provide electronic copies of each.

- B. The Contractor shall provide a record specification including all Addenda and other modifications. Record substantial variations in actual work performed. Identify all substitutions.

3.16 RECORD AND INFORMATION BOOKLET:

- A. The Contractor shall have prepared three (3) copies of the Record and Information Booklet as well as an electronic copy and deliver these copies of the booklet to the Owner. The booklet shall be as specified herein. The booklet must be approved and will not be accepted as final until so stamped.
- B. The booklet shall be bound in a three-ring loose-leaf binder similar to "National" No. 3881 with the following title lettered on the front and on the spine of the binder: "Record and Information Booklet (insert name of the project)". No sheets larger than 8-1/2" x 11" shall be used, except sheets that may be neatly folded to 8-1/2" x 11" and used as a pull-out. An Index will include the section tabs for each subject included. If more than one binder is required, print covers and spines with Volume numbers. Include in the front of every binder an index to all binders.
 - 1. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
 - 2. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
 - 3. Part 1: Directory, listing names, addresses, and telephone numbers of Electrical Engineers; Contractor; Electrical Subcontractors; and major Electrical equipment suppliers. Provide sales and service representative names and phone numbers of all equipment.
 - 4. Part 2: Operation and Maintenance Instructions, arranged by Specification Section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment. Complete record of material list. Catalog brochures and product data for all components. Include all submittal comments, and corrected catalog data and shop drawings on each piece of equipment and each system.
 - c. Parts list for each component, including recommended spare parts list. Include motor starter overload schedules.
 - d. Operating instructions, including sequence of operation.
 - i. Description of function, normal operating characteristics and limitations, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts. Provide a description of each system installed.
 - ii. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; control, stopping.
 - e. Maintenance instructions for equipment and systems. Detailed checkout procedures to insure operation of systems and gear, including

- recommended cleaning methods and materials and special precautions identifying detrimental agents.
- f. Servicing, diagnostic and troubleshooting instructions and procedures for systems and major equipment.
 - g. Recommended preventative maintenance program, including a list of items requiring inspection and servicing. Provide Chart Form indicating time and type of routine and preventative maintenance of electrical equipment, etc. The chart shall also indicate tag number, model number of equipment, location and service.
 - i. For replacement items, indicate type, size and quantity of the replaceable items.
 - ii. Provide lubrication schedule, including type, grade, temperature range and frequency.
 - iii. Provide a list of each type of lighting fixture lamp used, lamp fixture used, and source.
 - iv. Include estimated mean time between failures for major parts.
 - h. Wiring Diagrams, Block Diagrams, and Assembly Drawings.
 - i. Panelboard Circuit Directory for each panelboard, including Panel Name, Panel Location, Panel Ratings, spare circuit breakers, spaces for additional circuit breakers.
 - i. List of equipment keys turned over to the Owner.
5. Part 3: Project Documents and Certificates, including the following:
- a. Shop Drawings and Product Data. Record Documents of the systems.
 - b. Photocopies of certificates.
 - c. Photocopies of Manufacturers' and Contractors' warranties, guarantees.
 - d. Test Reports: Copies of the approved results of all tests required under all sections of specifications.
 - e. Inspection Certificates.
 - f. Manufacturer's Conformance Certificates.
6. Provide one copy (DVD video disk) of video instruction session with each booklet set. Label video disk with all pertinent information.
7. Submit one copy of completed volumes in final form 15 days prior to final Inspection. This copy will be returned with Engineer comments. Revise content of documents as required prior to final submittal.
8. Submit final volumes revised and electronic copies, within ten days after final inspection.
- C. Upon completion of the project, the Contractor shall furnish the Owner a complete list of suppliers of equipment for parts and maintenance purposes. The list shall include the name, address, and telephone number of the parts and maintenance firm on a single 8-1/2" x 11" sheet of paper.
- D. This item shall include the furnishing of a complete list of equipment installed on the project, including the Manufacturer's name, the make and model number of the equipment, and

address and telephone number of the nearest supplier who stocks maintenance and/or replacement parts. The list should be submitted along with as-built drawings and be typed in an organized manner.

END OF SECTION 260501

SECTION 260526- GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 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.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
 - 1. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - a. Test wells.
 - b. Ground rods.
 - c. Ground rings.
 - d. Grounding arrangements and connections for separately derived systems.
 - 2. Instructions for periodic testing and inspection of grounding features at test wells ground rings grounding connections for separately derived systems based on NETA MTS NFPA 70B.
 - a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - b. Include recommended testing intervals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.
- B. 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.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Burndy; Part of Hubbell Electrical Systems.
 - 2. Dossert; AFL Telecommunications LLC.
 - 3. ERICO International Corporation.
 - 4. Fushi Copperweld Inc.
 - 5. Galvan Industries, Inc.; Electrical Products Division, LLC.
 - 6. Harger Lightning & Grounding.
 - 7. ILSCO.
 - 8. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 9. Robbins Lightning, Inc.
 - 10. SIEMENS Industry, Inc.; Energy Management Division.

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 B 3.
 - 2. Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.
 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) 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 (41 mm) wide and 1/16 inch (1.6 mm) thick.
 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) 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.

2.4 CONNECTORS

- A. 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.
- B. Welded Connectors: Exothermic-welding kits, **equivalent to cadweld (Addendum No. 4)** of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- J. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- K. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- L. Straps: Solid copper, copper lugs. Rated for 600 A.
- M. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal one two-piece clamp.
- N. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

O. Water Pipe Clamps:

1. Mechanical type, two pieces with stainless-steel bolts.
 - a. Material: Die-cast zinc alloy.
 - b. Listed for direct burial.
2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet (19 mm by 3 m).
- B. Ground Plates: 1/4 inch (6 mm) 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 tinned-copper conductor, No. 4/0 AWG minimum.
 1. Bury at least 24 inches (600 mm) below grade.
- C. 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 (50 mm) minimum from wall, 6 inches (150 mm) 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.
- D. 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 (100 mm) 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 (50 mm) above to 6 inches (150 mm) 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 (150 mm) 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.
- 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. 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.
- F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-24-inch (6-by-50-by-600-mm) grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.6 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 (50 mm) 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.
- D. 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.
- E. 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.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. 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, and at individual ground rods. 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.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 2. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
 3. Substations and Pad-Mounted Equipment: 5 ohms.
 4. Manhole Grounds: 10 ohms.
- F. 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 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, 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 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.2 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.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
1. Structural members in paths of conduit groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Appleton
4. Cooper Course-Hinds
5. O-Z Gedney; a unit of General Signal.
6. Spring City
7. Thomas & Betts
8. Wheatland Tube Company.

- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- E. EMT: Comply with ANSI C80.3 and UL 797.
- F. FMC: Comply with UL 1; zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Compression type.
 3. 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.
 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- I. Joint Compound for IMC, GRC: 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, TUBING, AND FITTINGS

- A. Available 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. Allied Tube & Conduit
 2. Arnco
 3. Beck Manufacturing
 4. CANTEX Inc.

- 5. CertainTeed Corp.; Pipe & Plastics Group.
 - 6. Carlon
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - C. ENT: Comply with NEMA TC 13 and UL 1653.
 - D. RNC: Type EPC-40-PVC complying with NEMA TC 2 and UL 651 unless otherwise indicated.
 - E. LFNC: Comply with UL 1660.
 - F. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
 - G. Fittings for LFNC: Comply with UL 514B.

2.3 BOXES, ENCLOSURES, AND CABINETS

- A. Available 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. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Hoffman.
 - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 6. O-Z/Gedney; a unit of General Signal.
 - 7. RACO; a Hubbell Company.
 - 8. Robroy Industries, Inc.; Enclosure Division.
 - 9. Scott Fetzer Co.; Adalet Division.
 - 10. Spring City Electrical Manufacturing Company.
 - 11. Thomas & Betts Corporation.
 - 12. Walker Systems, Inc.; Wiremold Company (The).
 - 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- 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, aluminum, 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.

2. Type: Fully 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, round.
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 (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- L. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep).
- M. Gangable boxes are allowed.
- N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- O. Cabinets:
1. NEMA 250, Type 1 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.
- 2.4 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.
- C. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation.
 - d. NewBasis.
 2. Standard: Comply with SCTE 77.
 3. Configuration: Designed for flush burial with closed 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.
- D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete.
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Christy Concrete Products.
 - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
 2. Standard: Comply with SCTE 77.
 3. Configuration: Designed for flush burial with closed 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." "Telephone".
 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: GRC.
 3. Underground Conduit: RNC, Type EPC-40-PVC direct buried unless otherwise noted.
 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 (Addendum No. 4)**.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated.
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: **EMT (Addendum No. 4)** 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. Boiler rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: MC Cable.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC.
 7. 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 (21-mm) trade size.
- D. Aluminum conduit is prohibited.
- E. 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 type, 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.
- F. Do not install aluminum 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 (49 deg C).

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems" for hangers and supports.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. 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 (300 mm) of changes in direction.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches ((300 mm)) of enclosures to which attached.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) 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 (3-m) intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 2 inches (50 mm) 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 RNC, Type EPC-40-PVC to GRC before rising above floor, including into wall cavity.
- I. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- J. 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.

- K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- M. 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 (35-mm) 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.
- N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300-mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- O. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 - 2. Secure surface raceway with two hole straps at intervals not exceeding 32 inches (813-mm) 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.
- P. 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.
- Q. 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. Where otherwise required by NFPA 70.
- R. Expansion-Deflection Fittings: Provide an expansion/deflection fitting in each concealed or exposed electrical run crossing a building expansion joint. Fittings shall be complete with bronze end couplings, neoprene sleeve, tinned copper braid integral bonding jumper and stainless steel bands. Expansion/deflection fittings shall be suitable for the size and type of conduit run they connect. Bonding jumper shall comply with NEC and UL requirements.
 - 1. Expansion/deflection fitting shall accommodate the following movements without collapsing or fracturing the conduit and damaging the wires it contains:
 - a. Axial expansion or contraction up to 3/4-inch.
 - b. Angular misalignment of the axes of the conduits up to 30 degrees in all directions.
 - c. Parallel misalignment of the axes of the conduits up to 3/4-inch in all directions.

2. Expansion/Deflection fitting shall be OZ/Gedney Type DX or approved equal by Crouse Hinds (Type XD).
- S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi recessed 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.
- T. 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 top of box unless otherwise indicated.
- U. 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 the box and cover plate or the supported equipment and box.
- V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- W. Locate boxes so that cover or plate will not span different building finishes.
- X. 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.
- Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- Z. Set metal floor boxes level and flush with finished floor surface.
- AA. 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 Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) 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 (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
 4. Install manufactured duct elbows for stub-up 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 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 (75 mm) of concrete for a minimum of 12 inches (300 mm) 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 (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. 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 (12.5-mm) sieve to No. 4 (4.75-mm) 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 (25 mm) above finished grade.
- D. Install handholes with bottom below frost line below grade.
- 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.
- F. 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 the enclosure.
- G. Field-cut openings for ducts and 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.
- H. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete," with a troweled finish.
 2. Dimensions: 10 inches wide by 12 inches deep (250 mm wide by 300 mm deep).

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 Division 26 Section "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 Division 7 Section "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.

3.8 GROUNDING

- A. Ground underground ducts and utility structures according to Division 26 Section "Grounding."

3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
 - 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
 - 3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.10 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260533

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. 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 for types other than NEMA 250, Type 1.
 - 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.
- 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.

B. Seismic Qualification Data: Certificates, for enclosed switches and circuit breakers, accessories, and components, from manufacturer.

C. Field quality-control reports.

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.

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 (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

2. Altitude: Not exceeding 6600 feet (2010 m).

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: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 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. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.3 MANUFACTURERS:

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric or comparable product by one of the following:
 1. Eaton.
 2. ABB – GE Electrification Products.

2.4 FUSIBLE SWITCHES

- A. Type HD, Heavy Duty:
 1. Single throw.
 2. Three pole.
 3. 600-V ac.
 4. 1200 A and smaller.
 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.
 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- B. Accessories (Required per device):
 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. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 4. Lugs: Compression type, suitable for number, size, and conductor material.
- C. Optional Accessories (As specified on Drawings):

1. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact, arranged to activate before switch blades open. Contact rating – 120-V ac.
2. Service-Rated Switches: Labeled for use as service equipment.

2.5 NONFUSIBLE SWITCHES

A. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 600-V ac.
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories (Required per device):

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. Lugs: Compression type, suitable for number, size, and conductor material.

C. Optional Accessories (As specified on Drawings):

1. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact, arranged to activate before switch blades open. Contact rating – 120-V ac.
2. Service-Rated Switches: Labeled for use as service equipment.

2.6 MOLDED-CASE CIRCUIT BREAKERS

A. 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.

B. 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.

C. MCCBs shall be equipped with a device for locking in the isolated position.

D. Lugs shall be suitable for 140 deg F (60 deg C) rated wire on 100-A circuit breakers and below. 167 deg F (75 deg C) rated wire, sized according to the 167 deg F (75 deg C) temperature rating in NFPA 70.

- E. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- F. 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.
- G. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings for circuit breaker frame sizes 400A and larger:
 - 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.
- H. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- I. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- J. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Compression 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/NC 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. Electrical Operator: Provide remote control for on, off, and reset operations.
 - 11. Accessory Control Power Voltage: Integrally mounted, self-powered.

2.7 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).
- 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.

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 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 (Addendum No. 4)**.
 - 3. Kitchen, Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4X, stainless steel.

3.3 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. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

3.4 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.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
 - 1. Visually and Mechanical inspect all equipment on project prior to installation.
 - 2. Correct malfunctioning units on-site, with new units.

3.6 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 approved Coordination Study Shop Drawing.

END OF SECTION 262816

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:

1. Full-voltage manual.
2. Full-voltage magnetic.
3. Multispeed.

1.2 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. N.C.: Normally closed.
- E. N.O.: Normally open.
- F. OCPD: Overcurrent protective device.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed controller.
- B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.7 QUALITY ASSURANCE

- 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 NFPA 70.
- C. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

- A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.
- A. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric or comparable product by one of the following:
 - a. Eaton.
 - b. ABB – GE Electrification Products.
 - 2. Configuration: Nonreversing.
 - 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
 - 4. Surface mounting.
 - 5. Pilot light.
 - 6. Hand-Off-Automatic selector switch.
- B. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric or comparable product by one of the following:
 - a. Eaton.
 - b. ABB – GE Electrification Products.
 2. Configuration: Nonreversing.
 3. Contactor Coils: Pressure-encapsulated type.
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 6. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor running overload protection.
 - b. Sensors in each phase.
 - c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 7. External overload reset push button.
- C. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric or comparable product by one of the following:
 - a. Eaton.
 - b. ABB – GE Electrification Products.
 2. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
 3. Nonfusible Disconnecting Means:
 - a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

2.2 MULTISPEED MAGNETIC CONTROLLERS

- A. General Requirements for Multispeed Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A.

- B. Multispeed Magnetic Controllers: Two speed, full voltage, across the line, electrically held.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric or comparable product by one of the following:
 - a. Eaton.
 - b. ABB – GE Electrification Products.
 2. Configuration: Nonreversing; consequent pole or two winding.
 3. Contactor Coils: Pressure-encapsulated type.
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 4. Power Contacts: Totally enclosed, double break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.
 6. Compelling relays shall ensure that motor will start only at low speed.
 7. Decelerating timer relays shall ensure automatically timed deceleration through each speed.
 8. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor running overload protection.
 - b. Sensors in each phase.
 - c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 9. External overload reset push button.
- C. Combination Multispeed Magnetic Controller: Factory-assembled combination of multispeed magnetic controller, OCPD, and disconnecting means.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric or comparable product by one of the following:
 - a. Eaton.
 - b. ABB – GE Electrification Products.
 2. Nonfusible Disconnecting Means:
 - a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

2.3 ENCLOSURES

- A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
 - 1. Dry and Clean Indoor Locations: Type 1.
 - 2. Outdoor Locations: Type **NEMA 3R (Addendum No. 4)**.
 - 3. Kitchen Wash-Down Areas: Type 4X, stainless steel.
 - 4. Other Wet or Damp Indoor Locations: Type 4X, stainless steel.

2.4 ACCESSORIES

- A. Push Buttons, Pilot Lights, and Selector Switches: NEMA ICS 5; heavy-duty type; factory installed in controller enclosure cover unless otherwise indicated.
 - 1. Pilot Lights: LED type; red for "Power Available", green for "Running"; push to test.
- B. Control Relays: Auxiliary and adjustable time-delay relays.
- C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings. Provide ICM controls ICM450 or approved equal, locate in separate enclosure at equipment; match NEMA enclosure rating with starter/disconnect.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height, and with disconnect operating handles not higher than 79 inches (206 mm) above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in each fusible-switch enclosed controller.
- D. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."
- E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- F. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified 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 nameplate.
 - 3. Label each enclosure-mounted control and pilot device.

3.3 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices.
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
 - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
 - 2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 - 2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
 - 3. Test continuity of each circuit.
 - 4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager before starting the motor(s).
 - 5. Test each motor for proper phase rotation.
 - 6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Set field-adjustable switches and overload-relay pickup and trip ranges.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

SECTION 283112 - PUBLIC SAFETY DISTRIBUTED ANTENNA SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This specification describes technical and performance criteria for deploying a public safety distributed antenna system capable of supporting Public Safety Networks (PSN).

1.3 SYSTEM DESCRIPTION

- A. Services: Upon acceptance testing, the system shall provide coverage for the PSNs listed below:

Table 1

Service	Uplink (MHz)	Downlink (MHz)
700 Band	799-805	769-775
800 Band	806-824	851-869

1.4 PERFORMANCE REQUIREMENTS

- A. The system shall comply with IFC 510 and NFPA 72.
- B. The system shall deliver coverage per the criteria in Table 1 throughout 95% of all occupied building spaces and 99% in critical areas as defined in NFPA 72.
- C. Minimum Downlink RSL at 700/800 MHz: -95dBm.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on drawings.
- B. Shop Drawings: Include plans, details, and attachments to other work.
 - 1. Scale floor plans showing the location of system components and wiring between them.
 - 2. Detail drawings for donor antenna, together with its associated and grounding mounting hardware.
 - 3. Battery calculations.

4. RF propagation modeling (heat maps).
5. Product data sheets for each type of equipment and device to be installed.

C. Submittal Requirements at Project Close Out

1. Drawings: Submit as-built drawings indicating:
 - a. Donor antenna, grounding and lightning protection details.
 - b. Cable routing, coupler and coverage antenna locations.
 - c. Active component locations, layout and configuration.
2. Cable Test Reports: Submit cable test results for all cable segments. Testing shall include Return Loss (RL), Distance to Fault (DTF) and Passive Intermodulation (PIM).
3. Operation and Maintenance Data: Submit hardware manuals for all system components.
4. Warranty Documents:
 - a. Submit for all manufactured components specified in this Section.
 - b. Submit Contractor's System Warranty.
 - c. Submit Manufacturer's Warranty

1.6 SUBSTITUTIONS

- A. Contract Documents are based on equipment manufacturers and minimum performance characteristics as called out in these specifications and/or indicated on the drawings. Acceptance of substitute equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials, which meet the performance as, stated or implied in the Contract Documents.
- B. Proposed substitution shall conform to the size, ratings, and operating characteristics of the equipment or systems as specified herein and/or shown/inidcated on the drawings.

1.7 CODES AND STANDARDS

- A. All work, including but not limited to: cabling, pathways, support structures, wiring, equipment, installation, workmanship, maintenance and testing shall comply with the latest editions of the National Electrical Code, applicable local building codes and equipment manufacturer's instructions.
- B. As applicable, equipment and cabling installation shall comply with the following standards. All publications must be of the latest issue and addenda:
 1. International Fire Code.
 2. International Building Code.
 3. NFPA 101
 4. NFPA 1
 5. National Fire Alarm and Signalling Code.
 6. Federal Communications Commission (FCC) - Title 47 of the Code of Federal Regulations, Part 90.
 7. Federal Communications Commission (FCC) Rules, Parts 15 and 22
 8. ANSI/TIA-568-C.O: Generic Telecommunications Cabling for Customer Premises.

9. ANSI/TIA-568-C.1: Commercial Building Telecommunications Cabling Standard Part 1: General Requirements.
10. ANSI/TIA-569-B: Commercial Building Standard for Telecommunications Pathways and Spaces.
11. ANSI/TIA-606-A: The Administration Standard for the Telecommunications Infrastructure of Commercial Building.
12. ANSI/ TIA-J-STD-607 -A: Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
13. BICSI Information Transport Systems Installation Methods Manual.
14. BICSI Telecommunications Distribution Methods Manual.

1.8 QUALITY ASSURANCE

- A. 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.
- B. The work specified in this Section is acknowledged to require special skills mastered by education, experience, or both. The contractor shall have direct access to all tools and test equipment required to complete the work prior to submitting a bid.
- C. Requirements set forth by first-responder code, ordinance, or the PSN AHJ shall supersede the requirements described herein and shall be met in their entirety. It is the Contractor's responsibility to ensure that the system complies with local code, ordinances or requirements established by the PSN AHJ.
- D. PSN Approval
 1. When approval of the system deployment is required by code or ordinance, the Contractor shall be responsible for facilitating the AHJ approval(s) per the requirements of the code or ordinance.

1.9 WARRANTY

- A. Manufacturer Warranty:
 1. Couplers and Antennas: 5-year limited warranty from date of system acceptance.
 2. Coaxial Cable and Connectors: 10-year limited warranty from date of system acceptance.
 3. Active Components: The earliest of 1-year limited warranty from date of system installation or 15 months from date of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the minimum requirements indicated herein and on the drawings.

2.2 HEAD END EQUIPMENT

- A. 700/ 800mhz Bidirectional Amplifier (BDA)
 - 1. Characteristics:
 - a. Operating Temperature Range: -33 °C to +60 °C
 - b. Chassis: NEMA 4 with red color.
 - c. Channel Bandwidth: 12.5/25 KHz.
 - d. Number of Channels: 32
 - e. Total Output Power, Uplink: 25dBm
 - f. Total Output Power, Downlink: 33dBm.
 - g. Maximum System Gain: 90dB.
 - h. Gain Adjustment Range (1dB step): 0-30.
 - i. Pass Band Ripple: <5dB.
 - j. Uplink Noise Figure: <5dB.
 - k. Absolute Maximum RF Input Power: -10dBm.
 - l. Input VSWR: <1.5.
 - m. Impedance: 50 Ohms.

2.3 EMERGENCY POWER

- A. Battery Backup Power Unit
 - 1. Characteristics:
 - a. Sustain operation of system for a minimum of 24 hours upon loss of utility power.
 - b. Chassis: NEMA 4 welded aluminum with red color.
 - c. NFPA Compliant for all required monitoring alarms.
 - d. Input Voltage: 120 VAC.
 - e. Output Voltage: 48 VDC.
 - f. Batteries: Sealed lead acid.
 - g. Battery breaker.
 - h. AC input breaker.

2.4 DONOR ANTENNA

- A. 746-896 MHz Yagi Antenna with watertight coaxial cable pigtail and N-Female end connector and U-Bolt mounting hardware for 1 7/8" OD pipe/mast.

B. Electrical Specifications

Gain	11 dB
VSWR	<1.7 : 1
Horizontal Beamwidth	48 °
Vertical Beamwidth	42 °
Polarization	Vertical
Maximum Input Power	100 Watts
Electrical Downtilt	0 °
Front-back Ratio	>16 dB
Connectors	N-Female
Lightning Protection Direct	Ground
Rated Wind Speed	134 mph / (216 Kph)
Max. Dimensions of Antenna	2.2" x 8" x 33.1" / (55.8 x 203.20 x 840 mm)
Weight of Antenna	1.76 lb. / (0.8 Kg)

2.5 LIGHTNING SURGE PROTECTOR

A. Prior to cabling entering the building, provide DC type block protector with the following minimum characteristics:

1. Dc Blocked Protector

- a. Solid brass construction.
- b. Fully weatherized housing.
- c. Impedance: 50 Ohms.
- d. Frequency Range: 680MHz to 2200MHz
- e. Connections: N-Female.
- f. Minimum Surge Current: 50kA.
- g. VSWR: ≤1.1:1 <-26dB (700-2200MHz), 1.13:1 <-24dB (680-700MHz).
- h. Insertion Loss: ≤0.1 dB.
- i. Average Power: 500 Watts.

2.6 OMNI-DIRECTIONAL ANTENNAS

A. Omni-directional coverage dome antennas shall feature a multi band design, accommodating multiple frequency bands in a single small antenna.

Pattern Type:	Omni-directional
Frequency Range:	450-2700 MHz
Gain:	1.9dBd (4dBi) (similar at 2100MHz and 450 MHz)
VSWR:	1.2:1-1.8:1
Polarization:	Multi-Polarized
Impedance:	50 ohms nominal
Connector:	F type -Female
Dome Construction:	UV Stabilized ABS

Plenum Rated Pig-tail/ Length	Yes - 18 in
H. Beamwidth (deg.)	360

2.7 CABLE

A. Cables:

1. Air Dielectric, Plenum Rated Coaxial Cable, Low PIM, Braided Coaxial cable, black jacket.
2. Material Characteristics:
 - a. Jacket: PVC.
 - b. Braid Material: Tinned Copper.
 - c. Shield Tape Material: Aluminum.
 - d. Dielectric Material: Foam PE.
 - e. Inner conductor: Copper Clad Aluminum wire.
 - f. Jacket color: Black.
3. Electrical Characteristics:
 - a. Impedance: 50 Ohm.
 - b. Frequency Band: 30 - 6000 MHz.
 - c. Return Loss > 24dB@3GHz.
4. Electrical Performance:

Frequency	Attenuation (dB/100 ft)
50 MHz	0.93
150 MHz	1.65
200 MHz	1.95
220 MHz	2.03
300 MHz	2.47
450 MHz	3.10
900 MHz	4.63
1500 MHz	6.15
1800 MHz	6.82
1900 MHz	7.10
2000 MHz	7.25
2500 MHz	8.25

5. Environmental:
 - a. Meet IEC60068 standard.
 - b. IP65 water resistance level.
 - c. Outdoor rated with the application of adhesive heat shrink tube to the jumper boot and wrapped with butyl tape.
6. Connectors:
 - a. N-Male.

2.8 COUPLERS

A. Splitters:

1. Wideband type suitable for both indoor and outdoor environments. Number of ports as required.
2. Electrical Characteristics:
 - a. Impedance: 50 Ohm.
 - b. Frequency Band: 555-2700 MHz.
 - c. Split Loss: 3dB to 6dB.
 - d. Insertion Loss: .5dB to .8dB
 - e. Isolation: 18dB to 20 dB
 - f. Average Power: 50 Watts.
 - g. Port VSWR: 1.2 to 1.3
3. Connectors:
 - a. N-Female.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall design, install, commission and test the system in accordance with the component manufacturer's instructions and recommendations.
- B. All system cabling shall be installed in a dedicated conduit rceway system. Minimum conduit size of 3/4". EMT conduit with compression fitting shall be used for interior locations. Rigid steel conduit with threaded couplings in exterior, damp or wet locations.
- C. Using engraved, laminated-plastic nameplate, identify bi-directional amplifier, and secure nameplate with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

3.2 COORDINATION WITH OTHER TRADES

- A. Field coordinate the installation of equipment and antennas with other trades:
 1. 120V, 20A circuit served from the lifesafety generator system.
 2. Grounding per NEC and TIA standards.
 3. Coordinate alarm and monitoring points with the fire alarm contractor.

3.3 EXAMINATION

- A. The contractor must examine areas and conditions under which DAS components are to be installed and notify the owner's representative, in writing of those conditions which are, in the Contractor's opinion, potentially detrimental to proper completion of the work. The Contractor shall not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the owner.

- B. Examine pathway elements intended for cable, check raceways, cable trays and other elements for compliance with space allocations, installations tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 TESTING

- A. Acceptance testing shall be performed in order to confirm that the minimum requirements have been met.

- B. Testing Procedure:

- 1. Test Locations

- a. Each floor of the building shall be divided into a grid of 20 approximately equal test areas.
- b. Downlink received signal level measurements shall be recorded in the coverage area using a CW test signal. Measurements shall be collected using a spectrum analyzer and a dipole antenna.
- c. Failure of a maximum of two nonadjacent test areas shall not result in failure of the test.
- d. In the event that three of the test area fail the test, in order to be more statistically accurate, the floor shall be divided into 40 equal test areas. Failure of a maximum of 4 non adjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 90% coverage.
- e. A test location approximately in the center of each test area shall be selected for the test. Once the location has been selected, the location shall represent the entire test area.

- 2. Equipment Requirements

- a. Test equipment shall be allowed to stabilize in test environment prior to calibration for a minimum of thirty minutes. Any change in temperature can void the calibration.
- b. Signal generator must be connected to the Head end downlink (TX) interface via tested and approved coaxial cabling and connectors.
- c. Signal generator transmits frequency (MHz) and Power (dBm) must be preapproved by project engineer prior to testing. The control channel from the base station can be used as a signal source as well.
- d. Verify that all remote units for the area under test are ON.
- e. Test frequency and power must be recorded corresponding to the date and time of each site walk measurement.
- f. Spectrum analyzer with unity gain (0dB, frequency specific) dipole receive antenna must be preapproved by the project engineer.
- g. Site walk screen shots shall be saved with frequency span +/- 20 MHz relative to the center/measured frequency.

- 3. Documentation

- a. Exact location of measurement must be marked on the grid print.

- b. Screen shots must be taken in all designated grid spaces. If more than one reading is saved per grid zone, saved results shall be distinguished from one another using Grid##"A", Grid## "B" etc.
- c. Results of testing are reported to project engineer for analysis and reporting.

C. Proof of Performance and Testing Methodology:

- 1. Test requirements specified in this document shall be successfully completed prior to issuance of a Certificate of Occupancy and yearly thereafter. Also testing with a successful result shall occur whenever a design change is made to the system, which changes the technical performance or coverage of the system. All tests shall be coordinated 10 days in advance with the AHJ. Results of the test shall be reported in writing to the AHJ.

D. Technical training

- 1. The Contractor shall be responsible for organizing a structured demonstration of acceptance tests to ensure organized and efficient testing.
- 2. The Contractor shall provide written notice to the owner's representative at least thirty (30) calendar days in advance of the initiation of final system acceptance testing. Included in the advance notice shall be three (3) copies of the approved test plans and procedures to ensure acceptance test monitoring personnel are familiar with the tests, procedures and the expected results.
- 3. It is the responsibility of the Contractor to notify the owner's representative at appropriate times to permit visual inspections of all system components. No Installation work shall be covered until a visual inspection has been completed.
- 4. Provide the owner's representative with the opportunity to witness all testing. On reasonable request and with ten (10) working days' notice, the Contractor shall demonstrate that the test procedure competently identifies the parameter being demonstrated or the fault condition being tested.
- 5. The Contractor shall provide a Certificate of Compliance signed by a responsible company representative after completion of the site installation. This document shall certify that each element of the installed system and wiring complies with the requirements of the Contract Documents and the certification shall be included with the final acceptance report.
- 6. The Contractor shall provide training for elements of the system. Such training shall include management, operational and maintenance levels and shall be provided to individuals (maximum of 3) to be designated by the owner's representative.
- 7. Training shall be conducted by qualified personnel fully conversant on the equipment, materials, software, and over all operation of the installed elements. Training shall be based upon as much hands-on training as is possible. The Contractor shall provide all necessary training aids and materials, which shall include written handouts.
- 8. All training shall be completed prior to Final Acceptance.

3.5 TRAINING

- A. Instruct the Owner/ Owners Maintenance Personnel on the proper operation of the system including alarms.

1. Provide time for 1 training session for one hour.
- B. Training shall be conducted by qualified personnel fully conversant on the equipment, materials, and over all operation of the installed elements. Training shall be based upon as much hands-on training as is possible. The contractor shall provide all necessary training aids and materials, which shall include written handouts.

END OF SECTION 283112

SECTION 312000 – EARTH MOVING

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. All work shall be in accordance with Baltimore City Specifications and Details, latest Edition.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for slabs-on-grade walks, pavements, turf and grasses and plants.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Subbase course for concrete walks and pavements.
 - 4. Subbase course and base course for asphalt paving.
 - 5. Subsurface drainage backfill for walls and trenches.
 - 6. Excavating and backfilling for utility trenches.
 - 7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
- B. Related Sections include the following:
 - 1. Division 01 Section "Unit Prices" for unit-price authorized additional excavation provisions.
 - 2. Division 01 Sections "Submittal Procedures" for recording pre-excavation and earthwork progress.
 - 3. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
 - 4. Division 03 Section "Cast-in-Place Concrete."
 - 5. Divisions 21, 22, 23, 26, 27 and 28 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
 - 6. Section 31 10 00 "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping topsoil, and removal of above- and below-grade improvements and utilities.
 - 7. Section 31 23 19 "Dewatering" for lowering and disposing of ground water during construction.
 - 8. Section 31 50 00 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
 - 9. Division 32 Section "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.

1.3 UNIT PRICES

- A. Work of this section is affected by unit prices for earth moving specified in Division 01 Section "Unit Prices." Unit prices are applied only to areas beyond volumes as outlined in Part B of this section.
- B. Rock Measurement: Weight of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation, measured in "tons" include replacement with approved materials.
 - 1. 24 inches outside of concrete forms other than at footings.
 - 2. 12 inches outside of concrete forms at footings.
 - 3. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - 4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - 5. 6 inches beneath bottom of concrete slabs-on-grade.
 - 6. 9 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
 - 7. 24 inches beneath recharge bed for Stormwater Management Facilities.
 - 8. Outermost dimensions as required to provide geogrid reinforcement for segmental block retaining walls
 - 9. 6 inches beneath bottom of pavement base material.
 - 10. 8 inches beneath finished grades outside of secured areas.
 - 11. 12 inches beneath finished grades inside of secured areas.

1.4 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil (Select Borrow) imported from off-site, or manufactured onsite and approved by the Geotechnical Engineer, for use as fill or backfill.
- E. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations as directed by the Geotechnical Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations without direction by

the Geotechnical Engineer. Unauthorized excavation, as well as remedial work directed by the Geotechnical Engineer, shall be without additional compensation.

- F. Fill: Soil materials approved by the Geotechnical Engineer to be used to raise existing grades.
- G. Recycled Material: Recycled Material shall contain a minimum of 90% post-consumer material.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
 - 1. Excavation of Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.
 - 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Structures: Buildings, footings, retaining walls, slabs, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt and clay particles; friable and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter in secure areas and 2 inches in diameter in unsecure; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials. Topsoil composition and characteristics shall be in accordance with MSHA Standard Specifications for Construction and Materials Section 920.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

- A. Product Data: For the following:

1. Detectable warning tape.
 2. Geotextile fabric.
 3. Recycled Materials.
 4. Requirements for local material source.
- B. Qualification Data: For qualified testing agency.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
1. Classification according to ASTM D 2487 of each borrow soil material proposed for fill and backfill.
 2. Laboratory compaction curve according to ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.
- D. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the topsoil.
1. Laboratory analysis of composition and characteristics of topsoil for each source, whether onsite or offsite borrow, shall be in accordance with MSHA Standard Specifications for Construction and Materials Section 920. A qualified soils scientist, approved by the owner, shall furnish a nutrient management plan for soils amendments. Topsoil shall be amended as specified by the nutrient management plan. Costs of all testing, the nutrient management plan, and amendments shall be included in the base bid, with no additional compensation by the owner.
 2. Report suitability of tested topsoil for turf growth including testing laboratory recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.
- E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.
- F. LEED Submittals.
1. Product data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include statement indicating cost of each product with recycled content..
 2. Product data for Credit MR 5: For products having regional material content, documentation indicating location of manufacture and location of extraction, recovery or harvest of primary raw materials. Include statement indicating cost of each product with regional material content.

1.6 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Contractor shall follow all OSHA requirements and all local, State and Federal regulations for soil excavation, rock removal, and rock blasting.
- C. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 General Requirements.

1.7 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Owner and Architect not less than 72 hours in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
 - 4. Verify existing utility services for area where Project is located before excavation.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- C. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.
- E. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 31 Section "Site Clearing," are in place.
- F. Do not commence earth moving operations until plant-protection measures specified in the Maryland Department of Environment approved Erosion and Sedimentation Control Plans are in place.
- G. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.

3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- H. Do not direct vehicle or equipment exhaust towards protection zones.
- I. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Refer to Sections 916 and 920 of MSHA Standard Specifications for Construction and Materials.
- B. General: Provide select borrow soil materials for replacement of all excavated unsuitable material removed from the pipe trench. All excavated material removed from the trench excavations shall be hauled and disposed off-site. Provide test results or certifications that borrow material meets the requirements for the specified material.
- C. Recycled Content of Backfill: Recycled concrete (RC-6) for temporary roads, subbase, pipe bedding, and fill material. Recycled aggregates shall contain a minimum of 90% post-consumer aggregate content.
- D. Regional Materials: Provide aggregate and sand products manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.
- E. Satisfactory Soils: Select Borrow as Per Section 916.01.01 of the MSHA Standard Specifications for Construction and Materials. The geotechnical Engineer shall approve satisfactory soil materials.
- F. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve per Section 901 of the MSHA Standard Specifications for Construction and Materials .
- G. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve per Section 901 of the MSHA Standard Specifications for Construction and Materials.
- H. Engineered Fill: Soils classified as CL, CM, SC, SM, GC or GM per ASTM D-2487, free organic matter (less than 3 percent by weight) and debris, and containing no particles greater than 4 inches in their largest dimension. In addition, soils classified as CL or ML should have a liquid limit and plastic index less than 40 and 20, respectively and a maximum dry density greater

than 105 pcf. However, materials used as backfill behind below-grade walls or retaining walls should have classifications of SM, or more granular, in accordance with ASTM D 2487.

- I. Bedding Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Topsoil: Loam, without stones or debris larger than 1 inch in diameter in secure areas and 2 inches in diameter in unsecure areas, without roots, vegetation, and without harmful materials or other debris which may be harmful to plant life. The topsoil shall contain a minimum of 2% of organic matter by weight when tested in accordance with AASHTO T 194. Other components shall be in accordance with MSHA Section 920 with the following percentages by weight:

Silt	10 – 60 %
Clay	5 – 30 %
Sand	20 – 75 %
pH	6.2 – 7.0
Soluble Salts	500 ppm maximum
- 1. Off-Site Topsoil: Topsoil furnished by the Contractor shall meet the requirements specified above, as tested by the Contractor per Section 1.5.C of this specification and approved by the Geotechnical Engineer.
- K. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- L. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- M. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- N. Structural Fill: All fills placed directly below or within the zone of influence of any bearing foundation or structural slab. Structural fill material shall consist of soils meeting Unified Soil Classification System (USCS) of SC or greater (i.e. SC through GW) with a Liquid Limit no greater than 30 and a maximum Plasticity Index of 10. All soil materials that fall within the USCS type ML, CL, CL-ML, OL, MH, CH, OH, PT, as well as material containing organic matter, ashes, cinders, refuse, frozen or other unsuitable materials are prohibited for use as Structural Fill.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Woven; manufactured for subsurface drainage applications, made from fibers consisting of long chain synthetic polymers, composed of a minimum 95 percent by weight of polyolefins or polyesters; with 15 percent minimum elongation; complying with Maryland State Highway Administration type ST per SHA Standard Specifications for Construction and Materials.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:
1. Portland Cement: ASTM C 150, Type I Type II or Type III.
 2. Fly Ash: ASTM C 618, Class C or F.
 3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
 4. Foaming Agent: ASTM C 869.
 5. Water: ASTM C 94.
 6. Air-Entraining Admixture: ASTM C 260.

2.4 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with a metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches. Color shall be as follows.
1. Red: Electric.
 2. Yellow: Gas, oil, steam and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.
 6. Purple: Storm Drain Systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Prepare subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.
- E. Provide soil moisture control for sub grade material, imported or excavated borrow material,

backfill, bedding, and top soil; in accordance with the recommendations of the geotechnical engineer. Costs of all soil moisture control will be solely the onus of the contractor with no additional compensation by the owner.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

- A. Explosives: Are not to be used on this project.

3.4 EXCAVATION, GENERAL

- A. All excavations and trenching shall be accomplished in strict accordance with applicable OSHA regulations.
- B. Do not excavate within twelve (12) inches of any building wall, column, pier, etc. Where excavation is required next to an existing structure or utility pole, excavate up to twenty-four (24) inches and allow the balance of soil to “fall away”. Take care to not damage the existing structure or utility pole.
- C. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, trash, debris, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of trash, debris, soil materials, or obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without

forms or exterior waterproofing treatments.

- e. 6 inches beneath bottom of concrete slabs-on-grade.
- f. 9 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
- g. 24 inches beneath recharge bed for Stormwater Management Facilities.
- h. Outermost dimensions as required to provide geogrid reinforcement for segmental block retaining walls
- i. 6 inches beneath bottom of pavement base material.
- j. 8 inches beneath finished grades outside of secured areas.
- k. 12 inches beneath finished grades inside of secured areas.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to the indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Excavation for Underground Basins and Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
 - 1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 - 2. Cut and protect roots according to the written recommendations of the Landscape Architect.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of

pipe or conduit, unless otherwise indicated.

1. Clearance: As indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes. Shape subgrade to provide continuous support for bells, joints and barrels of pipes, unless otherwise indicated.

1. For pipes less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe on an undisturbed subgrade.
2. For pipes 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 9 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to the written recommendations of the Landscape Architect.

3.8 SUBGRADE INSPECTION

A. Notify Geotechnical Engineer when excavations have reached required subgrade.

B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Geotechnical Engineer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for Unit Price Items.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations by extending bottom elevation of concrete foundation to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by the Engineer.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by the Engineer.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under structure and within 18 inches of bottom of structure with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete."
- D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely

encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete"

- E. After installing compacted pipe bedding material, place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact initial bedding material under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.
- G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- H. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- I. Install detectable warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

SOI Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to Maryland Department of Environment (MDE) approved erosion- and sedimentation-control drawings.

3.13 L FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain

- frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.
 3. Soil moisture control shall be the responsibility of the contractor and is to be done with no additional cost to the owner.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Compaction requirements shall be determined by the site's geotechnical engineer for specific soils used for fill placement.
- C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- D. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698, or the geotechnical engineers recommendations, whichever is more stringent:
 1. Under structures and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 4. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 5. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 6. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface

- tolerances.
3. Grassed or vegetated permanent site slopes shall not exceed 3:1.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1/4 inch. ADA routes to remain in compliance.
 3. Pavements: Plus or minus 1/4 inch.
 4. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
1. Install separation geotextile fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place base course material over subbase course under hot-mix asphalt pavement.
 3. Shape subbase and base course to required crown elevations and cross-slope grades.
 4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
 5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 FIELD QUALITY CONTROL

- A. Testing Agency: The Contractor shall engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Geotechnical Engineer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following

locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 2. Foundation Wall and Retaining Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to the specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
- C. Where settling occurs before Project warranty period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 221123-DOMESTIC WATER PUMPS

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. In-line pump(s).
 - 2. Domestic Water Booster Pumps

1.3 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- 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. All wetted surfaces must comply with NSF61. All components in contact with the water stream shall also comply with NSF 372 and COMAR 09.20.01.03 provisions of “Maryland Plumbing Act.”
- C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 - PRODUCTS

2.1 IN-LINE PUMP

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Taco
 - 2. Armstrong Pumps Inc.
 - 3. Bell & Gossett Domestic Pump; ITT Corporation.
 - 4. Grundfos Pumps Corp.
 - 5. Or approved equal.
- B. Description: Factory-assembled and -tested, in-line, lead free, pump. Compact, high velocity performance. Quiet efficiency operation. Self-lubricating and no mechanical seal.
- C. Pump Construction:
 - 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
 - 2. Casing: Bronze or stainless steel, with threaded or companion-flange connections.
 - 3. Motor: Single speed, unless otherwise indicated.

2.2 DOMESTIC WATER BOOSTER PUMP

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Grundfos Pumps Corp
 - 2. Armstrong Pumps Inc.
 - 3. Bell & Gossett Domestic Pump; ITT Corporation.
 - 4. Or approved equal
- B. VARIABLE SPEED PACKAGED PUMPING SYSTEM WITH INTEGRATED VARIABLE FREQUENCY DRIVE MOTORS
 - 1. Furnish and install a pre-fabricated and tested variable speed packaged pumping system to maintain constant water delivery pressure.
 - 2. The packaged pump system shall be a standard product of a single pump manufacturer. The entire pump system including pumps and pump logic controller, shall be designed, built, and tested by the same manufacturer.

3. The complete packaged water booster pump system shall be certified and listed by UL (Category QCZJ – Packaged Pumping Systems) for conformance to U.S. and Canadian Standards.
4. The complete packaged pumping system shall be NSF372 Listed for drinking water and low lead requirements.

C. PUMPS

1. The pumps shall be NSF 372 Listed for drinking water.
2. The pumps shall be of the end-suction horizontal multi-stage design with the discharge vertical on the centerline of the pump.
3. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.
4. Cast Iron Horizontal End-suction Multi-Stage Pumps (12mm or 16mm shaft, Nominal flow from 10 to 130 gallons per minute) shall have the following features:
 - a. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement with a Stop Ring and Nord-lock® washer or similar, which makes it possible to disassemble the pump from the pump side.
 - b. The suction/discharge shall have internal pipe thread (NPT) connections as determined by the pump station manufacturer.
 - c. 3. On the top of the inlet part should be a priming plug to allow the pump to be nearly completely filled with the liquid to be pumped.
 - d. 4. On the lower side of the inlet part should be a drain plug.
 - e. 5. Pump Construction.
 - 1) Inlet Part, Discharge Part: Cast iron (Class 30)
 - 2) Impellers, chambers: 304 Stainless Steel
 - 3) Shaft: 431 Stainless Steel
 - 4) Spacing Pipe: 316 Stainless Steel
 - 5) O-rings: EPDM
 - f. The shaft seal shall be an o-ring seal with fixed driver type with the following features:
 - 1) Retainer and Driver for Seal Ring: 304 or 316 Stainless Steel
 - 2) Spring: 304 or 316 Stainless Steel
 - 3) Stationary Seal: Silicon Carbide (Graphite Imbedded)
 - 4) Rotating Seal: Silicon Carbide (Graphite Imbedded)
 - 5) O-rings: EPDM
 - g. AISI 304 or 316 Stainless Steel End-suction Horizontal Multi-Stage Pumps Nominal flow from 10 to 130 gallons per minute) shall have the following features:
 - 1) The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement with a Stop Ring and Nord-lock® washer or similar, which makes it possible to disassemble the pump from the pump side.
 - 2) The suction/discharge shall have internal pipe thread (NPT) connections as determined by the pump station manufacturer.
 - 3) On the upper area of the flange should be a priming port to allow the pump to be nearly completely filled with the liquid to be pumped.
 - 4) On the bottom side of the pump sleeve should be a drain hole
 - 5) Pump Construction.

- a) Flange: Cast Iron
- b) Impellers, Chambers, Sleeve: 304 or 316 Stainless Steel
- c) Shaft: 304 or 316 Stainless Steel
- d) Spacing Pipe: 316 Stainless Steel
- e) O-rings: EPDM
- f) The shaft seal shall be an o-ring seal with fixed driver type with the following features:
- g) Retainer and Driver for Seal Ring: 304 or 316 Stainless Steel
- h) Spring: 304 or 316 Stainless Steel
- i) Stationary Seal: Silicon Carbide (Graphite Imbedded)
- j) Rotating Seal: Silicon Carbide (Graphite Imbedded)
- k) O-rings: EPDM

D. INTEGRATED VARIABLE FREQUENCY DRIVE MOTORS

1. Each motor shall be of the Integrated Variable Frequency Drive design consisting of a motor and a Variable Frequency Drive (VFD) built and tested as one unit by the same manufacturer.
2. The VFD shall be of the PWM (Pulse Width Modulation) design using current IGBT (Insulated Gate Bipolar Transistor) technology.
3. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of motor. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump control and to eliminate the need for motor de-rating.
4. The VFD shall utilize an energy optimization algorithm to minimize energy consumption. The output voltage shall be adjusted in response to the load, independent of speed.
5. The VFD shall automatically reduce the switching frequency and/or the output voltage and frequency to the motor during periods of sustained ambient temperatures that are higher than the normal operating range. The switching frequency shall be reduced before motor speed is reduced.
6. An integral RFI filter shall be standard in the VFD.
7. The VFD shall have a minimum of two skip frequency bands which can be field adjustable.
8. The VFD shall have internal solid-state overload protection designed to trip within the range of 125-150% of rated current.
9. The integrated VFD motor shall include protection against input transients, phase imbalance, loss of AC line phase, over-voltage, under-voltage, VFD over-temperature, and motor over-temperature. Three-phase integrated VFD motors shall be capable of providing full output voltage and frequency with a voltage imbalance of up to 10%.
10. The integrated VFD motor shall have, as a minimum, the following input/output capabilities:
 - a. Speed Reference Signal: 0-10 VDC, 4-20mA
 - b. Digital remote on/off
 - c. Fault Signal Relay (NC or NO)
 - d. Fieldbus communication port (RS485)
11. The motor shall be Totally Enclosed Fan Cooled (TEFC) with a standard NEMA C-Face, Class F insulation with a temperature rise no higher than Class B.
12. The cooling design of the motor and VFD shall be such that a Class B motor temperature rise is not exceeded at full rated load and speed at a minimum switching frequency of 9.0 kHz.

13. Motor drive end bearings shall be adequately sized so that the minimum L10 bearing life is 17,500 hours at the minimum allowable continuous flow rate for the pump at full rated speed.

E. PUMP SYSTEM CONTROLLER

1. The pump system controller shall be a standard product developed and supported by the pump manufacturer.
2. The controller shall be microprocessor based capable of having software changes and updates via personal computer (notebook). The controller shall be designed specifically for control of parallel connect pumps in constant pressure applications.
3. The controller shall provide internal galvanic isolation to all digital and analog inputs as well as all fieldbus connections.
4. The controller shall display the following as status readings from a single display on the controller (this display shall be the default):
 - a. Current value of the control parameter, (typically discharge pressure)
 - b. Alarm indication (if any)
 - c.
5. The controller shall have as a minimum the following hardware inputs and outputs:
 - a. Two analog inputs (4-20mA or 0-10VDC)
 - b. Two digital inputs
 - c. Two digital outputs
 - d. Three PTC connections for motor monitoring
 - e. Field Service connection to PC for advanced programming and data logging
6. Pump system programming (field adjustable) shall include as a minimum the following:
 - a. Current setpoint
 - b. Pump control Off/Auto
 - c. System control On/Off
 - d. Alarm reset
7. Pump system programming (field Service connection to PC for advanced programming) shall include as a minimum the following:
 - a. Water shortage protection (analog or digital)
 - b. Transducer Settings (Suction and Discharge Analog supply/range)
 - c. PI Controller (Proportional gain and Integral time) settings
 - d. High system pressure indication and shut-down
 - e. Low system pressure indication and shut-down
 - f. Low suction pressure/level shutdown (via digital contact)
 - g. Low suction pressure/level warning (via analog signal)
 - h. Low suction pressure/level shutdown (via analog signal)
 - i. Flow meter settings (if used, analog signal)
8. The controller shall be capable of receiving a remote analog set-point (4-20mA or 0-10 VDC) as well as a remote system on/off (digital) signal.
9. The pump system controller shall be mounted in a UL Type 3R rated enclosure. A self-certified NEMA enclosure rating shall not be considered equal. The entire control panel shall

be UL 508 listed as an assembly. The control panel shall include a main disconnect, circuit breakers for each pump and the control circuit and control relays for alarm functions.

Control panel options shall include:

Emergency/Normal Operation Switches, located on front of panel.

- a. The controller shall be capable of receiving a redundant sensor input to function as a backup to the primary sensor (typically discharge pressure).
- b. The controller shall have the ability to communicate common field-bus protocols, (BACnet, Modbus, Profibus, and LON), via optional communication expansion card installed inside controller.

F. SEQUENCE OF OPERATION

1. The system controller shall operate equal capacity variable speed pumps to maintain a constant discharge pressure (system set-point). The system controller shall receive an analog signal [4-20mA] from the factory installed pressure transducer on the discharge manifold, indicating the actual system pressure. As flow demand increases the pump speed shall be increased to maintain the system set-point pressure. When the operating pump(s) reach 97% of full speed (adjustable), an additional pump will be started and will increase speed until the system set-point is achieved. When the system pressure is equal to the system set-point all pumps in operation shall reach equal operating speeds. As flow demand decreases the pump speed shall be reduced while system set-point pressure is maintained. When all pumps in operation are running at low speed the system controller shall switch off pumps when fewer pumps are able to maintain system demand.
2. The system controller shall be capable of switching pumps on and off to satisfy system demand without the use of flow switches, motor current monitors or temperature measuring devices.
3. All pumps in the system shall alternate automatically based on demand, time and fault. If flow demand is continuous (no flow shut-down does not occur), the system controller shall have the capability to alternate the pumps every 24 hours, every 48 hours or once per week. The interval and actual time of the pump change-over shall be field adjustable.

G. LOW FLOW STOP FUNCTION

1. The system controller shall be capable of stopping pumps during periods of low-flow or zero-flow without wasting water or adding unwanted heat to the liquid. Temperature based no flow shut-down methods that have the potential to waste water and add unwanted temperature rise to the pumping fluid are not acceptable.
2. Standard Low Flow Stop and Energy Saving Mode
If a low or no flow shut-down is required (periods of low or zero demand) a bladder type diaphragm tank shall be installed with a pre-charge pressure of 70% of system set-point. The tank shall be piped to the discharge manifold or system piping downstream of the pump system. When only one pump is in operation the system controller shall be capable of detecting low flow (less than 10% of pump nominal flow) without the use of additional flow sensing devices. When a low flow is detected, the system controller shall increase pump speed until the discharge pressure reaches the stop pressure (system set-point plus 50% of programmed on/off band). The pump shall remain off until the discharge pressure reaches the start pressure (system set-point minus 50% of programmed on/off band). Upon low flow shut-down a pump shall be restarted in one of the following two ways:

- a. Low Flow Restart: If the drop in pressure is slow when the start pressure is reached (indicating the flow is still low), the pump shall start and the speed shall again be increased until the stop pressure is reached and the pump shall again be switched off.
- b. Normal Flow Restart: If the drop in pressure is fast (indicating the flow is greater than 10% of pump nominal flow) the pump shall start and the speed shall be increased until the system pressure reaches the system set-point.

H. SYSTEM CONSTRUCTION

1. Suction and discharge manifold construction shall be in way that ensures minimal pressure drops, minimize potential for corrosion, and prevents bacteria growth at intersection of piping into the manifold. Manifold construction that includes sharp edge transitions or interconnecting piping protruding into manifold is not acceptable. Manifold construction shall be such that water stagnation can not exist in manifold during operation to prevent bacteria growth inside manifold.
2. The suction and discharge manifolds shall be constructed of 316 stainless steel. Manifold connection sizes shall be as follows:

3 inch and smaller: Male NPT threaded
4 inch ANSI Class 150 rotating flanges
3. Pump Isolation valves shall be provided on the suction and discharge of each pump. Isolation valve sizes 2 inch and smaller shall be nickel plated brass full port ball valves. Isolation valve sizes 3 inch and larger shall be a full lug style butterfly valve. The valve disk shall be of stainless steel. The valve seat material shall be EPDM and the body shall be cast iron, coated internally and externally with fusion-bonded epoxy.
4. A spring-loaded non-slam type check valve shall be installed on the discharge of each pump. The valve shall be a wafer style type fitted between two flanges. The head loss through the check valve shall not exceed 5 psi at the pump design capacity. Check valves 1-1/2" and smaller shall have a POM composite body and poppet, a stainless steel spring with EPDM or NBR seats. Check valves 2" and larger shall have a body material of stainless steel or epoxy coated iron (fusion bonded) with an EPDM or NBR resilient seat. Spring material shall be stainless steel. Disk shall be of stainless steel or leadless bronze.
5. For systems that require a diaphragm tank, a connection of no smaller than 3/4" shall be provided on the discharge manifold.
6. A pressure transducer shall be factory installed on the discharge manifold (or field installed as specified on plans). A factory installed pressure switch on the suction manifold for water shortage protection. Pressure transducers shall be made of 316 stainless steel. Transducer accuracy shall be +/- 1.0% full scale with hysteresis and repeatability of no greater than 0.1% full scale. The output signal shall be 4-20 mA with a supply voltage range of 9-32 VDC.
7. A bourdon tube pressure gauge, 2.5 inch diameter, shall be placed on the suction and discharge manifolds. The gauge shall be liquid filled and have copper alloy internal parts in a stainless steel case. Gauge accuracy shall be 2/1/2 %. The gauge shall be capable of a pressure of 30% above its maximum span without requiring recalibration.
8. The base frame shall be constructed of corrosion resistant 304 stainless steel. Rubber vibration dampers shall be fitted between each pumps and baseframe to minimize vibration.

I. TESTING

1. The entire pump station shall be factory tested for functionality. Functionality testing shall include the following parameters: Dry Run Protection, Minimum Pressure and Maximum Pressure alarms (where applicable), Setpoint Operation, and Motor Rotation.
2. The system shall undergo a factory hydrostatic test at the end of the production cycle. The system shall be filled with water and pressurized to 1.5 times the nameplate maximum pressure. Systems with 150# flange connections shall be tested at 350 psig, and systems with 300# flange connections shall be tested at 450 psig. The pressure shall be maintained for a minimum of 15 minutes with no leakage (slight leakage around pump(s) mechanical seal is acceptable) prior to shipment.

J. WARRANTY

1. The warranty period shall be a non-prorated period of 24 months from date of installation, not to exceed 30 months from date of manufacture.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install in-line pump with shaft horizontal unless otherwise indicated.
 1. Comply with requirements for hangers and supports specified in Division 23 Section "Hangers and Supports for Mechanical Piping and equipment."
- C. Pump must be designed for vertical mount if placed vertically,
- D. Install thermostats in hot-water return piping.

3.3 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
- D. Comply with Division 26 Sections for electrical connections, and wiring methods.

3.4 IDENTIFICATION

- A. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.5 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 6. Start motor.
 - 7. Open discharge valve slowly.
 - 8. Adjust temperature settings on thermostats.
 - 9. Adjust timer settings.

3.6 ADJUSTING

- A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated, or as recommended by manufacturer.

END OF SECTION 221123

SECTION 221423-STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to the work under Divisions 22 and 23.

1.2 SUMMARY

- A. Section Includes the following storm drainage piping specialties:
 1. Downspout boot adapter.
 2. Roof Drains.
 3. Cleanouts.
 4. Backwater Valves

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.5 COORDINATION

- A. Coordinate size and location of architectural downspouts.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

- A. Downspout Boot Adapters
 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products by one of the following:
 - a. Neehan R-4927
 - b. Zurn Plumbing Products Group; Specification Drainage Operation.
Barry Foundry
 2. Description: cast-iron soil pipe.
 3. Size: Coordinate size with architectural downspout and connecting round pipe. Match to existing.

B. Roof Drain And Overflow Drains

1. Main roof drain and overflow drains shall have a cast iron body with low silhouette polypropylene dome secured to be vandal resistant, sump receiver, combination flashing clamp/gravel guards and adjustable extension collar. Overflow drain shall have 2” high internal water dam.
 - a. Zurn – ZC 100
 - b. J. R. Smith 1011-U-CID, inside caulk joint
 - c. Josam
2. Roof and overflow drain outlet connection and the first pipe joint connection shall be cast iron hub and spigot with lead and oakum joint seals.
3. Install clevis hanger within 12” of the first 90 degree elbow, below the roof and overflow drains.
4. Roof drains located in canopies only shall have a side pipe connection in three locations. Coordinate and confirm connections arrangements prior to purchasing.

C. Downspout Nozzles

1. Downspout Nozzles shall be nickel bronze construction with, stainless steel screen, decorative wall flange and goose-bill spout. Provide factory optional finish as selected by the Architect. Downspout nozzles shall be of the size and quantity indicated on the drawings. Downspout nozzles in exterior walls for secondary overflow roof drainage discharge above grade.
 - a. Zurn- Z199 SS
 - b. J. R. Smith
 - c. Josam
 - d.

D. Area Drains

1. Area drains shall have a cast iron body with rotatable square promenade frame with seepage openings, frame clamps, Nickel Bronze top, Deck extension, Vandal proof secured top, heavy duty heel proof duresist grate and sediment bucket.
 - a. Zurn – ZN 150
 - b. J. R. Smith
 - c. Josam
2. Coordinate and confirm connections arrangements and pipe sizes prior to purchasing.

2.2 CLEANOUTS

A. Exposed Cast Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products by one of the following:
 - a. Zurn Plumbing Products Group; Specification Drainage Operation.
 - b. Josam Company; Josam Div.
 - c. MIFAB, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
2. Standard: ASME A112.36.2M fr cast iron for cleanout test tee.

3. Size: Same as connected drainage piping.
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersink, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. Oatey.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M, for threaded, adjustable housing cleanouts.
3. Size: Same as connected branch.
4. Body or Ferrule Material: Cast iron
5. Closure: Brass plug with tapered threads
6. Adjustable Housing Material: Cast iron with threads.
7. Frame and Cover Material and Finish: Nickel-bronze, copper alloy Frame and Cover
Shape: Preferably Round
8. Top-Loading Classification: Medium Duty.
9. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
10. Standard: ASME A112.3.1.
11. Size: Same as connected branch.

C. Cast-Iron Wall Cleanouts :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M,. Include wall access.
3. Size: Same as connected drainage piping.
4. Body Material: as required to match connected piping.
5. Closure: Countersunk brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.

2.3 BACKWATER VALVES

A. Cast-Iron, Horizontal Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.14.1, for backwater valves.
3. Size: Same as connected piping.
4. Body Material: Cast iron.
5. Cover: Cast iron with bolted access check valve.
6. End Connections: Hub and spigot.
7. Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
8. Extension: ASTM A 74, Service class; full-size, cast-iron soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install downspout boot adapters, connect to sheet metal downspouts and piping.
- B. Install downspout boots adapters at grade with top no more than 18 inches above grade or otherwise indicated. Secure to building wall.
- C. Install cleanouts. Cleanouts in walls must be within 2” of the finished wall or it must be extended to within 2” of the finished wall.
- D. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.
 1. Install roof-drain flashing collar or flange so there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 2. Position roof drains for easy access and maintenance.
 3. Install drains per manufacturer’s requirements.
- E. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
 1. The same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical riser.
- F. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- G. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- H. Install horizontal backwater valves in floor with cover flush with floor.
- I. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- J. Install cast-iron downspout boots with top of hub 12 inches above floor/grade, or as indicated otherwise.
- K. Install downspout discharge nozzles at exposed bottom of conductors where they spill onto grade.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.4 TESTING

- A. Perform water tests on roof drain assemblies, including leader piping, and on gutter assemblies and scuppers. Plug roof drain bowl, and using 3/4 inch garden hose, fill sump area and bowl with water. Perform visual inspection below roof decking after thirty minutes. Then run water into the drainage components for thirty minutes. Inspect all drainage components for leakage and repair as required. If repair is needed to fix leaks, this shall be performed at no cost to owner.

END OF SECTION 221423

SECTION 224000-PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division Specification Sections, as applicable, shall apply to this section.

1.2 SUMMARY

- A. The work this Section of the Specification shall include the furnishing of labor, materials and equipment for the installation of complete system to provide continuous and satisfactory service.
- B. This Section includes the following conventional plumbing fixtures and related components:
 - 1. Sinks.
 - 2. Showers
 - 3. Service Sinks
 - 4. Clothes Washer Wall Box
 - 5. Can Washer
 - 6. Urinal

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.

- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, flow-control rates, diagram power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
- B. 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.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act" for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Solid-Surface-Material Sinks: ANSI/ICPA SS-1.

I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Faucets: ASME A112.18.1.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Engineered Brass Co.
- b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
- c. McGuire Manufacturing Co., Inc.
- d. Plumberex Specialty Products Inc.
- e. TCI Products.
- f. TRUEBRO, Inc.
- g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold- water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. TRUEBRO, Inc.

3. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

2.2 PLUMBING FIXTURES

A. Mounting Heights of Fixtures

1. To provide for the physically disabled, plumbing fixtures shall be provided for their use at a mounting height suitable for the disabled as set forth by the Federal Government. Fixtures for special uses need not meet this requirement. Fixture mounting heights are generally indicated on the drawings.
 2. Hot water and drain piping accessible to a wheelchair patient shall be suitably protected against high temperature by molded vinyl piping covers with access to shut-off valves, trap cleanout, etc. Insulation shall have out of sight fastening system, tie bands are not approved. Covers shall be Truebro 105/102.
- B. Hot and cold water connections to fixtures shall be provided with a stop valve. Stop valves, risers, etc. shall be commercial/institutional grade as manufactured by Brass Craft, Chicago, Engineered Systems or McGuire.
- C. Provide water temperature limiting device conforming ASSE 1070 as required by code.
- D. Provide metal supports necessary to adequately and substantially hang and set fixtures, supports must be floor mounted and anchored to the floor, no exceptions. Supports shall be Zurn, Josam or J. R. Smith and suitable for the wall thickness and piping arrangements shown.
- E. For sinks and fixtures specified under other Divisions or other contracts and not provided with faucets, tailpieces, traps, and stop valves; provide necessary fittings and completely connect the sinks and fixtures.
- F. Plumbing fixtures shall be caulked at wall and floor with silicone caulking material of same color as the fixture.
- G. All plumbing fixture trim is to have vandal resistant fittings and fasteners.
- H. Fixtures shall be as follows:
1. P-1A,P-1B, P-1C WATER CLOSET
 - a. See specification section 224213.13 Water Closet
 2. P-2A, P-2B, P-2C, P-2D, P-2E, LAVATORY
 - a. See specification section 224216.13 Lavatory
 3. P-3A SINK
 - a. Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 16 x 16 x 10 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - b. Model
 - 1) Elkay DLKQ202210
 - 2) Approved equal
 - c. Faucet – Concealed widespread faucet dual 2-5/8” lever handles, 11” Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439C
 - 2) Approved equal
 - d. Drain - stainless steel drain with removable grid strainer and tailpiece.
 - 1) Elkay LK99
 - 2) Approved equal

4. P-3B CLASSROOM SINK
 - a. ADA, Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 13-1/2 x 16 x 5-1/2 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - 1) Model
 - a) Elkay DRKAD222055
 - b) Approved equal
 - b. Faucet – Concealed widespread faucet dual 4” lever handles, 11” Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439BHC
 - 2) Approved equal
 - 3) Bubbler – Vandal resistant ADA Lead free bubbler. Comply with ANSI/NSF 61. Adjustable flow regulator and self -closing push bottom activator. Confirm mounting location with architectural drawings prior to purchase and installation.
 - a) Elkay LKSSVR1141A
 - b) Approved Equal
 - c. Drain - stainless steel drain with removable grid strainer and offset tailpiece.
 - 1) Elkay LK35
 - 2) Approved equal
 - d. Deck Mount Swivel-Type, Plumbed Eyewash Unit:
 - 1) Basis of Design Product: Subject to compliance with requirements, provide Bradley Model: S19-270 or comparable product by one of the following:
 - a) a. Acorn Safety; a division of Acorn Engineering Company.
 - b) b. Haws Corporation.
 - 2) Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - 3) Supply Piping: NPS 1/2 (DN 15) chrome-plated brass with flow regulator and stay-open control valve.
 - 4) Control-Valve Actuator: Movement of spray-head assembly to position over sink.
 - 5) Control Spray-Head Assembly: Two spray heads with offset piping.
 - 6) Mounting: Deck next to sink.
 - 7) Provide emergency thermostatic mixing valve Bradley S19-2000
 - 8) Confirm right or left hand mount with architectural drawings prior to purchase and installation.
5. P-3C CLASSROOM SINK
 - a. ADA, Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 13-1/2 x 16 x 5-1/2 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - 1) Model
 - a) Elkay DRKAD222055
 - b) Approved equal
 - b. Faucet – Concealed widespread faucet dual 4” lever handles, 11” Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439BHC
 - 2) Approved equal

- c. Bubbler – Vandal resistant ADA Lead free bubbler. Comply with ANSI/NSF 61. Adjustable flow regulator and self -closing push bottom activator. Confirm mounting location with architectural drawings prior to purchase and installation.
 - 1) Elkay LKSSVR1141A
 - 2) Approved Equal
 - d. Drain - stainless steel drain with removable grid strainer and offset tailpiece.
 - 1) Elkay LK35
 - 2) Approved equal
6. P-3D SINK (ART)
- a. ADA, Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 18 x 14 x 4-7/8 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - 1) Model
 - a) Elkay Iradq221950
 - b) Approved equal
 - b. Faucet – Concealed widespread faucet dual 4” lever handles, 11” Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439BHC
 - 2) Approved equal
 - c. Drain - stainless steel drain with removable grid strainer and offset tailpiece.
 - 1) Elkay LK99
 - 2) Approved equal
 - d. Provide a top access solids trap with removable stainless steel bucket and chrome plated brass or steel wall flange, Zurn Z-1180.
7. P-3E SINK (ART)
- a. Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 16 x 16 x 7-5/8 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - b. Model
 - 1) Elkay LR2022
 - 2) Approved equal
 - c. Faucet – Concealed widespread faucet dual 2-5/8” lever handles, 11” Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439C
 - 2) Approved equal
 - d. Drain - stainless steel drain with removable grid strainer and tailpiece.
 - 1) Elkay LK99
 - 2) Approved equal
 - e. Provide a top access solids trap with removable stainless steel bucket and chrome plated brass or steel wall flange, Zurn Z-1180.
8. P-3F SINK (SCIENCE)
- a. Provide drop in epoxy resin sink. Sink bowl is 18x15x5 with corner drain. Mount sink in counter furnished under another division.
 - b. Model
 - 1) Chemtops/Durcon model A25
 - 2) Approved equal

- c. Faucet – ADA, Polished chrome-plated double laboratory faucet with integral shank, quarter turn ceramic disc cartridges and a 6" centerline rigid gooseneck spout with vacuum breaker. Unit is furnished with a serrated nozzle, vandal-resistant 2 1/2" color-coded metal lever handles, mounting hardware and stainless steel flex connection hoses. Vandal resistant .5 gpm aerator.
 - 1) Zurn Z82601-6M
 - 2) Approved equal
 - d. Drain Outlet- Propylene.
 - 1) Chemtops/Durcon model OUTL-S03R
 - 2) Approved equal
 - e. Overflow Drain Outlet- Propylene.
 - 1) Chemtops/Durcon model OVRP-OE
 - 2) Approved equal
 - f. Sink Strainer Cap- Propylene.
 - 1) Chemtops/Durcon model STRN-BH-001
 - 2) Approved equal
 - g. Sink Stopper- Rubber.
 - 1) Chemtops/Durcon model STPR-02P
 - 2) Approved equal
 - h. Provide point of use PHX Cartridge Acid Neutralization system includes industrial strength glass filled polypropylene body with a 1-1/2" compression fitting inlet and 1-1/2 No Hum outlet, removable upper neutralization chamber and lower sediment collection chamber. Cartridge has a maximum flow of 8 gpm. System media, a mix of non-hazardous solid alkali non resin materials to neutralize acids in a self-contained system. Piping from sink to Acid Neutralization system shall be acid resistance such as HP PVDF.
9. P-3G SINK (SCIENCE)
- a. Provide drop in epoxy resin sink. Sink bowl is 18x15x5 with corner drain. Mount sink in counter furnished under another division.
 - b. Model
 - 1) Chemtops/Durcon model A25
 - 2) Approved equal
 - c. Faucet – ADA, Polished chrome-plated double laboratory faucet with integral shank, quarter turn ceramic disc cartridges and a 6" centerline rigid gooseneck spout with vacuum breaker. Unit is furnished with a serrated nozzle, vandal-resistant 2 1/2" color-coded metal lever handles, mounting hardware and stainless steel flex connection hoses. Vandal resistant .5 gpm aerator.
 - 1) Zurn Z82601-6M
 - 2) Approved equal
 - d. Drain Outlet- Propylene.
 - 1) Chemtops/Durcon model OUTL-S03R
 - 2) Approved equal
 - e. Overflow Drain Outlet- Propylene.
 - 1) Chemtops/Durcon model OVRP-OE
 - 2) Approved equal
 - f. Sink Strainer Cap- Propylene.
 - 1) Chemtops/Durcon model STRN-BH-001
 - 2) Approved equal
 - g. Sink Stopper- Rubber.
 - 1) Chemtops/Durcon model STPR-02P

- 2) Approved equal
 - h. Deck Mount Swivel-Type, Plumbed Eyewash Unit:
 - 1) Basis of Design Product: Subject to compliance with requirements, provide Bradley Model: S19-270 or comparable product by one of the following:
 - a) a. Acorn Safety; a division of Acorn Engineering Company.
 - b) b. Haws Corporation.
 - 2) Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
 - 3) Supply Piping: NPS 1/2 (DN 15) chrome-plated brass with flow regulator and stay-open control valve.
 - 4) Control-Valve Actuator: Movement of spray-head assembly to position over sink.
 - 5) Control Spray-Head Assembly: Two spray heads with offset piping.
 - 6) Mounting: Deck next to sink.
 - 7) Provide emergency thermostatic mixing valve Bradley S19-2000
 - 8) Confirm right or left hand mount with architectural drawings prior to purchase and installation.
 - i. Provide point of use PHX Cartridge Acid Neutralization system includes industrial strength glass filled polypropylene body with a 1-1/2" compression fitting inlet and 1-1/2 No Hum outlet, removable upper neutralization chamber and lower sediment collection chamber. Cartridge has a maximum flow of 8 gpm. System media, a mix of non-hazardous solid alkali non resin materials to neutralize acids in a self-contained system. Piping from sink to Acid Neutralization system shall be acid resistance such as HP PVDF.
10. P-3H SINK (SCIENCE)
- a. Provide drop in epoxy resin sink. Sink bowl is 18x15x7-1/2 with corner drain. Mount sink in counter furnished under another division.
 - b. Model
 - 1) Chemtops/Durcon model D25
 - 2) Approved equal
 - c. Faucet – Polished chrome-plated double laboratory faucet with integral shank, quarter turn ceramic disc cartridges and a 6" centerline rigid gooseneck spout with vacuum breaker. Unit is furnished with a serrated nozzle, vandal-resistant 2 1/2" color-coded metal lever handles, mounting hardware and stainless steel flex connection hoses. Vandal resistant .5 gpm aerator.
 - 1) Zurn Z82601-6M
 - 2) Approved equal
 - d. Drain Outlet- Propylene.
 - 1) Chemtops/Durcon model OUTL-S03R
 - 2) Approved equal
 - e. Overflow Drain Outlet- Propylene.
 - 1) Chemtops/Durcon model OVRP-OE
 - 2) Approved equal
 - f. Sink Strainer Cap- Propylene.
 - 1) Chemtops/Durcon model STRN-BH-001
 - 2) Approved equal
 - g. Sink Stopper- Rubber.
 - 1) Chemtops/Durcon model STPR-02P
 - 2) Approved equal

- h. Provide point of use PHX Cartridge Acid Neutralization system includes industrial strength glass filled polypropylene body with a 1-1/2" compression fitting inlet and 1-1/2 No Hum outlet, removable upper neutralization chamber and lower sediment collection chamber. Cartridge has a maximum flow of 8 gpm. System media, a mix of non-hazardous solid alkali non resin materials to neutralize acids in a self-contained system. Piping from sink to Acid Neutralization system shall be acid resistance such as HP PVDF.
11. P-3J SINK
- a. ADA, Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 13-1/2 x 16 x 5-1/2 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - 1) Model
 - a) Elkay DRKAD222055
 - b) Approved equal
 - b. Faucet – Concealed widespread faucet dual 4" lever handles, 11" Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439BHC
 - 2) Approved equal
 - c. Drain - stainless steel drain with removable grid strainer and offset tailpiece.
 - 1) Elkay LK35
 - 2) Approved equal
12. P-3K SINK
- a. ADA, Single compartment 18 gauge, type 304 stainless steel, drop in sink. Sink bowl shall be 13-1/2 x 16 x 5-1/2 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - 1) Model
 - a) Elkay DRKAD222055
 - b) Approved equal
 - b. Faucet – Concealed widespread faucet dual 4" lever handles, 11" Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.
 - 1) Elkay LKD2439BHC
 - 2) Approved equal
 - c. Drain - stainless steel drain with removable grid strainer and offset tailpiece.
 - 1) Elkay LKD35
 - 2) Approved equal
13. P-3L SINK (DOUBLE)
- a. ADA, Double compartments 18 gauge, type 304 stainless steel, drop in sink. Each sink bowl shall be 12 x 12 x 6-1/2 deep. Provide chrome plated cast brass P trap and stop valves in the supply pipes. Underside shall be coated with sound deadening material. Mount sink in counter furnished under another division.
 - 1) Model
 - a) Elkay LRAD291865PD
 - b) Approved equal
 - b. Faucet – Concealed widespread faucet dual 4" lever handles, 11" Arc (rigid) spout and chrome finish. Vandal resistant .5 gpm aerator.

- 1) Elkay LKD2439BHC
 - 2) Approved equal
 - c. Drain - stainless steel drain with removable grid strainer and offset tailpiece.
 - 1) Elkay LKDS99
 - 2) Approved equal
14. P-4 SHOWER
- a. Enclosure provided under Architectural Division.
 - b. Shower Valve –Pressure Balance, ADA.
 - 1) Bradley Equa-Flo
 - 2) Approved equal
 - c. Shower System Faucet/kit- lever handle, single control, Pressure balancing valve, 36” slide bar, 59” metal shower hose. Faceplate and vacuum breaker shall be chrome plated. FloWise showerhead shall be 3-function, ADA compliant and limited to 1.5 GPM.
 - 1) Model
 - a) American Standard 1662SG.211
 - b) Approved equal
 - d. Drain 2” outlet – cast iron adjustable nickel bronze 8 inch round strainer.
 - 1) Zurn Z415B
 - 2) J. R. Smith
15. P-5 SERVICE SINK
- a. 36 x 24 inch molded stone basin with 10 inch high sides, cast-in strainer, stainless steel caps on curbs.
 - 1) Model
 - a) Fiat - MSB-3624
 - b) Stern Williams
 - b. Faucet - wall mounted with vacuum breaker, integral stops, adjustable wall brace, pail hook, and hose end.
 - 1) Fiat - 830-AA
 - 2) Stern Williams
 - c. Hose and Hose Bracket - heavy duty hose with chrome coupling and stainless steel bracket with rubber grip.
 - 1) Fiat - 832-AA
 - 2) Stern Williams
 - d. Mop Hanger - stainless steel bracket with 3 rubber grips.
 - 1) Fiat - 889-CC
 - 2) Stern Williams
 - e. Silicone Sealant
 - 1) Fiat - 833-AA
 - 2) Stern Williams
16. P-6 DOMESTIC CLOTHES WASHER
- a. Provided by owner or under another division of the specification. Provide connections only and make connection under division 22.
 - b. Washing machine standpipe box.
 - 1) Provide washing machine standpipe box suitable for flush mounting. Box shall be constructed of galvanized steel with lead free domestic valve and overflow guard. Valves shall comply with ASME A112.18.1.

- 2) Provide “Duo-Cloz” ball valve assembly with hose ends to control hot and cold water supplies with a single lever. Provide vacuum breakers on hot and cold water supplies.
 - 3) Standpipe box shall be Guy Gray model BB200TS or Symmons W602.
17. P-7 DOMESTIC CLOTHES DRYER
- a. Provided by owner or under another division of the specification.
18. P-8 WATER COOLER
- a. See specification section 224700 Drinking Fountains and Water Coolers
19. P-9 WATER COOLER AND BOTTLE FILL
- a. See specification section 224700 Drinking Fountains and Water Coolers
20. P-10 CAN WASHER
- a. Square cast iron can wash drain with acid resisting interior, double drainage flange with weepholes, bottom outlet, removable sediment bucket, bronze spray nozzle assembly and nikaloy rim and light-duty nikaloy secured grate. Provide vandal proof screws, prime adapter water supply control box.
 - 1) Josam series 49870a
 - b. Dual temperature remote supply box of 304 stainless steel. Includes ½” compression valves, vacuum breaker and screwdriver stops. Door provided with cam and cylinder lock.
 - 1) Josam (-98)
21. P-11 URINAL
- a. White vitreous china, syphon jet action, wall hung urinal and 3/4" top spud. Provide with the appropriate carrier system to accommodate the piping arrangement and wall cavity restrictions. Provide heights as indicated on architectural and ADA compliant.
 - 1) Model
 - a) American Standard - WashbrookFlowise - 6590.001
 - b. Flush Valve:
 - 1) Manufacturer:
 - a) Royal 186
 - 2) Standard: ASSE 1037.
 - 3) Hard wired sensor with override button and transformer
 - 4) Features: Include integral check stop and backflow-prevention device.
 - 5) 11-1/2” Exposed Flushometer-Valve Finish: Chrome plated.
 - 6) Style: Exposed.
 - 7) Consumption: .125 gal. per flush.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install wall-mounting fixtures with tubular waste piping attached to supports.
- C. Install counter-mounting fixtures in and attached to casework.
- D. Install fixtures level and plumb according to roughing-in drawings.
- E. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- F. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- G. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- H. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- I. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- J. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- K. Provide and install water temperature limiting devices as required by code.
- L. Install per manufacturer's requirements.
- M. Install traps on fixture outlets.
- N. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- O. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 224213.13-COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division Specification Sections, as applicable, shall apply to this section.

1.2 SUMMARY

- A. Section includes:
 - 1. Water closets.
 - 2. Flush valves.
 - 3. Toilet seats.
 - 4. Fixture supports.
- B. The work under this Section of the Specification shall include the furnishing of labor, materials and equipment for the installation of complete system to provide continuous and satisfactory service.
- C. Related Sections
 - 1. Division 10 Section “Toilet and Bath Accessories”
 - 2. Division 22 Section “Domestic Water Piping Specialties”.
 - 3. Section 224216.13 “Commercial Lavatories.”

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 water closets.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Provide informational submittals in Operation and Maintenance Manuals in addition to action submittals and section 017823 “Operation and Maintenance Data”.
- B. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WATER CLOSETS

- A. P-1A Water Closet: Floor mounted, back outlet, top spud. ADA Compliant.
1. Manufacturers: Subject to compliance with requirements, provide products by Zurn or comparable product of one of the following:
 - a. Model
 - 1) Zurn Z-5645-BWL
 - 2) Kohler
 - 3) Sloan
 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: ADA Compliant (16-3/4" to top of bowl).
 - f. Rim Contour: Universal/Elongated.
 - g. Water Consumption: Dual 1.6/1.1 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
 - i. Color: White
 3. Flushometer Valve:
 - a. Manufacturer:
 - 1) Sloan WES 111
 - b. ADA Compliant
 - c. Standard: ASSE 1037.
 - d. Features: Include integral check stop and backflow-prevention device, Antimicrobial coating on handle
 - e. Exposed Flushometer-Valve Finish: Chrome plated.
 - f. Style: Exposed.
 - g. Consumption: High Efficiency, dual 1.6/1.1 gal. per flush.
 4. Toilet Seat:
 - a. Manufacturer: Olsonite #95
 - b. Standard: IAPMO/ANSI Z124.5.
 - c. Material: Plastic.
 - d. Type: Commercial (Heavy Duty).
 - e. Shape: Elongated rim, open front without cover.
 - f. Hinge: Self Sustaining Concealed check.
 - g. Hinge Material: Stainless steel posts and Pintles.
 - h. Color: White.
 5. Support:
 - a. Standard: ASME A112.6.1M.
 - b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space. Floor mounted supports shall be provided, NO Exceptions.
 - c. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

- B. P-1B Water Closet: Floor mounted, back outlet, top spud. Youth Standard/ADA Compliant.
1. Manufacturers: Subject to compliance with requirements, provide products by Zurn or comparable product of one of the following:
 - a. Model
 - 1) Zurn Z-5635-BWL
 - 2) Kohler
 - 3) Sloan
 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: ADA Compliant (14" to top of bowl).
 - f. Rim Contour: Universal/Elongated.
 - g. Water Consumption: Dual 1.6/1.1 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
 - i. Color: White
 3. Flushometer Valve:
 - a. Manufacturer:
 - 1) Sloan WES 111
 - b. ADA Compliant
 - c. Standard: ASSE 1037.
 - d. Features: Include integral check stop and backflow-prevention device, Antimicrobial coating on handle
 - e. Exposed Flushometer-Valve Finish: Chrome plated.
 - f. Style: Exposed.
 - g. Consumption: High Efficiency, dual 1.6/1.1 gal. per flush.
 4. Toilet Seat:
 - a. Manufacturer: Olsonite #95
 - b. Standard: IAPMO/ANSI Z124.5.
 - c. Material: Plastic.
 - d. Type: Commercial (Heavy Duty).
 - e. Shape: Elongated rim, open front without cover.
 - f. Hinge: Self Sustaining Concealed check.
 - g. Hinge Material: Stainless steel posts and Pintles.
 - h. Color: White.
 5. Support:
 - a. Standard: ASME A112.6.1M.
 - b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space. Floor mounted supports shall be provided, NO Exceptions.
 - c. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.
- C. P-1C Water Closet: Floor mounted, bottom outlet, top spud. ADA Compliant.
1. Manufacturers: Subject to compliance with requirements, provide products by American Standard or comparable product of one of the following:
 - a. Model
 - 1) American Standard Baby DeVoro 2282.001

- 2) Kohler
 - 3) Sloan
 - 4) Zurn
2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: ADA Compliant (10.25" to top of bowl).
 - f. Rim Contour: Universal/Elongated.
 - g. Water Consumption: Dual 1.6/1.1 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
 - i. Color: White
 3. Flushometer Valve:
 - a. Manufacturer:
 - 1) Sloan WES 111
 - b. ADA Compliant
 - c. Standard: ASSE 1037.
 - d. Features: Include integral check stop and backflow-prevention device, Antimicrobial coating on handle
 - e. Exposed Flushometer-Valve Finish: Chrome plated.
 - f. Style: Exposed.
 - g. Consumption: High Efficiency, dual 1.6/1.1 gal. per flush.
 4. Toilet Seat:
 - a. Manufacturer: Olsonite #95
 - b. Standard: IAPMO/ANSI Z124.5.
 - c. Material: Plastic.
 - d. Type: Commercial (Heavy Duty).
 - e. Shape: Elongated rim, open front without cover.
 - f. Hinge: Self Sustaining Concealed check.
 - g. Hinge Material: Stainless steel posts and Pintles.
 - h. Color: White.
 5. Support:
 - a. Standard: ASME A112.6.1M.
 - b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space. Floor mounted supports shall be provided, NO Exceptions.
 - c. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

2.2 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.3 INSTALLATION

- A. Water-Closet Installation:
 - 1. Install level and plumb according to roughing-in drawings.
- B. Flush-Valve Installation:
 - 1. Install flush-valve, water-supply fitting on each supply to each water closet.
 - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
- C. Install toilet seats on water closets.
- D. No offset toilet flanges allowed.
- E. Wall Flange and Escutcheon Installation:
 - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
 - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
- F. Joint sealing:
 - 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 - 2. Match sealant color to water-closet color.
 - 3. Comply with sealant requirements specified in Section 079200 “Joint Sealants.”

2.4 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 “Domestic Water Piping.”
- C. Comply with soil and waste piping requirements specified in Section 221316 “Sanitary Waste and Vent Piping.”
- D. Compression valves are not permitted on domestic water.
- E. Where installing piping adjacent to water closets, allow space for service and maintenance.

2.5 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flush valves to produce proper flow.

2.6 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers’ recommended cleaning methods and materials.

- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 260501- GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

- A. Provide all labor, materials, equipment and services necessary for and incidental to the complete installation and operation of all electrical work.
- B. All work under this Division is subject to the General Conditions and Special Requirements for the entire contract.
- C. Unless otherwise specified, all shop drawings and submissions required under Division 26 shall be made to, and acceptances and approvals made by, the ENGINEER.
- D. Conform to the requirements of all rules, regulations, and codes of local, state, and federal authorities having jurisdiction. Conform to the National Electrical Code and all NECA – National Electrical Installation Standards (NEIS).
- E. Perform the work in a first-class, substantial, and workmanlike manner. Any materials installed which do not present an orderly and neat workmanlike appearance shall be removed and replaced when so directed by the Engineer, at the Contractor's expense.
- F. Coordinate the work of all trades.
- G. Arrange conduit, wiring, equipment, and other work generally as shown, providing proper clearances and access. Carefully examine all contract drawings and fit the work in each location without substantial alteration. Where departures are proposed because of field conditions or other causes, prepare and submit detailed drawings for approval in accordance with "Submittals" specified below. The right is reserved to make reasonable changes in location of equipment, conduit, and wiring up to the time of rough-in or fabrication.
- H. The contract drawings are generally diagrammatic and all offsets, bends, fittings, and accessories are not necessarily shown. Provide all such items as may be required to fit the work to the conditions.
- I. Be responsible for all construction means, methods, techniques, procedures, and phasing sequences used in the work. Furnish all tools, equipment and materials necessary to properly perform the work in a first class, substantial, and workmanlike manner, in accordance with the full intent and meaning of the Contract Documents.
- J. The Contractor shall provide other work and services not otherwise included in the Contract Documents that are customarily forwarded in accordance with generally-accepted construction practices.

1.2 PERMITS, INSPECTIONS, AND FEES:

- A. The Contractor shall obtain and pay for all charges and fees, and deliver all permits, licenses, certificates of inspection, etc., required by the authorities having jurisdiction. Deliver inspection, approval, and other certificates to the Owner prior to final acceptance of the work.
- B. File necessary plans, prepare documents, give proper notices, and obtain necessary approvals.
- C. Permits and fees shall comply with the General Requirements of the Specification.
- D. The Owner will pay for the building permit.
- E. Notify Inspection Authorities to schedule inspections of work. All work shall be subject to field inspections.
- F. Notify Architect in advance of scheduled inspections.
- G. An electrical foreman, superintendent or other supervisor shall be in attendance for all scheduled inspections.
- H. The Contractor shall provide an electrical certificate from an independent electrical inspection agency approved by the Owner and the State Fire Marshal. The Contractor shall submit certificate prior to final payment invoice. The Contractor shall pay all fees, including filing fees.

1.3 ELECTRICAL WORK UNDER OTHER DIVISIONS:

- A. Mechanical Equipment and Systems
 - 1. In general, power wiring and motor starting equipment for mechanical equipment and systems are furnished and installed under Electrical Division 26.
 - 2. Certain mechanical units contain starters, contacts, transformers, fuses, wiring, etc., required for fans, pumps, etc., furnished with the equipment from the factory. When this equipment is supplied from the factory, the Contractor must supply power circuit(s) to the unit and a disconnecting means. Coordinate with Contractor so that one, and only one, set of starters, fuses, switches, etc., is provided and installed.
 - 3. In general, control and interlock equipment for HVAC systems (including associated wiring, conduit, transformers, relays, contacts, etc.) is furnished under Mechanical Divisions. Contractor shall install and connect all such equipment as necessary.
 - 4. Controls, wiring, conduit, transformers, etc., for smoke, fire, and motor-operated dampers are provided by Mechanical Contractor. Electrical shall install and connect all such equipment.
- B. Architectural Equipment: In general, any electrically operated or controlled equipment furnished under architectural divisions shall be supplied with control wiring, transformers, contacts, etc. Contractor shall provide power circuits to such equipment and install all electrical control equipment related thereto.
- C. Carefully review the contract documents and coordinate the electrical work under the various Divisions.

1.4 CONTRACTOR QUALIFICATION:

- A. Any Contractor performing work under this Division shall be fully qualified and acceptable to the Engineer. Submit the following evidence for approval:
 - 1. A list of not less than five (5) comparable projects that the Contractor completed.
 - 2. Letters of reference from not less than three (3) registered professional engineers, contractors, or building owners, explaining Contractor proficiency, quality of work, or other attribute on projects of similar size or substance.
 - 3. Membership in trade or professional organization where required.
 - 4. Copy of Master Electrician’s License.
- B. Contractor is any individual, partnership, corporation, or firm performing work by Contract or subcontract on this project. Corporations should be in Good Standing with the State.
- C. Acceptance of a subcontractor will not relieve the Contractor of any contractual requirements or his responsibility to supervise and coordinate the various trades.
- D. Supervisory Qualifications: The electrical work on the project shall be under the direct supervision of a licensed Master Electrician.
- E. Qualifications of Installers:
 - 1. For the actual fabrication, installation, and testing of the work, the Contractor shall use only thoroughly trained, experienced, and certified journeyman who are completely familiar with the requirements of this work and with the installation recommendations of the manufacturers of the specified items.
 - 2. The Electrical Installer shall utilize a full-time project foreman in charge of all electrical work. This person shall be fully qualified and experienced in such work and shall be available, on site, at all times during Construction. All problems, questions, coordination, etc., relating to electrical work shall take place through this person to the Architect.
- F. Qualifications of Video Tape Technician: For videotaping specified in “Operating Instructions”, the Contractor shall provide the services of persons skilled in videotape production and editing.

1.5 FIRE SAFE MATERIALS:

- A. Unless otherwise indicated, materials and equipment shall conform to UL, NFPA, or ASTM Standards for Fire Safety with Smoke and Fire Hazard Rating not exceeding flame spread of 25 and smoke developed of 50.

1.6 REFERENCED STANDARDS, CODES, ORDINANCES AND SPECIFICATIONS

- A. Specifications, Codes and Standards listed below are included as part of this specification, latest edition.

ADA	Americans with Disabilities Act

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
IBC	International Building Code
CABO	Council of American Building Officials
FM	Factory Mutual
IEEE	Institute of Electrical and Electronics Engineers
MOSHA	Maryland Occupational Safety & Health Administration
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety & Health Administration
UL	Underwriters Laboratories

- B. All electrical equipment and materials shall comply with the Codes and Standards listed in the latest edition of IEEE Standard 241, *Electric Power Systems in Commercial Buildings*, Chapter 1, Section 1.6, entitled “Codes and Standards”.
- C. Comply with all Codes applicable to the work:
1. Bidders shall inform themselves of all local and state codes and regulations.
 2. In case of conflict between Contract Documents and governing Codes, the most stringent shall take precedence. Where, in any specific case, different sections of any applicable codes or when Drawings and Specifications specify different materials, methods of Construction, or other requirements, the most restrictive shall govern.
 3. Where Contract Documents exceed minimum Code requirements, and are permitted under the Code, the Contract Documents take precedence and shall govern.
 4. No extra payment will be allowed for work or changes required by local Code enforcement authorities.

- D. Underwriters Laboratories Labels shall apply to all materials and devices, etc., except specified items not covered by existing UL Standards.
- E. Conflicts with applicable regulations:
 - 1. Resolve at Contractor's expense.
 - 2. Prepare and submit details of alternate construction:
 - a. Acceptable solution of conflict.
 - b. List of substitute materials:
For approval of inspecting authorities.
For approval of Engineer.
- F. Comply with all NECA's National Electrical Installation Standards (NEIS), including NECA 1-2000 "Standard Practices for Good Workmanship in Electrical Contracting".

1.7 INTERPRETATION OF DOCUMENTS

- A. Any discrepancies between Drawings, Specifications, Drawings and Specifications, or within Drawing and Specifications shall be promptly brought to the attention of the Owner during the bidding period. No allowance shall subsequently be made to the Contractor by reason of his failure to have brought said discrepancies to the attention of the Owner during the bidding period or of any error on the Contractor's part.
- B. The locations of products shown on Drawings are approximate. The Contractor shall place the devices to eliminate all interference with above-ceiling ducts, piping, etc. Where any doubt exists, the exact location shall be determined by the Owner and Architect.
- C. All general trades and existing conditions shall be checked before installing any outlets, power wiring, etc.
- D. Equipment sizes shown on the Drawings are estimated. Before installing any wire or conduit, the Contractor shall obtain the exact equipment requirements and install wire, conduit, or other item of the correct size for the equipment actually installed. However, wire and conduit sizes shown on the Drawings shall be taken as a minimum and shall not be reduced without written approval from the Architect/Engineer.
- E. Where variances occur between the drawings and specifications or within either document itself, the item or arrangement of better quality, greater quality, or higher cost shall be included in the Contract Price. The Engineer will decide on the item and manner in which the work shall be installed.
- F. Contract Drawings are generally diagrammatic and all offsets, fittings, transitions, and accessories are not necessarily shown. Furnish and install all such items as may be required to fit the work to the conditions encountered. Arrange conduits, equipment, and other work generally as shown on the Contract Drawings, providing proper clearance and access. Where departures are proposed because of field conditions or other causes, prepare and submit detailed Shop Drawings for approval in accordance with "submittals" specified below. The right

is reserved to make reasonable changes in location of equipment, piping, and ductwork, up to the time of rough-in or fabrication.

- G. Work not specifically outlined, but reasonably incidental to the completion of the work, shall be included without additional compensation from the Owner.

1.8 CUTTING AND PATCHING

- A. The cutting of walls, floors, partitions, etc., for the passage and/or accommodation of conduits, etc., the closing of superfluous openings and the removal of all debris caused by said work under this contract shall be performed by and at the expense of the Electrical Contractor.
- B. No cutting of any structure or finishes shall be done until the condition requiring such cutting has been examined and approved by the Architect.
- C. All surfaces disturbed as a result of such cutting shall be restored under this division to match original work and all materials used for any patching, mending or finishing must conform to the class of materials originally installed.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material and equipment installed as a part of the permanent installation shall be new, unless otherwise indicated or specified, and shall be approved by the Underwriters' Laboratories, Inc., for installation in each particular case where standards have been established.
- B. Where material or equipment is identified by proprietary name, model number, and/or manufacturer, furnish the named item or equivalent thereof, subject to acceptance.
- C. Material submissions shall conform to requirements outlined in SUBMITTALS, REVIEW, AND ACCEPTANCE.
- D. The suitability of named item only has been verified. Where more than one Manufacturer is named, only the first named Manufacturer has been verified as suitable alternate. Manufacturers and items other than the first named shall be equal or better in quality and performance to that of specified items, and must be suitable for available space, required arrangement, and application. Submit all data necessary to determine suitability of alternate manufacturers for review. Provide a list company proposed and specified products and performance on the first page of the submittal. Failure to clearly identify differences will result in the submittal being returned as "Revise and Resubmit". The Contractor, by providing other than the first named Manufacturer, assumes responsibility for all necessary adjustments and modifications necessary for a satisfactory installation.
- E. The Contractor shall only submit those manufacturers indicated in the Specification. Proposed manufacturers other than those indicated will not be considered unless the specific item

indicates “or as approved equal”. Submit all data necessary to determine suitability of substituted items for approval. Failure to do so will result in a “Revise and Resubmit” response.

- F. All items of equipment furnished shall have a service record of at least five (5) years.

2.2 SUBSTITUTIONS

- A. Substituted items or items other than those named shall be equal or better in quality and performance and must be suitable for the available space, required arrangement, and application. Submit any and all data necessary to determine the suitability of substituted items. The Contractor shall be responsible for correct application, placement, and installation of substituted equipment. Cost savings data shall also be submitted with submittal data for substituted items. Total cost savings or a per-unit saving to the Owner shall be clearly indicated. If a substituted item is accepted, all cost savings shall be returned to the Owner as a credit.
- B. Substitutions will not be permitted for specific items of material or equipment where specifically indicated.
- C. For substituted items, clearly list on the first page of the submittal all differences (i.e. paragraph-by-paragraph, performance differences, physical differences, etc.) between the specified item and the proposed item. The Contractor shall be responsible for corrective action (or replacement with the specified item) while maintaining the specification requirements if differences have not been clearly indicated in the submittal.
- D. Where the Contractor proposes to use an item of equipment or application other than that specified or detailed on the Drawings, which requires any redesign of the structure, partitions, foundation, HVAC, piping, wiring, or any other part of the mechanical, electrical, or architectural layout, all such redesign and all new drawings and detailing required thereafter shall be prepared by the Contractor at his own expense for review by the Owner representative, Architect and Engineer before any such work is implemented.
- E. All Contractor-proposed changes and revisions shall be at the Contractor’s risk and expense. The Contractor shall fully coordinate all revisions, substitutions and changes with other trades. The Contractor shall provide all necessary provisions, including HVAC, ventilation, foundations, access, etc., for a complete, code compliant, and fully functional installation.
- F. Where the Contractor elects to submit a substitution for equipment or materials, he shall:
 - 1. Submit Shop Drawings that show complete compliance to each statement or requirement of the Specifications.
 - 2. Submit certified test data from an independent testing laboratory for each product.
 - 3. Submit one complete working sample of the equipment or materials to be furnished. In cases involving large or heavy items of equipment, the Owner may waive the requirement to submit the sample.
- G. Failure to comply with the above-required submissions shall constitute an automatic rejection of the substitution.

2.3 SUBMITTALS, REVIEW, AND ACCEPTANCE

A. General:

1. The equipment, material, installation, workmanship, arrangement of work, final instruction, and final documentation is subject to review and acceptance. No substitution will be permitted after acceptance of equipment or materials except where such substitution is considered by the Engineer to be in the best interest of the Owner. Submit for review in clear and legible form the following documents:
 - a. Material and Equipment List
 - b. Descriptive Data
 - c. Shop Drawings
 - d. Installation and Coordination Drawings
 - e. Contractor As-Built Drawings
 - f. Owner Instructions and Manuals
 - g. Construction Phasing and Outage Schedule
2. Prepare all submittals specifically for this project and stamp each submittal in a form indicating that the documents have been Contractor reviewed, are complete, and are in compliance with the requirements of the plans and specifications. Each submittal item shall be clearly identified and numbered. Each submittal shall contain a complete schedule of Manufacturer's part numbers and quantity listings of all supplied components. Each proposed item shall be highlighted and tagged with a star, an arrow, etc., including all options and accessories.
3. Coordinate the installation requirements and any mechanical requirements for the equipment submitted. Submittals will be reviewed for general compliance with design concept in accordance with the contract documents. The Contractor is responsible for the correctness of all submittals. Reviews will not verify dimensions, quantities, or other details.
4. Identify all submittals, indicating the intended application, location, or service of the submitted item. Refer to specification sections or paragraphs where applicable. Clearly indicate the exact type, model number, size, and special features of the proposed item. Clearly list on the first page of the Submittal all differences between the specified item and the proposed item. The Contractor shall be responsible for corrective action (or replacement with the specified item) while maintaining the specification requirements, if differences have not been clearly indicated in the submittal. Submittals of a general nature will not be acceptable.
5. Submit actual operating conditions or characteristics for all equipment where required capacities are indicated. Factory order forms showing only required capacities will not be acceptable. Indicate all options used to meet the specifications. It is not the responsibility of the Engineer or Owner to make selections of factory options other than colors. Submittals lacking proper selection of factory options or special features required by the specification shall be RETURNED WITHOUT REVIEW.
6. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted.
7. Documents of general form indicating options shall be clearly marked to show what is specifically proposed for this project.
8. Submittals NOT IN COMPLIANCE with the requirements of this section will be RETURNED WITHOUT REVIEW.

- B. Material, Equipment, Manufacturer and Subcontractor List: Within 30 calendar days after the award of contract, submit a complete MATERIAL, EQUIPMENT, MANUFACTURER AND SUBCONTRACTOR LIST for preliminary review. List all proposed materials and equipment, the associated proposed Manufacturer, and any proposed subcontractors. After the receipt of reviewed Material and Equipment List, submit complete Shop Drawings for approval. List all materials and equipment, indicating manufacturer, type, class, model, curves, and other general identifying information. Submittals shall be specific for each building as contained in the individual building Specifications and Drawings.
- C. Upon approval of the List of Materials, the Contractor shall prepare a complete Master Submittal Register, listing all products and materials that will be submitted for approval. Items shall be listed by referenced specification paragraph in ascending order. This master list shall be included with each submittal, updated to reflect the status of approval for each item, and shall highlight the items pertaining to the submittal. A suggested Submittal Register Format is shown below:

SUBMITTAL REGISTER					
Item/Material	Ref'd Spec. Paragraph	Specified or Substitute	Submittal Date	Status	Remarks

- D. No Shop Drawing Submittals will be considered for approval until the complete List of Subcontractors and the complete List of Materials/Manufacturers and Equipment have been approved.
- E. Descriptive Data: After acceptance of the MATERIAL and EQUIPMENT LIST, submit additional DESCRIPTIVE DATA for all items. Data shall consist of specifications, data sheets, samples, capacity ratings, performance curves, operating characteristics, catalog cuts, dimensional drawings, installation instructions, and any other information necessary to indicate complete compliance with the contract documents. Where several ratings or sizes are shown or available, clearly indicate the exact size or rating relating to the particular device being proposed.
- F. Submit complete descriptive data for all items. Data shall consist of Specifications, data sheets, samples, capacity ratings, performance curves, operating characteristics, catalog cuts, dimensional drawings, wiring diagrams, specific electrical/wiring requirements and connections including control and interlock wiring, installation instructions, and any other information necessary to indicate complete compliance with the Contract Documents. Edit submittal data specifically for application to this project.

- G. Shop Drawings shall be submitted and approved for all materials and equipment prior to installation. If any material and/or equipment is installed prior to receipt by the Contractor of approved Shop Drawings, the Contractor is liable for its replacement at no additional cost to the Owner.
- H. Data submitted shall include information on all materials and equipment to demonstrate compliance with the Contract Drawings and Specifications. Where installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.
- I. Any deviation of submitted material or equipment from the Contract Drawings or Specifications shall be clearly marked in red ink on Submittals, and itemized in a transmittal letter, in order to receive consideration for approval.
- J. Approval of material or equipment submittals containing deviations not specifically identified by Contractor shall not relieve the Contractor from compliance with specified requirements.
- K. Thoroughly review and stamp all submittals to indicate compliance with Contract requirements prior to submission. Coordinate installation requirements and any electrical requirements for equipment submitted. Contractor shall be responsible for correctness of all submittals.
- L. Submittals will be reviewed for general compliance with design concept in accordance with Contract Documents, but dimensions, quantities, or other details will not be verified.
- M. Increase, by the quantity listed below, the number of electrical related Shop Drawings, product data, and samples submitted, to allow for required distribution plus two copies of each submittal required, which will be retained by the Electrical Consulting Engineer.
 - 1. Shop Drawings - Initial Submittal: 1 additional blue- or black-line print.
 - 2. Shop Drawings - Final Submittal: 1 additional blue- or black-line print.
 - 3. Product Data: 1 additional copy of each item.
- N. Additional copies may be required by individual sections of these Specifications.
- O. Shop Drawings (include but not limited to):
 - 1. Prepare and submit SHOP DRAWINGS AND/OR DIAGRAMS for all specially fabricated items, modifications to standard items, specially designed systems where detailed design is not shown on the contract drawings, or where the proposed installation differs from that shown on the contract drawings.
 - 2. Shop drawings shall include plans, elevations, sections, mounting details of component parts, point to point interconnection diagrams, elementary diagrams, single line diagrams, and any other drawings necessary to show the fabrication and connection of the complete item or system.
 - 3. Shop drawings shall be provided for, but not limited to the following items:

Analysis and Coordination Study

Automatic Transfer Switches
Ballasts
Basic Electrical Materials
Cable - 600 volt
Cable – Medium Voltage
Cable Tray
Circuit Breakers
Conduit and Surface Raceway
Contractor and Subcontractor Qualifications
Controllers & Control Devices
Cord Reels
Disconnects
Electrical Connection Coordination Schedule
Engine/Generator
Equipment Connections
Equipment Pads
Excavation and Backfill
Fire Alarm Systems
Firestopping
Fuses
Ground Conductors, Rods
Ground Connection to Underground Water Pipe
Identification System
Innerduct
Lamps
Lighting Control Equipment
Lighting Fixtures
Low Voltage Fuses
Material and Equipment List
Motor Starters
Occupancy Sensors
Outlet Boxes
PA System
Panelboards
Receptacles
Record and Information Booklet
Safety Switches
Schedule of Values
Sleeves, Hangers, Supports
Sound Systems
Special Systems
Submittal Schedule
Surge Protection Devices
Switchboards
Tests and Reports
Transformers
Underground Cable
Wiring Devices

Wiring Diagrams

- P. The Contractor, additionally, shall submit for approval any other shop drawings as required by the Architect. No item listed above shall be delivered to the site, or installed, until approved. After the proposed materials have been approved, no substitution will be permitted except where approved by the Engineer.
- Q. The Contractor shall prepare and submit a Detail Schedule of Values indicating the Contract costs for the major work items. The Contractor shall provide additional detail and information as requested by the Engineer.
- R. The Contractor shall prepare and submit a complete Submittal Schedule. The Schedule shall include a listing of all Submittals, Shop Drawings, and Coordination Drawings.
- S. The Contractor shall review and coordinate with all other not order major electrical gear that serves HVAC and plumbing motors until all HVAC and plumbing equipment with motors have been reviewed. Additionally, the Contractor shall review all mechanical and plumbing submittals for coordination items (disconnect switch, capacitors, etc.) prior to the Mechanical Contractor submitting products for review.

2.4 INSTALLATION AND COORDINATION DRAWINGS:

- A. Prepare, submit, and use composite installation and coordination drawings to assure proper coordination and installation of the work. Drawings shall include, but not be limited to the following:
 - 1. Telecommunication Rooms indicating data rack assemblies, panels, etc.
 - 2. Electrical Rooms indicating switchboard assemblies, transformers, equipment pads, panels, etc.
 - 3. Mechanical Equipment Rooms, including panels, transformers, starters, equipment, etc.
 - 4. Cable tray, light fixtures.
- B. Draw plans to a scale not less than 1/4 inch equals one foot. Include plans of the proposed work, showing all equipment, major elements, conduit, and wiring in the areas involved. Fully dimension all work, horizontally and vertically. Show coordination with other work including piping, ductwork and other mechanical work, walls, doors, ceilings, columns, beams, joists, and other architectural and structural work.
- C. Identify all equipment and devices on wiring diagrams. Where field connections are shown to factory-wired terminals, furnish manufacturer's literature showing internal wiring.
- D. Prepare, submit, and use scaled layout drawings indicating dimensions, clearances, and actual equipment dimensions. Layout drawing shall include, but not be limited to the following:
 - 1. Pad-mounted equipment and equipment connections.
 - 2. Underground conduits, ductbanks, manholes, handholes, and building penetrations.
- E. The Electrical Contractor shall develop and prepare an AutoCAD or Revit coordination model for the entire building to be used in conjunction with the mechanical, plumbing, structural and architectural model for coordination purposes. Model shall include major above ground feeders (2" and larger) cable trays, light fixtures, etc.

- F. The Mechanical Contractor shall schedule bi-weekly Coordination Drawing Reviews with the Owner, Mechanical Engineer, and all associated subcontractors, including but not limited to the following:
1. Mechanical Contractor
 2. Finishes Contractor
 3. Sheet Metal Contractor
 4. Sprinkler Contractor
 5. Electrical Contractor
 6. Plumbing Contractor
 7. Owner/Architect/Engineer
 8. Commissioning Agent
 9. Note: A Foreman or Project Manager responsible for Decision-Making of each company shall attend all Coordination Meetings.
- G. The purpose of these meetings is to coordinate proposed installations of systems and equipment, including clearances, routing, penetrations, as well as to review potential conflicts. The Mechanical Contractor shall base preliminary equipment sizes and connections on proposed products and the final coordination drawing for review shall reflect approved/reviewed products. Coordination Meetings shall be held at the Contractor's Field Office.

2.5 RECORD DRAWINGS:

- A. As the work progresses, record on a set of white prints the installed locations, sizes of electric feeders, equipment, etc. Upon completion of the work, submit one (1) complete set of white prints with "As-Built" information neatly recorded thereon in red ink. Use other colors to distinguish between variations in separate categories of the work. Note related change-order numbers where applicable. Provide electronic copies to the owner and architect at the completion of the project.
- B. Write step-by-step detailed instructions for turn-on, turn-off, seasonal changeover, and periodic checks of all systems and equipment. Include all precautions and warnings.
- C. Prepare a list of the manufacturers of all major equipment, their local service representative and procedures for obtaining service.
- D. Post one (1) copy of all instructions, lists, charts, and diagrams at the equipment or where indicated, mounted under glass or approved plastic cover.
- E. Furnish to the Owner two (2) copies of the Manufacturer's installation and operations instructions, and an electronic copy. Include replacement parts lists where applicable. Also include copies of all posted instructions, lists and charts. Assemble the material in one or more heavy duty 8- 1/2" x 11" loose leaf binders with tab separators. Submit for approval before final delivery. Binder shall be labeled on spine and on cover with Project Name.
- F. Deliver all instruction materials to the Owner prior to the formal instruction period.

- G. Deliver two (2) complete sets of all approved submittals to the Owner for filing, including electronic copies.
- H. Prepare record documents in accordance with the requirements in the specifications. In addition to the requirements specified, indicate installed conditions for:
 - 1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and circuit breaker size and arrangements.
 - 2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 3. Approved Substitutions, Contract Modifications, and actual equipment and materials installed.
- I. The Contractor shall keep at the site at all times during construction, one set of up-to-date Contract prints for the express purpose of showing any and all changes made during construction. The Contractor shall make the prints showing each change and shall incorporate all changes in "Record/As-Built Drawings" to be submitted to the Engineer upon completion of the project.
- J. The Contractor shall show proof of up-to-date record drawings to the Owner prior to submitting monthly invoice.
- K. The Contractor shall conform to all drawings, including all revisions, addendums, alternates, change orders, deletions, existing conditions, and as-built conditions without extra cost to the Owner.

2.6 DEMONSTRATION AND OPERATING INSTRUCTIONS

- A. Furnish the necessary technicians, skilled workers, and helpers to operate the electrical systems and equipment of the entire project. The Contractor shall provide a minimum of three 2-hour sessions of system demonstration and operation for each system including, but not limited to: lighting controls, switchboards, generator, transfer switches.
- B. Where specified in technical sections, provide longer periods required for specialized equipment.
- C. Contractor shall provide start-up of all systems in an orderly, organized, and coordinated manner to ensure that all systems are functioning as designed. The Contractor shall provide a detailed start-up, testing, and demonstration plan for all systems in a coordinated manner that is documented in writing at least 45 days prior to system start-up. Start-up, testing and demonstration plans shall include detailed point-by-point checklists that clearly show that systems are, in fact, functioning as designed. Instruct the Owner or designated personnel in operation, maintenance, lubrication, and adjustment of systems and equipment.
- D. The Operating and Maintenance Manual shall be available at the time of the instructions, for use by Instructors and Owner personnel.

- E. Videotape each instruction session, including both the sessions specified above and added sessions required in technical sections for specialized equipment. Provide one complete set of DVD video disks with each Operating and Maintenance Manual.
- F. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and Engineer. All operation training and demonstrations shall be complete prior to Owner acceptance of any given system.

PART 3 - EXECUTION

3.1 EXAMINATION OF SITE, SURVEYS, AND MEASUREMENTS:

- A. Examine the site, determine all conditions and circumstances under which the work must be performed, and make all necessary allowances for same. No additional cost to the Owner shall be permitted for Contractor's failure to do so.
- B. Examine the site and observe the conditions under which the work will be done or other circumstances which will affect the contemplated work. No allowance will be made subsequently in this connection for any error or negligence on the Contractor's part.
- C. The Contractor shall base all measurements, both horizontal and vertical, from established benchmarks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.
- D. Any discovery of discrepancy between actual measurements and those indicated which prevents following good practice or the intent of the Drawings and Specifications shall be brought to the attention of the Owner's Representative. Work shall not proceed until receiving instructions from the Owner's Representative.
- E. The Contractor shall follow Drawings in laying out the work and check Drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, the Owner's Representative shall be notified before proceeding with the installation.
- F. To prevent conflict with the work of other trades and for proper execution of the work, the Contractor, as directed by the Architect/Engineer, shall make the necessary modifications in the layout as needed, at no extra charge to the Owner.
- G. The Contractor shall be solely responsible for the proper arrangement of his conduit and equipment.
- H. The Engineer shall make all final decisions as to any conditions that require the changing of any work.
- I. The Contractor shall have competent supervision on the site at all times to lay out, check, coordinate, and supervise the installation of all electrical work and be responsible for the

accuracy thereof. He shall plan the installation of all electrical work, giving consideration to the work of other trades, to prevent interference.

- J. The Contractor shall determine the location, size, etc., of all chases, sleeve openings, etc., required for the proper installation of the electrical work and see that such are provided. All chases, sleeves, openings, etc., shall be set prior to erection of new work to prevent delay in the progress of other work or trades.
- K. Conditions and/or situations that prevent the proper installation of any equipment or item where shown on the Drawings shall be called to the attention of the Engineer for instructions.
- L. The Contractor shall have equipment shipped or fabricated in sections of suitable size for entering the building and being removed from the finished building in the future, if necessary.
- M. The Contractor shall fully investigate all peculiarities and space limitations for all materials and equipment.
- N. Outlet, pull, and junction boxes and other appliances that require operation, examination, adjustment, servicing or maintenance shall be readily accessible.
- O. The Contractor shall take all field measurements necessary for this work and shall assume responsibility for their accuracy.
- P. The Contractor shall coordinate the electrical work with all other sub-contractors. All work shall be so arranged that there will be no delay in the proper installation and completion of any part or parts of electrical equipment. All electrical work shall be installed in proper sequence with other trades without any unnecessary delay.
- Q. The Drawings are to some extent diagrammatic and indicate the general arrangement of the equipment, the runs of conduit, and the manner of connection.
- R. The Contractor shall confer with all sub-contractors engaged in the construction of the project, regarding the work that may, in any way, affect his installation. Whenever interference occurs, before installing any of the work in question, the Contractor shall consult with all sub-contractors and shall come to an agreement with them as to the exact location and level of his conduit parts of his equipment.
- S. The Contractor shall be responsible for determining exact property lines and area of work. The Contractor shall not install any equipment or conduits outside of the property lines and/or area of work without written direction from the Owner. Any work indicated diagrammatically on the Contract Documents to be installed beyond the property lines and/or area of work shall be verified with the Owner prior to installation.

3.2 GENERAL RESPONSIBILITIES:

- A. The Contractor shall be responsible for systems and related damages possible, and shall hold harmless the Owner, the Architect and his consultants from malfunction of systems and

equipment installed under this Contract as defined by the applicable state laws pertaining to real property for the period of time as defined by such laws.

- B. It is the intent of these Specifications to fully cover without exception all required labor and materials so that the finished work will be delivered to the Owner in a complete and satisfactory working installation. Excavation, wiring, distribution, etc., shall be performed in compliance with the Contract Documents.
- C. Work not specifically outlined, but reasonably incidental to the completion of the work, shall be included without additional compensation from the Owner.
- D. Conflicting points in the Specifications or on the Drawings shall be called to the attention of the Architect prior to the execution of the Contract.

3.3 STORAGE AND PROTECTION OF EQUIPMENT

- A. All electrical equipment to be used in the construction shall be properly stored and protected against the elements. All equipment shall be stored under cover, and shall not be stored at the construction site on the ground, in mud, water, snow, rain, sleet or dust. Large diameter cables may be stored on reels with weatherproof materials. Such weatherproof materials shall be heavy-duty, securely fastened and made impervious to the elements.
- B. Conventional electrical construction materials such as building wire, outlet and junction boxes, wiring devices, conduit, lighting fixtures, fittings, etc., shall be stored in construction buildings, covered trailers or portable covered warehouses. Any equipment subject to damage or corrosion from excessive moisture shall be stored in dry, heated areas. Any equipment containing plastic or material subject to damage caused by excessive heat or sunlight shall be stored to prevent such damage. This includes plastic ducts and lenses.
- C. Switchboard, motor controllers, panelboards, breakers, emergency lighting, and supervisory equipment, if delivered to the construction site before the building is under cover, shall be warehoused and protected as follows: All gear and equipment shall be covered and protected from the elements and other damage and shall be stored in a clean, dry, heated atmosphere, under cover.
- D. All gear and equipment delivered to the construction site after the building is under cover shall be protected as described above and in addition shall be provided with auxiliary heat to prevent condensation damage. The gear shall also be protected against damage caused by installation of any building systems and equipment; or damage caused by carelessness of workmen who are installing equipment connected to or adjacent to the above electrical equipment.
- E. Equipment damaged as a result of the above conditions shall be properly repaired at the Contractor's expense or shall be replaced at the Contractor's expense, if, in the opinion of the Engineer the equipment has been damaged to such an extent it cannot operate properly after repairs are made.

- F. All electrical enclosures exposed to construction damages such as paint spots, spackling or plaster spatter, grout splashes, waterproofing compound, tar spots or runs and pipe covering compound splashes, shall be completely covered and protected against damage.
- G. In the event leakage into the building of any foreign material or fluid occurs or may occur, the Contractor shall take all steps as described above to protect any and all equipment.
- H. After connections to electrical equipment are complete and the equipment is ready for operation, all construction debris shall be removed from all enclosures. Such debris includes dust, dirt, wire clippings, tape and insulation removed in order to make the connection.

3.4 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate electrical systems, equipment, materials, and installation with landscape/irrigation contractor(s).
 - 2. Verify all dimensions by field measurements.
 - 3. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
 - 4. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components where installed exposed in finished spaces.
 - 5. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. All equipment and disconnects shall maintain proper working space to conform to NEC.
 - 6. Install systems, materials, and equipment giving right-of-way priority to systems that require installation at a specified slope.
 - 7. Arrange for chases, slots and openings in other building components during progress of construction, to allow for electrical installation.
 - 8. Space, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work.

3.5 SUPERVISION AND COORDINATION:

- A. Provide complete supervision, direction, scheduling and coordination of all work under the contract, including that of subcontractors, using full attention and the best skill. Be responsible for all work and make all subcontractors, suppliers and manufacturers fully aware of all requirements of the contract.
- B. Coordinate the rough-in of all work performed under Mechanical & Electrical Divisions.

- C. The Contractor shall coordinate all electrical rough-ins with approved shop drawings and coordination drawings. Any rough-in installed without complete coordination shall be at the Contractor's risk and expense.
- D. Coordinate the installation of all necessary rough-in of work, sleeves, anchors and supports for conduit, wiring, and other work performed under Divisions Mechanical and Electrical Divisions.
- E. Coordinate the spacing and arrangement of lighting fixtures, diffusers, grilles and access panels in ceilings to establish a symmetrical pattern.
- F. Where a discrepancy exists within the Specifications or drawings or between the Specifications and Drawings, the more stringent (or costly) requirement shall apply until a clarification can be obtained from the Engineer. Failure to clarify such discrepancies with the Engineer will not relieve the Contractor of the responsibility of conforming to the requirements of the Contract.
- G. Failure of the Contractor to obtain a full and complete set of Contract Documents (either before or after bidding) will not relieve the Contractor of the responsibility of complying with the intent of the Contract Documents.
- H. To insure proper electrical coordination between the electrical components supplied under the Electrical Divisions and the equipment supplied under the Mechanical Divisions, a schedule shall be submitted, prior to start of work and prior to fabrication of panels and/or gear which power is fed from, for review by the Engineer with the following column headings:

1. Equip. or Item	2. HP or KVA	3. Voltage and Phase	4. Power Factor	5. Capacitor	6. Motor Starter	7. Discon.	8. Controls	9. Remarks
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Description of Column Headings:

1. List all the approved equipment furnished under Mechanical Division that requires electrical connections and designate the equipment as it appears in the Mechanical Divisions. Indicate the quantity, if more than one, in parentheses of identical equipment being supplied.
2. Indicate the supplied horsepower of the equipment listed under Column No. 1. If equipment listed has more than one motor, indicate each motor and its respective horsepower. Indicate the kVA rating for all other equipment requiring an electrical connection, unless the electrical connection is for a control circuit only.
3. Indicate the voltage and phase requirements for equipment listed under Column No. 1. If more than one electrical circuit or voltage is required for the listed equipment, it shall be so indicated. Indicate wiring required for connection, including all phase, neutral, and ground conductors.
4. Indicate the power factor rating for all motors listed under Column No. 2
5. Where a capacitor is to be provided, indicate specification it is supplied under and indicate the KVAR size for any capacitor provided under Division 26.

6. Where a motor starter is required, indicate the specification division it is supplied under and the type of motor starter; across-the-line, reversible, variable speed, two speed-single winding, etc. Indicate In Column No. 9 if the motor starter provided under Division 26 is not compatible with the motor specified.
 7. Where a disconnect switch is required by the National Electric Code or by the contract documents for the equipment listed under Column No. 1, indicate under which Division the disconnect switch is supplied.
 8. Indicate the Division under which the controls for the equipment listed under Column No. 1 are provided.
 9. Indicate any discrepancies between what is indicated in the contract documents and what is actually being provided.
- I. The Contractor shall fully coordinate the electrical connections to all equipment prior to installations, with the approved Shop Drawings and the trades involved. Coordination shall include voltage, phases, quantity and size of wiring, device sizes, terminations, rough-in work, and other coordination for a complete installation.
- J. Coordinate Division 26 work with all trades.
- K. Install work with proper clearances and access. Carefully examine all contract drawings and fit the work in each location without substantial alteration. Where departures are proposed or required, submit detailed drawings for acceptance. The right is reserved to make reasonable changes in location of equipment, conduit and wiring up to the time of rough-in or fabrication.
- L. Coordinate light switch locations with door swings prior to rough-in. No switches permitted behind doors.
- M. Coordinate electrical work with architectural items and equipment. Typical equipment refers to, but is not limited to, the following:
1. Countertops, Casework and Cabinets.
 2. Fume and Exhaust Hoods.
 3. Kitchen equipment.
 4. Do not install outlets, switches, etc., behind casework, cabinets, etc.
 5. Data, phone, and other low voltage system outlets shall be mounted above the counter tops to match power outlets in the same areas.
 6. Coordinate counter top outlets with drilling of casework/counters.
 7. Coordinate surface raceways and outlets above and below counters with approved casework shop drawings to avoid conflicts with sinks and other appurtenances.
 8. Verify lab/kitchen equipment nameplates and connection requirements prior to rough-in.
 9. Shop equipment connections, including busways.
- N. This Contractor shall make all system connections required to equipment furnished and installed under other divisions. Connections shall be complete in all respects to render this equipment functional to its fullest intent. The Contractor shall make all system connections required to equipment furnished under other Divisions. Circuits shall be extended to all equipment which is

incidental to, but not necessarily shown, for equipment specified under other divisions such as magnetic flow meters, ATC panels, liquid level controls, leak detection systems, etc. Connections shall be complete in all respects to render this equipment functional to its fullest extent. Coordinate quantity, locations and power requirement for all items with the mechanical, plumbing and general trades contractors.

- O. It shall be the responsibility of the Contractor to obtain complete instructions for connections.

3.6 GUARANTEE:

- A. Guarantee obligations shall be as hereinbefore specified in the GENERAL AND SPECIAL CONDITIONS of these specifications, except as follows:
 - 1. Guarantee the complete electrical system free from all mechanical and electrical defects for the period of **two (2) (Addendum No. 4)** years beginning from the day of substantial completion of the work by the Architect. Refer to the Alternates specification section for additional years of guarantee. In all cases (base bid or alternates) specific equipment or materials warranties shall be guaranteed as stated hereinafter or as indicated on the drawings.
 - 2. Also, during the guarantee period, be responsible for the proper adjustments of all systems, equipment and apparatus installed by the Contractor and do all work necessary to ensure efficient and proper functioning of the systems and equipment.
 - 3. Upon receipt of notice from the Owner of failure of any part of the electrical installation during the guarantee period, new replacement parts shall be furnished and installed promptly at no cost.
 - 4. Warranty From the Manufacturer: Contractor shall obtain all warranty papers and records from the Original Equipment Manufacturer according to their warranty policy and deliver the same to the Owner. Contractor shall fulfill all the Original Manufacturer's requirements to validate the warranty as offered by the Original Equipment Manufacturer.
- B. Provide 24-hour service for any and all warranty problems experience in the operation of the equipment provided.
- C. Any equipment or system in need of warranty work whether during regular hours or on an emergency basis, shall be immediately serviced and repaired. The warranty work and guarantee shall include all parts and labor and shall be furnished at no cost to the Owner.
- D. The Contractor shall guarantee to make good any and all defects in his work, exclusive of lamps, which may develop due to defective workmanship or materials, within three years from the date of final acceptance of the work by the Owner.
- E. In addition to the warranty and correction of work obligations contained in the General and supplementary Conditions, correct the work of the system as embraced by the Specification, free from Mechanical and Electrical defects for the warranty period beginning from the day of acceptance of the building by the Architect for the beneficial use of the Owner.

- F. During the warranty period, take responsibility for the proper adjustments of systems, equipment and apparatus installed and perform work necessary to ensure the efficient and proper functioning of the systems and equipment.
- G. Certain items of equipment hereinafter specified shall be guaranteed for a longer time than the general warranty period. These guarantees shall be strictly adhered to and the Contractor shall be responsible for service or replacement required in connection with guarantee of these items. These guarantees shall commence on the same date as the final acceptance by the Architect.
- H. Submission of a bid proposal for this Project warrants that the Contractor has reviewed the Contract Documents and has found them free from ambiguities and sufficient for the construction and proper operation of systems installed for this project. If discrepancies are found, have them clarified by Addendum.
- I. It is possible that certain areas of the building or certain systems will be accepted at a time different than as specified. The date of acceptance by the Architect for beneficial use of the Owner for these building areas or systems will be adjusted accordingly.

3.7 SCHEDULING OF WORK:

- A. The Contractor shall not be permitted to do any work in any area of any occupied building during normal hours, except in areas specifically assigned.
- B. Coordination of work by the Contractor is essential such that power outages are kept to a minimum in quantity and duration. All required outages shall be approved by the Owner for optimum time scheduling. Written notice of not less than 15 calendar days shall precede all power outages. Utility disruptions during normal school hours are prohibited.

3.8 TEMPORARY FACILITIES:

- A. General: Refer to the Division 1 Sections for general requirements on temporary facilities.
- B. Description: Furnish and install the necessary metering and distribution equipment or an adequate, 3-phase, 4 wire temporary service and all temporary wiring, including step-down or step-up dry-type transformers. Exact requirements for temporary service will be determined by the Contractor. Temporary wiring shall follow specification requirements regarding workmanship, proper overcurrent protection, as well as conductor ampacity limits.
- C. The Contractor's attention is directed to the Occupational Safety and Health Act, Americans with Disabilities Act and NEC requirements for electrical work on construction sites.
- D. Materials: Lights at each floor in each stair. At least one light outlet per 1200 square feet on each floor, exclusive of stairs.
 - 1. One 20-ampere circuit for each 7500 square feet of gross floor area per floor to which various trades may attach their cords.

2. One temporary 220v power online in corridor (each elevator lobby) including connections to saws, fireproofing equipment and wood sanding equipment, if required.
 3. Power for testing and operating of elevators.
 4. Temporary lighting for stripping forms for all floors below grade.
 5. Power for crane operation.
- E. Installation: Temporary lighting shall provide minimum foot candle levels for construction as follows:

AREA	FOOT CANDLE LEVEL
General construction area lighting, corridors, hallways and exit ways.	10
Electrical equipment rooms, active storerooms, shops, locker and dressing areas	10

- F. The Contractor shall pay for all material and labor to provide and maintain temporary service.
- G. The Contractor shall obtain and shall pay for temporary electrical service for construction power.
- H. Provide all underground and/or overhead equipment, transformers, overcurrent devices, wires, connections, etc., for obtaining power from utility company lines.
- I. Remove all temporary power installations and connections after permanent power is established and/or prior to completion of the project.
- J. Contractor responsible for any and all temporary utility power connection fees.

3.9 DEMONSTRATION:

- A. As a part of this contract, the Contractor shall provide for the services of equipment manufacturers or their established representatives to demonstrate to selected maintenance personnel the correct operation, safety and maintenance of all electrical equipment under this contract.

3.10 PAINTING AND FINISHES:

- A. Provide protective finishes on all materials and equipment. Use coated or corrosion-resistant materials, hardware and fittings throughout the work. Paint bare, untreated ferrous surfaces with rust-inhibiting paint. All exterior components including supports, hangers, nuts, bolts, washers, vibration isolators, etc., shall be galvanized or stainless steel.
- B. Clean surfaces prior to application of coatings, paint, or other finishes.

- C. Provide factory-applied finishes where specified. Unless otherwise indicated factory-applied paints shall be baked enamel with proper pre-treatment.
- D. Protect all finishes and restore any finishes damaged as a result of work under Division 26 to their original condition.
- E. The preceding requirements apply to all work, whether exposed or concealed.
- F. Remove all construction marking and writing from exposed equipment, conduit, and building surfaces. Do not paint manufacturer's labels or tags.
- G. All exposed conduit, etc., shall be painted, except in electrical rooms, mechanical rooms, storage rooms, and crawl spaces. Colors shall be selected by the Architect and conform to ANSI Standards.
- H. Submit color of factory-finished equipment for approval prior to ordering.

3.11 PROTECTION OF WORK:

- A. Protect work, material and equipment from weather and construction operations before and after installation. Properly store and handle all materials and equipment.
- B. Cover temporary openings in conduit and equipment to prevent the entrance of water, dirt, debris, or other foreign matter.
- C. Cover or otherwise protect all finishes.
- D. Replace damaged materials, devices, finishes and equipment.

3.12 OPERATION OF EQUIPMENT:

- A. Clean all systems and equipment prior to initial operation for testing, retesting, or other purposes. Set, adjust, and test all equipment in accordance with manufacturer's instructions. Do not operate equipment unless all proper safety devices or controls are operational. Provide all maintenance and service for equipment that is authorized for operation during construction.
- B. Where specified, or otherwise required, provide the services of the manufacturer's factory-trained servicemen or technicians to start up the equipment.
- C. Do not use electrical systems for temporary services during construction unless authorized in writing by the Owner. Where such authorization is granted, temporary use of equipment shall in no way limit or otherwise affect warranties or guaranty period of the work.
- D. Upon completion of work, clean and restore all equipment to new conditions; replace expendable items such as filters.

3.13 TESTING AND ADJUSTMENT

- A. Perform all tests which are specified or required to demonstrate that the work is installed and operating properly. Where formal tests are required, give proper notices and perform all necessary preliminary tests to assure that the work is complete and ready for final test.
- B. Adjust all systems, equipment and controls to operate in a safe, efficient and stable manner.
- C. On all circuits, 600 volts or less, provide circuits that are free from ground faults, short circuits and open circuits.
- D. Other tests of a specific nature for special equipment shall be as specified under the respective equipment.

3.14 IDENTIFICATIONS, ELECTRICAL DIAGRAMS AND OPERATING INSTRUCTIONS:

- A. Contractor shall submit for approval schematic diagrams of each electrical system installed in the building. Diagrams shall indicate device location, service, type, make, model number and the identification number of each device in the particular system. Following approval by all authorities, the diagrams shall be framed, mounted under glass and hung in each Main Equipment Room where directed. Contractor shall deliver the tracing or sepia from which the diagrams were reproduced to the Owner.
- B. All equipment shall be plainly tagged.
- C. All items of equipment, including motor starters, panels, etc., shall be furnished with white letters and numbers on black plastic identification plates or aluminum letters and numbers on black engraved aluminum identification plates. Lettering shall be a minimum of 1/4" high. Identification plates shall be securely affixed to each piece of equipment, starters, panels, etc., by screws or adhesive (Tuff-Bond #TB2 or as approved equal). Pressure sensitive tape backing is prohibited.
- D. Provide three (3) copies and electronic copies of operating and maintenance instructions for all principal items of equipment furnished. This material shall be bound as a volume of the "Record and Information Booklet" as hereinafter specified.
- E. Provide at least 24 hours of straight time instruction to the operating personnel. This instruction period shall consist of not less than three (3) consecutive 8-hour days. Time of instruction shall be designated by the Owner. Provide two DVD/Digital copies of all instructional periods/demonstrations.

3.15 RECORD DRAWINGS AND SPECIFICATIONS:

- A. Upon completion of the Electrical installations, the Contractor shall deliver to the Engineer one complete set of prints of the Electrical Contract Drawings which shall be legibly marked in red pencil to show all Addenda, approved Shop Drawings, Change Orders, changes and departures of the installation as compared with the original design. They shall be suitable for use in preparation of Record Drawings. Provide electronic copies of each.

- B. The Contractor shall provide a record specification including all Addenda and other modifications. Record substantial variations in actual work performed. Identify all substitutions.

3.16 RECORD AND INFORMATION BOOKLET:

- A. The Contractor shall have prepared three (3) copies of the Record and Information Booklet as well as an electronic copy and deliver these copies of the booklet to the Owner. The booklet shall be as specified herein. The booklet must be approved and will not be accepted as final until so stamped.
- B. The booklet shall be bound in a three-ring loose-leaf binder similar to "National" No. 3881 with the following title lettered on the front and on the spine of the binder: "Record and Information Booklet (insert name of the project)". No sheets larger than 8-1/2" x 11" shall be used, except sheets that may be neatly folded to 8-1/2" x 11" and used as a pull-out. An Index will include the section tabs for each subject included. If more than one binder is required, print covers and spines with Volume numbers. Include in the front of every binder an index to all binders.
 - 1. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
 - 2. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
 - 3. Part 1: Directory, listing names, addresses, and telephone numbers of Electrical Engineers; Contractor; Electrical Subcontractors; and major Electrical equipment suppliers. Provide sales and service representative names and phone numbers of all equipment.
 - 4. Part 2: Operation and Maintenance Instructions, arranged by Specification Section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment. Complete record of material list. Catalog brochures and product data for all components. Include all submittal comments, and corrected catalog data and shop drawings on each piece of equipment and each system.
 - c. Parts list for each component, including recommended spare parts list. Include motor starter overload schedules.
 - d. Operating instructions, including sequence of operation.
 - i. Description of function, normal operating characteristics and limitations, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts. Provide a description of each system installed.
 - ii. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; control, stopping.
 - e. Maintenance instructions for equipment and systems. Detailed checkout procedures to insure operation of systems and gear, including

- recommended cleaning methods and materials and special precautions identifying detrimental agents.
- f. Servicing, diagnostic and troubleshooting instructions and procedures for systems and major equipment.
 - g. Recommended preventative maintenance program, including a list of items requiring inspection and servicing. Provide Chart Form indicating time and type of routine and preventative maintenance of electrical equipment, etc. The chart shall also indicate tag number, model number of equipment, location and service.
 - i. For replacement items, indicate type, size and quantity of the replaceable items.
 - ii. Provide lubrication schedule, including type, grade, temperature range and frequency.
 - iii. Provide a list of each type of lighting fixture lamp used, lamp fixture used, and source.
 - iv. Include estimated mean time between failures for major parts.
 - h. Wiring Diagrams, Block Diagrams, and Assembly Drawings.
 - i. Panelboard Circuit Directory for each panelboard, including Panel Name, Panel Location, Panel Ratings, spare circuit breakers, spaces for additional circuit breakers.
 - i. List of equipment keys turned over to the Owner.
5. Part 3: Project Documents and Certificates, including the following:
- a. Shop Drawings and Product Data. Record Documents of the systems.
 - b. Photocopies of certificates.
 - c. Photocopies of Manufacturers' and Contractors' warranties, guarantees.
 - d. Test Reports: Copies of the approved results of all tests required under all sections of specifications.
 - e. Inspection Certificates.
 - f. Manufacturer's Conformance Certificates.
6. Provide one copy (DVD video disk) of video instruction session with each booklet set. Label video disk with all pertinent information.
7. Submit one copy of completed volumes in final form 15 days prior to final Inspection. This copy will be returned with Engineer comments. Revise content of documents as required prior to final submittal.
8. Submit final volumes revised and electronic copies, within ten days after final inspection.
- C. Upon completion of the project, the Contractor shall furnish the Owner a complete list of suppliers of equipment for parts and maintenance purposes. The list shall include the name, address, and telephone number of the parts and maintenance firm on a single 8-1/2" x 11" sheet of paper.
- D. This item shall include the furnishing of a complete list of equipment installed on the project, including the Manufacturer's name, the make and model number of the equipment, and

address and telephone number of the nearest supplier who stocks maintenance and/or replacement parts. The list should be submitted along with as-built drawings and be typed in an organized manner.

END OF SECTION 260501

SECTION 260526- GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 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.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
 - 1. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - a. Test wells.
 - b. Ground rods.
 - c. Ground rings.
 - d. Grounding arrangements and connections for separately derived systems.
 - 2. Instructions for periodic testing and inspection of grounding features at test wells ground rings grounding connections for separately derived systems based on NETA MTS NFPA 70B.
 - a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - b. Include recommended testing intervals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.
- B. 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.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Burndy; Part of Hubbell Electrical Systems.
 - 2. Dossert; AFL Telecommunications LLC.
 - 3. ERICO International Corporation.
 - 4. Fushi Copperweld Inc.
 - 5. Galvan Industries, Inc.; Electrical Products Division, LLC.
 - 6. Harger Lightning & Grounding.
 - 7. ILSCO.
 - 8. O-Z/Gedney; a brand of Emerson Industrial Automation.
 - 9. Robbins Lightning, Inc.
 - 10. SIEMENS Industry, Inc.; Energy Management Division.

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 B 3.
 - 2. Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.
 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) 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 (41 mm) wide and 1/16 inch (1.6 mm) thick.
 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) 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.

2.4 CONNECTORS

- A. 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.
- B. Welded Connectors: Exothermic-welding kits, **equivalent to cadweld (Addendum No. 4)** of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- J. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- K. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- L. Straps: Solid copper, copper lugs. Rated for 600 A.
- M. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal one two-piece clamp.
- N. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

- O. Water Pipe Clamps:
 - 1. Mechanical type, two pieces with stainless-steel bolts.
 - a. Material: Die-cast zinc alloy.
 - b. Listed for direct burial.
 - 2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet (19 mm by 3 m).
- B. Ground Plates: 1/4 inch (6 mm) 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 tinned-copper conductor, No. 4/0 AWG minimum.
 - 1. Bury at least 24 inches (600 mm) below grade.
- C. 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 (50 mm) minimum from wall, 6 inches (150 mm) 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.
- D. 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 (100 mm) 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 (50 mm) above to 6 inches (150 mm) 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 (150 mm) 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.
- 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. 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.
- F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-24-inch (6-by-50-by-600-mm) grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.6 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 (50 mm) 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.
- D. 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.
- E. 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.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. 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, and at individual ground rods. 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.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 2. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
 3. Substations and Pad-Mounted Equipment: 5 ohms.
 4. Manhole Grounds: 10 ohms.
- F. 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 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, 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 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.2 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.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
1. Structural members in paths of conduit groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Appleton
4. Cooper Course-Hinds
5. O-Z Gedney; a unit of General Signal.
6. Spring City
7. Thomas & Betts
8. Wheatland Tube Company.

- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- E. EMT: Comply with ANSI C80.3 and UL 797.
- F. FMC: Comply with UL 1; zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Compression type.
 3. 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.
 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- I. Joint Compound for IMC, GRC: 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, TUBING, AND FITTINGS

- A. Available 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. Allied Tube & Conduit
 2. Arnco
 3. Beck Manufacturing
 4. CANTEX Inc.

- 5. CertainTeed Corp.; Pipe & Plastics Group.
 - 6. Carlon
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - C. ENT: Comply with NEMA TC 13 and UL 1653.
 - D. RNC: Type EPC-40-PVC complying with NEMA TC 2 and UL 651 unless otherwise indicated.
 - E. LFNC: Comply with UL 1660.
 - F. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
 - G. Fittings for LFNC: Comply with UL 514B.

2.3 BOXES, ENCLOSURES, AND CABINETS

- A. Available 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. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Hoffman.
 - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 6. O-Z/Gedney; a unit of General Signal.
 - 7. RACO; a Hubbell Company.
 - 8. Robroy Industries, Inc.; Enclosure Division.
 - 9. Scott Fetzer Co.; Adalet Division.
 - 10. Spring City Electrical Manufacturing Company.
 - 11. Thomas & Betts Corporation.
 - 12. Walker Systems, Inc.; Wiremold Company (The).
 - 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- 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, aluminum, 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.

2. Type: Fully 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, round.
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 (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- L. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep).
- M. Gangable boxes are allowed.
- N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- O. Cabinets:
1. NEMA 250, Type 1 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.
- 2.4 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.
- C. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation.
 - d. NewBasis.
 2. Standard: Comply with SCTE 77.
 3. Configuration: Designed for flush burial with closed 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.
- D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete.
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Christy Concrete Products.
 - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
 2. Standard: Comply with SCTE 77.
 3. Configuration: Designed for flush burial with closed 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." "Telephone".
 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: GRC.
 3. Underground Conduit: RNC, Type EPC-40-PVC direct buried unless otherwise noted.
 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 (Addendum No. 4)**.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated.
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: **EMT (Addendum No. 4)** 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. Boiler rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: MC Cable.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC.
 7. 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 (21-mm) trade size.
- D. Aluminum conduit is prohibited.
- E. 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 type, 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.
- F. Do not install aluminum 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 (49 deg C).

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems" for hangers and supports.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. 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 (300 mm) of changes in direction.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches ((300 mm)) of enclosures to which attached.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) 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 (3-m) intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 2 inches (50 mm) 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 RNC, Type EPC-40-PVC to GRC before rising above floor, including into wall cavity.
- I. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- J. 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.

- K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- M. 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 (35-mm) 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.
- N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300-mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- O. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 - 2. Secure surface raceway with two hole straps at intervals not exceeding 32 inches (813-mm) 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.
- P. 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.
- Q. 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. Where otherwise required by NFPA 70.
- R. Expansion-Deflection Fittings: Provide an expansion/deflection fitting in each concealed or exposed electrical run crossing a building expansion joint. Fittings shall be complete with bronze end couplings, neoprene sleeve, tinned copper braid integral bonding jumper and stainless steel bands. Expansion/deflection fittings shall be suitable for the size and type of conduit run they connect. Bonding jumper shall comply with NEC and UL requirements.
 - 1. Expansion/deflection fitting shall accommodate the following movements without collapsing or fracturing the conduit and damaging the wires it contains:
 - a. Axial expansion or contraction up to 3/4-inch.
 - b. Angular misalignment of the axes of the conduits up to 30 degrees in all directions.
 - c. Parallel misalignment of the axes of the conduits up to 3/4-inch in all directions.

2. Expansion/Deflection fitting shall be OZ/Gedney Type DX or approved equal by Crouse Hinds (Type XD).
- S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi recessed 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.
- T. 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 top of box unless otherwise indicated.
- U. 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 the box and cover plate or the supported equipment and box.
- V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- W. Locate boxes so that cover or plate will not span different building finishes.
- X. 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.
- Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- Z. Set metal floor boxes level and flush with finished floor surface.
- AA. 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 Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) 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 (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
 4. Install manufactured duct elbows for stub-up 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 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 (75 mm) of concrete for a minimum of 12 inches (300 mm) 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 (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. 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 (12.5-mm) sieve to No. 4 (4.75-mm) 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 (25 mm) above finished grade.
- D. Install handholes with bottom below frost line below grade.
- 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.
- F. 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 the enclosure.
- G. Field-cut openings for ducts and 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.
- H. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete," with a troweled finish.
 2. Dimensions: 10 inches wide by 12 inches deep (250 mm wide by 300 mm deep).

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 Division 26 Section "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 Division 7 Section "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.

3.8 GROUNDING

- A. Ground underground ducts and utility structures according to Division 26 Section "Grounding."

3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
 - 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
 - 3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.10 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260533

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. 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 for types other than NEMA 250, Type 1.
 - 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.
- 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.

B. Seismic Qualification Data: Certificates, for enclosed switches and circuit breakers, accessories, and components, from manufacturer.

C. Field quality-control reports.

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.

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 (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

2. Altitude: Not exceeding 6600 feet (2010 m).

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: Two (2) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 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. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.3 MANUFACTURERS:

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric or comparable product by one of the following:
 1. Eaton.
 2. ABB – GE Electrification Products.

2.4 FUSIBLE SWITCHES

- A. Type HD, Heavy Duty:
 1. Single throw.
 2. Three pole.
 3. 600-V ac.
 4. 1200 A and smaller.
 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.
 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- B. Accessories (Required per device):
 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. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 4. Lugs: Compression type, suitable for number, size, and conductor material.
- C. Optional Accessories (As specified on Drawings):

1. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact, arranged to activate before switch blades open. Contact rating – 120-V ac.
2. Service-Rated Switches: Labeled for use as service equipment.

2.5 NONFUSIBLE SWITCHES

A. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 600-V ac.
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories (Required per device):

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. Lugs: Compression type, suitable for number, size, and conductor material.

C. Optional Accessories (As specified on Drawings):

1. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact, arranged to activate before switch blades open. Contact rating – 120-V ac.
2. Service-Rated Switches: Labeled for use as service equipment.

2.6 MOLDED-CASE CIRCUIT BREAKERS

A. 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.

B. 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.

C. MCCBs shall be equipped with a device for locking in the isolated position.

D. Lugs shall be suitable for 140 deg F (60 deg C) rated wire on 100-A circuit breakers and below. 167 deg F (75 deg C) rated wire, sized according to the 167 deg F (75 deg C) temperature rating in NFPA 70.

- E. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- F. 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.
- G. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings for circuit breaker frame sizes 400A and larger:
 - 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.
- H. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- I. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- J. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Compression 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/NC 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. Electrical Operator: Provide remote control for on, off, and reset operations.
 - 11. Accessory Control Power Voltage: Integrally mounted, self-powered.

2.7 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).
- 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.

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 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 (Addendum No. 4)**.
 - 3. Kitchen, Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4X, stainless steel.

3.3 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. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

3.4 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.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections.
 - 1. Visually and Mechanical inspect all equipment on project prior to installation.
 - 2. Correct malfunctioning units on-site, with new units.

3.6 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 approved Coordination Study Shop Drawing.

END OF SECTION 262816

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:

1. Full-voltage manual.
2. Full-voltage magnetic.
3. Multispeed.

1.2 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. N.C.: Normally closed.
- E. N.O.: Normally open.
- F. OCPD: Overcurrent protective device.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed controller.
- B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.7 QUALITY ASSURANCE

- 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 NFPA 70.
- C. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

- A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.
- A. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric or comparable product by one of the following:
 - a. Eaton.
 - b. ABB – GE Electrification Products.
 - 2. Configuration: Nonreversing.
 - 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
 - 4. Surface mounting.
 - 5. Pilot light.
 - 6. Hand-Off-Automatic selector switch.
- B. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric or comparable product by one of the following:
 - a. Eaton.
 - b. ABB – GE Electrification Products.
 2. Configuration: Nonreversing.
 3. Contactor Coils: Pressure-encapsulated type.
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 6. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor running overload protection.
 - b. Sensors in each phase.
 - c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 7. External overload reset push button.
- C. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric or comparable product by one of the following:
 - a. Eaton.
 - b. ABB – GE Electrification Products.
 2. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
 3. Nonfusible Disconnecting Means:
 - a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

2.2 MULTISPEED MAGNETIC CONTROLLERS

- A. General Requirements for Multispeed Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A.

- B. Multispeed Magnetic Controllers: Two speed, full voltage, across the line, electrically held.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric or comparable product by one of the following:
 - a. Eaton.
 - b. ABB – GE Electrification Products.
 2. Configuration: Nonreversing; consequent pole or two winding.
 3. Contactor Coils: Pressure-encapsulated type.
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 4. Power Contacts: Totally enclosed, double break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
 5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.
 6. Compelling relays shall ensure that motor will start only at low speed.
 7. Decelerating timer relays shall ensure automatically timed deceleration through each speed.
 8. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor running overload protection.
 - b. Sensors in each phase.
 - c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 9. External overload reset push button.
- C. Combination Multispeed Magnetic Controller: Factory-assembled combination of multispeed magnetic controller, OCPD, and disconnecting means.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; by Schneider Electric or comparable product by one of the following:
 - a. Eaton.
 - b. ABB – GE Electrification Products.
 2. Nonfusible Disconnecting Means:
 - a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
 - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
 - c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

2.3 ENCLOSURES

- A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
 - 1. Dry and Clean Indoor Locations: Type 1.
 - 2. Outdoor Locations: Type **NEMA 3R (Addendum No. 4)**.
 - 3. Kitchen Wash-Down Areas: Type 4X, stainless steel.
 - 4. Other Wet or Damp Indoor Locations: Type 4X, stainless steel.

2.4 ACCESSORIES

- A. Push Buttons, Pilot Lights, and Selector Switches: NEMA ICS 5; heavy-duty type; factory installed in controller enclosure cover unless otherwise indicated.
 - 1. Pilot Lights: LED type; red for "Power Available", green for "Running"; push to test.
- B. Control Relays: Auxiliary and adjustable time-delay relays.
- C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings. Provide ICM controls ICM450 or approved equal, locate in separate enclosure at equipment; match NEMA enclosure rating with starter/disconnect.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height, and with disconnect operating handles not higher than 79 inches (2006 mm) above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in each fusible-switch enclosed controller.
- D. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."
- E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- F. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified 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 nameplate.
 - 3. Label each enclosure-mounted control and pilot device.

3.3 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices.
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
 - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
 - 2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 - 2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
 - 3. Test continuity of each circuit.
 - 4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager before starting the motor(s).
 - 5. Test each motor for proper phase rotation.
 - 6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Set field-adjustable switches and overload-relay pickup and trip ranges.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

SECTION 27 41 00 - AUDIO VISUAL AND SOUND SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Audio system for Dining Room.
 - 2. AV System for the Gymnasium.

1.2 DEFINITIONS

- A. "Communications Network Outlet (CNO)" refers to a collection of one or more mechanical cable termination device for horizontal cable in the work area.
- B. "Drop" refers to the vertical transition to a location of one or more CNOs.
- C. "Horizontal Cabling" refers to the cabling between and including the work area communications network outlet and the horizontal cross-connect in the telecommunications room.
- D. "Jack" refers to a female-style telecommunication receptacle.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements
 - 1. Auxiliary Sound/Video Systems:
 - a. Gym AV System - A multi-loudspeaker system with video projector and associated wiring and equipment shall be provided, installed and programmed.
 - b. Cafeteria Sound Reinforcement System - A multi-loudspeaker system shall be provided. Clearly label and color code the controls for all functions.
 - c. Hearing Assistance System - Provide a reinforcement system for the hearing impaired in the Gymnasiums and Dining. The hearing assistance system shall be an FM radio system that shall not limit operation to certain seats or areas of the room(s). Provide approximately 20-40 milliseconds of high-quality digital signal delay to help in the localization of the sound source.
 - 2. All stand-alone sound systems must have call override from the Intercom/PA system in the case of an emergency.
- B. Performance Requirements
 - 1. Comply with applicable requirements in Local, State and Federal Codes, TIA/EIA Standards, and BICSI methodology.
 - 2. Specified cabling system derived from recommendations in approved telecommunications industry codes, standards and methods, including the following documents:
 - a. ANSI/TIA-568-C.0: Generic Telecommunications Cabling for Customer Premises.
 - b. ANSI/TIA-568-C.1: Commercial Building Telecommunications Cabling Standard
 - c. ANSI/TIA-568-C.2: Balanced Twisted Pair Cabling and Components Standard
 - d. ANSI/TIA-568-C.3: Optical Fiber Cabling Components Standard

- e. ANSI/TIA-569-B: Commercial Building Standard for Telecommunications Pathways and Spaces
- f. ANSI/TIA-570-B: Residential Telecommunications Cabling Standard
- g. ANSI/TIA-606-A: Administration Standard for Telecommunications Infrastructure of Commercial Buildings
- h. TIA-607-C: Commercial Building Grounding and Bonding Requirements for Telecommunications
- i. BICSI Telecommunications Distribution Methods Manual (TDMM), Latest Edition
- j. National Fire Protection Agency (NFPA-70): National Electrical Code (NEC)

1.4 SUBMITTALS

- A. Comply with requirements of Division 0 and Division 1 - Submittals and as modified below.
- B. Product Data: Submit manufacturer's product literature, technical specifications and similar information for the following items demonstrating compliance with the specified requirements.
 - 1. Sound coverage and pressure level diagram for each auxiliary sound system
 - 2. Sound Amplifier
 - 3. Sound Speakers
 - 4. Sound Microphones
 - 5. Sound Cabling and Wiring
 - 6. Audio Visual cables and connectors
 - 7. DSP Units
 - 8. A/V switchers
 - 9. A/V controllers
 - 10. Signal Extenders
 - 11. A/V Mixers
 - 12. Communications outlets, faceplates, and accessories.
 - 13. Wall outlets
- C. Samples: Provide samples of equipment, cables, microphones and assemblies as described below, prior to installation, for approval by designer.
 - 1. Sound Enhancement – Submit samples of audio visual cables provided including following components and characteristics:
 - a. Sample characteristics:
 - i. Provide all components in colors selected by Design consultant.
 - ii. Provide multiple samples to accurately represent range of cables to be provided.
- D. The Contractor shall submit line drawings of all systems showing major components of the systems. Submit wiring diagrams showing connections for all systems and equipment.

- E. Submit floor plan drawings clearly indicating all equipment and locations of equipment.
- F. Quality Control Submittal
 - 1. Test Reports: Submit complete sample test data and reports with exact labels used on cables and faceplates.
 - 2. Certificates
 - a. Manufacturer Certification: Submit certification from manufacturer of products to be installed under this contract certifying that Installer is authorized by manufacturer to install specified products.
 - b. Installer Experience Listing: Submit list of at least 5 completed projects as specified below in "Quality Assurance – Qualifications – Installer."
- G. Contract Closeout Submittal: Comply with requirements of Division 0, including submission of operating and maintenance instructions as item in "Operation and Maintenance Data" manual described in that Section.

1.5 QUALITY ASSURANCE

- A. All Work shall be installed in a first class, neat and professional manner by skilled Technicians. The quality of the workmanship shall be subject to inspection and approval by authorized school district personnel. Any work found to be of inferior quality and/or workmanship shall be replaced and/or reworked until the approval of the school district is obtained.
- B. Installer Qualifications: Qualified to cable, terminate and test cabling system specified in this Section, certified by manufacturer of products to be installed, and completed at least 5 installations of similar size, nature and complexity as specified for this project.
- C. Conditions for Consideration of "Or Equal" Products: Where products are specified by name and accompanied by the term "or equal", the proposed "or equal" product will be considered when the following conditions are satisfied. If all the following conditions are not satisfied, Design Consultant will return requests without action, except to record noncompliance with these requirements:
 - 1. Proposed product does not require extensive revisions to the Contract Documents.
 - 2. With the exception of the product name or number and manufacturer's name, proposed product conforms with requirements indicated on the Drawings and in the Specifications in every respect and will produce indicated results.
 - 3. Proposed product is fully documented and properly submitted.
 - 4. Proposed product has received necessary approvals of authorities having jurisdiction.
 - 5. Proposed product is compatible with AND has been coordinated with other portions of the Work.
 - 6. Proposed product provides specified warranty.
 - 7. If proposed product involves more than one contractor, proposed product has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
 - 8. Submission is accompanied with detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes

such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

9. Submission is accompanied with a list of similar installations for completed projects with project names and addresses and names and addresses of design consultants and authorities, if requested.
10. Submission is accompanied with proposed product's Manufacturer signed written statement on Manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents.

1.6 WARRANTY

- A. Installer's Warranty: Provide manufacturer's system warranty against electrical or mechanical defects for 1 year from date of final acceptance.
 1. System Certification: Upon successful completion of the installation and subsequent inspection, the Authority shall be provided with a numbered certificate, from the manufacturing company, registering the installation.

PART 2 - PRODUCTS

2.1 MATERIALS – ALL MATERIALS SHALL BE NEW AND UNUSED

- A. Acceptable Products
 1. The A/V Systems are based on Extron, Community, Biamp, Shure, Lowell and other like reputable manufacturers.
 - a. Equipment substitutions must be submitted in writing to the design team for review and approval.
 - b. Any equipment not meeting the design criteria will be rejected at the contractor's expense.
- B. Gym A/V System
 1. Equipment Cabinet
 - a. Middle Atlantic SR-40-32 Wall Mounted Swing Cabinet
 2. Intercom Shunt
 - a. Biamp Ex-Logic Box
 3. A/V Projector
 - a. Epson Pro G7200W Projector with Lens. Provide proper lens for throw and screen size.
 - b. Coordinate with exact screen.
 - c. Provide all mounts necessary.
 4. A/V Switch
 - a. 8 port gigabit PoE switch
 5. A/V Mixer
 - a. Extron IN1608xi

6. A/V Controller
 - a. Extron IPCP Pro 350
7. A/V Touch Panel
 - a. Extron TLP Pro 525M
 - b. RWM-1 Back Box
8. A/V Extenders
 - a. Extron DTP T UWP 4K 232 Wall Plate
 - b. Extron DTP R UWP 4K 231 D
9. A/V Faceplates
 - a. Extron DTP Series
 - b. Custom Stainless Steel plates
 - c. Attero Tech unD610-BT
10. Mixer/DSP
 - a. Biamp TesiraFORTE DAN AI
11. Amplifier
 - a. QSC RMX 1450HDa
 - b. Extron XPA-4002 70v
12. Assistive Listening
 - a. Listen Technologies LS-54-072 Kit
13. Loudspeakers
 - a. Extron SI 26 CT
 - b. Extron SF 10C Subwoofer
 - c. Include all mounts and secure to structure
14. Wireless Mics
 - a. Shure SLXD124/85/sm58
15. DVD/CD Player
 - a. Denon DN-300z
16. Power Conditioner
 - a. Surge X SEQ 2 RU
17. Equipment Drawer
 - a. Atlas SD4-14 Drawer

18. Mic Level Input

- a. Neutrik 1/4" XLR Combo

19. Line Level Input

- a. Neutrik Connector

20. Stereo Input

- a. Neutrik ¼" XLR Combo

21. Wired Microphone

- a. Shure SM58S
- b. Provide 3

22. Podium Microphone

- a. Shure MX 412/C Gooseneck Podium Microphone
- b. Provide 1

23. Microphone Stands

- a. Atlas TEB-E
- b. Provide 3

24. Wiring

- a. Extron XTP
- b. Shielded Cat 6 or greater.
- c. 18/2 AWG
- d. XLR Microphone cable.
- e. West Penn 226, or equal.

25. Projection Screen

- a. See Division 11

26. Miscellaneous Connectors

- a. Provide Neutrik NC3 series "XLR", Neutrik NP3C "TRS" or Canare F-09 "RCA" connectors.
- b. Provide Switchcraft N112B connectors.
- c. Provide crimped or gas-tight terminals for all loudspeaker connections. Wirenuts are not acceptable.

C. Large Gymnasium Sound System

1. Equipment Cabinet

- a. Middle Atlantic SR-40-32 Wall Mounted Swing Cabinet

2. Intercom Shunt
 - a. Bogen VAR1
 - b. Biamp Tesira Ex-Logic Box
3. Mixer/DSP
 - a. Biamp TesiraFORTE DAN AI
 - b. Biamp TEC-1S
 - i. Mounted in cabinet
4. A/V Switch
 - a. 8 Port gigabit PoE Switch
5. Amplifier
 - a. Crown CDi 1000
6. Assistive Listening
 - a. Listen Technologies LS-54-072 Kit
7. Loudspeakers
 - a. EV SX100+
 - b. Include all mounts and secure to structure
8. Wireless Mics
 - a. Shure SLXD124/85/sm58
9. DVD/CD Player
 - a. Denon DN-300z
10. Auxiliary Input Switcher
 - a. RDL EZ-HSX4
11. Remote Control
 - a. Crestron MC4
 - b. Crestron TSR-310 Remote
 - c. Crestron ANT-EXT-10
12. Power Conditioner
 - a. Surge X SEQ 2 RU
13. Equipment Drawer
 - a. Atlas SD4-14 Drawer
14. Mic Level Input

- a. Neutrik 1/4" XLR Combo
15. Line Level/Bluetooth Input
- a. Attero Tech unD610-BT
16. Line Level Input
- a. Neutrik Connector
17. Stereo Input
- a. Neutrik 1/4" XLR Combo
 - b. Whirlwind Isopod
18. Wired Microphone
- a. Shure SM58S
 - b. Provide 3
19. Podium Microphone
- a. Shure MX 412/C Gooseneck Podium Microphone
 - b. Provide 1
20. Microphone Stands
- a. Atlas TEB-E
 - b. Provide 3
21. Wiring
- a. Shielded Cat 6 or greater.
 - b. 18/2 AWG
 - c. XLR Microphone cable.
 - d. West Penn 226, or equal.
22. Miscellaneous Connectors
- a. Provide Neutrik NC3 series "XLR", Neutrik NP3C "TRS" or Canare F-09 "RCA" connectors.
 - b. Provide Switchcraft N112B connectors.
 - c. Provide crimped or gas-tight terminals for all loudspeaker connections. Wirenuts are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine conditions under which AV cabling and sound enhancement equipment and related components are to be installed in coordination with Installer of materials and components specified in this Section and notify affected Prime

Contractors and Design consultant in writing of any conditions detrimental to proper and timely installation. Do not proceed with installation until unsatisfactory conditions have been corrected to ensure a safe and timely installation.

1. When Installer confirms conditions as acceptable to ensure proper and timely installation and to ensure requirements for applicable warranty or guarantee can be satisfied, submit to Design consultant written confirmation from applicable Installer. Failure to submit written confirmation and subsequent installation will be assumed to indicate conditions are acceptable to Installer.
2. Visit Site to identify and become familiar with existing field conditions and specific requirements of each Site.
3. Verify all dimensions in field and confirm condition of existing hardware to be utilized.
4. Confirm space requirements and physical confines of all work areas to ensure that all materials can be installed in indicated spaces.
5. Confirm all outlet locations and cable pathways and advise Design consultant in writing of any discrepancies or issues in Design described in Contract Documents.

3.2 PREPARATION

- A. Protection: Provide adequate protection of equipment and hardware before and after installation.
- B. Existing Communications Services: Ensure all telecommunications systems (voice, video and data) remain operational throughout the project.
 1. Identify any additional outlets, circuits, and wiring at the site not shown on T-Drawings and interfering with installation of specified equipment.
 2. Remove all accessible portions of abandoned communications cabling per NEC 800.52. Tag all communications cabling not terminated at both ends but retained for future use.

3.3 CUTTING AND PATCHING

- A. The contractor shall provide his own cutting and patching necessary to install his work. Patching shall match adjacent surfaces and shall be to the satisfaction of the Architect and Engineer.
- B. No structural members shall be cut without the approval of the Engineer and all such cutting shall be done in a manner directed by him.
- C. When installing conduit, pipe or any other work in insulated concrete form (ICF) wall, the responsible subcontractor for the work shall provide spray foam insulation to patch the rigid insulation to maintain full integrity of the insulating value of the wall after the mechanical and electrical work is complete. All new work shall NOT be installed in concrete center of wall. All mechanical and electrical installations shall be on the interior side of the concrete.

3.4 INSTALLATION

- A. Provide and install all components necessary to install complete AV cabling and sound enhancement equipment systems, including (but is not limited to) connectors, electronics, terminators, pass-thrus, cables etc...
 1. Velcro straps shall be used to loosely bundle cables. Zip Ties are not acceptable for use.
 2. Cable runs shall be factory terminated. Splicing of any cable is prohibited
 3. Secure all cables within ceiling cavities to building structure.

4. Loosely bundle all cables and support from structure at unequal intervals from 5 to 6 feet with spring steel fasteners and cable clip rated for use with high performance cables where cable tray or other support structure has not been provided as indicated on Drawings. All mounting clips shall be seismic type as per BOCA.
5. Do not violate manufacturer’s recommended loadings. Leave 30% capacity for future use of pathway.
6. Verify all horizontal cable run lengths prior to installation. Ensure cables do not exceed distances that would degrade the signal transmission requirements
7. Do not support cables from ceiling grid T-Bars, grid wire supports or bridle rings. Do not allow cables to touch ceiling grid.
8. Install cables in EMT in all unfinished or exposed areas.
9. Do not secure cables with permanent cable ties. Do not tighten cable bundles in such a way as to cause jacket deformation or damage.
10. Place cables in compliance with ANSI/TIA-568.C standards and BICSI recommended methods.
11. Tight 90-degree bends are unacceptable, and use of plastic “cinch-type” tie-wraps are not permitted, in order to prevent damage to cable jacket and compromise the cable’s electrical or optical characteristics.
12. Communications outlets shall be located to be no more than 6 feet from an electrical outlet.

B. Determine allowable cable proximity to other electrical power sources of 480 Volts or less using TIA/EIA-569A “Cabling Pathway Standard” for UTP cable separations from sources of EMI:

1. Minimum separation distance from Power Source at 480 V or less:

CONDITION	<u>< 2kVA</u>	<u>2-5 Kva</u>	<u>> 5 kVA</u>
a. Unshielded power lines or electrical equipment in proximity to open or non-metal pathways	6 in.	12 in.	24 in.
b. Unshielded power lines or electrical equipment in proximity to open or non-metal pathways	3 in.	6 in.	12 in.
c. Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to grounded metal conduit pathway	3 in.	6 in.	12 in.
d. Transformers & Elec. Motors	40 in.	40 in.	40 in.
e. Fluorescent Lighting	12 in.	12 in.	12 in.

C. Install all cable in accordance with National, state and local codes and TIA/EIA Standards, and BICSI methods.

1. Follow manufacturer’s guidelines and requirements for all cable termination.

- D. Permanently identify all system components following ANSI/TIA-606A “Administration Standard for Commercial Telecommunications Infrastructure” with identification format:
 - 1. Identification: Provide permanent identification labels for outlets, faceplates and cables.
 - 2. Each individual cable shall be labeled on both ends of cable terminations regardless of cable intended use. Labels must be machine printed with permanent black ink on laminated white label material. Contractors must check with appropriate school district personnel for appropriate labeling scheme. The intended format and labeling material must be approved by the school district Technology Department before labeling begins.

3.5 TESTING

A. Audio Visual System

- 1. The contractor shall test all cables included for proper signal transmission based on manufacturer standards.

The contractor shall record remove any cable that does not meet manufacturer standards and replace it with a correctly functioning cable.

- 2. The contractor shall demonstrate that the installed cables meet manufacturer standards for signal transmission prior to the job being considered complete.

B. Sound / Video System

- 1. The contractor shall test all aspects of the sound and video equipment once it is installed and demonstrate these functions to the owner or owner’s representative.
 - a. Speaker levels shall be verified to function individually and as a unit
 - b. Microphones shall be demonstrated to work as intended by the manufacturer.
 - c. Input shall be shown to work correctly.
 - d. Outputs shall be shown work correctly.
 - e. Displays shall be adjusted for proper viewing.
 - f. Audio shall be adjusted for proper sound levels.
 - g. Edid and HDCP shall be properly set up and programmed.
 - h. All programming shall be included and completed for system operation.

3.6 ACCEPTANCE

A. Contractors work shall be considered complete after the following conditions have been met:

- 1. Cable installation is complete and all cable runs have been tested and documented to be installed according to specifications and drawings.
- 2. Equipment installation is complete and all functions have been tested and documented to function as designed and per the manufacturer’s recommendations.
- 3. All punch list items have been reconciled.
- 4. All disturbed ceiling panels, fire stopping materials, covers, etc. have been properly reinstalled.
- 5. All materials and trash have been removed from the site.

6. A 1-Year Installers warranty has been given to a school district Technology representative.
7. Submit Manufacturers Extended Warranty Application.

END OF SECTION 274100

SECTION 283112 - PUBLIC SAFETY DISTRIBUTED ANTENNA SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This specification describes technical and performance criteria for deploying a public safety distributed antenna system capable of supporting Public Safety Networks (PSN).

1.3 SYSTEM DESCRIPTION

- A. Services: Upon acceptance testing, the system shall provide coverage for the PSNs listed below:

Table 1

Service	Uplink (MHz)	Downlink (MHz)
700 Band	799-805	769-775
800 Band	806-824	851-869

1.4 PERFORMANCE REQUIREMENTS

- A. The system shall comply with IFC 510 and NFPA 72.
- B. The system shall deliver coverage per the criteria in Table 1 throughout 95% of all occupied building spaces and 99% in critical areas as defined in NFPA 72.
- C. Minimum Downlink RSL at 700/800 MHz: -95dBm.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on drawings.
- B. Shop Drawings: Include plans, details, and attachments to other work.
 - 1. Scale floor plans showing the location of system components and wiring between them.
 - 2. Detail drawings for donor antenna, together with its associated and grounding mounting hardware.
 - 3. Battery calculations.

4. RF propagation modeling (heat maps).
5. Product data sheets for each type of equipment and device to be installed.

C. Submittal Requirements at Project Close Out

1. Drawings: Submit as-built drawings indicating:
 - a. Donor antenna, grounding and lightning protection details.
 - b. Cable routing, coupler and coverage antenna locations.
 - c. Active component locations, layout and configuration.
2. Cable Test Reports: Submit cable test results for all cable segments. Testing shall include Return Loss (RL), Distance to Fault (DTF) and Passive Intermodulation (PIM).
3. Operation and Maintenance Data: Submit hardware manuals for all system components.
4. Warranty Documents:
 - a. Submit for all manufactured components specified in this Section.
 - b. Submit Contractor's System Warranty.
 - c. Submit Manufacturer's Warranty

1.6 SUBSTITUTIONS

- A. Contract Documents are based on equipment manufacturers and minimum performance characteristics as called out in these specifications and/or indicated on the drawings. Acceptance of substitute equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials, which meet the performance as, stated or implied in the Contract Documents.
- B. Proposed substitution shall conform to the size, ratings, and operating characteristics of the equipment or systems as specified herein and/or shown/inidcated on the drawings.

1.7 CODES AND STANDARDS

- A. All work, including but not limited to: cabling, pathways, support structures, wiring, equipment, installation, workmanship, maintenance and testing shall comply with the latest editions of the National Electrical Code, applicable local building codes and equipment manufacturer's instructions.
- B. As applicable, equipment and cabling installation shall comply with the following standards. All publications must be of the latest issue and addenda:
 1. International Fire Code.
 2. International Building Code.
 3. NFPA 101
 4. NFPA 1
 5. National Fire Alarm and Signalling Code.
 6. Federal Communications Commission (FCC) - Title 47 of the Code of Federal Regulations, Part 90.
 7. Federal Communications Commission (FCC) Rules, Parts 15 and 22
 8. ANSI/TIA-568-C.O: Generic Telecommunications Cabling for Customer Premises.

9. ANSI/TIA-568-C.1: Commercial Building Telecommunications Cabling Standard Part 1: General Requirements.
10. ANSI/TIA-569-B: Commercial Building Standard for Telecommunications Pathways and Spaces.
11. ANSI/TIA-606-A: The Administration Standard for the Telecommunications Infrastructure of Commercial Building.
12. ANSI/ TIA-J-STD-607 -A: Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
13. BICSI Information Transport Systems Installation Methods Manual.
14. BICSI Telecommunications Distribution Methods Manual.

1.8 QUALITY ASSURANCE

- A. 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.
- B. The work specified in this Section is acknowledged to require special skills mastered by education, experience, or both. The contractor shall have direct access to all tools and test equipment required to complete the work prior to submitting a bid.
- C. Requirements set forth by first-responder code, ordinance, or the PSN AHJ shall supersede the requirements described herein and shall be met in their entirety. It is the Contractor's responsibility to ensure that the system complies with local code, ordinances or requirements established by the PSN AHJ.
- D. PSN Approval
 1. When approval of the system deployment is required by code or ordinance, the Contractor shall be responsible for facilitating the AHJ approval(s) per the requirements of the code or ordinance.

1.9 WARRANTY

- A. Manufacturer Warranty:
 1. Couplers and Antennas: 5-year limited warranty from date of system acceptance.
 2. Coaxial Cable and Connectors: 10-year limited warranty from date of system acceptance.
 3. Active Components: The earliest of 1-year limited warranty from date of system installation or 15 months from date of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the minimum requirements indicated herein and on the drawings.

2.2 HEAD END EQUIPMENT

- A. 700/ 800mhz Bidirectional Amplifier (BDA)
 - 1. Characteristics:
 - a. Operating Temperature Range: -33 °C to +60 °C
 - b. Chassis: NEMA 4 with red color.
 - c. Channel Bandwidth: 12.5/25 KHz.
 - d. Number of Channels: 32
 - e. Total Output Power, Uplink: 25dBm
 - f. Total Output Power, Downlink: 33dBm.
 - g. Maximum System Gain: 90dB.
 - h. Gain Adjustment Range (1dB step): 0-30.
 - i. Pass Band Ripple: <5dB.
 - j. Uplink Noise Figure: <5dB.
 - k. Absolute Maximum RF Input Power: -10dBm.
 - l. Input VSWR: <1.5.
 - m. Impedance: 50 Ohms.

2.3 EMERGENCY POWER

- A. Battery Backup Power Unit
 - 1. Characteristics:
 - a. Sustain operation of system for a minimum of 24 hours upon loss of utility power.
 - b. Chassis: NEMA 4 welded aluminum with red color.
 - c. NFPA Compliant for all required monitoring alarms.
 - d. Input Voltage: 120 VAC.
 - e. Output Voltage: 48 VDC.
 - f. Batteries: Sealed lead acid.
 - g. Battery breaker.
 - h. AC input breaker.

2.4 DONOR ANTENNA

- A. 746-896 MHz Yagi Antenna with watertight coaxial cable pigtail and N-Female end connector and U-Bolt mounting hardware for 1 7/8" OD pipe/mast.

B. Electrical Specifications

Gain	11 dB
VSWR	<1.7 : 1
Horizontal Beamwidth	48 °
Vertical Beamwidth	42 °
Polarization	Vertical
Maximum Input Power	100 Watts
Electrical Downtilt	0 °
Front-back Ratio	>16 dB
Connectors	N-Female
Lightning Protection Direct	Ground
Rated Wind Speed	134 mph / (216 Kph)
Max. Dimensions of Antenna	2.2" x 8" x 33.1" / (55.8 x 203.20 x 840 mm)
Weight of Antenna	1.76 lb. / (0.8 Kg)

2.5 LIGHTNING SURGE PROTECTOR

A. Prior to cabling entering the building, provide DC type block protector with the following minimum characteristics:

1. Dc Blocked Protector

- a. Solid brass construction.
- b. Fully weatherized housing.
- c. Impedance: 50 Ohms.
- d. Frequency Range: 680MHz to 2200MHz
- e. Connections: N-Female.
- f. Minimum Surge Current: 50kA.
- g. VSWR: ≤1.1:1 <-26dB (700-2200MHz), 1.13:1 <-24dB (680-700MHz).
- h. Insertion Loss: ≤0.1 dB.
- i. Average Power: 500 Watts.

2.6 OMNI-DIRECTIONAL ANTENNAS

A. Omni-directional coverage dome antennas shall feature a multi band design, accommodating multiple frequency bands in a single small antenna.

Pattern Type:	Omni-directional
Frequency Range:	450-2700 MHz
Gain:	1.9dBd (4dBi) (similar at 2100MHz and 450 MHz)
VSWR:	1.2:1-1.8:1
Polarization:	Multi-Polarized
Impedance:	50 ohms nominal
Connector:	F type -Female
Dome Construction:	UV Stabilized ABS

Plenum Rated Pig-tail/ Length	Yes - 18 in
H. Beamwidth (deg.)	360

2.7 CABLE

A. Cables:

1. Air Dielectric, Plenum Rated Coaxial Cable, Low PIM, Braided Coaxial cable, black jacket.
2. Material Characteristics:
 - a. Jacket: PVC.
 - b. Braid Material: Tinned Copper.
 - c. Shield Tape Material: Aluminum.
 - d. Dielectric Material: Foam PE.
 - e. Inner conductor: Copper Clad Aluminum wire.
 - f. Jacket color: Black.
3. Electrical Characteristics:
 - a. Impedance: 50 Ohm.
 - b. Frequency Band: 30 - 6000 MHz.
 - c. Return Loss > 24dB@3GHz.
4. Electrical Performance:

Frequency	Attenuation (dB/100 ft)
50 MHz	0.93
150 MHz	1.65
200 MHz	1.95
220 MHz	2.03
300 MHz	2.47
450 MHz	3.10
900 MHz	4.63
1500 MHz	6.15
1800 MHz	6.82
1900 MHz	7.10
2000 MHz	7.25
2500 MHz	8.25

5. Environmental:
 - a. Meet IEC60068 standard.
 - b. IP65 water resistance level.
 - c. Outdoor rated with the application of adhesive heat shrink tube to the jumper boot and wrapped with butyl tape.
6. Connectors:
 - a. N-Male.

2.8 COUPLERS

A. Splitters:

1. Wideband type suitable for both indoor and outdoor environments. Number of ports as required.
2. Electrical Characteristics:
 - a. Impedance: 50 Ohm.
 - b. Frequency Band: 555-2700 MHz.
 - c. Split Loss: 3dB to 6dB.
 - d. Insertion Loss: .5dB to .8dB
 - e. Isolation: 18dB to 20 dB
 - f. Average Power: 50 Watts.
 - g. Port VSWR: 1.2 to 1.3
3. Connectors:
 - a. N-Female.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall design, install, commission and test the system in accordance with the component manufacturer's instructions and recommendations.
- B. All system cabling shall be installed in a dedicated conduit rceway system. Minimum conduit size of 3/4". EMT conduit with compression fitting shall be used for interior locations. Rigid steel conduit with threaded couplings in exterior, damp or wet locations.
- C. Using engraved, laminated-plastic nameplate, identify bi-directional amplifier, and secure nameplate with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

3.2 COORDINATION WITH OTHER TRADES

- A. Field coordinate the installation of equipment and antennas with other trades:
 1. 120V, 20A circuit served from the lifesafety generator system.
 2. Grounding per NEC and TIA standards.
 3. Coordinate alarm and monitoring points with the fire alarm contractor.

3.3 EXAMINATION

- A. The contractor must examine areas and conditions under which DAS components are to be installed and notify the owner's representative, in writing of those conditions which are, in the Contractor's opinion, potentially detrimental to proper completion of the work. The Contractor shall not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the owner.

- B. Examine pathway elements intended for cable, check raceways, cable trays and other elements for compliance with space allocations, installations tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 TESTING

- A. Acceptance testing shall be performed in order to confirm that the minimum requirements have been met.

- B. Testing Procedure:

- 1. Test Locations

- a. Each floor of the building shall be divided into a grid of 20 approximately equal test areas.
- b. Downlink received signal level measurements shall be recorded in the coverage area using a CW test signal. Measurements shall be collected using a spectrum analyzer and a dipole antenna.
- c. Failure of a maximum of two nonadjacent test areas shall not result in failure of the test.
- d. In the event that three of the test area fail the test, in order to be more statistically accurate, the floor shall be divided into 40 equal test areas. Failure of a maximum of 4 non adjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 90% coverage.
- e. A test location approximately in the center of each test area shall be selected for the test. Once the location has been selected, the location shall represent the entire test area.

- 2. Equipment Requirements

- a. Test equipment shall be allowed to stabilize in test environment prior to calibration for a minimum of thirty minutes. Any change in temperature can void the calibration.
- b. Signal generator must be connected to the Head end downlink (TX) interface via tested and approved coaxial cabling and connectors.
- c. Signal generator transmits frequency (MHz) and Power (dBm) must be preapproved by project engineer prior to testing. The control channel from the base station can be used as a signal source as well.
- d. Verify that all remote units for the area under test are ON.
- e. Test frequency and power must be recorded corresponding to the date and time of each site walk measurement.
- f. Spectrum analyzer with unity gain (0dB, frequency specific) dipole receive antenna must be preapproved by the project engineer.
- g. Site walk screen shots shall be saved with frequency span +/- 20 MHz relative to the center/measured frequency.

- 3. Documentation

- a. Exact location of measurement must be marked on the grid print.

- b. Screen shots must be taken in all designated grid spaces. If more than one reading is saved per grid zone, saved results shall be distinguished from one another using Grid##"A", Grid## "B" etc.
- c. Results of testing are reported to project engineer for analysis and reporting.

C. Proof of Performance and Testing Methodology:

- 1. Test requirements specified in this document shall be successfully completed prior to issuance of a Certificate of Occupancy and yearly thereafter. Also testing with a successful result shall occur whenever a design change is made to the system, which changes the technical performance or coverage of the system. All tests shall be coordinated 10 days in advance with the AHJ. Results of the test shall be reported in writing to the AHJ.

D. Technical training

- 1. The Contractor shall be responsible for organizing a structured demonstration of acceptance tests to ensure organized and efficient testing.
- 2. The Contractor shall provide written notice to the owner's representative at least thirty (30) calendar days in advance of the initiation of final system acceptance testing. Included in the advance notice shall be three (3) copies of the approved test plans and procedures to ensure acceptance test monitoring personnel are familiar with the tests, procedures and the expected results.
- 3. It is the responsibility of the Contractor to notify the owner's representative at appropriate times to permit visual inspections of all system components. No Installation work shall be covered until a visual inspection has been completed.
- 4. Provide the owner's representative with the opportunity to witness all testing. On reasonable request and with ten (10) working days' notice, the Contractor shall demonstrate that the test procedure competently identifies the parameter being demonstrated or the fault condition being tested.
- 5. The Contractor shall provide a Certificate of Compliance signed by a responsible company representative after completion of the site installation. This document shall certify that each element of the installed system and wiring complies with the requirements of the Contract Documents and the certification shall be included with the final acceptance report.
- 6. The Contractor shall provide training for elements of the system. Such training shall include management, operational and maintenance levels and shall be provided to individuals (maximum of 3) to be designated by the owner's representative.
- 7. Training shall be conducted by qualified personnel fully conversant on the equipment, materials, software, and over all operation of the installed elements. Training shall be based upon as much hands-on training as is possible. The Contractor shall provide all necessary training aids and materials, which shall include written handouts.
- 8. All training shall be completed prior to Final Acceptance.

3.5 TRAINING

- A. Instruct the Owner/ Owners Maintenance Personnel on the proper operation of the system including alarms.

1. Provide time for 1 training session for one hour.
- B. Training shall be conducted by qualified personnel fully conversant on the equipment, materials, and over all operation of the installed elements. Training shall be based upon as much hands-on training as is possible. The contractor shall provide all necessary training aids and materials, which shall include written handouts.

END OF SECTION 283112

SECTION 312000 – EARTH MOVING

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. All work shall be in accordance with Baltimore City Specifications and Details, latest Edition.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for slabs-on-grade walks, pavements, turf and grasses and plants.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Subbase course for concrete walks and pavements.
 - 4. Subbase course and base course for asphalt paving.
 - 5. Subsurface drainage backfill for walls and trenches.
 - 6. Excavating and backfilling for utility trenches.
 - 7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
- B. Related Sections include the following:
 - 1. Division 01 Section "Unit Prices" for unit-price authorized additional excavation provisions.
 - 2. Division 01 Sections "Submittal Procedures" for recording pre-excavation and earthwork progress.
 - 3. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
 - 4. Division 03 Section "Cast-in-Place Concrete."
 - 5. Divisions 21, 22, 23, 26, 27 and 28 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
 - 6. Section 31 10 00 "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping topsoil, and removal of above- and below-grade improvements and utilities.
 - 7. Section 31 23 19 "Dewatering" for lowering and disposing of ground water during construction.
 - 8. Section 31 50 00 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
 - 9. Division 32 Section "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.

1.3 UNIT PRICES

- A. Work of this section is affected by unit prices for earth moving specified in Division 01 Section "Unit Prices." Unit prices are applied only to areas beyond volumes as outlined in Part B of this section.
- B. Rock Measurement: Weight of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation, measured in "tons" include replacement with approved materials.
 - 1. 24 inches outside of concrete forms other than at footings.
 - 2. 12 inches outside of concrete forms at footings.
 - 3. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - 4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - 5. 6 inches beneath bottom of concrete slabs-on-grade.
 - 6. 9 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
 - 7. 24 inches beneath recharge bed for Stormwater Management Facilities.
 - 8. Outermost dimensions as required to provide geogrid reinforcement for segmental block retaining walls
 - 9. 6 inches beneath bottom of pavement base material.
 - 10. 8 inches beneath finished grades outside of secured areas.
 - 11. 12 inches beneath finished grades inside of secured areas.

1.4 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil (Select Borrow) imported from off-site, or manufactured onsite and approved by the Geotechnical Engineer, for use as fill or backfill.
- E. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations as directed by the Geotechnical Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations without direction by

the Geotechnical Engineer. Unauthorized excavation, as well as remedial work directed by the Geotechnical Engineer, shall be without additional compensation.

- F. Fill: Soil materials approved by the Geotechnical Engineer to be used to raise existing grades.
- G. Recycled Material: Recycled Material shall contain a minimum of 90% post-consumer material.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
 - 1. Excavation of Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.
 - 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Structures: Buildings, footings, retaining walls, slabs, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt and clay particles; friable and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter in secure areas and 2 inches in diameter in unsecure; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials. Topsoil composition and characteristics shall be in accordance with MSHA Standard Specifications for Construction and Materials Section 920.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

- A. Product Data: For the following:

1. Detectable warning tape.
 2. Geotextile fabric.
 3. Recycled Materials.
 4. Requirements for local material source.
- B. Qualification Data: For qualified testing agency.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
1. Classification according to ASTM D 2487 of each borrow soil material proposed for fill and backfill.
 2. Laboratory compaction curve according to ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.
- D. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the topsoil.
1. Laboratory analysis of composition and characteristics of topsoil for each source, whether onsite or offsite borrow, shall be in accordance with MSHA Standard Specifications for Construction and Materials Section 920. A qualified soils scientist, approved by the owner, shall furnish a nutrient management plan for soils amendments. Topsoil shall be amended as specified by the nutrient management plan. Costs of all testing, the nutrient management plan, and amendments shall be included in the base bid, with no additional compensation by the owner.
 2. Report suitability of tested topsoil for turf growth including testing laboratory recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.
- E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.
- F. LEED Submittals.
1. Product data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include statement indicating cost of each product with recycled content..
 2. Product data for Credit MR 5: For products having regional material content, documentation indicating location of manufacture and location of extraction, recovery or harvest of primary raw materials. Include statement indicating cost of each product with regional material content.

1.6 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Contractor shall follow all OSHA requirements and all local, State and Federal regulations for soil excavation, rock removal, and rock blasting.
- C. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 General Requirements.

1.7 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Owner and Architect not less than 72 hours in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
 - 4. Verify existing utility services for area where Project is located before excavation.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- C. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.
- E. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 31 Section "Site Clearing," are in place.
- F. Do not commence earth moving operations until plant-protection measures specified in the Maryland Department of Environment approved Erosion and Sedimentation Control Plans are in place.
- G. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.

3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- H. Do not direct vehicle or equipment exhaust towards protection zones.
- I. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Refer to Sections 916 and 920 of MSHA Standard Specifications for Construction and Materials.
- B. General: Provide select borrow soil materials for replacement of all excavated unsuitable material removed from the pipe trench. All excavated material removed from the trench excavations shall be hauled and disposed off-site. Provide test results or certifications that borrow material meets the requirements for the specified material.
- C. Recycled Content of Backfill: Recycled concrete (RC-6) for temporary roads, subbase, pipe bedding, and fill material. Recycled aggregates shall contain a minimum of 90% post-consumer aggregate content.
- D. Regional Materials: Provide aggregate and sand products manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.
- E. Satisfactory Soils: Select Borrow as Per Section 916.01.01 of the MSHA Standard Specifications for Construction and Materials. The geotechnical Engineer shall approve satisfactory soil materials.
- F. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve per Section 901 of the MSHA Standard Specifications for Construction and Materials .
- G. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve per Section 901 of the MSHA Standard Specifications for Construction and Materials.
- H. Engineered Fill: Soils classified as CL, CM, SC, SM, GC or GM per ASTM D-2487, free organic matter (less than 3 percent by weight) and debris, and containing no particles greater than 4 inches in their largest dimension. In addition, soils classified as CL or ML should have a liquid limit and plastic index less than 40 and 20, respectively and a maximum dry density greater

than 105 pcf. However, materials used as backfill behind below-grade walls or retaining walls should have classifications of SM, or more granular, in accordance with ASTM D 2487.

- I. Bedding Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Topsoil: Loam, without stones or debris larger than 1 inch in diameter in secure areas and 2 inches in diameter in unsecure areas, without roots, vegetation, and without harmful materials or other debris which may be harmful to plant life. The topsoil shall contain a minimum of 2% of organic matter by weight when tested in accordance with AASHTO T 194. Other components shall be in accordance with MSHA Section 920 with the following percentages by weight:

Silt	10 – 60 %
Clay	5 – 30 %
Sand	20 – 75 %
pH	6.2 – 7.0
Soluble Salts	500 ppm maximum

- 1. Off-Site Topsoil: Topsoil furnished by the Contractor shall meet the requirements specified above, as tested by the Contractor per Section 1.5.C of this specification and approved by the Geotechnical Engineer.

- K. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- L. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- M. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- N. Structural Fill: All fills placed directly below or within the zone of influence of any bearing foundation or structural slab. Structural fill material shall consist of soils meeting Unified Soil Classification System (USCS) of SC or greater (i.e. SC through GW) with a Liquid Limit no greater than 30 and a maximum Plasticity Index of 10. All soil materials that fall within the USCS type ML, CL, CL-ML, OL, MH, CH, OH, PT, as well as material containing organic matter, ashes, cinders, refuse, frozen or other unsuitable materials are prohibited for use as Structural Fill.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Woven; manufactured for subsurface drainage applications, made from fibers consisting of long chain synthetic polymers, composed of a minimum 95 percent by weight of polyolefins or polyesters; with 15 percent minimum elongation; complying with Maryland State Highway Administration type ST per SHA Standard Specifications for Construction and Materials.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:
1. Portland Cement: ASTM C 150, Type I Type II or Type III.
 2. Fly Ash: ASTM C 618, Class C or F.
 3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
 4. Foaming Agent: ASTM C 869.
 5. Water: ASTM C 94.
 6. Air-Entraining Admixture: ASTM C 260.

2.4 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with a metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches. Color shall be as follows.
1. Red: Electric.
 2. Yellow: Gas, oil, steam and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.
 6. Purple: Storm Drain Systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Prepare subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.
- E. Provide soil moisture control for sub grade material, imported or excavated borrow material,

backfill, bedding, and top soil; in accordance with the recommendations of the geotechnical engineer. Costs of all soil moisture control will be solely the onus of the contractor with no additional compensation by the owner.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

- A. Explosives: Are not to be used on this project.

3.4 EXCAVATION, GENERAL

- A. All excavations and trenching shall be accomplished in strict accordance with applicable OSHA regulations.
- B. Do not excavate within twelve (12) inches of any building wall, column, pier, etc. Where excavation is required next to an existing structure or utility pole, excavate up to twenty-four (24) inches and allow the balance of soil to “fall away”. Take care to not damage the existing structure or utility pole.
- C. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, trash, debris, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of trash, debris, soil materials, or obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without

forms or exterior waterproofing treatments.

- e. 6 inches beneath bottom of concrete slabs-on-grade.
- f. 9 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
- g. 24 inches beneath recharge bed for Stormwater Management Facilities.
- h. Outermost dimensions as required to provide geogrid reinforcement for segmental block retaining walls
- i. 6 inches beneath bottom of pavement base material.
- j. 8 inches beneath finished grades outside of secured areas.
- k. 12 inches beneath finished grades inside of secured areas.

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to the indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Excavation for Underground Basins and Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
 - 1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 - 2. Cut and protect roots according to the written recommendations of the Landscape Architect.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of

pipe or conduit, unless otherwise indicated.

1. Clearance: As indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes. Shape subgrade to provide continuous support for bells, joints and barrels of pipes, unless otherwise indicated.

1. For pipes less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe on an undisturbed subgrade.
2. For pipes 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 9 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to the written recommendations of the Landscape Architect.

3.8 SUBGRADE INSPECTION

A. Notify Geotechnical Engineer when excavations have reached required subgrade.

B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Geotechnical Engineer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for Unit Price Items.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations by extending bottom elevation of concrete foundation to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by the Engineer.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by the Engineer.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under structure and within 18 inches of bottom of structure with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete."
- D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely

encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete"

- E. After installing compacted pipe bedding material, place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
 - 1. Carefully compact initial bedding material under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.
- G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- H. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- I. Install detectable warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

SOI Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to Maryland Department of Environment (MDE) approved erosion- and sedimentation-control drawings.

3.13 L FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain

- frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.
 3. Soil moisture control shall be the responsibility of the contractor and is to be done with no additional cost to the owner.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Compaction requirements shall be determined by the site's geotechnical engineer for specific soils used for fill placement.
- C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- D. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698, or the geotechnical engineers recommendations, whichever is more stringent:
 1. Under structures and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 4. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 5. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 6. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface

- tolerances.
3. Grassed or vegetated permanent site slopes shall not exceed 3:1.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1/4 inch. ADA routes to remain in compliance.
 3. Pavements: Plus or minus 1/4 inch.
 4. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
1. Install separation geotextile fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place base course material over subbase course under hot-mix asphalt pavement.
 3. Shape subbase and base course to required crown elevations and cross-slope grades.
 4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
 5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 FIELD QUALITY CONTROL

- A. Testing Agency: The Contractor shall engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Geotechnical Engineer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following

locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 2. Foundation Wall and Retaining Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to the specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
- C. Where settling occurs before Project warranty period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204
 410-528-0272



PROPOSED NEW
**MONTEBELLO ELEMENTARY/
 MIDDLE SCHOOL**
 BALTIMORE CITY PUBLIC SCHOOLS
 2040 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____

Title: **MSA APPROVAL**

Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
4	01/08/2021	ADDENDUM #4
3	12/30/2020	ADDENDUM #3
2	10/16/2020	ADDENDUM #2
1	12/03/2020	ADDENDUM #1

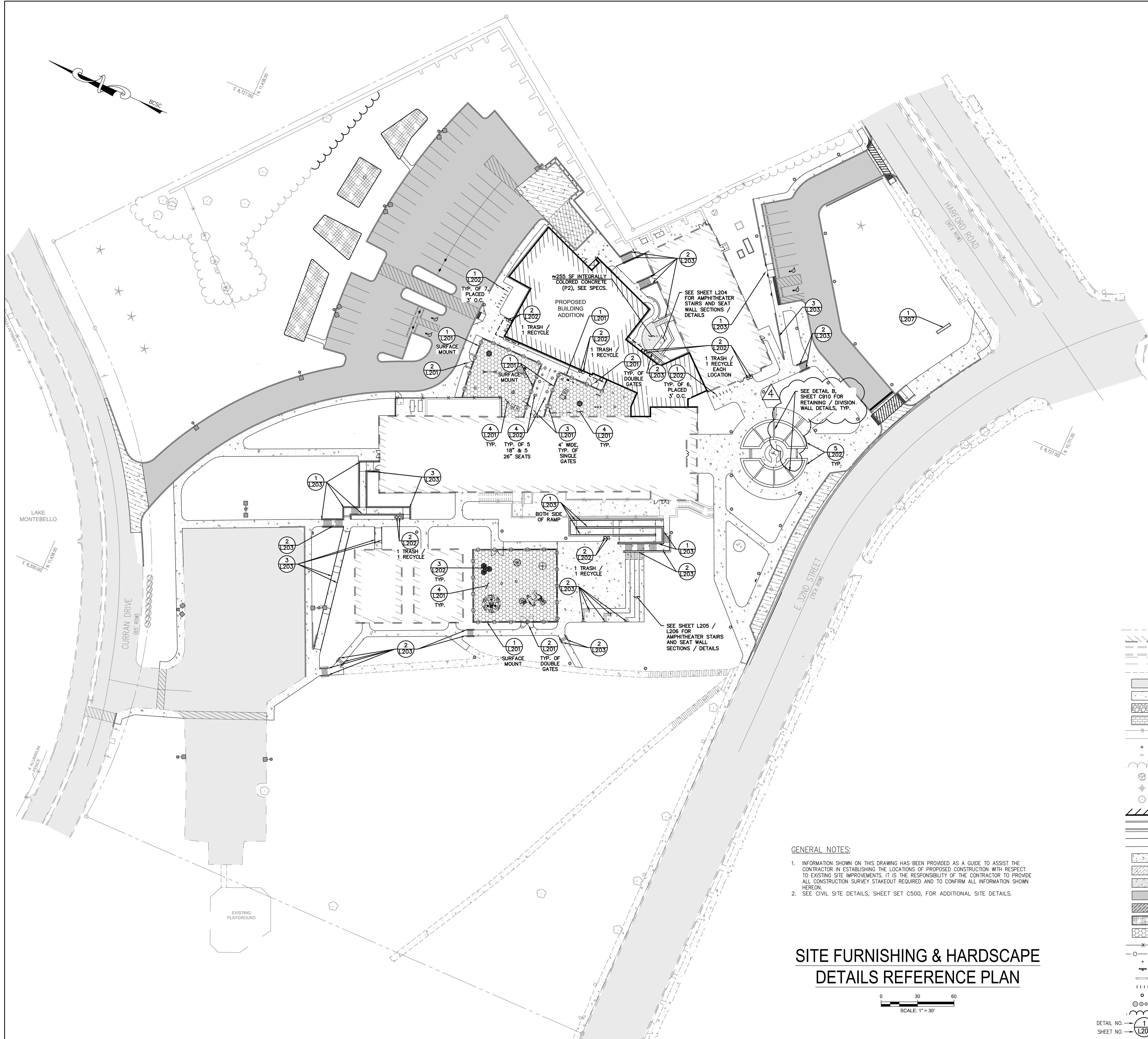
AS-BUILT REVISIONS

SUBMITTED BY:	
CAD DWG FILE:	
DRAWN BY:	CMF / EAN
CHECKED BY:	CMS
PROJECT NO.	BCS-02-004
DATE:	NOVEMBER 16, 2020

**SITE FURNISHING & HARDSCAPE
 DETAILS REFERENCE PLAN**

SCALE: AS SHOWN

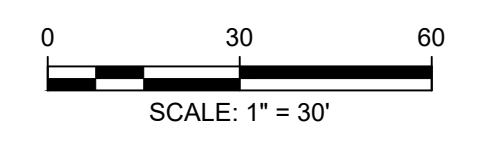
DRAWING NO. **L200**



GENERAL NOTES:

- INFORMATION SHOWN ON THIS DRAWING HAS BEEN PROVIDED AS A GUIDE TO ASSIST THE CONTRACTOR IN ESTABLISHING THE LOCATIONS OF PROPOSED CONSTRUCTION WITH RESPECT TO EXISTING SITE IMPROVEMENTS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE ALL CONSTRUCTION SURVEY STAKEOUT REQUIRED AND TO CONFIRM ALL INFORMATION SHOWN HEREON.
- SEE CIVIL SITE DETAILS, SHEET SET C500, FOR ADDITIONAL SITE DETAILS.

**SITE FURNISHING & HARDSCAPE
 DETAILS REFERENCE PLAN**



LEGEND

	EXISTING PROPERTY LINE
	EXISTING BUILDING
	EXISTING CURB
	EXISTING CURB & GUTTER
	EXISTING ROADWAY
	EXISTING PAVEMENT
	EXISTING ASPHALT PAVING
	EXISTING CONCRETE PAVING
	EXISTING GRAVEL
	EXISTING BRICK PAVING
	EXISTING FENCELINE
	EXISTING RECREATION FIELD
	EXISTING BOLLARD
	EXISTING SIGN
	EXISTING TREELINE
	EXISTING DECIDUOUS TREE
	EXISTING EVERGREEN TREE
	EXISTING SHRUB
	PROPOSED BUILDING
	PROPOSED CURB
	PROPOSED CURB & GUTTER
	PROPOSED ROADWAY
	PROPOSED SIDEWALK
	PROPOSED CONCRETE WALK
	PROPOSED HEAVY-DUTY CONCRETE PAVEMENT
	PROPOSED COLORED CONCRETE PAVEMENT
	PROPOSED ASPHALT PAVING
	PROPOSED HEAVY-DUTY ASPHALT PAVING
	PROPOSED MICRO-BIORETENTMENT AREA
	PROPOSED RUBBERIZED PLAY SURFACE
	PROPOSED CHAIN LINK FENCELINE
	PROPOSED ORNAMENTAL FENCELINE
	PROPOSED BOLLARD
	PROPOSED SIGN
	PROPOSED WHEEL STOP
	PROPOSED BICYCLE RACKS
	PROPOSED TRASH/RECYCLING RECEPTACLE
	PROPOSED INDIVIDUAL SITE SEATS
	PROPOSED TREELINE

DETAIL NO. **1**
 SHEET NO. **L201**

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
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PROPOSED NEW
**MONTEBELLO ELEMENTARY/
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 BALTIMORE CITY PUBLIC SCHOOLS
 2040 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____

MSA APPROVAL

Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
4	01/08/2021	ADDENDUM #04
3	12/30/2020	ADDENDUM #03
2	10/16/2020	ADDENDUM #02
1	12/03/2020	ADDENDUM #01

AS-BUILT REVISIONS		
MARK	DATE	DESCRIPTION

SUBMITTED BY: _____
 CAD DWG FILE: _____

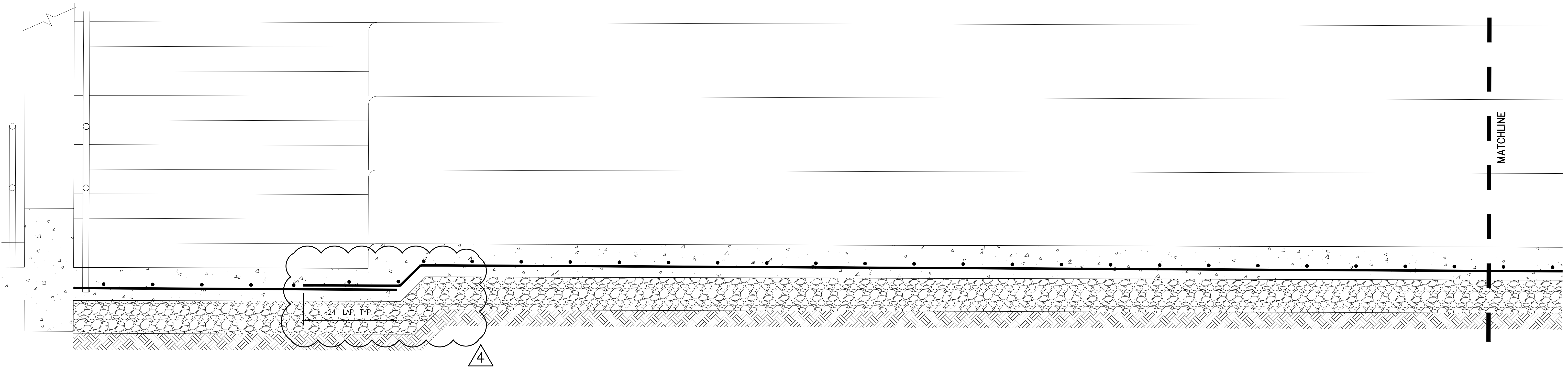
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 CHECKED BY: CMS

PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

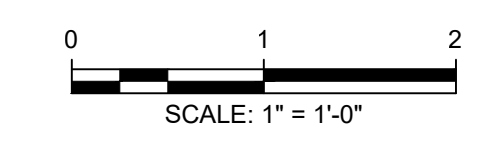
**SITE FURNISHING &
 HARDSCAPE DETAILS**

SCALE: AS SHOWN

DRAWING NO. **L206**



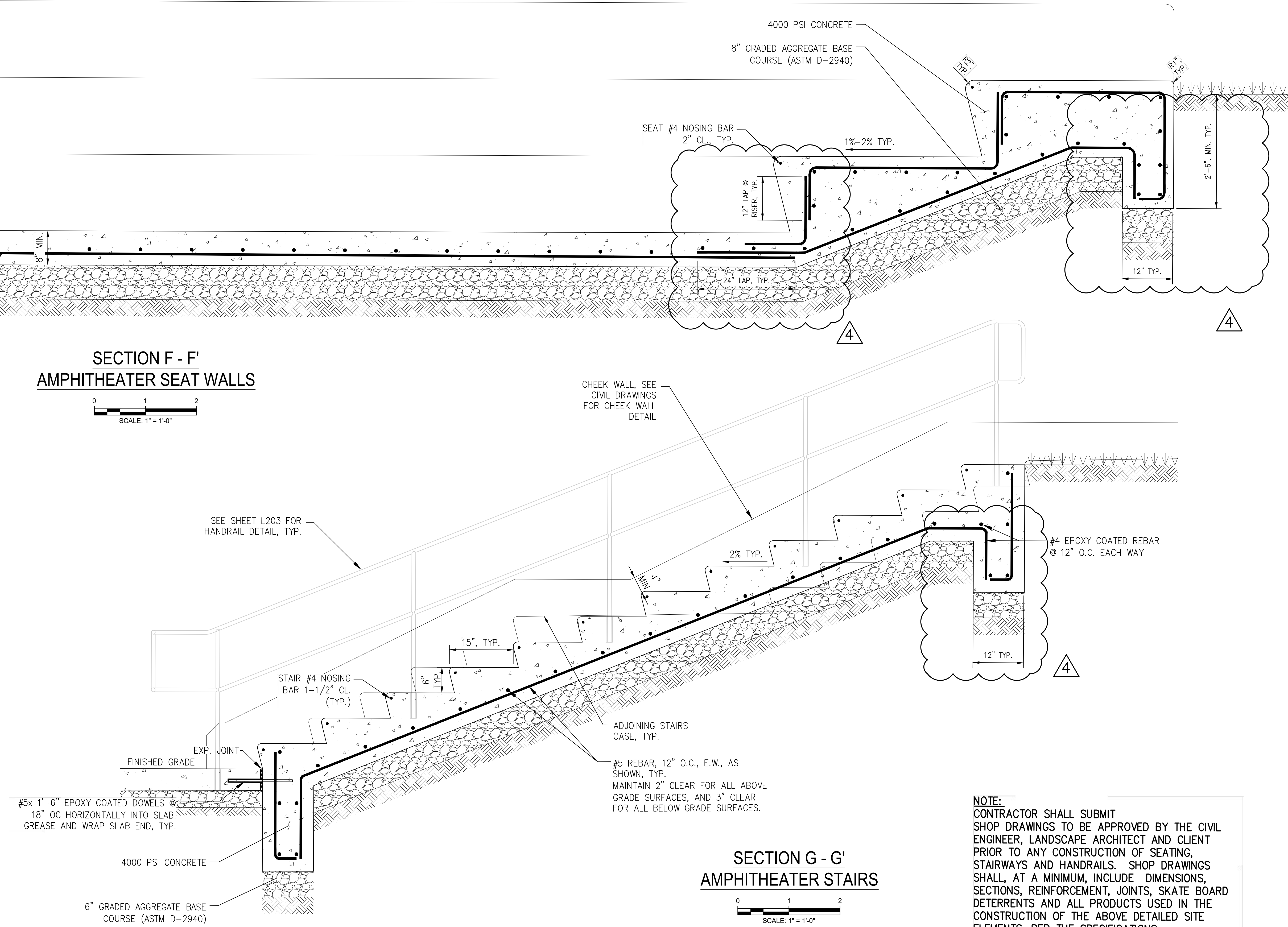
**SECTION F - F'
 AMPHITHEATER SEAT WALLS**



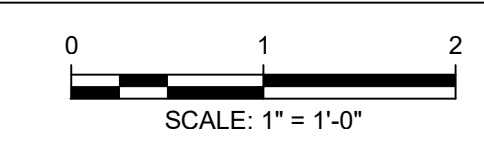
4000 PSI CONCRETE
 8" GRADED AGGREGATE BASE COURSE (ASTM D-2940)
 #5 REBAR, 12" O.C., E.W., AS SHOWN, TYP.
 MAINTAIN 2" CLEAR FOR ALL ABOVE GRADE SURFACES, AND 3" CLEAR FOR ALL BELOW GRADE SURFACES.

- GENERAL NOTES:**
- CONTRACTOR SHALL SUBMIT SHOP DRAWINGS SHOWING ALL NECESSARY SECTIONS AND DETAILS TO THE ARCHITECT/ENGINEER FOR REVIEW BEFORE FABRICATION AND CONSTRUCTION.
 - CONCRETE SHALL CONFORM TO ASTM A318, LATEST EDITION AND SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH (f'_c) OF 4,000 PSI.
 - PROVIDE MIX DESIGNS WITH A WATER-CEMENT RATIO OF 0.45.
 - SLUMP SHALL BE $4" \pm 1"$.
 - AIR ENTRAIN ALL CONCRETE EXPOSED TO WEATHER OR EARTH TO $5\% \pm 1\%$.
 - NO CALCIUM CHLORIDE IN ANY FORM WILL BE PERMITTED IN CONCRETE.
 - CONCRETE SURFACE SHALL HAVE A SMOOTH TROWELED FINISH.
 - EXCAVATIONS SHALL BE KEPT FREE OF WATER. NO CONCRETE SHALL BE PLACED IN WATER.
 - INSTALL $1/2"$ FULL DEPTH, WATER TIGHT EXPANSION JOINTS AT INTERFACE BETWEEN SEAT WALLS AND RIGID PAVEMENT. JOINT TO BE SEALED WITH POLYURETHANE SELF-LEVELING SEALANT, COLOR TO MATCH ADJOINING PAVEMENT. SEE CIVIL DETAILS FOR EXPANSION JOINT DETAILING.
 - VERTICAL CONTROL JOINTS TO BE INSTALLED IN COORDINATION WITH THE PAVEMENT JOINT LAYOUT PLANS, 5' O.C. MAX.
 - VERTICAL EXPANSION JOINT TO BE INSTALLED IN COORDINATION WITH THE PAVEMENT JOINT LAYOUT PLANS, 20' O.C. MAX.
 - SKATE BOARD DETERRENT TO BE PLACED 5' O.C. MAX. SEE SHEET L204 FOR SKATE BOARD DETERRENT DETAIL.

- REINFORCEMENT NOTES:**
- ALL REINFORCEMENT SHALL BE SPECIFIED BY THE FABRICATOR AND INCLUDED IN SHOP DRAWINGS FOR REVIEW.
 - STEEL REINFORCEMENT SHALL CONFORM TO ASTM A615, GRADE 60 WITH A MINIMUM YIELD STRENGTH OF 60 KSI.
 - ALL DEVELOPMENT AND SPLICES OF REINFORCEMENT SHALL CONFORM TO THE PROVISIONS OF ACI BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE (ACI 318-LATEST EDITION).
 - CONTRACTOR SHALL SUBMIT SHOP DRAWINGS SHOWING ALL NECESSARY SECTIONS AND DETAILS FOR THE PROPER POSITIONING OF ALL REINFORCING STEEL TO THE ARCHITECT/ENGINEER FOR REVIEW BEFORE FABRICATION OR PLACEMENT OF THE STEEL.
 - ALL REINFORCEMENT SHALL MAINTAIN 2" CLEAR BETWEEN REINFORCEMENT AND EDGE OF CONCRETE ABOVE GRADE, AND 3" CLEAR BETWEEN REINFORCEMENT AND EDGE OF CONCRETE BELOW GRADE.



**SECTION G - G'
 AMPHITHEATER STAIRS**



CHEEK WALL, SEE CIVIL DRAWINGS FOR CHEEK WALL DETAIL

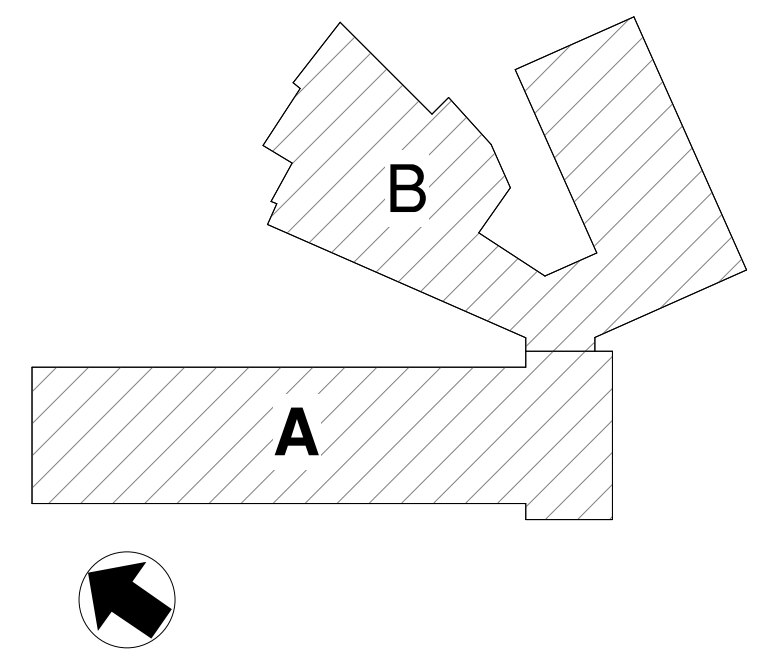
SEE SHEET L203 FOR HANDRAIL DETAIL, TYP.

#5x 1"-6" EPOXY COATED DOWELS @ 18" OC HORIZONTALLY INTO SLAB. GREASE AND WRAP SLAB END, TYP.

#5 REBAR, 12" O.C., E.W., AS SHOWN, TYP. MAINTAIN 2" CLEAR FOR ALL ABOVE GRADE SURFACES, AND 3" CLEAR FOR ALL BELOW GRADE SURFACES.

NOTE:
 CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO BE APPROVED BY THE CIVIL ENGINEER, LANDSCAPE ARCHITECT AND CLIENT PRIOR TO ANY CONSTRUCTION OF SEATING, STAIRWAYS AND HANDRAILS. SHOP DRAWINGS SHALL, AT A MINIMUM, INCLUDE DIMENSIONS, SECTIONS, REINFORCEMENT, JOINTS, SKATE BOARD DETERRENTS AND ALL PRODUCTS USED IN THE CONSTRUCTION OF THE ABOVE DETAILED SITE ELEMENTS, PER THE SPECIFICATIONS.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204

RENOVATIONS & ADDITIONS
 MONTEBELLO ELEMENTARY/
 MIDDLE SCHOOL
 BALTIMORE CITY PUBLIC SCHOOLS
 2040 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____

Title: _____
 MSA APPROVAL

Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
4	01/08/2021	ADDENDUM #4
3	12/30/2020	ADDENDUM #3
2	12/16/2020	ADDENDUM #2

MARK	DATE	DESCRIPTION
AS-BUILT REVISIONS		

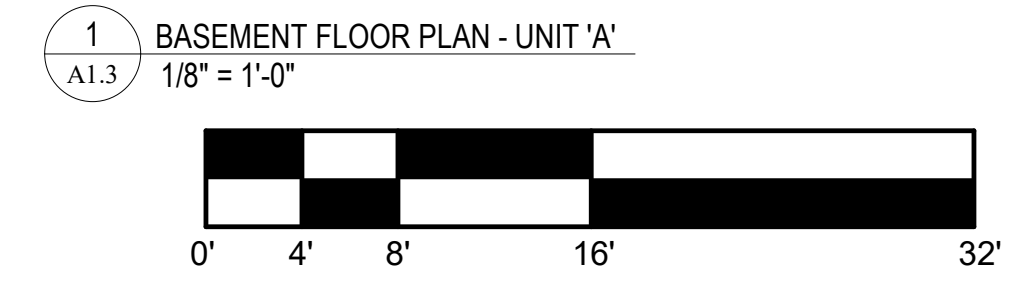
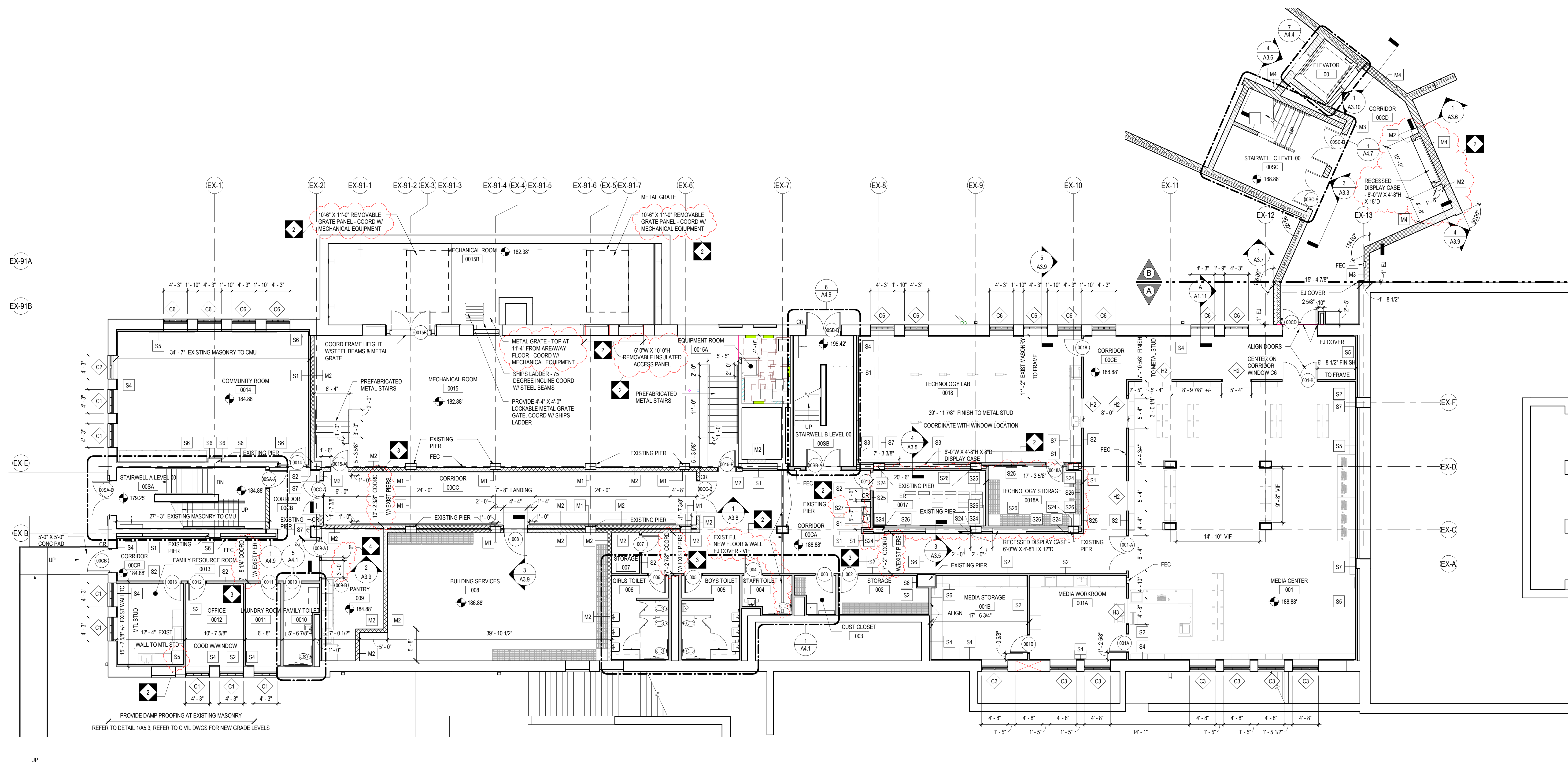
SUBMITTED BY: _____
 CAD DWG FILE: R. AUGUSTINE
 DRAWN BY: R. AUGUSTINE
 CHECKED BY: T. VUKMANIC
 PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

BASEMENT FLOOR PLAN - UNIT A & B

SCALE: 1/8" = 1'-0"
 DRAWING NO.

A1.3

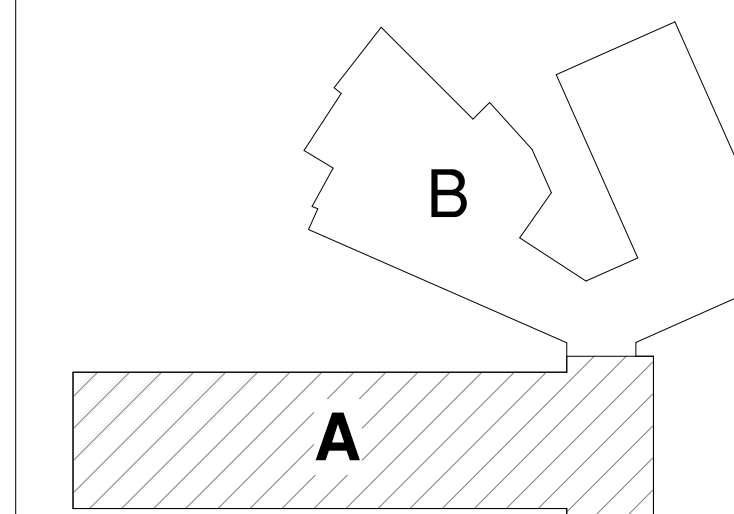
90% CONSTRUCTION DOCUMENTS



GENERAL NOTES:

- ALL DOOR JAMBES SHALL BE LOCATED 4" FROM INSIDE CORNER OF WALL ON HINGE SIDE UNLESS OTHERWISE INDICATED.
- COORDINATE LOCATION OF MEP EQUIPMENT, DEVICES, OUTLET BOXES, ETC. WITH OTHER EQUIPMENT AND FINISH SCHEDULE PRIOR TO INSTALLATION.
- ALL EXTERIOR ENTRANCE PADS SHALL BE SLOPED 2% MAX AWAY FROM THE BUILDING TO EDGE OF PAD. REFER TO STRUCTURAL DRAWINGS.
- UNLESS NOTED OTHERWISE, ALL FLOOR DRAINS SHALL BE SET 1/4" MAX. BELOW FIN FLOOR. DISH FIN. FLOOR MIN. OF 24" RADIUS TO TOP OF FLOOR DRAIN. REFER TO PLUMBING DRAWINGS.
- UNLESS NOTED OTHERWISE, WHERE DIFFERENT FLOOR ELEVATIONS OCCUR ON OPPOSITE SIDES OF INTERIOR MASONRY WALLS, PROVIDE COLD FLUID APPLIED WATERPROOFING (CFWP) ON THE BACKFILLED FACE OF WALL. APPLY CFWP FROM UNDERSIDE OF CONC. SLAB TO TOP OF FOOTING BELOW. CFWP NOT TO INTERFERE WITH INSTALLATION OF CONC. SLAB VAPOR BARRIER.
- GC TO PROVIDE ALL LOUVERS COORDINATE WITH MEP DRAWINGS.
- ALL WALL LAYOUT DIMENSIONS ARE FROM FACE OF STUD & FACE OF CMU UNLESS OTHERWISE NOTED.
- SEE SHEET AS.4 FOR LOCKER INFORMATION.
- VERIFY IN FIELD ALL EXISTING PIERS.
- EXISTING CONCRETE LOCKER BASE IS NOTED (W/F). REMAINING SHALL BE NEW.
- APPLY STAINLESS STEEL CORNER GUARD TO ALL GWB CORNERS, REFER TO DETAIL 8A6.3.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
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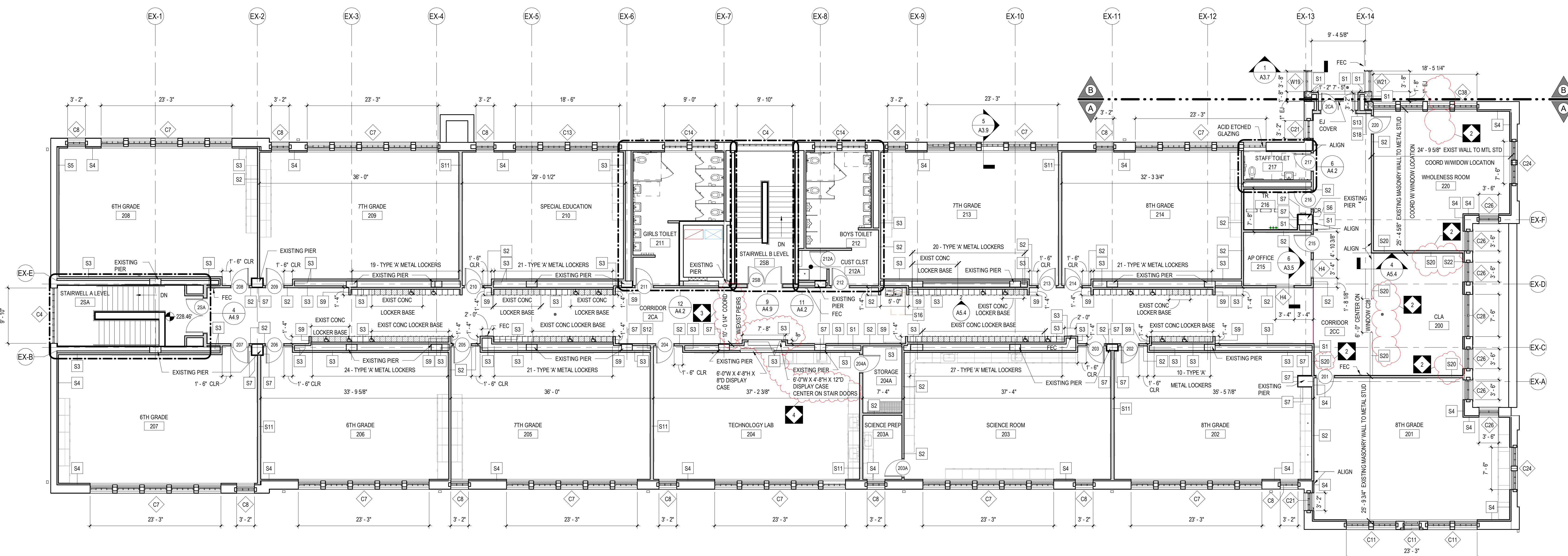
SECOND FLOOR PLAN - UNIT A

SCALE: 1/8" = 1'-0"

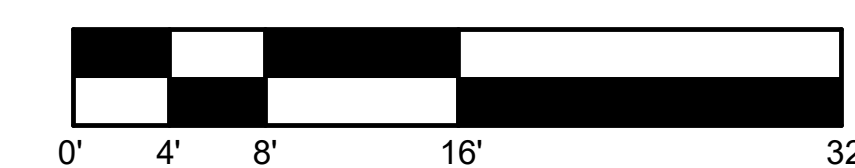
DRAWING NO.

A1.8

90% CONSTRUCTION DOCUMENTS



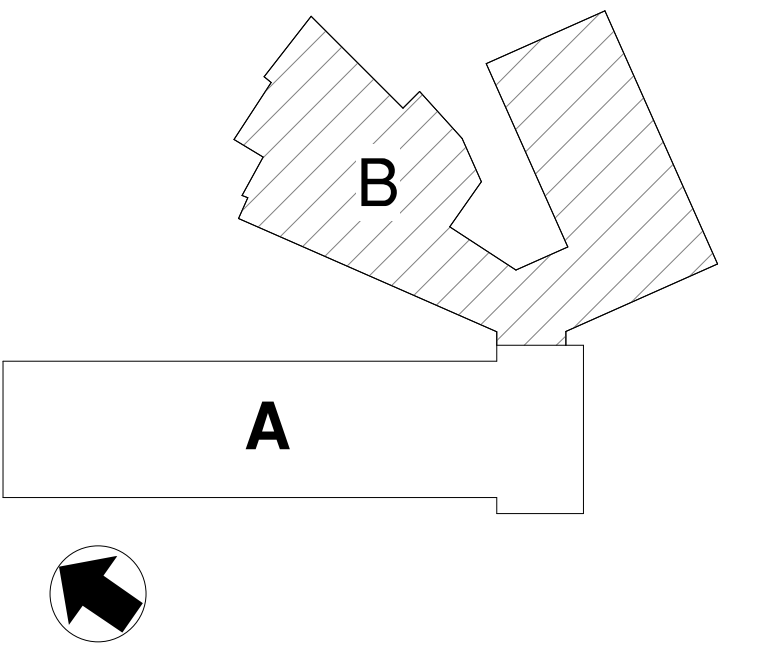
1 SECOND FLOOR PLAN - UNIT 'A'
 A1.8 1/8" = 1'-0"



GENERAL NOTES:

- ALL DOOR JAMBS SHALL BE LOCATED 4" FROM INSIDE CORNER OF WALL ON HINGE SIDE UNLESS OTHERWISE INDICATED.
- COORDINATE LOCATION OF MEP EQUIPMENT, DEVICES, OUTLET BOXES, ETC. WITH OTHER EQUIPMENT AND FINISH SCHEDULE PRIOR TO INSTALLATION.
- ALL EXTERIOR ENTRANCE PADS SHALL BE SLOPED 2% MAX AWAY FROM THE BUILDING TO EDGE OF PAD. REFER TO STRUCTURAL DRAWINGS.
- UNLESS NOTED OTHERWISE, ALL FLOOR DRAINS SHALL BE SET 1/4" MAX. BELOW FIN FLOOR. DISH FIN. FLOOR MIN. OF 24" RADIUS TO TOP OF FLOOR DRAIN. REFER TO PLUMBING DRAWINGS.
- UNLESS NOTED OTHERWISE, WHERE DIFFERENT FLOOR ELEVATIONS OCCUR ON OPPOSITE SIDES OF INTERIOR MASONRY WALLS, PROVIDE COLD FLUID APPLIED WATERPROOFING (CFAMP) ON THE BACKSILLED FACE OF WALL. APPLY CFAMP FROM UNDERSIDE OF CONC. SLAB TO TOP OF FOOTING BELOW. CFAMP NOT TO INTERFERE WITH INSTALLATION OF CONC. SLAB VAPOR BARRIER.
- GC TO PROVIDE ALL LOUVERS COORDINATE WITH MEP DRAWINGS.
- ALL WALL LAYOUT DIMENSIONS ARE FROM FACE OF STUD & FACE OF CMU UNLESS OTHERWISE NOTED.
- SEE SHEET A5.4 FOR LOCKER INFORMATION.
- VERIFY IN FIELD ALL EXISTING PIERS.
- EXISTING CONCRETE LOCKER BASE IS NOTED (VIF). REMAINING SHALL BE NEW.
- APPLY STAINLESS STEEL CORNER GUARD TO ALL GWB CORNERS, REFER TO DETAIL BAA.3

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204

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 2040 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

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Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

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4	01/08/2021	ADDENDUM #4
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AS-BUILT REVISIONS

SUBMITTED BY: _____
 CAD DWG FILE: R. AUGUSTINE
 DRAWN BY: R. AUGUSTINE
 CHECKED BY: T. VUKMANIC
 PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

SECOND FLOOR PLAN - UNIT B

SCALE: 1/8" = 1'-0"

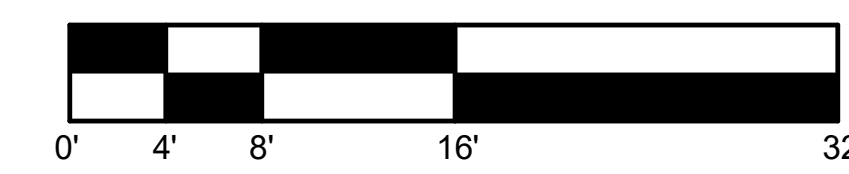
DRAWING NO.

A1.9

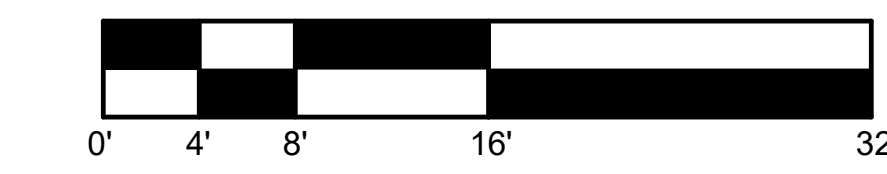
90% CONSTRUCTION DOCUMENTS



1 SECOND FLOOR PLAN - UNIT 'B'
 A1.9 1/8" = 1'-0"



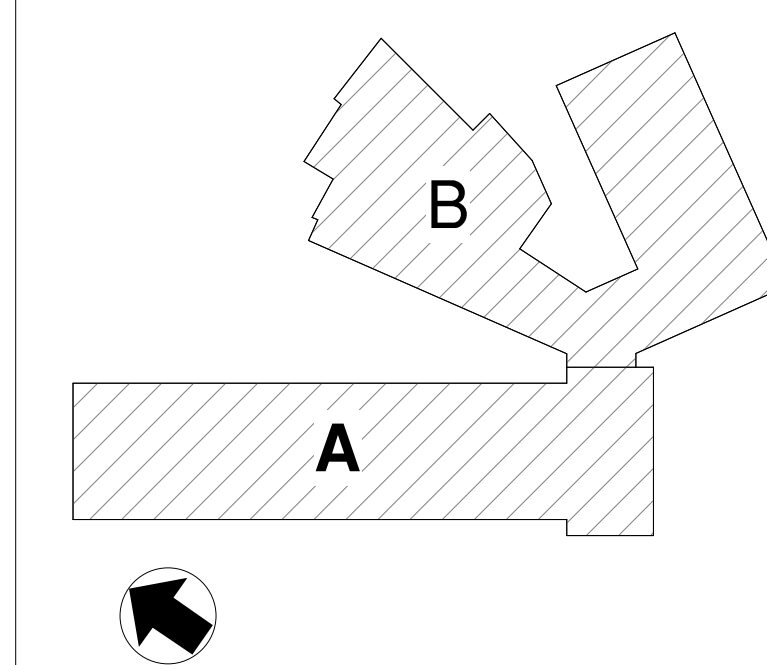
2 CLERESTORY PLAN - UNIT 'B'
 A1.9 1/8" = 1'-0"



GENERAL NOTES:

- ALL DOOR JAMBES SHALL BE LOCATED 4" FROM INSIDE CORNER OF WALL ON HINGE SIDE UNLESS OTHERWISE INDICATED.
- COORDINATE LOCATION OF MEP EQUIPMENT, DEVICES, OUTLET BOXES, ETC. WITH OTHER EQUIPMENT AND FINISH SCHEDULE PRIOR TO INSTALLATION.
- ALL EXTERIOR ENTRANCE PADS SHALL BE SLOPED 2% MAX AWAY FROM THE BUILDING TO EDGE OF PAD. REFER TO STRUCTURAL DRAWINGS.
- UNLESS NOTED OTHERWISE, ALL FLOOR DRAINS SHALL BE SET 1/4" MAX. BELOW FIN FLOOR. DISH FIN. FLOOR MIN. OF 24" RADIUS TO TOP OF FLOOR DRAIN. REFER TO PLUMBING DRAWINGS.
- UNLESS NOTED OTHERWISE, WHERE DIFFERENT FLOOR ELEVATIONS OCCUR ON OPPOSITE SIDES OF INTERIOR MASONRY WALLS, PROVIDE COLD FLUID APPLIED WATERPROOFING (CFAWP) ON THE BACKFILLED FACE OF WALL. APPLY CFAWP FROM UNDERSIDE OF CONC. SLAB TO TOP OF FOOTING BELOW. CFAWP NOT TO INTERFERE WITH INSTALLATION OF CONC. SLAB VAPOR BARRIER.
- GC TO PROVIDE ALL LOUVERS COORDINATE WITH MEP DRAWINGS.
- ALL WALL LAYOUT DIMENSIONS ARE FROM FACE OF STUD & FACE OF CMU UNLESS OTHERWISE NOTED.
- SEE SHEET A5.4 FOR LOCKER INFORMATION.
- VERIFY IN FIELD ALL EXISTING PIERS.
- EXISTING CONCRETE LOCKER BASE IS NOTED (VIF). REMAINING SHALL BE NEW.
- APPLY STAINLESS STEEL CORNER GUARD TO ALL GWB CORNERS, REFER TO DETAIL B/A5.3

KEY PLAN



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Project Manager:	Date:
Chief of PM&D:	Date:

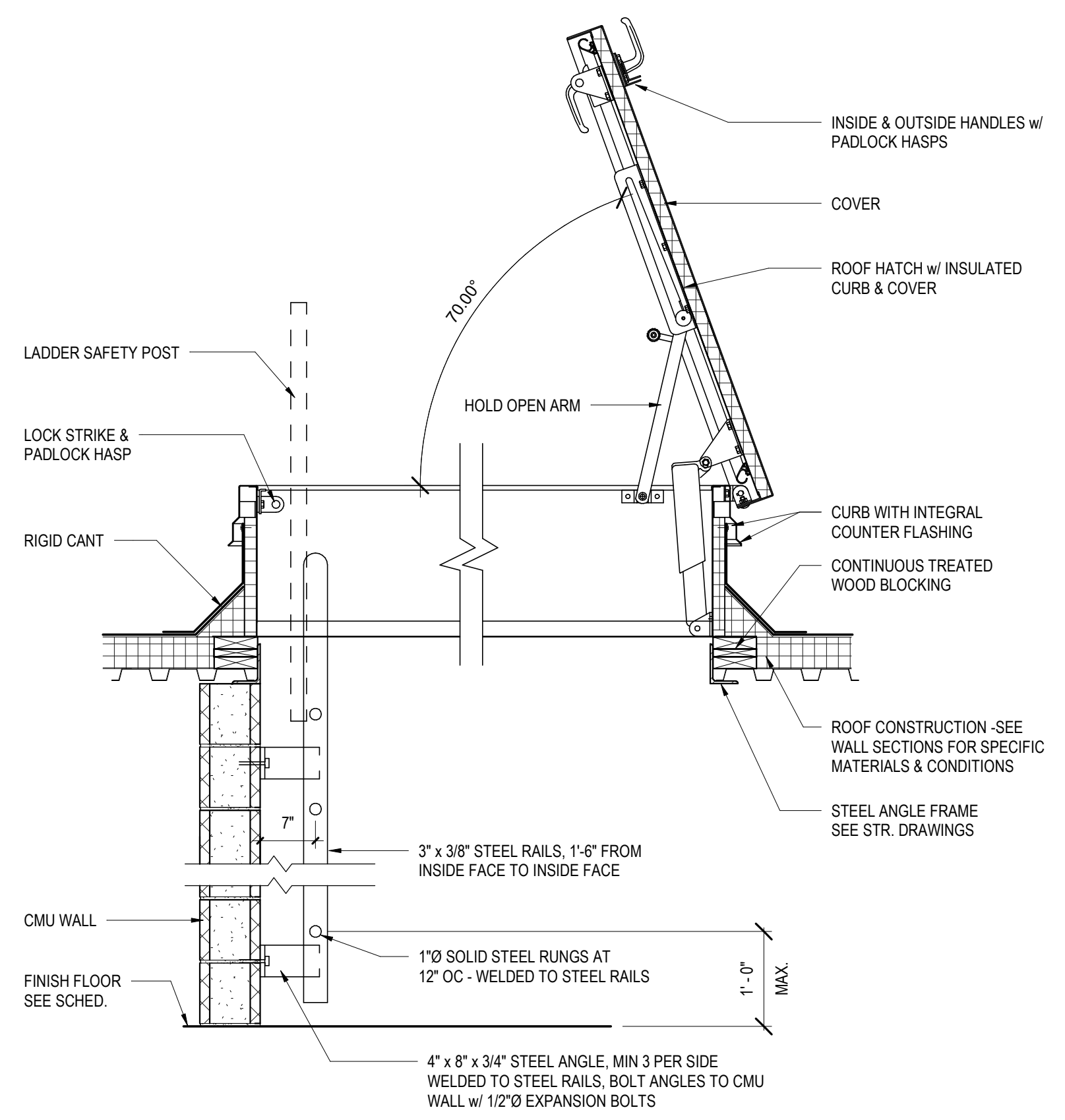
4	01/08/2021	ADDENDUM #4
MARK:	DATE:	DESCRIPTION:

AS-BUILT REVISIONS	
SUBMITTED BY:	
CAD DWG FILE:	R. AUGUSTINE
DRAWN BY:	R. AUGUSTINE
CHECKED BY:	T. VUKMANIC
PROJECT NO.:	BCS-02-004
DATE:	NOVEMBER 16, 2020

OVERALL ROOF PLAN

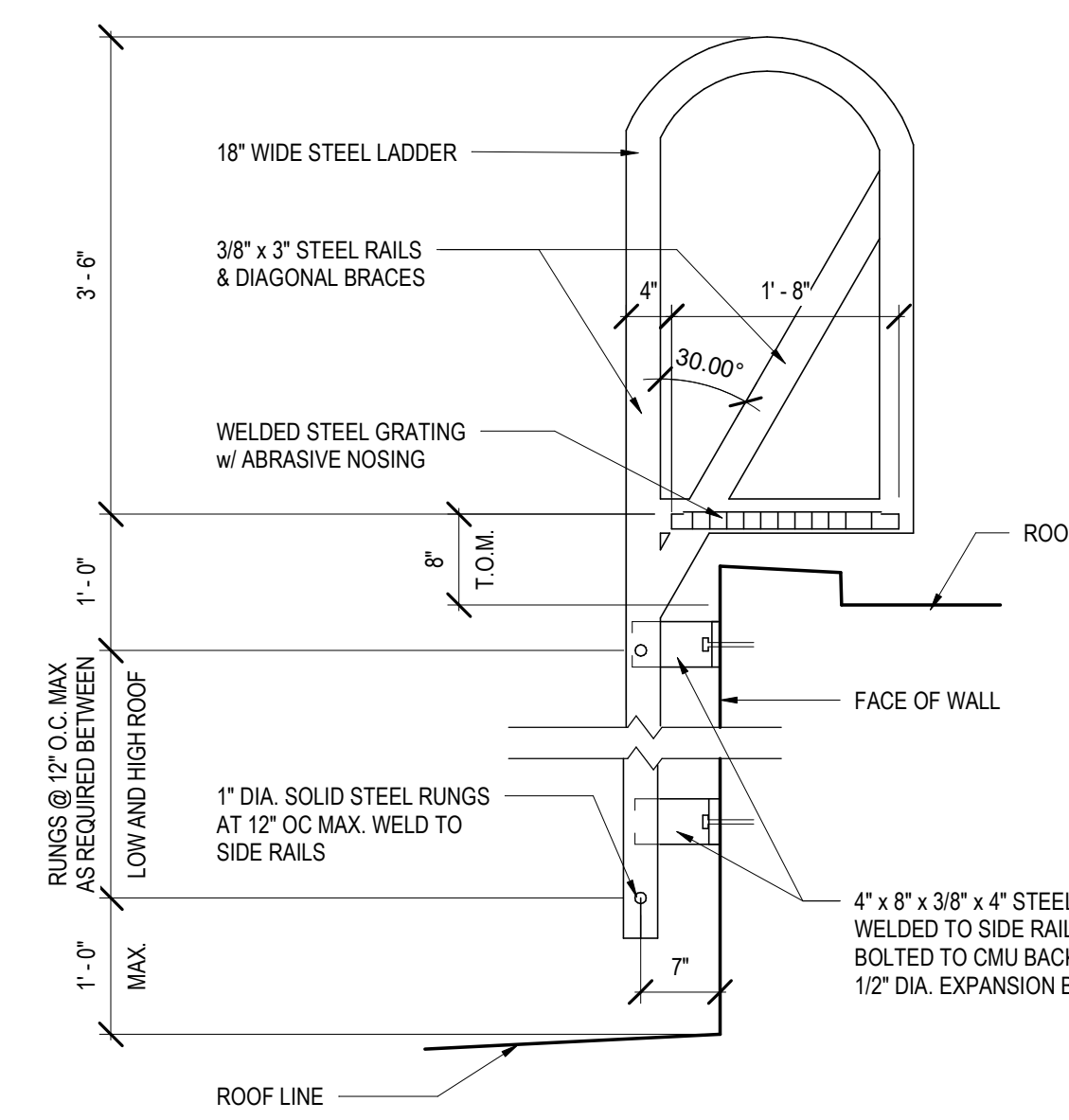
SCALE: As indicated

DRAWING NO. **A1.10**



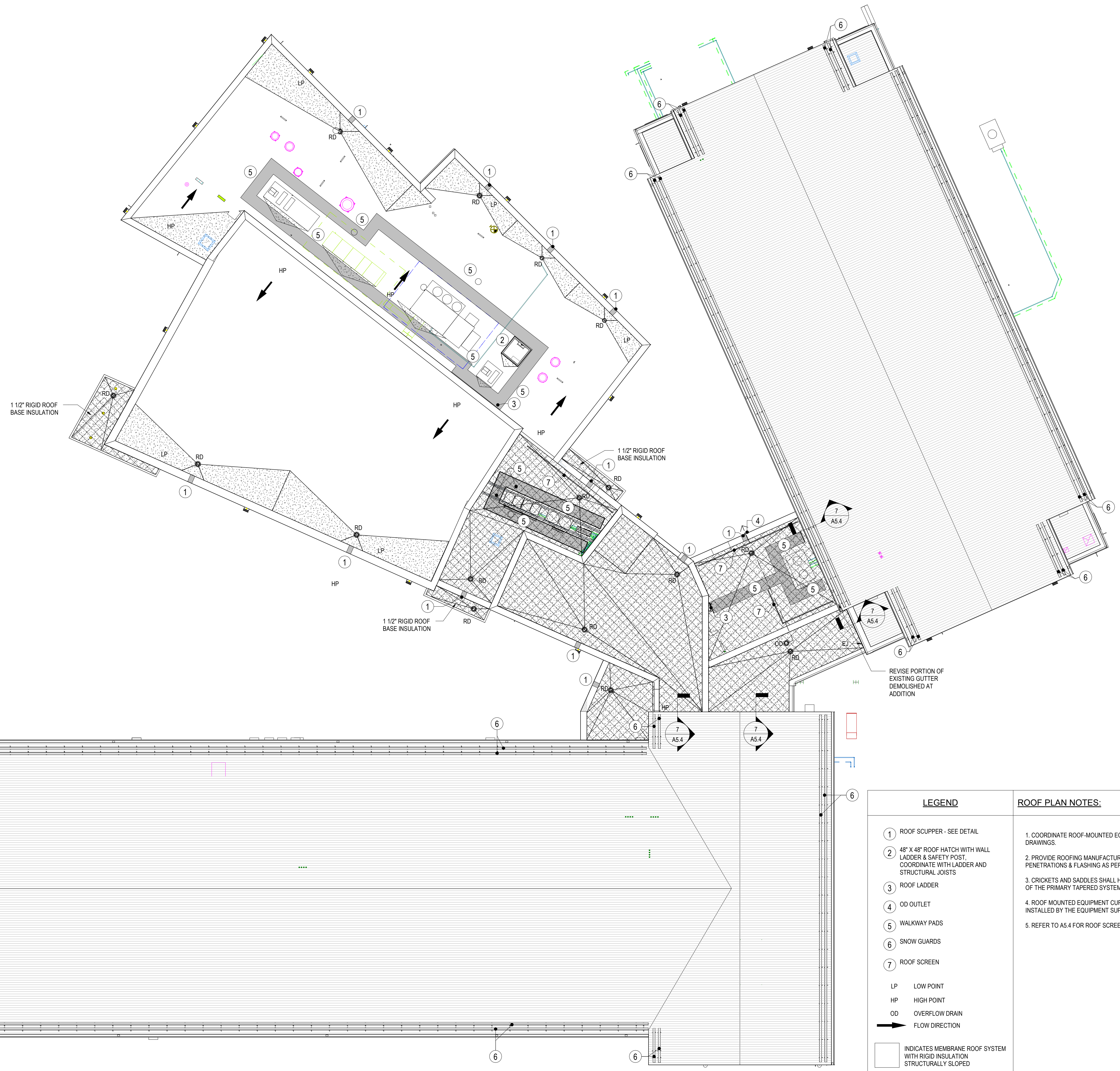
NOTES:
 1. CONTRACTOR SHALL VERIFY HEIGHT FROM FLOOR LINE TO ROOF WHERE LADDER OCCURS TO DETERMINE QUANTITY OF RUNGS
 2. SEE WALL SECTIONS FOR SPECIFIC MATERIALS AND CONDITIONS

2 ROOF HATCH DETAIL
 A1.10 3/4" = 1'-0"

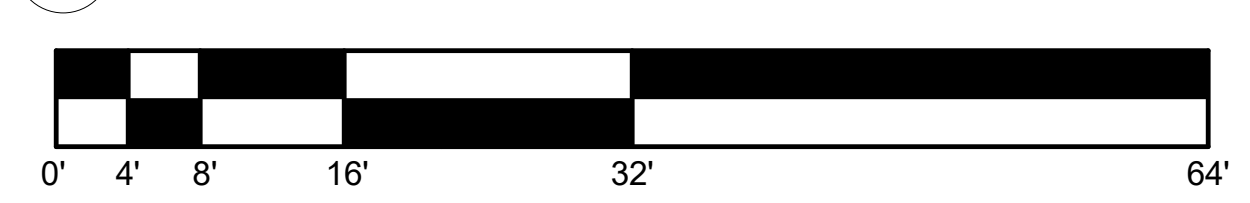


NOTES:
 1. CONTRACTOR SHALL VERIFY HEIGHT FROM LOW ROOF TO HIGH ROOF WHERE LADDER OCCURS TO DETERMINE QUANTITY OF RUNGS
 2. ALL EXPOSED STEEL COMPONENTS TO BE GALVANIZED

3 ROOF LADDER DETAIL
 A1.10 3/4" = 1'-0"

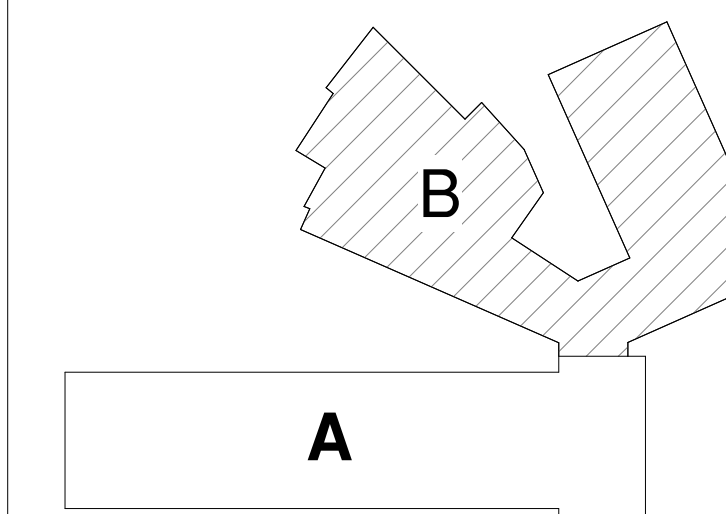


1 OVERALL ROOF PLAN
 A1.10 3/32" = 1'-0"



LEGEND	ROOF PLAN NOTES:
① ROOF SCUPPER - SEE DETAIL	1. COORDINATE ROOF-MOUNTED EQUIPMENT & PENETRATIONS. REFER TO MEP DRAWINGS.
② 48" x 48" ROOF HATCH WITH WALL LADDER & SAFETY POST. COORDINATE WITH LADDER AND STRUCTURAL JOISTS	2. PROVIDE ROOFING MANUFACTURERS' STANDARD DETAILS FOR ALL PENETRATIONS & FLASHING AS PER ROOFING MANUFACTURERS' WARRANTY.
③ ROOF LADDER	3. CRICKETS AND SADDLES SHALL HAVE A MINIMUM OF TWO TIMES THE SLOPE OF THE PRIMARY TAPERED SYSTEM OR STRUCTURAL SLOPE.
④ OD OUTLET	4. ROOF MOUNTED EQUIPMENT CURBS AND SUPPORTS SHALL BE FURNISHED AND INSTALLED BY THE EQUIPMENT SUPPLIER.
⑤ WALKWAY PADS	5. REFER TO A5.4 FOR ROOF SCREEN DETAIL.
⑥ SNOW GUARDS	
⑦ ROOF SCREEN	
LP LOW POINT	
HP HIGH POINT	
OD OVERFLOW DRAIN	
→ FLOW DIRECTION	
□ INDICATES MEMBRANE ROOF SYSTEM WITH RIGID INSULATION STRUCTURALLY SLOPED	
▨ INDICATES MEMBRANE ROOF SYSTEM WITH TAPERED INSULATION ROOF CRICKETS	
▩ INDICATES NEW ROOF SYSTEM ON EXISTING STRUCTURE	
▧ INDICATES MEMBRANE ROOF SYSTEM WITH 1/4" PER FOOT TAPERED INSULATION ON FLAT STRUCTURE	

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
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Title: **MSA APPROVAL**

Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

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AS-BUILT REVISIONS

SUBMITTED BY: _____
 CAD DWG FILE: R. AUGUSTINE
 DRAWN BY: R. AUGUSTINE
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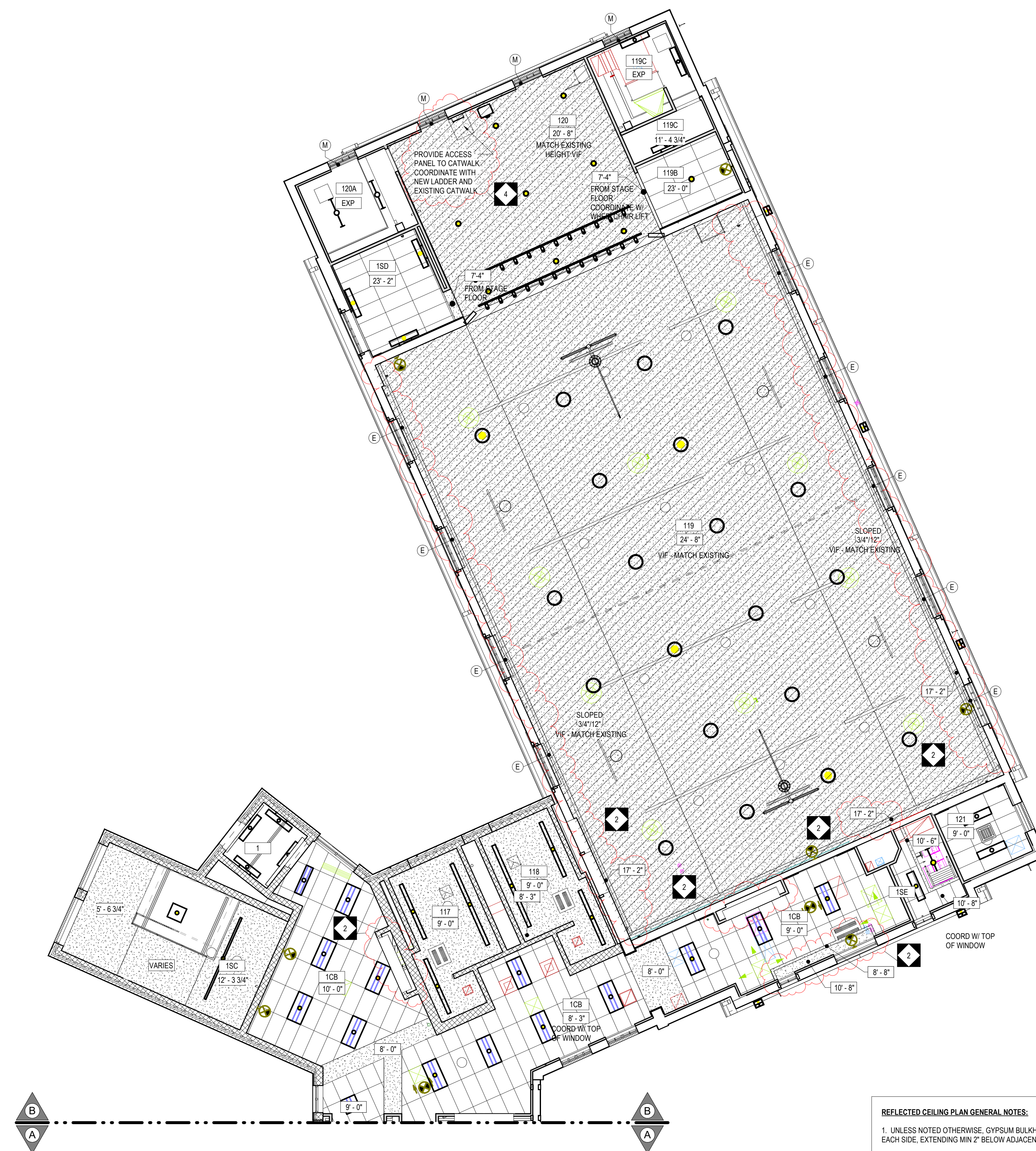
FIRST FLOOR REFLECTED CEILING PLAN - UNIT B

SCALE: 1/8" = 1'-0"

DRAWING NO.

A1.15

90% CONSTRUCTION DOCUMENTS



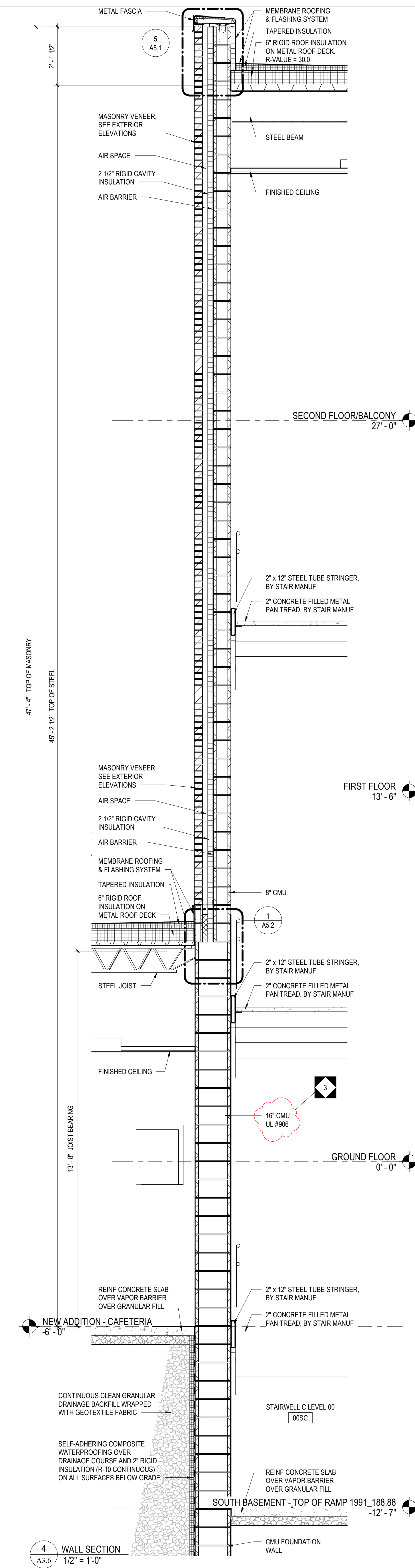
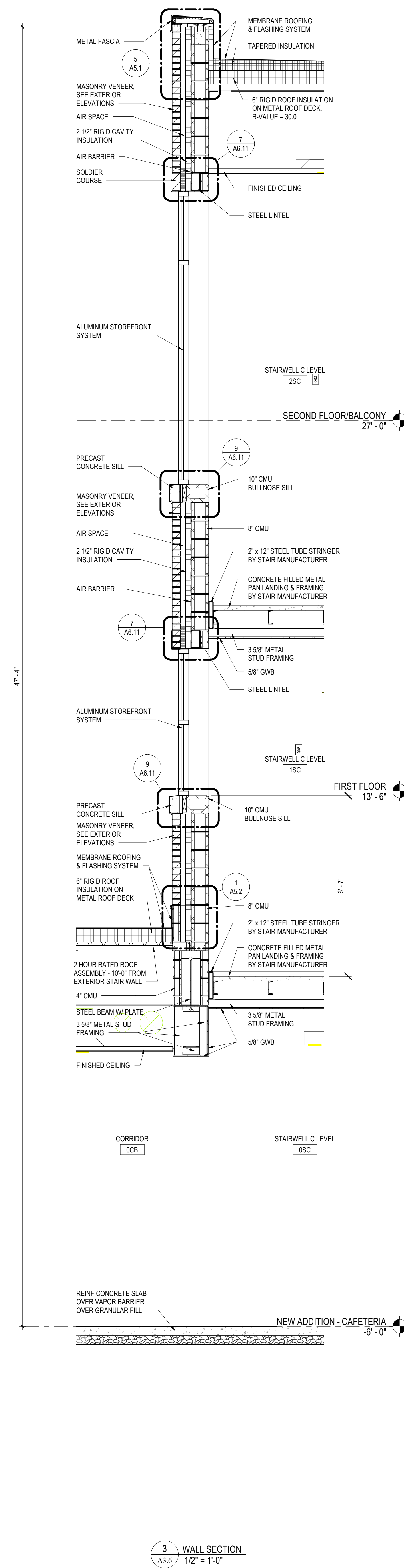
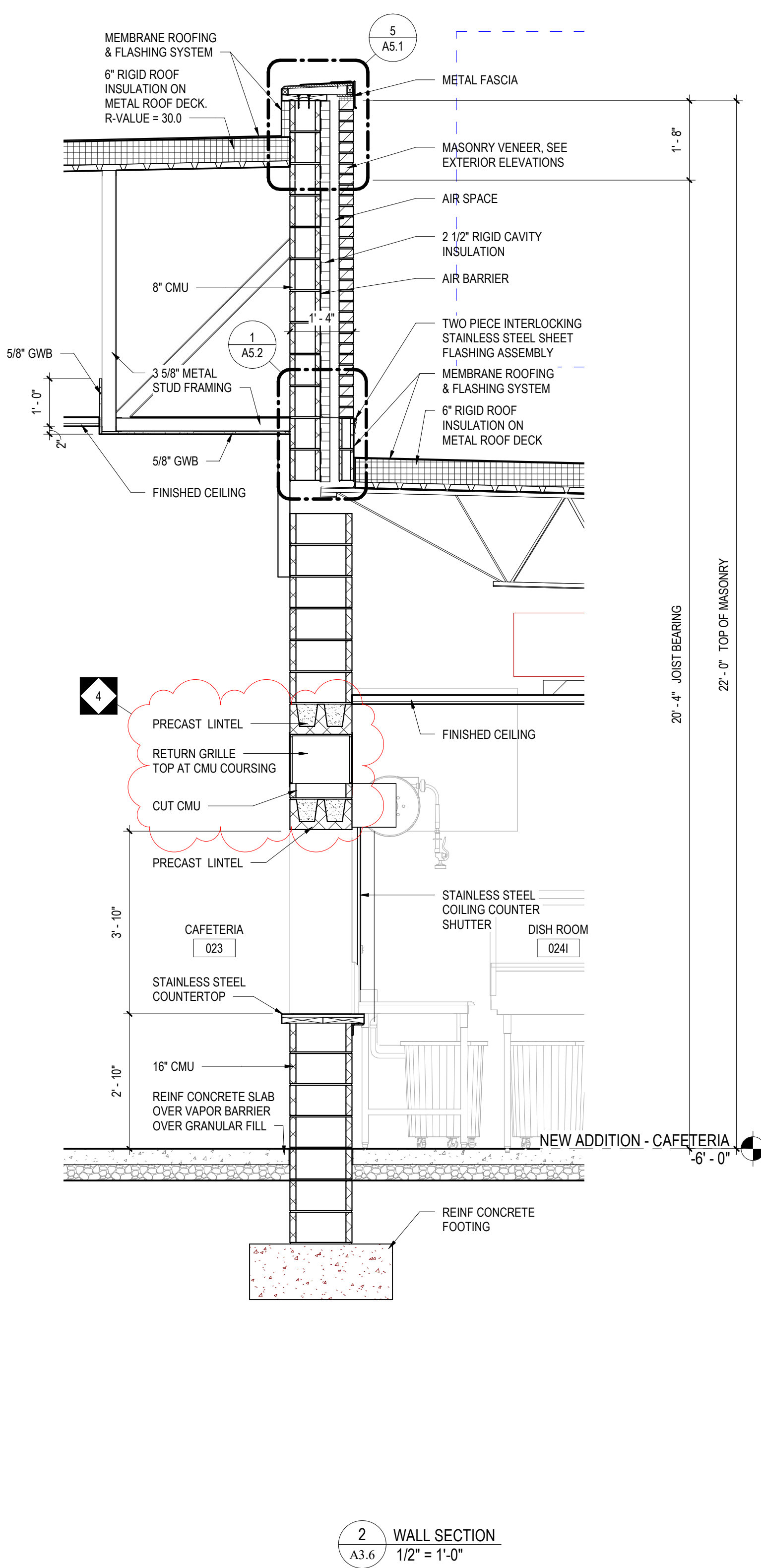
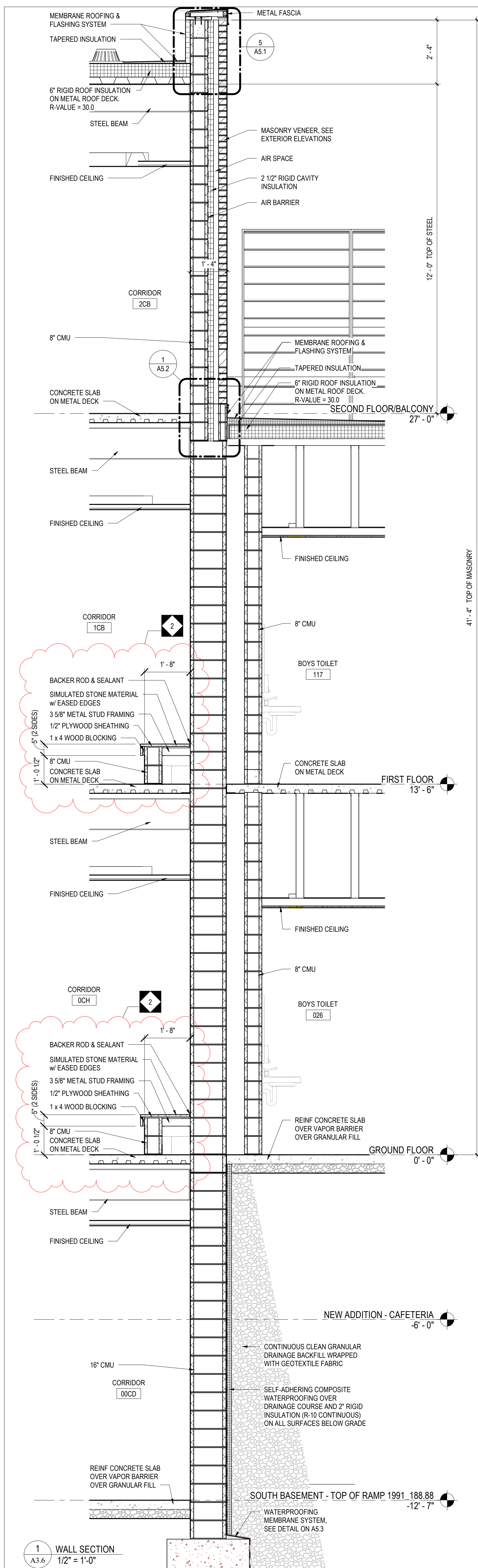
1 FIRST FLOOR REFLECTED CEILING PLAN - UNIT B
 A1.15 1/8" = 1'-0"

REFLECTED CEILING PLAN GENERAL NOTES:

- UNLESS NOTED OTHERWISE, GYPSUM BULKHEADS TO BE 3 5/8" METAL STUDS AT 16" O/C WITH 5/8" GWB EACH SIDE, EXTENDING MIN 2" BELOW ADJACENT CEILING.
- CEILING GRID SHALL BE COORDINATED WITH MEP EQUIPMENT AND DEVICES.
- UNLESS NOTED OTHERWISE, ALL VISIBLE STRUCTURAL STEEL, ROOF/FLOOR DECK, DUCTWORK, PIPING, CONDUIT, HANGER WIRES, ETC AT EXPOSED LOCATIONS OR ABOVE CEILING CLOUDS SHALL BE PAINTED.
- REFER TO ROOM FINISH SCHEDULE FOR CEILING TYPES.
- ALL VISIBLE HANGER WIRES, STRUCTURE AND BRACING AT EXPOSED CEILING GRID OR CEILING CLOUD LOCATIONS SHALL BE INSTALLED PLUMB AND LEVEL.
- FOR WINDOWS THAT REQUIRE TWO OR MORE ROLLER SHADES, EACH ROLLER SHADE SHALL TERMINATE AT THE CENTER OF THE WINDOW MULLION. REFER TO HOLLOW METAL AND ALUMINUM FRAME ELEVATIONS FOR DIMENSIONS AND WINDOW MULLION DESIGN AND ROLLER SHADE BRACKES.

LEGEND

	2 X 4 SUSPENDED CEILING SYSTEM		2 X 4 LIGHT FIXTURE
	GYPSUM WALLBOARD		1 X 4 LIGHT FIXTURE
	LINEAR METAL SOFFIT		2 X 2 LIGHT FIXTURE
	STEEL LINTEL - PAINTED		SEE MEP DRAWINGS
	PIPE GRID - SEE MEP DRAWINGS		SEE MEP DRAWINGS
	EXTERIOR PLASTER CEILING		RECESSED DOWN LIGHT
	1HR FIRE RATED GYPSUM WALLBOARD U.L. # F541 - SEE DETAILS FOR METAL STUD FRAMING SIZES		PENDANT LIGHT FIXTURES
			ROLLER SHADE - MANUAL
			ROLLER SHADE - MOTORIZED



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AS-BUILT REVISIONS

SUBMITTED BY:	
CAD DWG FILE:	R. AUGUSTINE
DRAWN BY:	R. AUGUSTINE
CHECKED BY:	T. VUKMANIC
PROJECT NO.:	BCS-02-004
DATE:	NOVEMBER 16, 2020

WALL SECTIONS

SCALE: 1/2" = 1'-0"
DRAWING NO. **A3.6**

90% CONSTRUCTION DOCUMENTS

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204

RENOVATIONS & ADDITIONS
 MONTEBELLO ELEMENTARY/
 MIDDLE SCHOOL
 BALTIMORE CITY PUBLIC SCHOOLS
 2040 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____

Title: _____

MSA APPROVAL

Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
4	01/08/2021	ADDENDUM #1
2	12/16/2020	ADDENDUM #2

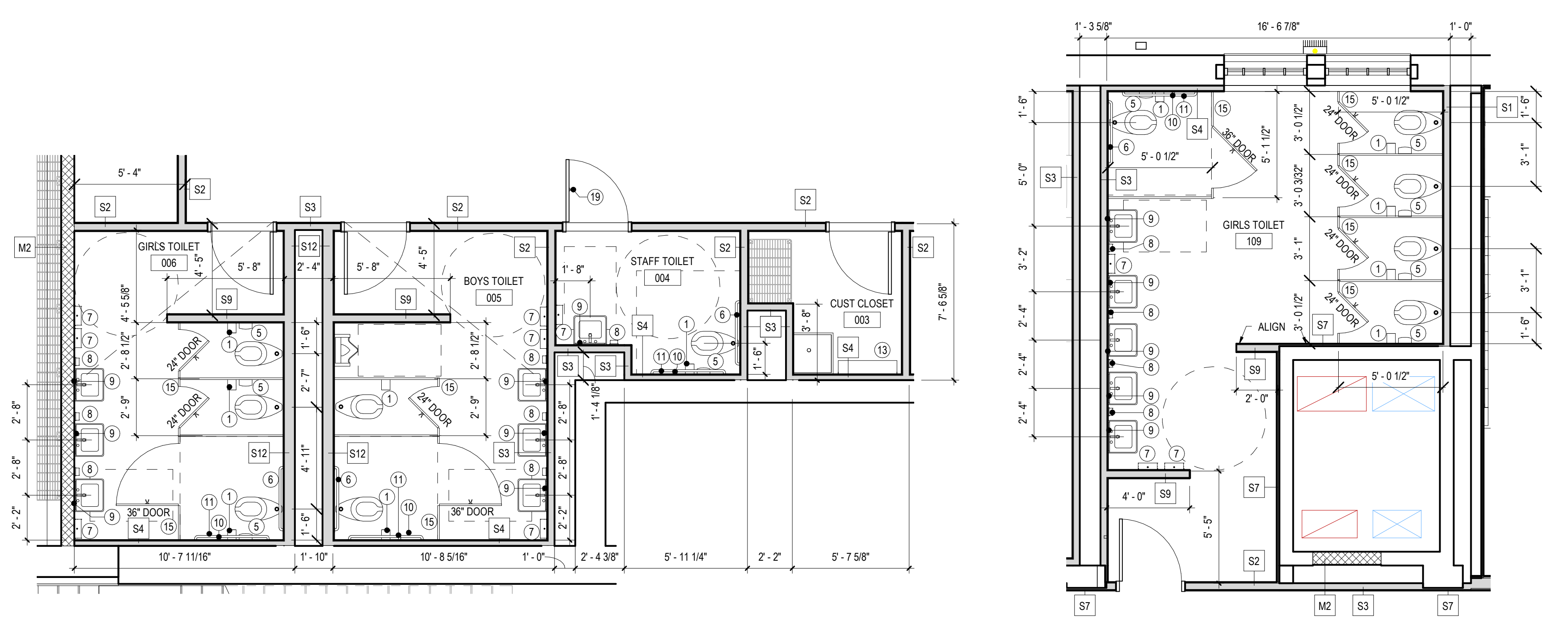
AS-BUILT REVISIONS	

SUBMITTED BY: _____
 CAD DWG FILE: R. AUGUSTINE
 DRAWN BY: R. AUGUSTINE
 CHECKED BY: T. VUKMANIC
 PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

LARGE SCALE TOILET PLANS

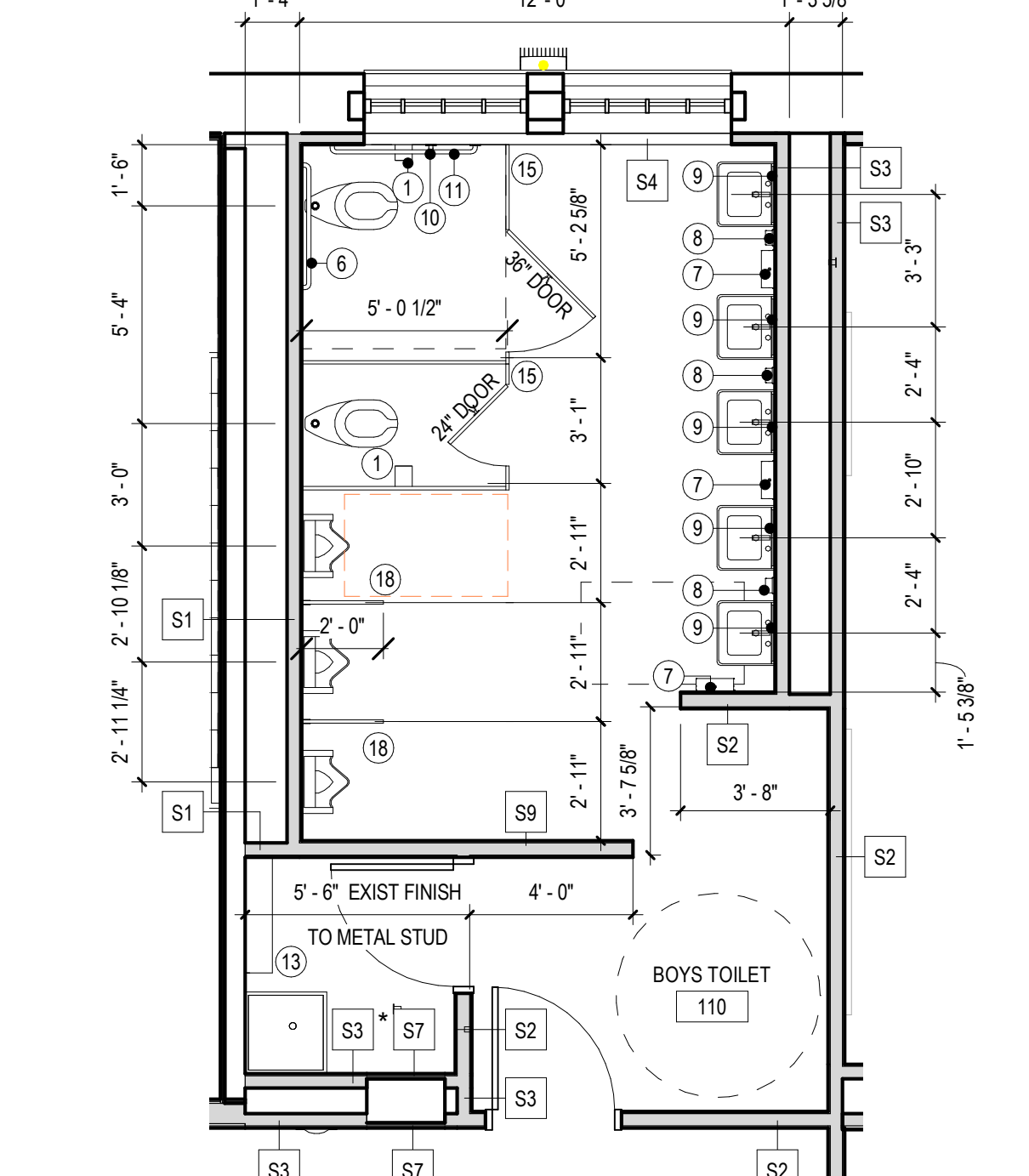
SCALE: 1/4" = 1'-0"

DRAWING NO. **A4.1**

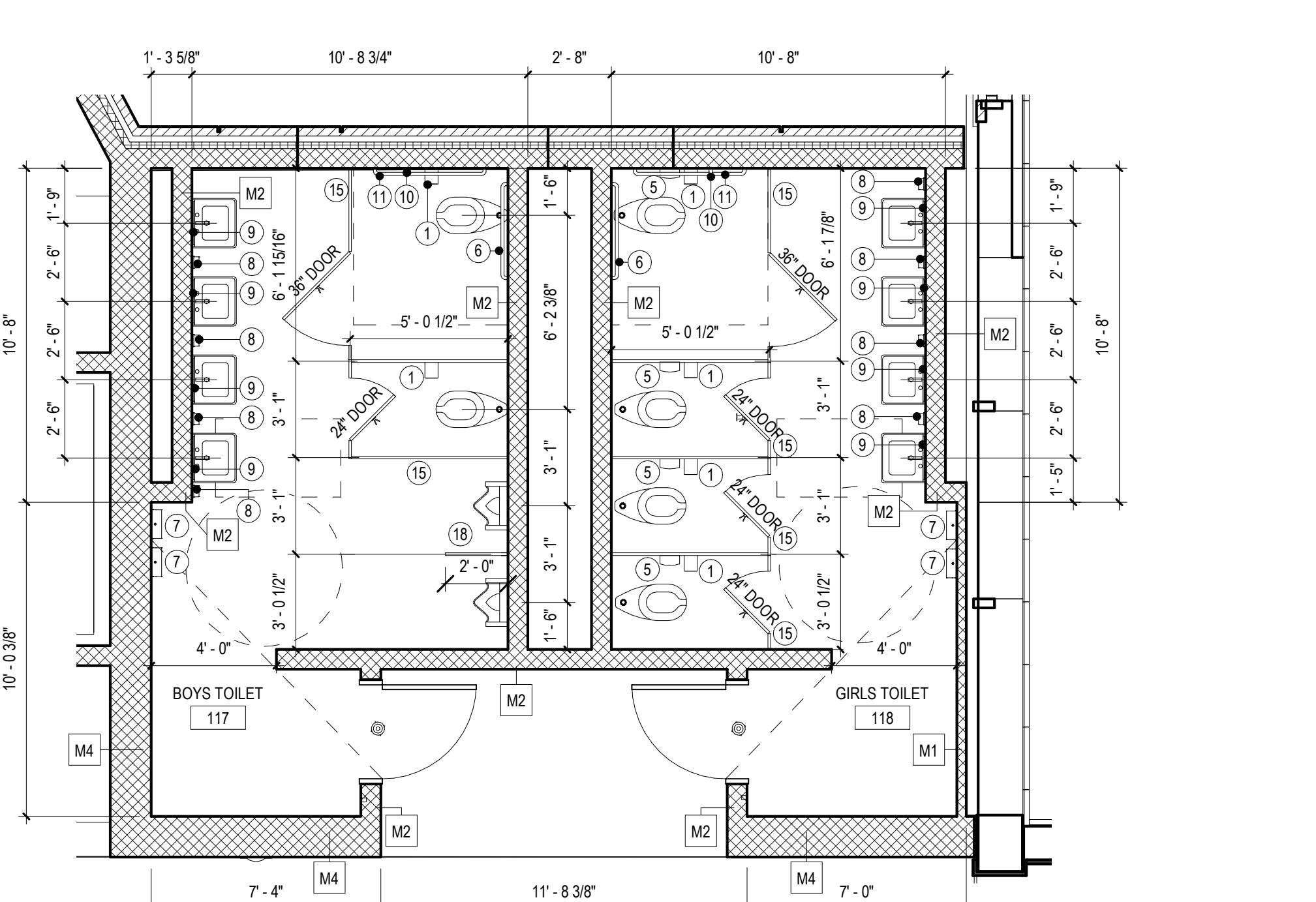


1 LARGE SCALE TOILET PLAN
 A4.1 1/4" = 1'-0"

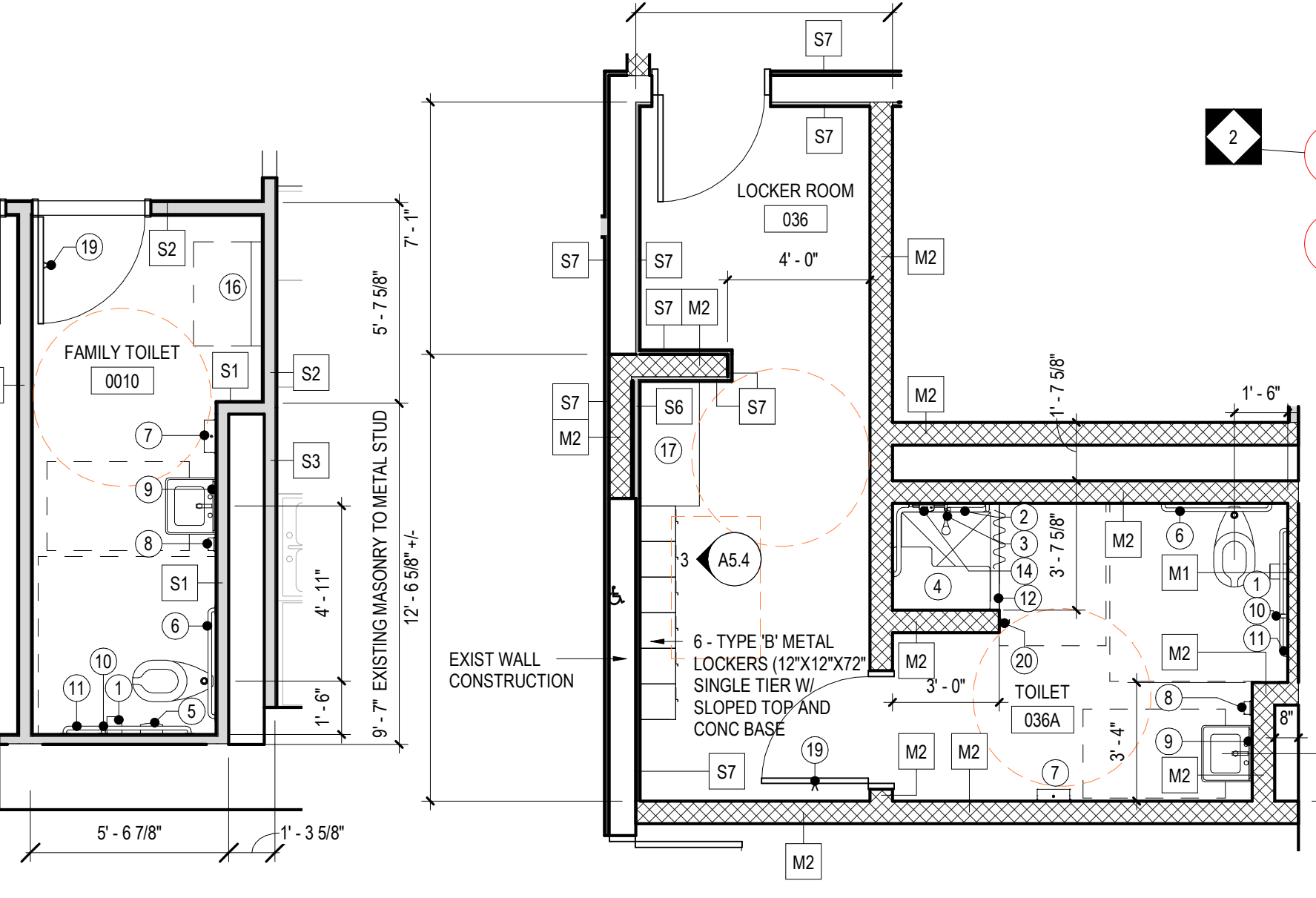
2 LARGE SCALE TOILET PLAN
 A4.1 1/4" = 1'-0"



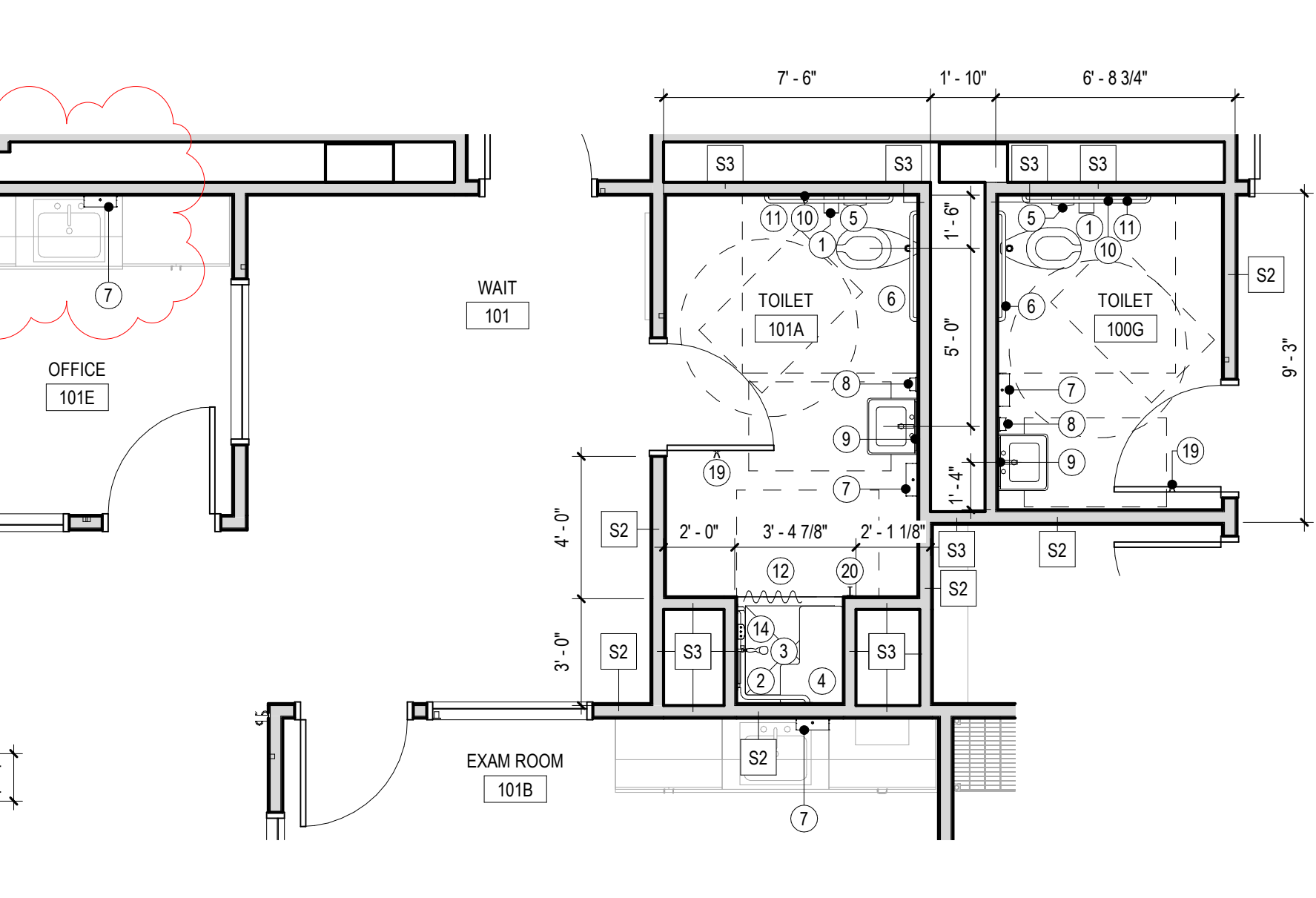
3 LARGE SCALE TOILET PLAN
 A4.1 1/4" = 1'-0"



4 LARGE SCALE TOILET PLAN
 A4.1 1/4" = 1'-0"



5 LARGE SCALE TOILET PLAN
 A4.1 1/4" = 1'-0"

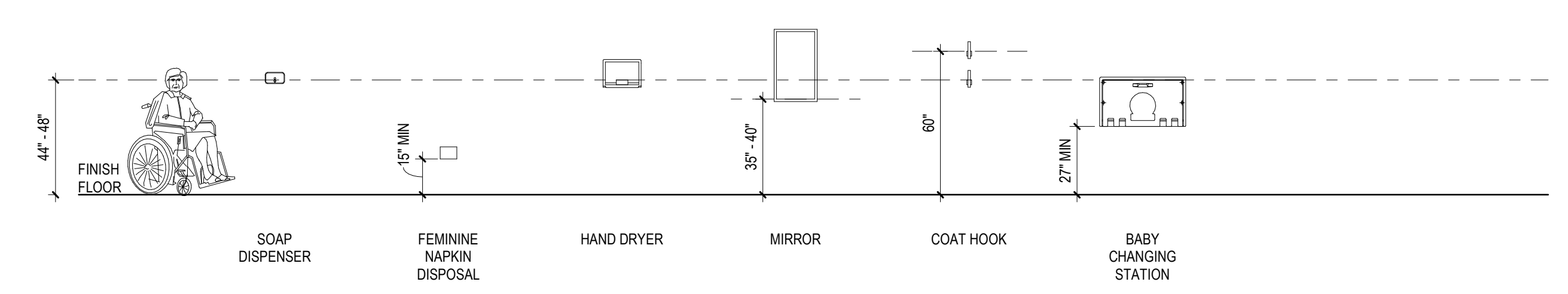


6 LARGE SCALE TOILET PLAN
 A4.1 1/4" = 1'-0"

7 LARGE SCALE TOILET & EXAM PLAN
 A4.1 1/4" = 1'-0"

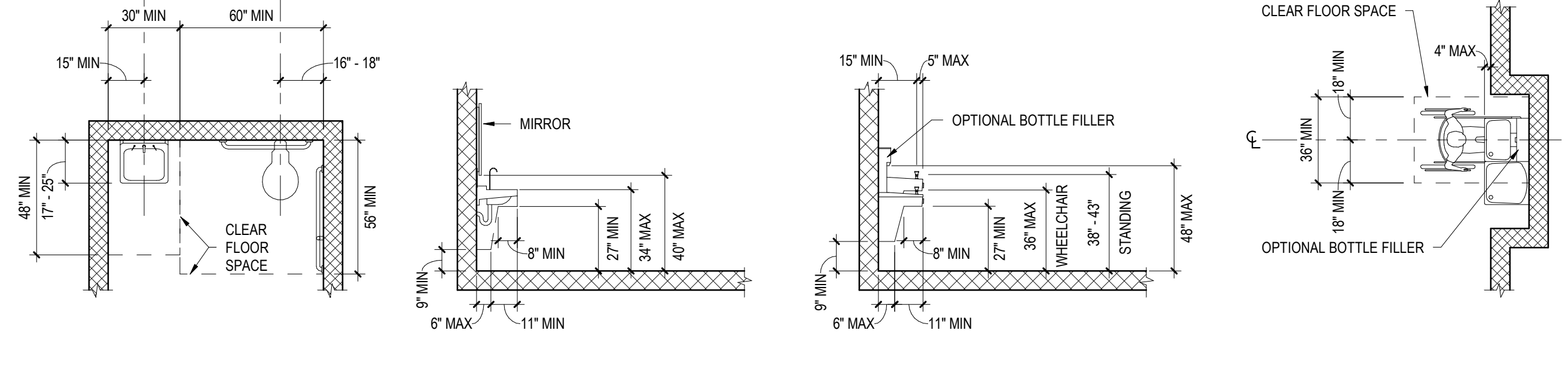
- GENERAL NOTES:**
- ACCESSIBLE FIXTURES ARE INDICATED WITH THE REQUIRED CLEAR FLOOR SPACE CLEARANCES FOR ALL ACCESSIBLE ROUTES & MANEUVERING CLEARANCES.
 - PLUMBING FIXTURE ROUGH-IN DIMENSIONS & TOILET PARTITION LAYOUT DIMENSIONS ARE FROM THE WALL FINISH MATERIAL.
 - PROVIDE WOOD BLOCKING IN STUD WALLS FOR ALL TOILET ACCESSORIES.
 - TOILET PARTITION DIMENSIONS ARE TO THE PANEL CENTERLINE UNLESS NOTED OTHERWISE. MINIMUM CLEAR DIMENSIONS MUST BE PROVIDED WHERE NOTED.
 - COORDINATE ALL WALL FINISHES WITH THE ROOM FINISH SCHEDULE.
 - CONTRACTOR TO CONFIRM WITH THE OWNER'S REPRESENTATIVE THE LOCATION OF ALL SURFACE-MOUNTED TOILET ROOM ACCESSORIES PRIOR TO INSTALLATION.
 - URINAL PARTITIONS SHALL BEGIN AT A HEIGHT NO MORE THAN 12" FROM AND EXTEND NOT LESS THAN 60" ABOVE THE FINISHED FLOOR SURFACE. URINAL PARTITIONS SHALL EXTEND FROM THE WALL SURFACE AT EACH SIDE OF THE URINAL A MINIMUM OF 18".
 - ACCESSIBLE LOCKERS ARE INDICATED AS "1" AT DOUBLE TIER LOCKERS, ONLY THE BOTTOM TIER IS REQUIRED TO BE ACCESSIBLE. FOR FOUR TIER LOCKERS, ONLY THE BOTTOM TWO TIERS ARE REQUIRED TO BE ACCESSIBLE.
 - REFER TO INTERIOR DRAWINGS FOR AN ADDITIONAL TOILET ACCESSORY SCHEDULE.

No.	DESCRIPTION	MOUNTING	MANUFACTURER	MODEL
1	SURFACE MOUNTED MULTI-ROLL TOILET TISSUE DISPENSER	TISSUE ACCESS @ 19" MIN AFF	BOBRICK	B-4288
2	GRAB BAR FOR 36" x 36" SHOWER STALL	36" AFF TO TOP OF GRIPPING SURFACE	BOBRICK	B-6661
3	HAND HELD SHOWER W/ 59" MIN FLEX HOSE	AS SPECIFIED	-	-
4	FOLDING SHOWER SEAT W/ PADDED CUSHION	18" AFF TO TOP	BOBRICK	B-517, B-518
5	SURFACE MOUNTED SANITARY NAPKIN DISPOSAL	15" MIN AFF	BOBRICK	B-270
6	36" GRAB BAR (HORIZONTAL)	33" MIN - 36" MAX AFF TO TOP OF GRIPPING SURFACE	BOBRICK	B-5806 x 36
7	SURFACE MOUNTED PAPER TOWEL DISPENSER	48" MAX TO OUTLET OF DISPENSER	BOBRICK	B-2660
8	SURFACE MOUNTED SOAP DISPENSER	PUSH BUTTON @ 44" MAX AFF	BOBRICK	B-2111
9	MIRROR 18" x 30" W/ SS FRAME	40" AFF TO BOTTOM EDGE OF REFLECTING SURFACE	BOBRICK	B-165 (1830)
10	18" GRAB BAR (VERTICAL)	39" MIN - 41" MAX AFF TO BOTTOM OF GRAB BAR	BOBRICK	B-5806 x 18
11	42" GRAB BAR (HORIZONTAL)	33" MIN - 36" MAX AFF TO TOP OF GRIPPING SURFACE	BOBRICK	B-5806 x 42
12	SS SHOWER ROD, VINYL SHOWER CURTAIN & SS SHOWER CURTAIN HOOKS	COORDINATE WITH SHOWER UNIT	-	-
13	UTILITY SHELF W/ MOP & BROOM HOLDER & RAG HOOKS	12" AFF TO TOP SHELF	BOBRICK	B-228 x 34
14	SOAP DISH (HEAVY DUTY)	40" AFF TO DISH	BRADLEY CORP	9014
15	TOILET PARTITION W/ COAT HOOK & BUMPER	AS SPECIFIED	AS SPECIFIED	-
16	BABY CHANGING STATION	34" AFF TO CHANGING SURFACE (DOWN POSITION)	BOBRICK	KB-200
17	ACCESSIBLE BENCH	AS SPECIFIED	AS SPECIFIED	-
18	URINAL SCREEN	AS SPECIFIED	AS SPECIFIED	-
19	SURFACE MOUNTED SS COAT HOOK	SEE GENERAL NOTES	AS SPECIFIED	-
20	SURFACE MOUNTED SS TOWEL PIN	48" AFF TO TOP OF TOWEL PIN	BOBRICK	B-6777

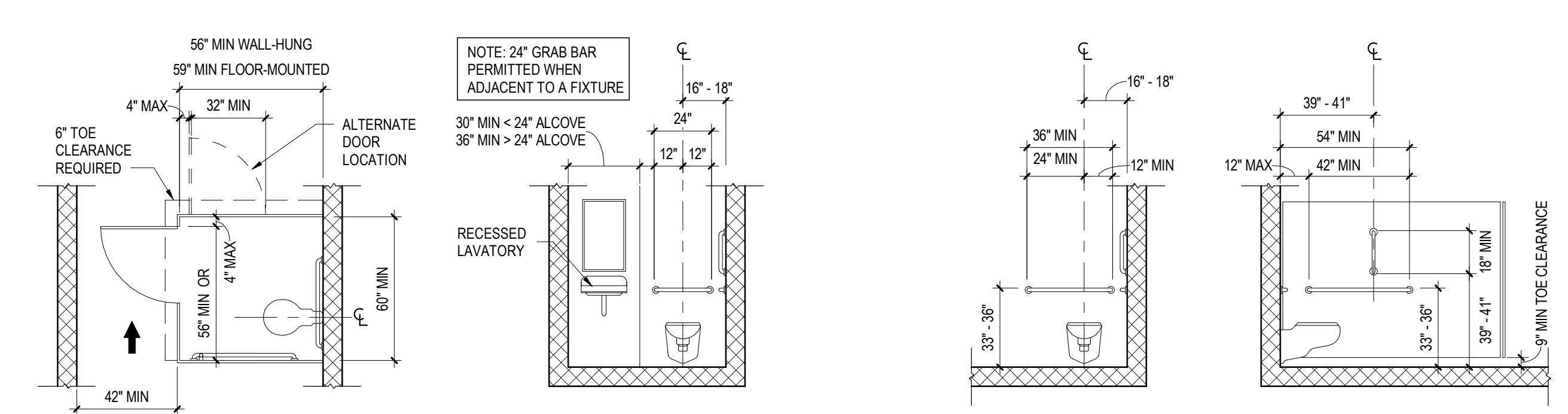


NOTE: OTHER FIXTURES NOT ALLOWED WITHIN CLEAR FLOOR SPACE.

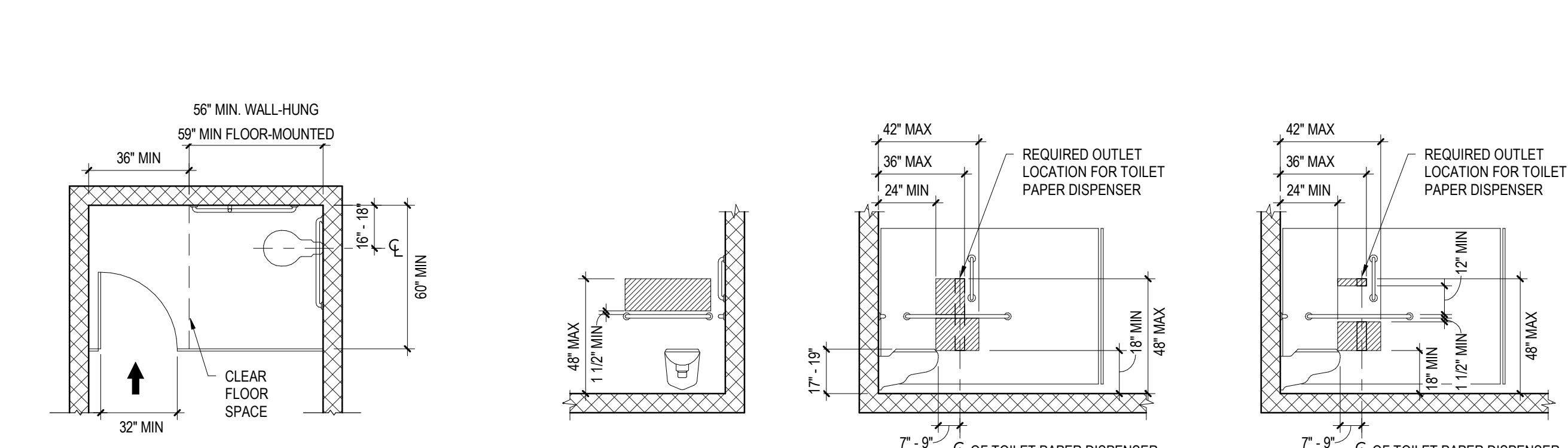
NOTE: THERE SHALL BE NO SHARP OR ABRASIVE SURFACES UNDER LAVATORIES OR SINKS. DASHED LINE INDICATED DIMENSIONAL CLEARANCE OF OPTIONAL UNDER FIXTURE ENCLOSURE.



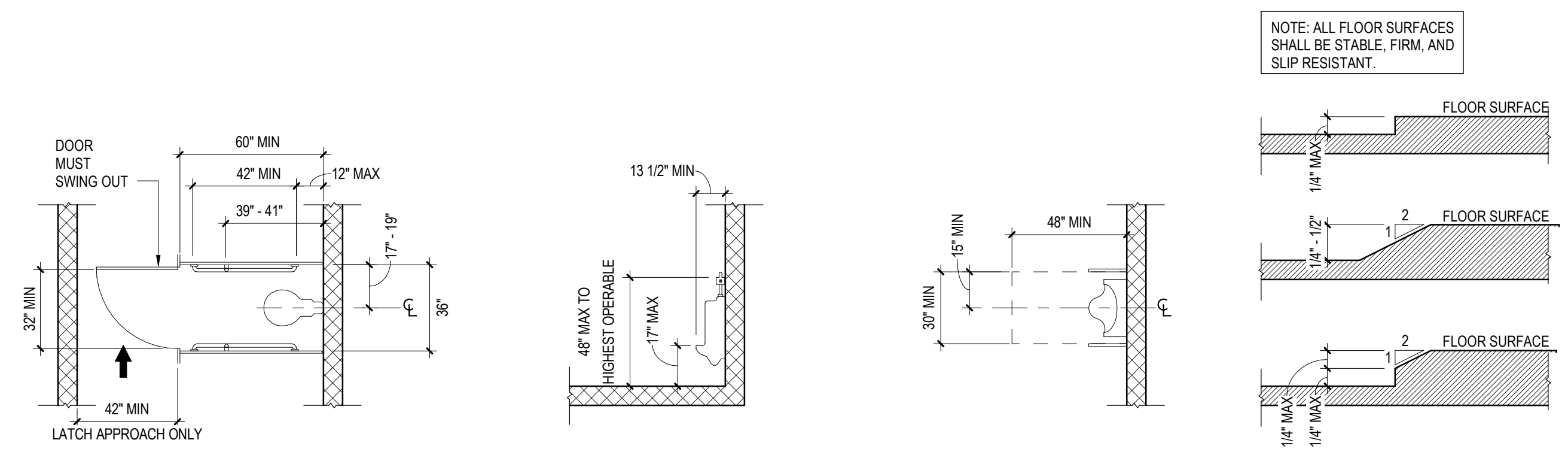
CLEAR FLOOR AT WALL HUNG WATER CLOSET AND LAVATORY LAVATORY HEIGHT AND LEG CLEARANCE DRINKING FOUNTAIN HEIGHT AND LEG CLEARANCE CLEAR FLOOR AT DRINKING FOUNTAIN



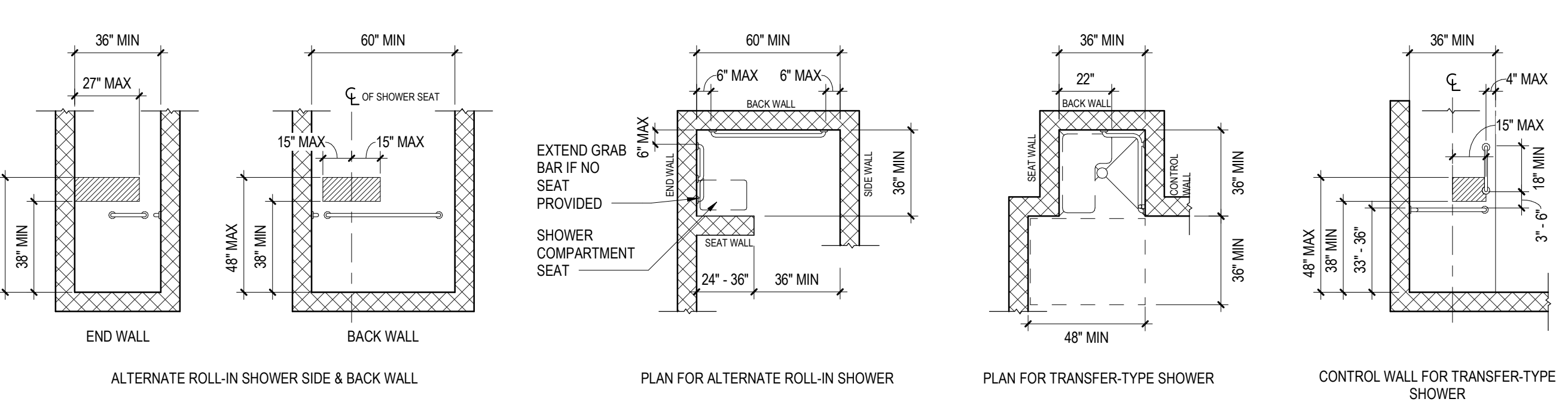
PLAN FOR WATER CLOSET REAR WALL FOR WATER CLOSET ADJACENT TO RECESSED LAVATORY REAR WALL FOR WATER CLOSET SIDE WALL FOR WATER CLOSET



ALTERNATE PLAN FOR WATER CLOSET REAR WALL RECESSED DISPENSERS SIDE WALL RECESSED DISPENSERS SIDE WALL PROTRUDING DISPENSERS



PLAN FOR AMBULATORY ACCESSIBLE TOILET COMPARTMENT WALL HUNG URINAL CLEARANCES WALL HUNG URINAL CLEARANCES CHANGES IN FLOOR LEVEL



ALTERNATE ROLL-IN SHOWER SEAT & BACK WALL PLAN FOR ALTERNATE ROLL-IN SHOWER PLAN FOR TRANSFER-TYPE SHOWER CONTROL WALL FOR TRANSFER-TYPE SHOWER

ACCESSIBILITY STANDARDS
 NOT TO SCALE

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204

RENOVATIONS & ADDITIONS
 MONTEBELLO ELEMENTARY/
 MIDDLE SCHOOL
 BALTIMORE CITY PUBLIC SCHOOLS
 2040 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____
 Title: _____
 Project Manager: _____ Date: _____
 Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
4	01/08/2021	ADDENDUM #4
3	12/30/2020	ADDENDUM #3

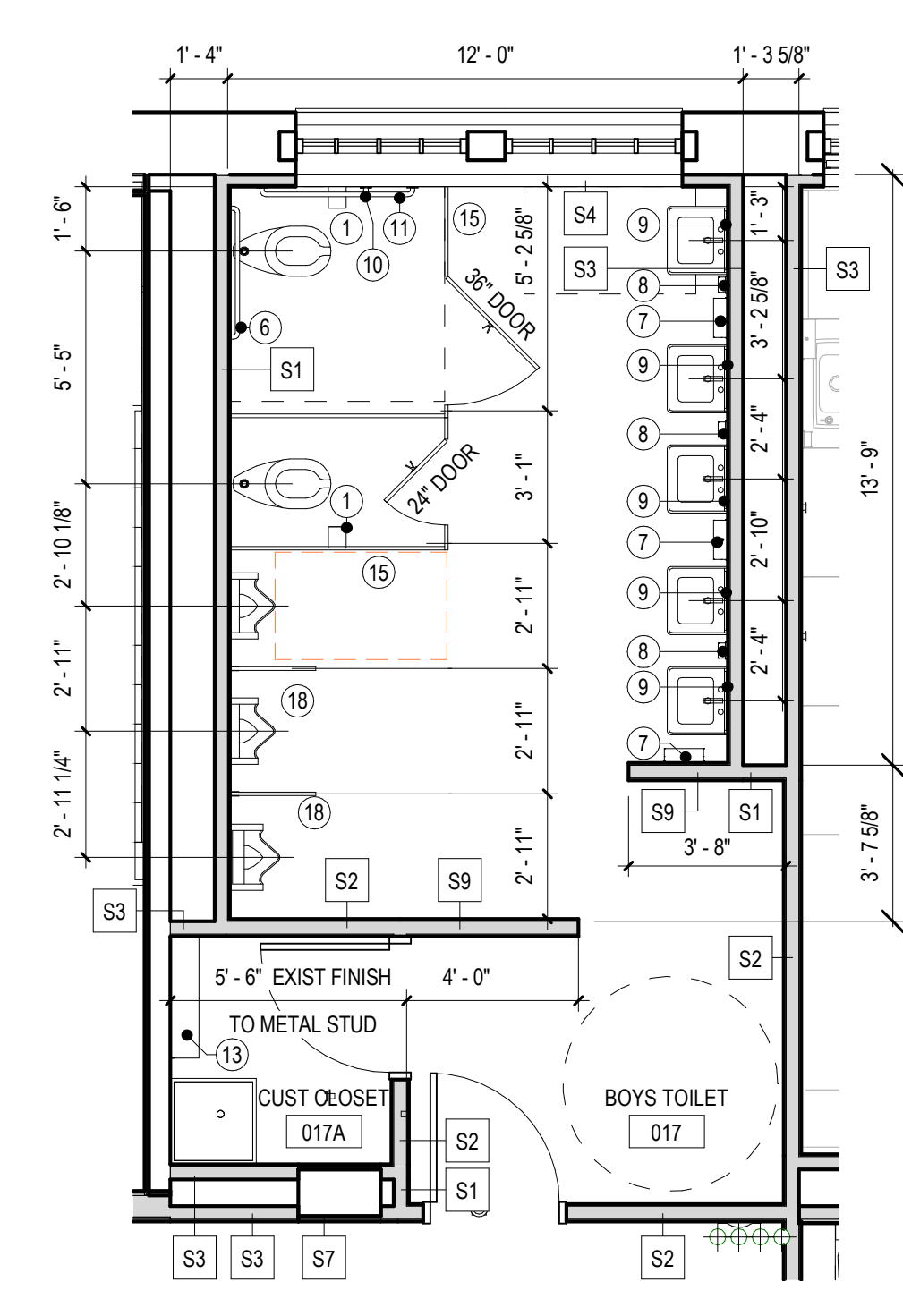
AS-BUILT REVISIONS

SUBMITTED BY: _____
 CAD DWG FILE: R. AUGUSTINE
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 CHECKED BY: T. VUKMANIC
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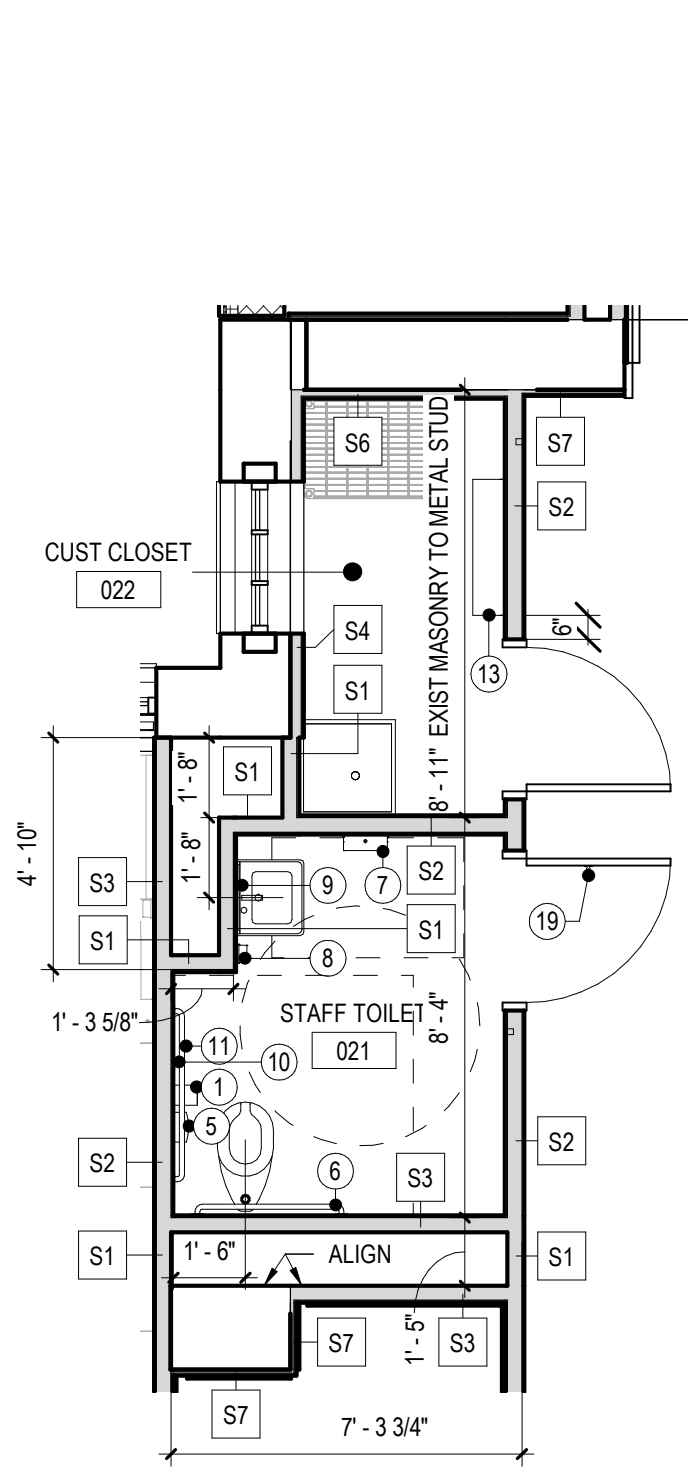
LARGE SCALE TOILET PLANS

SCALE: _____ As indicated

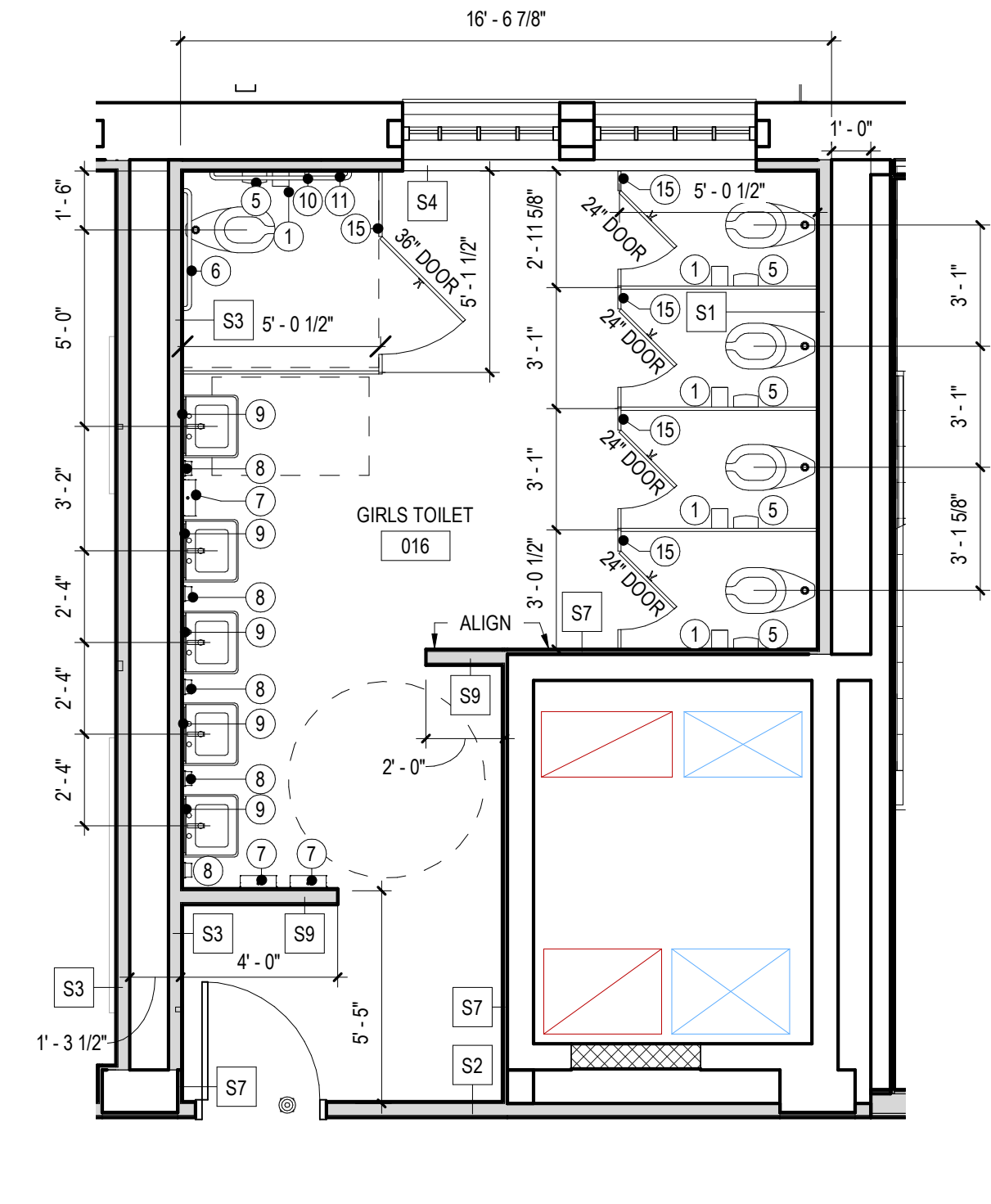
DRAWING NO. **A4.2**



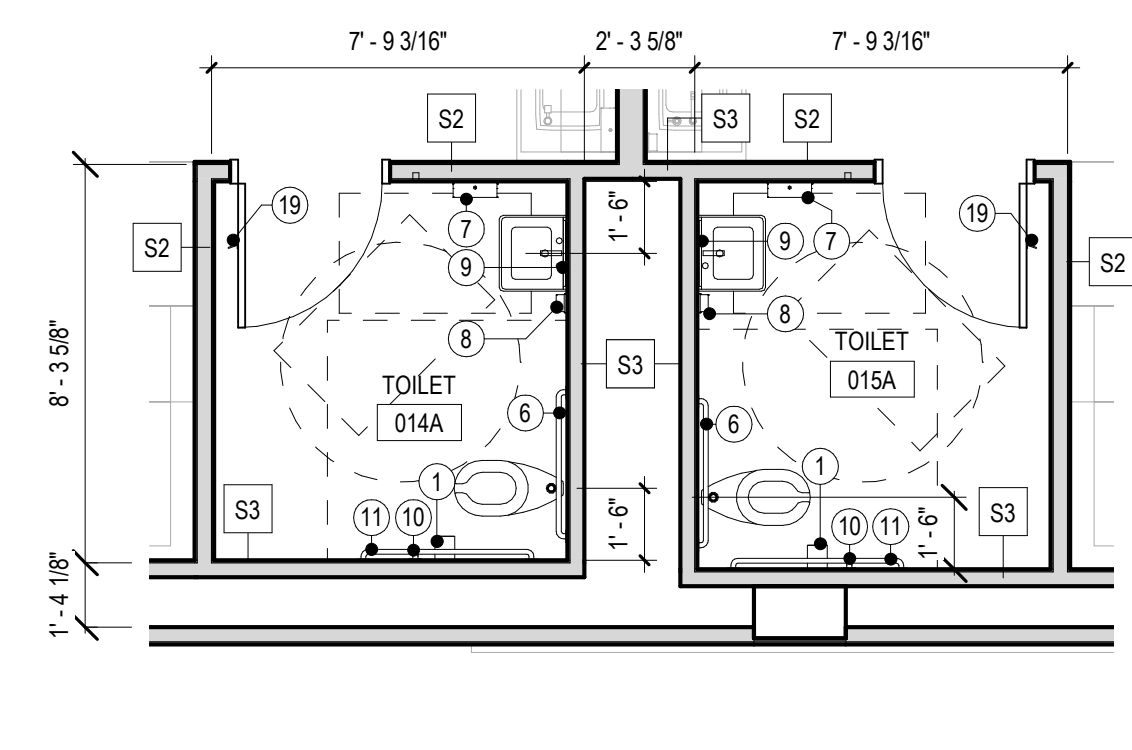
1 LARGE SCALE TOILET PLAN
 A4.2 1/4" = 1'-0"



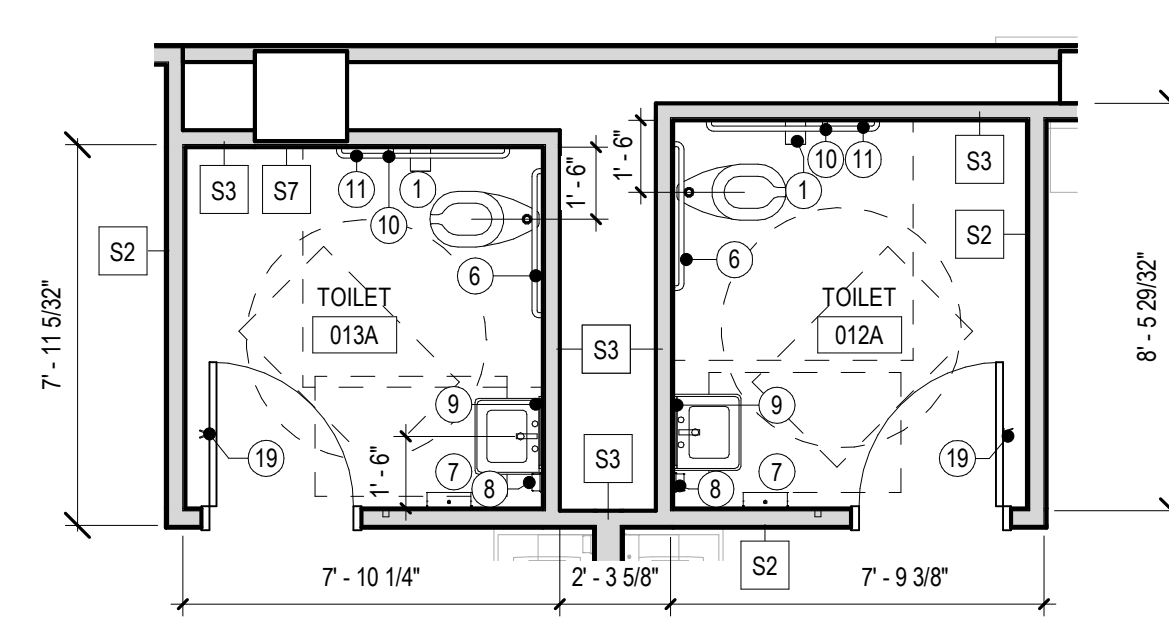
2 LARGE SCALE TOILET PLAN
 A4.2 1/4" = 1'-0"



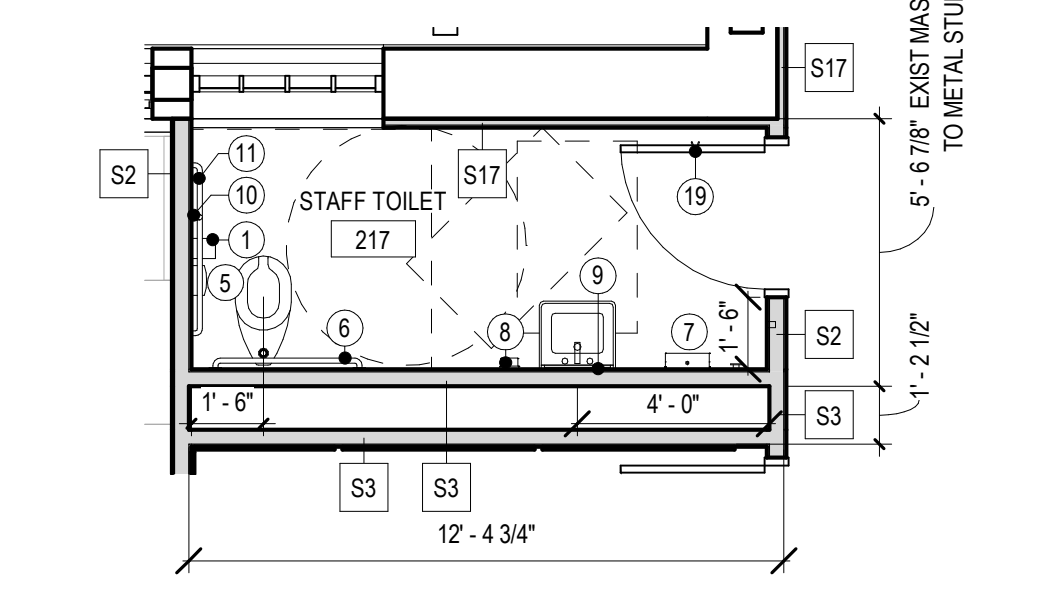
3 LARGE SCALE TOILET PLAN
 A4.2 1/4" = 1'-0"



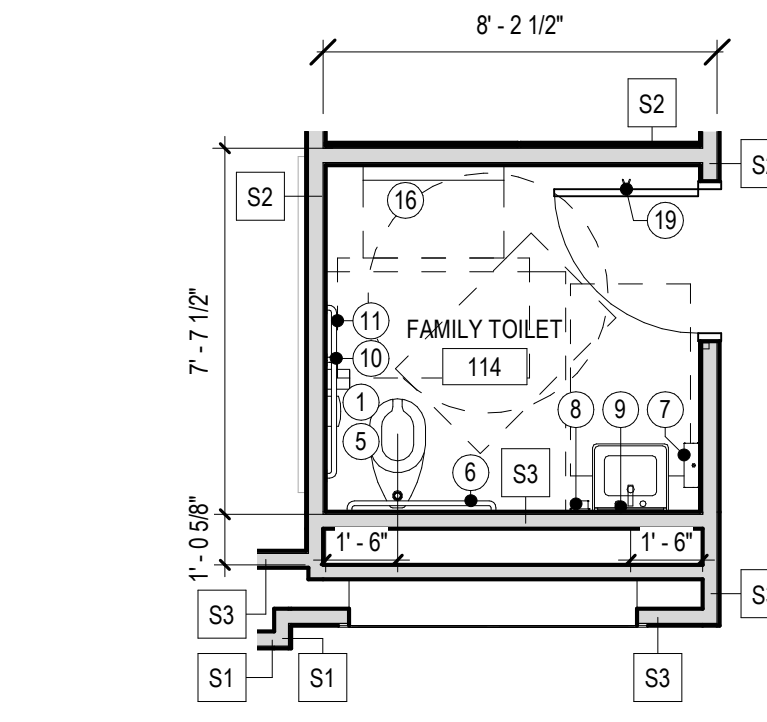
4 LARGE SCALE TOILET PLAN
 A4.2 1/4" = 1'-0"



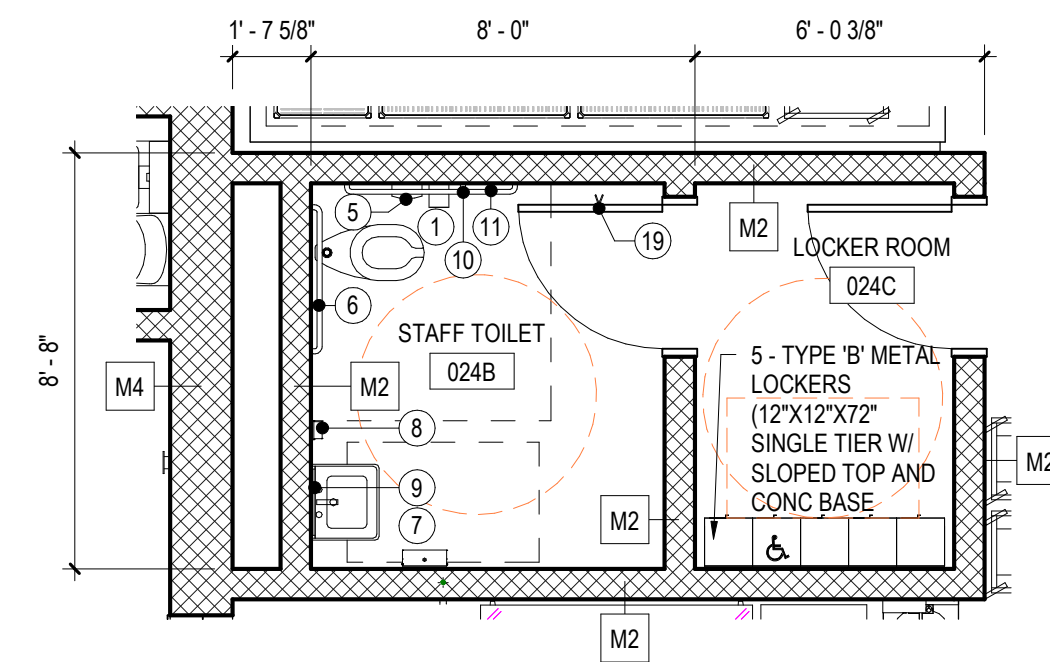
5 LARGE SCALE TOILET PLAN
 A4.2 1/4" = 1'-0"



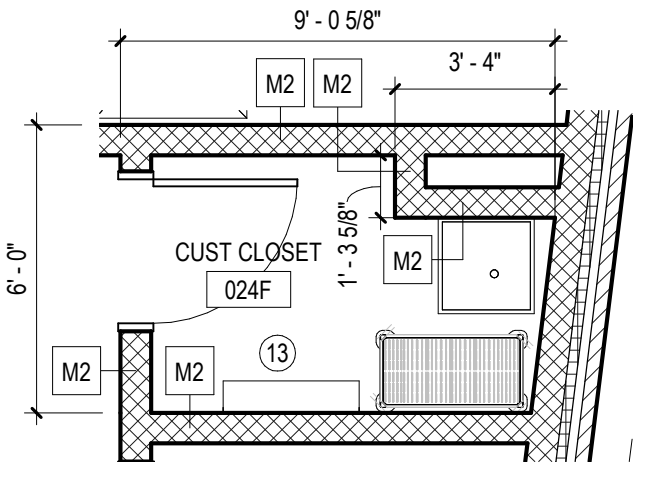
6 LARGE SCALE TOILET PLAN
 A4.2 1/4" = 1'-0"



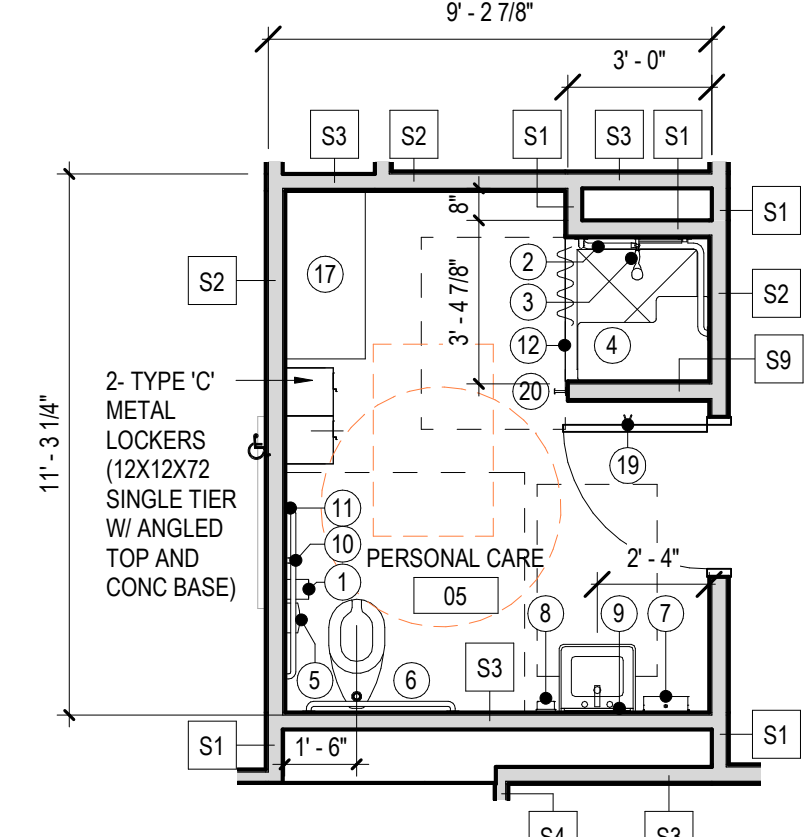
7 LARGE SCALE TOILET PLAN
 A4.2 1/4" = 1'-0"



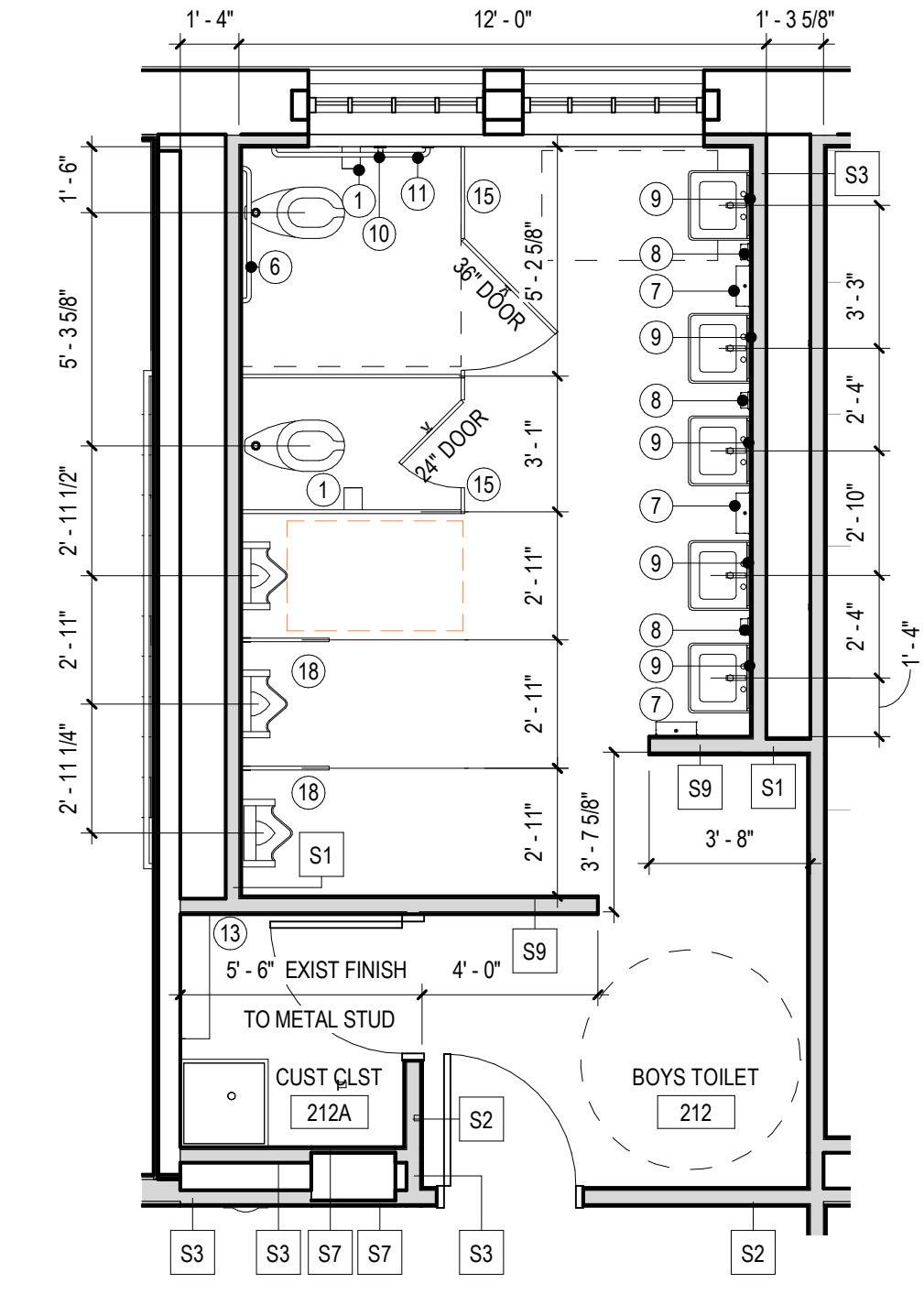
8 LARGE SCALE TOILET PLAN
 A4.2 1/4" = 1'-0"



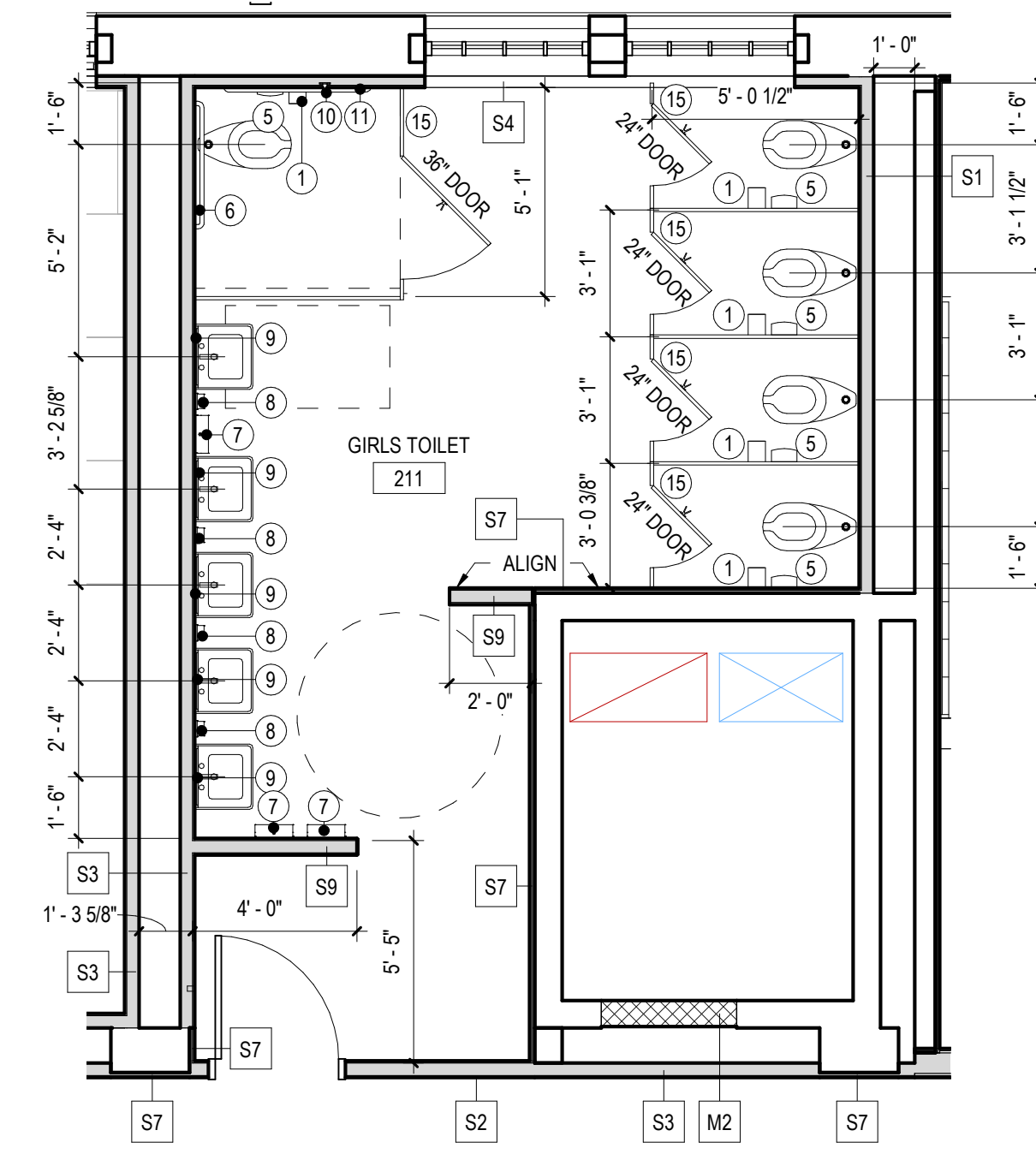
9 LARGE SCALE CUSTODIAL CLOSET PLAN
 A4.2 1/4" = 1'-0"



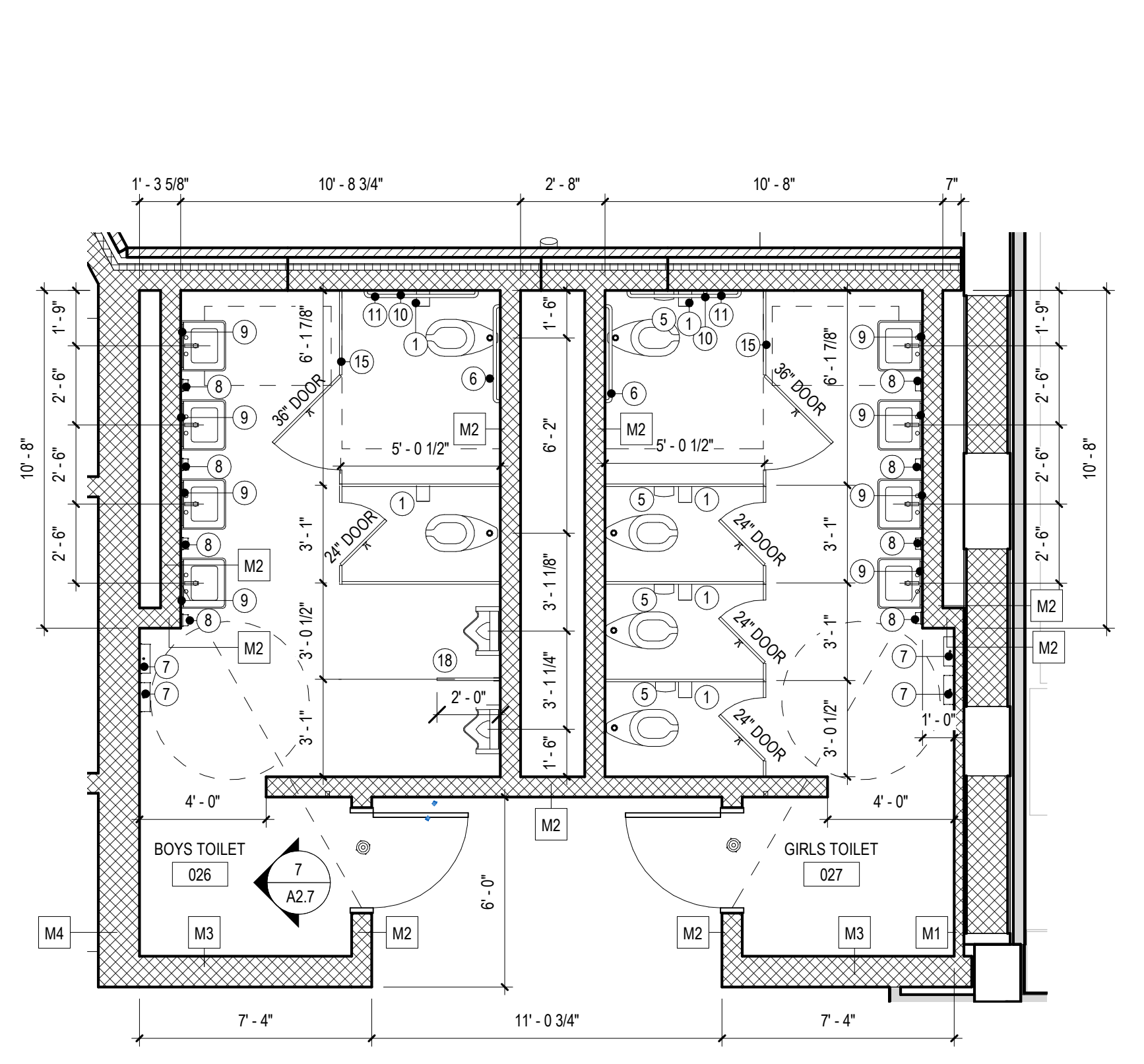
10 LARGE SCALE TOILET PLAN
 A4.2 1/4" = 1'-0"



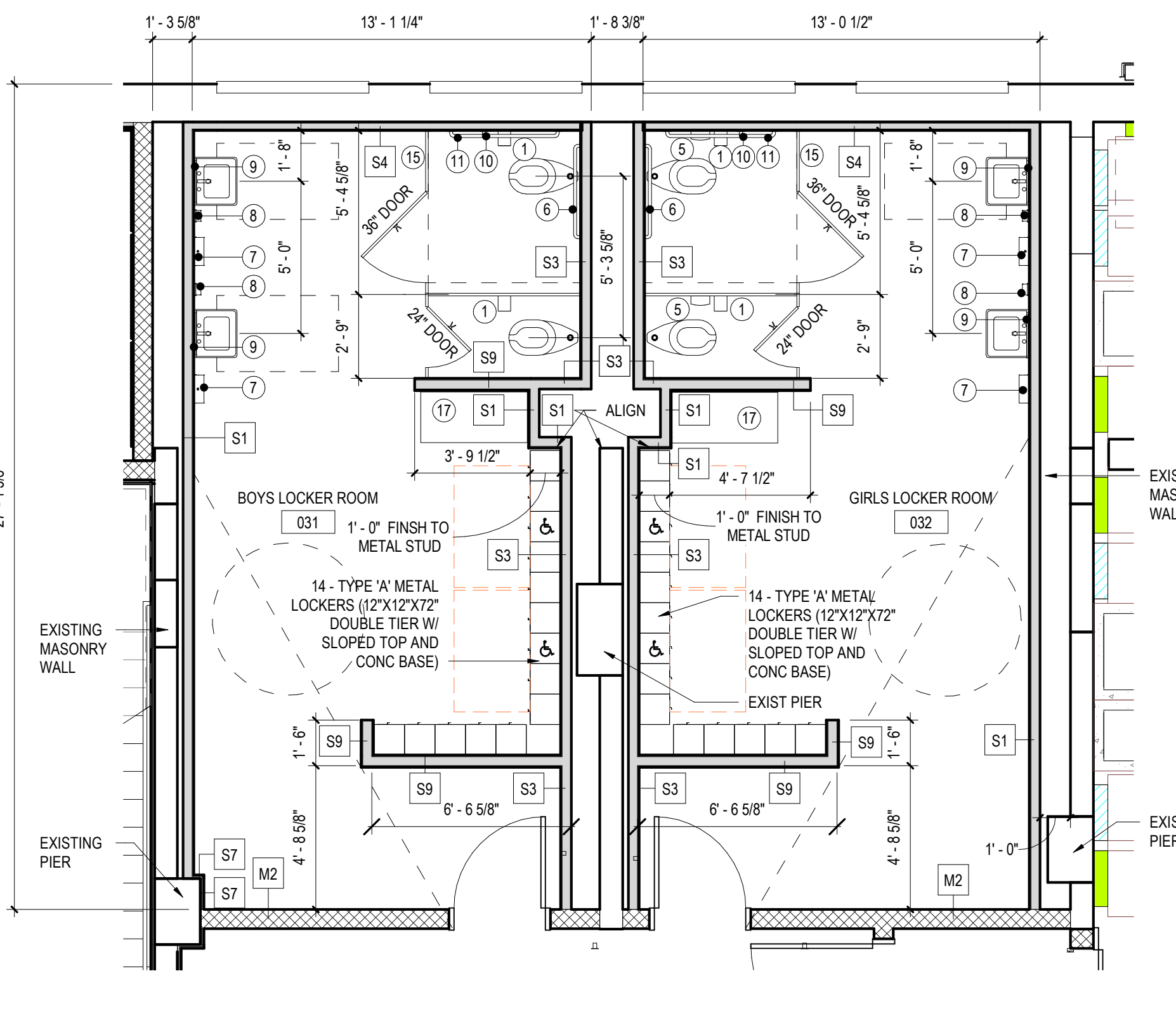
11 LARGE SCALE TOILET PLAN
 A4.2 1/4" = 1'-0"



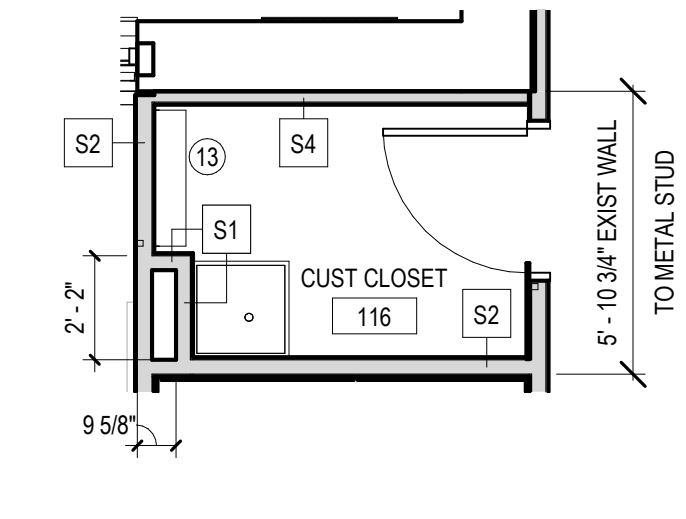
12 LARGE SCALE TOILET PLAN
 A4.2 1/4" = 1'-0"



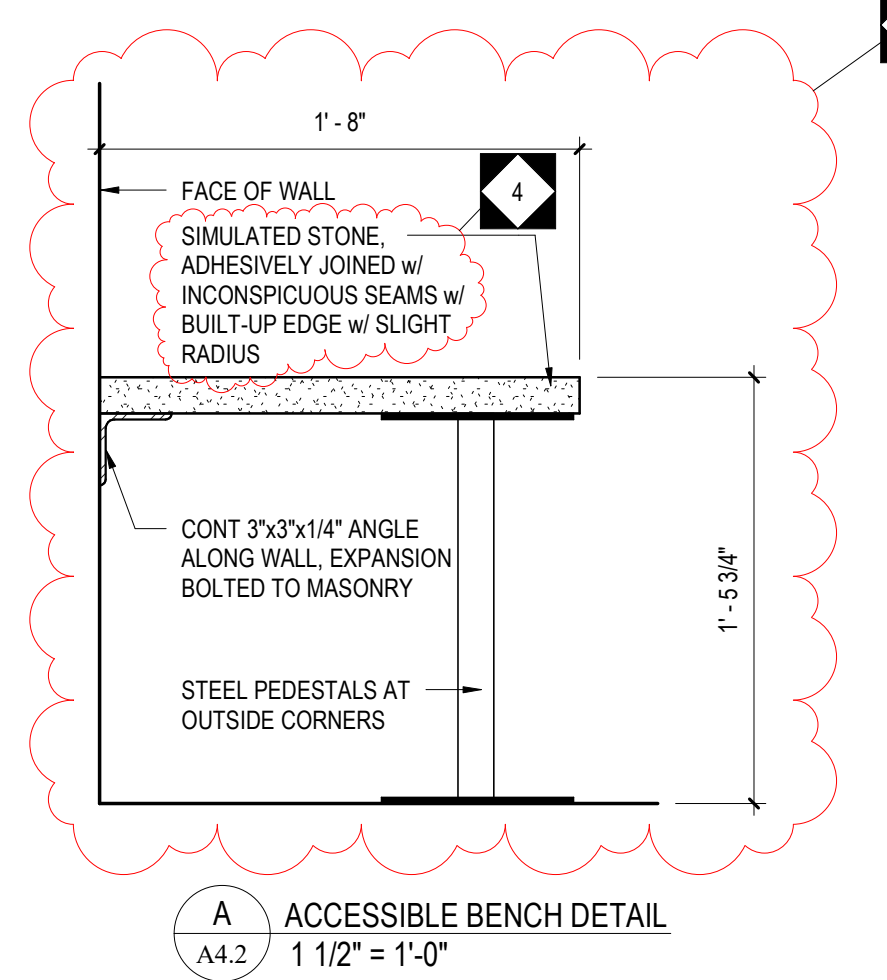
13 LARGE SCALE TOILET PLAN
 A4.2 1/4" = 1'-0"



14 LARGE SCALE TOILET PLAN
 A4.2 1/4" = 1'-0"



15 LARGE SCALE CUSTODIAL CLOSET PLAN
 A4.2 1/4" = 1'-0"



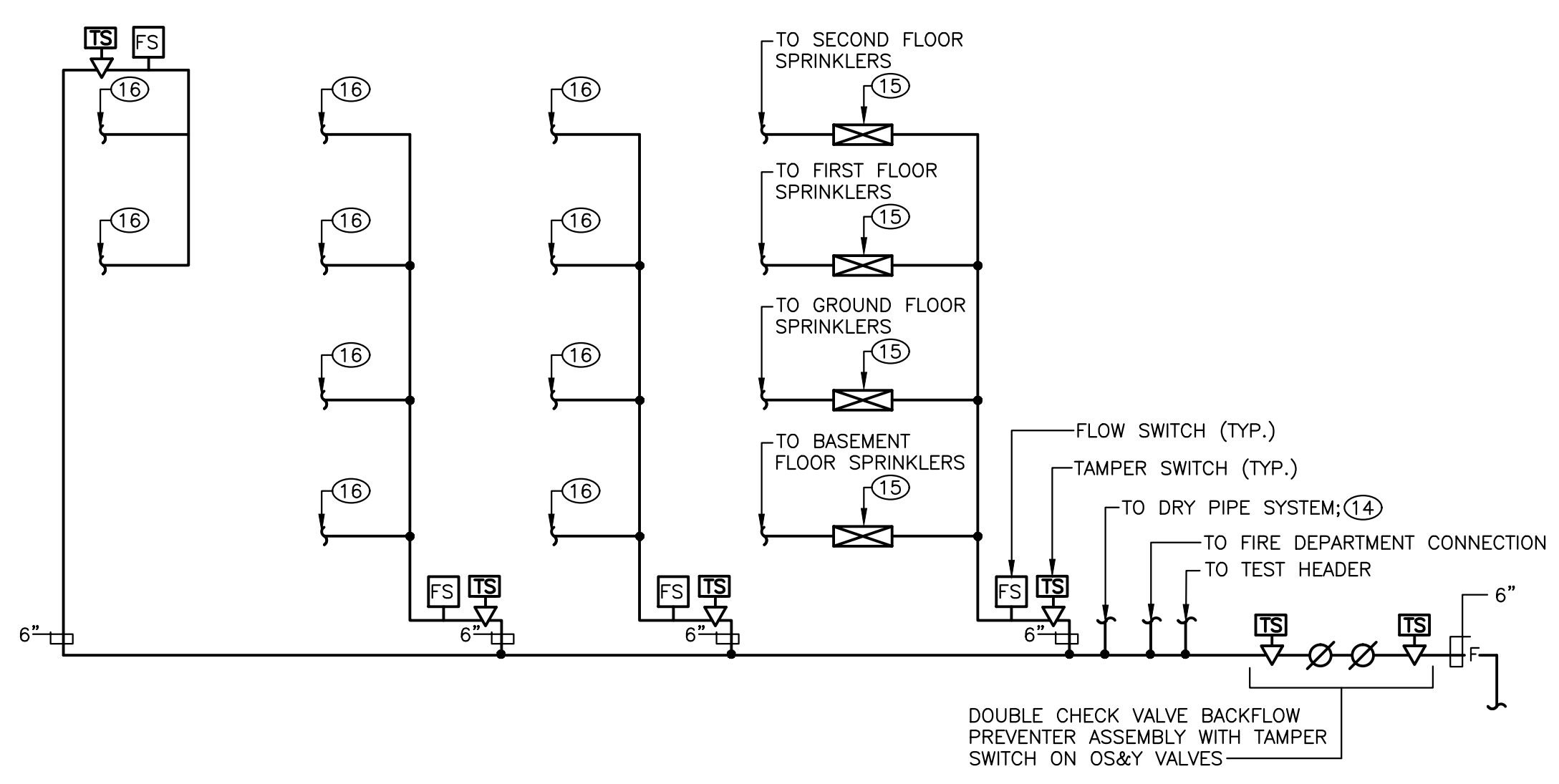
A ACCESSIBLE BENCH DETAIL
 A4.2 1 1/2" = 1'-0"

- GENERAL NOTES:**
- ACCESSIBLE FIXTURES ARE INDICATED WITH THE REQUIRED CLEAR FLOOR SPACE CLEARANCES FOR ALL ACCESSIBLE ROUTES & MANEUVERING CLEARANCES.
 - PLUMBING FIXTURE ROUGH-IN DIMENSIONS & TOILET PARTITION LAYOUT DIMENSIONS ARE FROM THE WALL FINISH MATERIAL.
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 - CONTRACTOR TO CONFIRM WITH THE OWNER'S REPRESENTATIVE THE LOCATION OF ALL SURFACE-MOUNTED TOILET ROOM ACCESSORIES PRIOR TO INSTALLATION.
 - URINAL PARTITIONS SHALL BEGIN AT A HEIGHT NO MORE THAN 12" FROM AND EXTEND NOT LESS THAN 60" ABOVE THE FINISHED FLOOR SURFACE. URINAL PARTITIONS SHALL EXTEND FROM THE WALL SURFACE AT EACH SIDE OF THE URINAL A MINIMUM OF 18".
 - ACCESSIBLE LOCKERS ARE INDICATED AS "A" AT DOUBLE TIER LOCKERS. ONLY THE BOTTOM TIER IS REQUIRED TO BE ACCESSIBLE. FOR FOUR TIER LOCKERS, ONLY THE BOTTOM TWO TIERS ARE REQUIRED TO BE ACCESSIBLE.
 - REFER TO INTERIOR DRAWINGS FOR AN ADDITIONAL TOILET ACCESSORY SCHEDULE.

No.	DESCRIPTION	MOUNTING	MANUFACTURER	MODEL
1	SURFACE MOUNTED MULTI-ROLL TOILET TISSUE DISPENSER	TISSUE ACCESS @ 18" MIN AFF	BOBRICK	B-4386
2	GRAB BAR FOR 36" x 36" SHOWER STALL	36" AFF TO TOP OF GRIPPING SURFACE	BOBRICK	B-6981
3	HAND HELD SHOWER W/ 59" MIN. FLEX HOSE	AS SPECIFIED	-	-
4	FOLDING SHOWER SEAT W/ PADDED CUSHION	18" AFF TO TOP	BOBRICK	B-517, B-518
5	SURFACE MOUNTED SANITARY NAPKIN DISPOSAL	15" MIN AFF	BOBRICK	B-270
6	36" GRAB BAR (HORIZONTAL)	33" MIN. 36" MAX AFF TO TOP OF GRIPPING SURFACE	BOBRICK	B-5806 x 36
7	SURFACE MOUNTED PAPER TOWEL DISPENSER	48" MAX TO OUTLET OF DISPENSER	BOBRICK	B-2960
8	SURFACE MOUNTED SOAP DISPENSER	PUSH BUTTON @ 44" MAX AFF	BOBRICK	B-2111
9	MIRROR 18" x 30" W/ SS FRAME	40" AFF TO BOTTOM EDGE OF REFLECTING SURFACE	BOBRICK	B-165 (1830)
10	18" GRAB BAR (VERTICAL)	39" MIN. 41" MAX AFF TO BOTTOM OF GRAB BAR	BOBRICK	B-5806 x 18
11	42" GRAB BAR (HORIZONTAL)	33" MIN. 36" MAX AFF TO TOP OF GRIPPING SURFACE	BOBRICK	B-5806 x 42
12	SS SHOWER ROD, VINYL SHOWER CURTAIN & SS SHOWER CURTAIN HOOKS	COORDINATE WITH SHOWER UNIT	-	-
13	UTILITY SHELF W/ MOP & BROOM HOLDER & RAG HOOKS	72" AFF TO TOP SHELF	BOBRICK	B-229 x 34
14	SOAP DISH (HEAVY DUTY)	40" AFF TO DISH	BRADLEY CORP	9014
15	TOILET PARTITION W/ COAT HOOK & BUMPER	AS SPECIFIED	AS SPECIFIED	-
16	BABY CHANGING STATION	34" AFF TO CHANGING SURFACE, (DOWN POSITION)	BOBRICK	KB-200
17	ACCESSIBLE BENCH	AS SPECIFIED	AS SPECIFIED	-
18	URINAL SCREEN	AS SPECIFIED	AS SPECIFIED	-
19	SURFACE MOUNTED SS COAT HOOK	SEE GENERAL NOTES	AS SPECIFIED	-
20	SURFACE MOUNTED SS TOWEL PIN	48" AFF TO TOP OF TOWEL PIN	BOBRICK	B-6777

DOOR SCHEDULE - BASEMENT FLOOR														
OPENING NUMBER	DOOR & FRAME UL RATING	DOOR						FRAME				HARDWARE SET	REMARKS	
		DOOR TYPE	DOOR MATERIAL	GLAZING TYPE	DIMENSIONS			FRAME TYPE	FRAME MATERIAL	DETAILS				
					LEAF 1	LEAF 2	HEIGHT			THICKNESS	HEAD			JAMB
00CB	--	FG2	ALUM	IG	3'-11 1/2"		7'-2"	2 1/4"	W17	ALUM	--	--	91	CARD READER, NEW DOOR IN EXISTING OPENING, VIF, ALUMINUM CLAD SOLID WOOD DOOR
00CC-A	--	N	HM	TG	3'-0"	3'-0"	7'-2"	1 3/4"	H1	HM	8/A6.6	9/A6.6	87	CARD READER
00CC-B	--	N	HM	TG	3'-0"	3'-0"	7'-2"	1 3/4"	H1	HM	8/A6.6	9/A6.6	87	CARD READER
00CD	--	F	HM	--	3'-0"	3'-0"	7'-2"	1 3/4"	H1	HM	21/A6.6	22/A6.6	39	NEW DOOR IN EXISTING OPENING, VIF
00SA-A	90 MIN	N	HM	TG	3'-0"		7'-2"	1 3/4"	H1	HM	8/A6.6	9/A6.6	34	CARD READER
00SA-B	--	FG2	ALUM	IG	3'-0"	3'-0"	7'-2"	2 1/4"	W1	ALUM	--	--	95	NEW DOOR IN EXISTING OPENING, VIF, ALUMINUM CLAD SOLID WOOD DOOR
00SB-A	90 MIN	N	HM	TG	3'-0"	3'-0"	7'-2"	1 3/4"	H1	HM	19/A6.6	20/A6.6	38	CARD READER
00SB-B	--	FG2	ALUM	IG	3'-0"	3'-0"	7'-2"	2 1/4"	W2	ALUM	--	--	96	CARD READER, NEW DOOR IN EXISTING OPENING, VIF, ALUMINUM CLAD SOLID WOOD DOOR
00SC-A	90 MIN	N	HM	TG	3'-0"	3'-0"	7'-2"	1 3/4"	H1	HM	14/A6.7	12/A6.6	38	
00SC-B	90 MIN	N	HM	TG	3'-0"	3'-0"	7'-2"	1 3/4"	H1	HM	14/A6.7	12/A6.6	38	
001-A	--	FG2	WD	TG	3'-0"	3'-0"	7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	36M	
001-B	--	FG2	HM	TG	3'-0"	3'-0"	7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	36M	
001A	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	52	
001B	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	50	
002	--	F	HM	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	50	
003	--	F	HM	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	54	
004	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	44	
005	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	62	
006	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	62	
007	--	F	HM	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	50	
008	--	F	HM	TG	4'-0"		7'-2"	1 3/4"	H1	HM	15/A6.7	16/A6.7	50	
009-A	--	D	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	50	
009-B	--	O	SS	--	3'-0"		4'-0"		SS	16/A6.6	17/A6.6	--		
0010	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	42	
0011	45 MIN	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	52	
0012	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	51	
0013	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	52	
0014	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	52	
0015-A	--	F	HM	--	3'-0"		7'-2"	1 3/4"	H1	HM	8/A6.6	9/A6.6	72	
0015-B	--	F	HM	--	3'-0"		7'-2"	1 3/4"	H1	HM	8/A6.6	9/A6.6	72	CARD READER
0017	--	F	HM	--	3'-6"	3'-6"	7'-2"	1 3/4"	H15	HM	11/A6.7	12/A6.7	95	CARD READER
0018	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	70	
0018A	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	50	

DOOR SCHEDULE - GROUND FLOOR														
OPENING NUMBER	DOOR & FRAME UL RATING	DOOR						FRAME				HARDWARE SET	REMARKS	
		DOOR TYPE	DOOR MATERIAL	GLAZING TYPE	DIMENSIONS			FRAME TYPE	FRAME MATERIAL	DETAILS				
					LEAF 1	LEAF 2	HEIGHT			THICKNESS	HEAD			JAMB
0CA	--	F	HM	--	4'-0"	4'-0"	7'-2"	1 3/4"	H1	HM	4/A6.6	5/A6.6	39	
0CB-A	--	FG2	ALUM	IG	3'-0"	3'-0"	7'-2"	2 3/8"	W3	ALUM	--	--	99	CARD READER
0CB-B	--	FG2	ALUM	IG	3'-0"	3'-0"	7'-2"	1 3/4"	W7	ALUM	--	--	94	CARD READER
0CC-A	45 MIN	N	HM	TG	3'-0"		7'-2"	1 3/4"	H1	HM	7/A6.7	8/A6.7	34	
0CC-B	--	FG2	ALUM	IG	2'-10"	2'-10"	7'-2"	2 1/4"	W16	ALUM	--	--	95	NEW DOOR IN EXISTING OPENING, VIF, ALUMINUM CLAD SOLID WOOD DOOR
0CD	--	F	HM	TG	3'-0"	3'-0"	7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	39	
0CE	--	N	HM	TG	4'-0"		7'-2"	1 3/4"	H1	HM	8/A6.6	9/A6.6	34	
0CG	--	F	HM	--	3'-6"	3'-6"	7'-2"	1 3/4"	H1	HM	4/A6.6	5/A6.6	39	
0CH	--	F	HM	--	2'-10"	2'-10"	7'-2"	1 3/4"	H1	HM	21/A6.6 SIM	22/A6.6 SIM	39	NEW DOOR IN EXISTING OPENING, VIF
0SA	90 MIN	N	HM	TG	3'-0"	3'-0"	7'-2"	1 3/4"	H1	HM	19/A6.6	20/A6.6	38	
0SB	90 MIN	N	HM	TG	3'-0"	3'-0"	7'-2"	1 3/4"	H1	HM	19/A6.6	20/A6.6	38	
0SC-A	90 MIN	N	HM	TG	3'-0"	3'-0"	7'-2"	1 3/4"	H1	HM	14/A6.7	12/A6.6	38	
0SC-B	90 MIN	N	HM	TG	3'-0"	3'-0"	7'-2"	1 3/4"	H1	HM	14/A6.7	12/A6.6	38	
0VA-A	--	FG2	HM	TG	3'-0"	3'-0"	7'-0"	1 3/4"	H1	HM	1/A6.6	2/A6.6	88	
0VA-B	--	FG2	ALUM	IG	2'-10"	2'-10"	7'-2"	2 1/4"	W6	ALUM	--	--	99	CARD READER, NEW DOOR IN EXISTING OPENING, VIF, ALUMINUM CLAD SOLID WOOD DOOR
0VB-A	--	FG2	ALUM	TG	3'-0"	3'-0"	7'-2"	1 3/4"	W9	ALUM	--	--	88	
0VB-B	--	FG2	ALUM	IG	3'-0"	3'-0"	7'-2"	2 3/8"	W5	ALUM	--	--	99	CARD READER
0VC-A	--	N	HM	TG	4'-0"	4'-0"	7'-2"	1 3/4"	H1	HM	8/A6.6	9/A6.6	35M	
0VC-B	--	N	HM	IG	4'-0"	4'-0"	7'-2"	1 3/4"	H1	HM	14/A6.6	15/A6.6	96	CARD READER, INSULATED DOOR
01	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	51	
02	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	51	
03	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	52	
04	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	52	
05	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	42	
06	--	F	HM	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	50	
07	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	55	
08	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	55	
09	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	51	
010	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	52	
011	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	55	
012	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	55	
012A	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	41	
013	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	55	
013A	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	41	
014	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	55	
014A	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	41	
015	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	55	
015A	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	41	
016	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	62	
017	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	62	
017A	--	F	HM	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	54	
018	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	55	
019	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	55	
020	--	F	HM	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	70	CARD READER
021	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	44	
022	--	F	HM	--	3'-0"		7'-2"	1 3/4"	H1	HM	1/A6.6	2/A6.6	54	
023-A	90 MIN	N	WD	TG	3'-6"	3'-6"	7'-2"	1 3/4"	H1	HM	11/A6.6	12/A6.6	36	
023-B	90 MIN	N	WD	TG	3'-6"	3'-6"	7'-2"	1 3/4"	H1	HM	11/A6.6	12/A6.6	36	
023A	--	F	HM	--	3'-0"		7'-2"	1 3/4"	H1	HM	11/A6.6	12/A6.6	50	
024	--	N	HM	TG	3'-6"		7'-2"	1 3/4"	H1	HM	14/A6.6	15/A6.6	90	CARD READER, INSULATED DOOR
024A-A	--	N	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	11/A6.6	12/A6.6	31	
024A-B	--	O	SS	--	8'-0"	8'-0"			O	SS	18/A6.7	19/A6.7	--	
024A-C	--	O	SS	--	8'-0"	8'-0"			O	SS	18/A6.7	19/A6.7	--	
024B	--	F	WD	--	3'-0"		7'-2"	1 3/4"	H1	HM	8/A6.6	9/A6.6	44	
024C	--	G	WD	TG	3'-0"		7'-2"	1 3/4"	H1	HM	8/A6.6	9/A6.6	60	
024E	--	F	HM	--	3'-0"		7'-2"	1 3/4"	H1	HM	8/A6.6	9/A6.6	50	
024F	--	F	HM	--	3'-0"		7'-2"	1 3/4"	H1	HM	8/A6.6	9/A6.6	54	
024G	--	G	WD	TG	3'-0"		7'-2"	1 3/4"	H13	HM	--	--	51	
024H	--	F	HM	--	3'-6"									

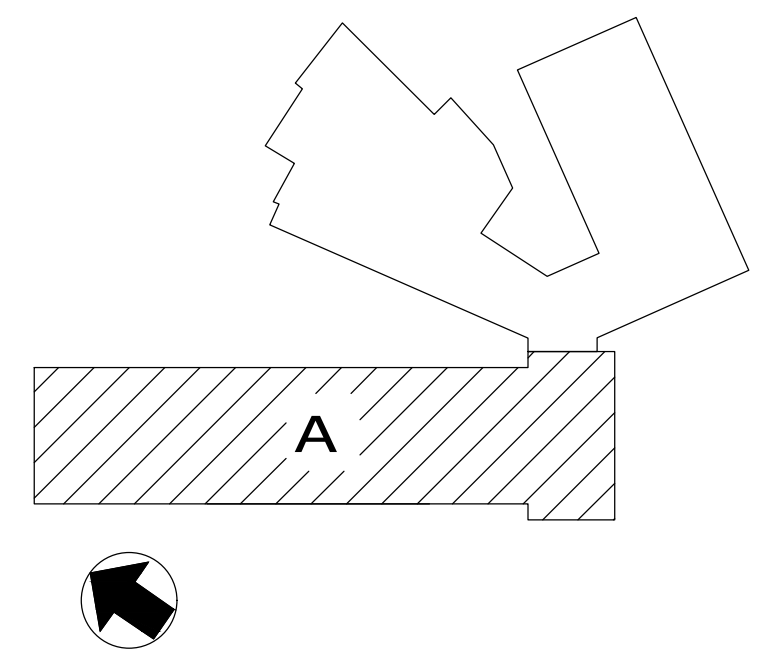


FIRE PROTECTION SCHEMATIC
NOT TO SCALE

DRAWING NOTES (APPLY TO DRAWINGS FP1.1):

1. 6" STANDPIPE RISER UP AND DN.
2. 6" STANDPIPE AND DRAIN RISER DN. DRAIN RISER TERMINATION ALONG EXTERIOR WALL.
3. 6" COMBINATION SPRINKLER/STANDPIPE RISER UP.
4. FOR VALVING SEE DETAIL-COMBINATION SPRINKLER/STANDPIPE ON DRAWING FP5.1.
5. PIPING TO SPRINKLERS.
6. DOUBLE CHECK VALVE BACKFLOW ASSEMBLY.
7. TO BACKFLOW PREVENTER TEST HEADER. PROVIDE SUPERVISED OS&Y VALVE (NORMALLY CLOSED) FOR BACKFLOW PREVENTER TESTING.
8. TO FIRE DEPARTMENT CONNECTION.
9. DRY PIPE RISER SYSTEM PIPING AND VALVING.
10. AIR COMPRESSOR FOR DRY PIPE SYSTEM.
11. EX. 6" INCOMING FIRE LINE TO REMAIN.
12. 6" STANDPIPE PIPING UP.
13. DRY PIPE SYSTEM PIPING UP.
14. SEE DETAIL-DRY SYSTEM VALVE ON DRAWING FP5.1.
15. SEE DETAIL-COMBINATION SPRINKLER/STANDPIPE ON DRAWING FP5.1.
16. SEE DETAIL-FIRE HOSE VALVE ON DRAWING FP5.1.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
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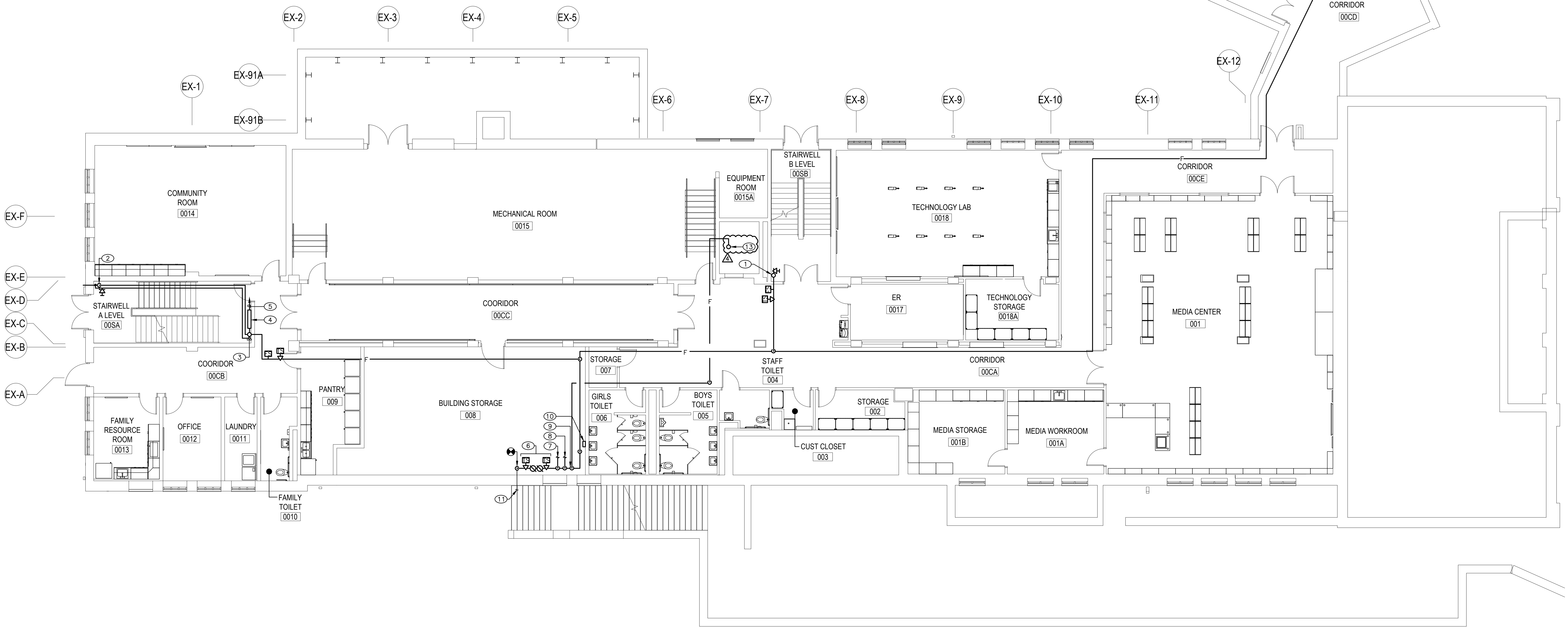
USING AGENCY APPROVAL

Name: _____ Date: _____
 Title: _____
 Project Manager: _____ Date: _____
 Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
	1/8/21	ADDENDUM NUMBER 4
	12/23/20	ADDENDUM NUMBER 3
	12/16/20	ADDENDUM NUMBER 2
	10/16/20	PROGRESS SET
	9/11/20	50% CD SUBMISSION
	7/10/20	100% DD SUBMISSION

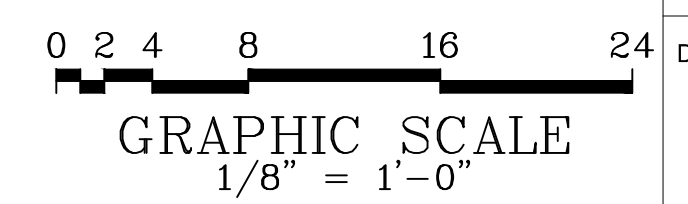
AS-BUILT REVISIONS

SUBMITTED BY: _____
 CAD DWG FILE: SAA
 DRAWN BY: SAA
 CHECKED BY: SAA
 PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020
BASEMENT FLOOR PLAN UNIT 'A'- NEW WORK-FIRE PROTECTION
 SCALE: AS NOTED
 DRAWING NO. _____



BASEMENT FLOOR PLAN UNIT 'A'-NEW WORK-FIRE PROTECTION

SCALE: 1/8" = 1'-0"
 NOTES:
 1. PIPING MAINS SHOWN FOR PROPOSED GENERAL ROUTING AND SHOULD BE COORDINATED WITH ALL TRADES AND EX. CONDITIONS.

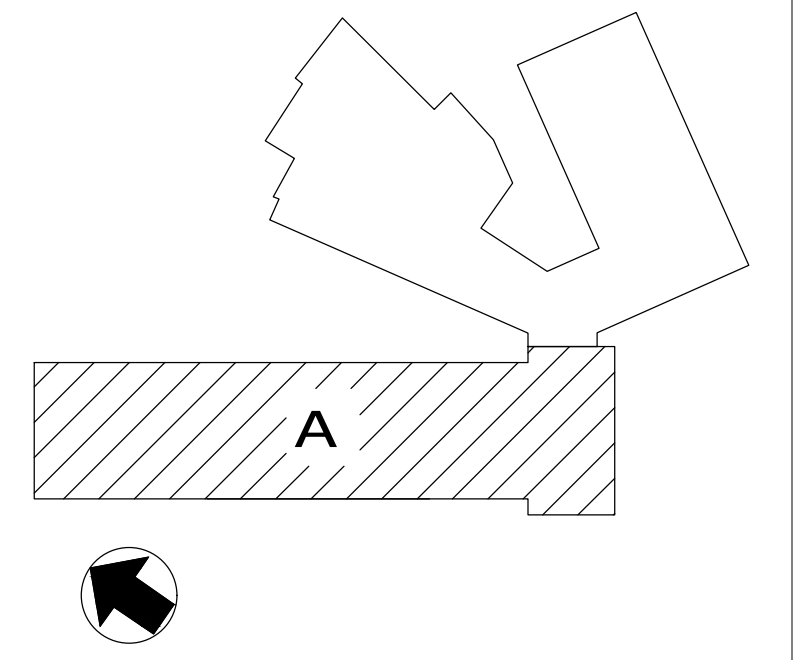


FP1.1

DRAWING NOTES (APPLY TO DRAWINGS FP1.2):

- ① 6" STANDPIPE RISER UP.
- ② 6" STANDPIPE RISER DN.
- ③ 6" COMBINATION SPRINKLER/STANDPIPE RISER UP AND DN.
- ④ FOR VALVING SEE DETAIL-COMBINATION SPRINKLER/STANDPIPE ON DRAWING FP5.1.
- ⑤ PIPING TO SPRINKLERS.
- ⑥ DRY PIPE SYSTEM PIPING UP AND DN.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204

Squared Plus Engineering Support Group, LLC
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 2020 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____
 Title: _____
 Project Manager: _____ Date: _____
 Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
	1/8/21	ADDENDUM NUMBER 4
	12/23/20	ADDENDUM NUMBER 3
	12/16/20	ADDENDUM NUMBER 2
	10/16/20	PROGRESS SET
	9/11/20	50% CD SUBMISSION
	7/10/20	100% DD SUBMISSION

AS-BUILT REVISIONS

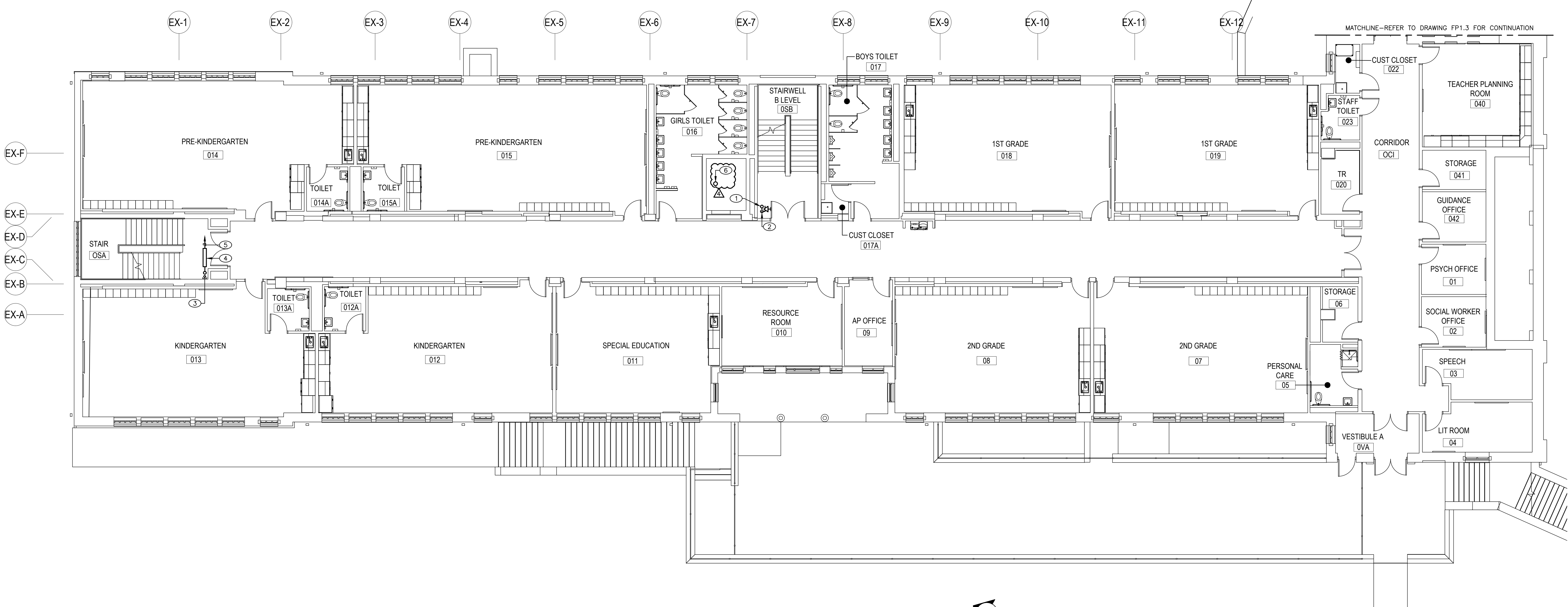
SUBMITTED BY: _____
 CAD DWG FILE: SAA
 DRAWN BY: SAA
 CHECKED BY: SAA

PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

**GROUND FLOOR PLAN UNIT 'A'-
 NEW WORK-FIRE PROTECTION**

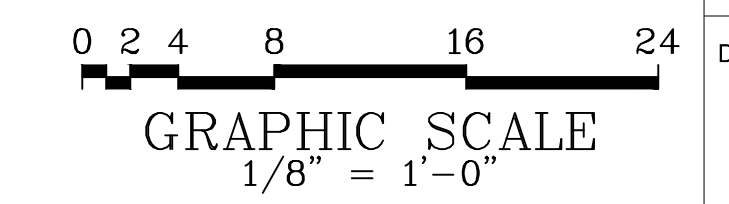
SCALE: AS NOTED
 DRAWING NO. _____

FP1.2



**GROUND FLOOR PLAN UNIT 'A'-NEW WORK-
 FIRE PROTECTION**

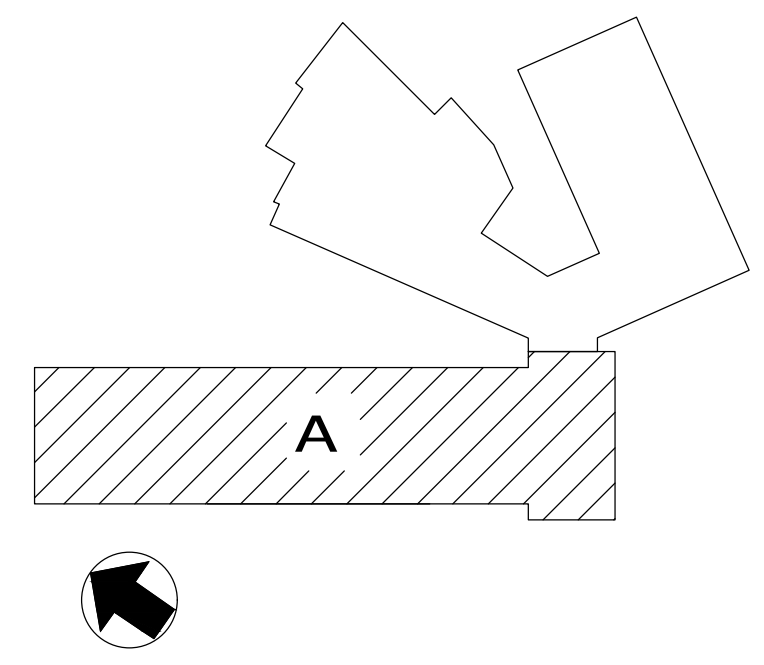
SCALE: 1/8"=1'-0"
 NOTES:
 1. PIPING MAINS SHOWN FOR PROPOSED GENERAL ROUTING AND SHOULD BE COORDINATED WITH ALL TRADES AND EX. CONDITIONS.



DRAWING NOTES (APPLY TO DRAWINGS FP1.4):

- ① 6" STANDPIPE UP AND DN.
- ② 6" COMBINATION SPRINKLER/STANDPIPE RISER UP AND DN.
- ③ FOR VALVING SEE DETAIL-COMBINATION SPRINKLER/STANDPIPE ON DRAWING FPS.1.
- ④ PIPING TO SPRINKLERS.
- ⑤ FIRE DEPARTMENT CONNECTION(S), TEST HEADER(S) AND DRAIN LINE(S).
- ⑥ DRY PIPE SYSTEM PIPING UP AND DN.
- ⑦ FOR CONTINUATION SEE FIRE PROTECTION SCHEMATIC ON DRAWING FP1.1.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
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 2020 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

Name:	Date:
Title:	MSA APPROVAL
Project Manager:	Date:
Chief of PM&D:	Date:

MARK	DATE	DESCRIPTION
	1/8/21	ADDENDUM NUMBER 4
	12/23/20	ADDENDUM NUMBER 3
	12/16/20	ADDENDUM NUMBER 2
	10/16/20	PROGRESS SET
	9/11/20	50% CD SUBMISSION
	7/10/20	100% DD SUBMISSION

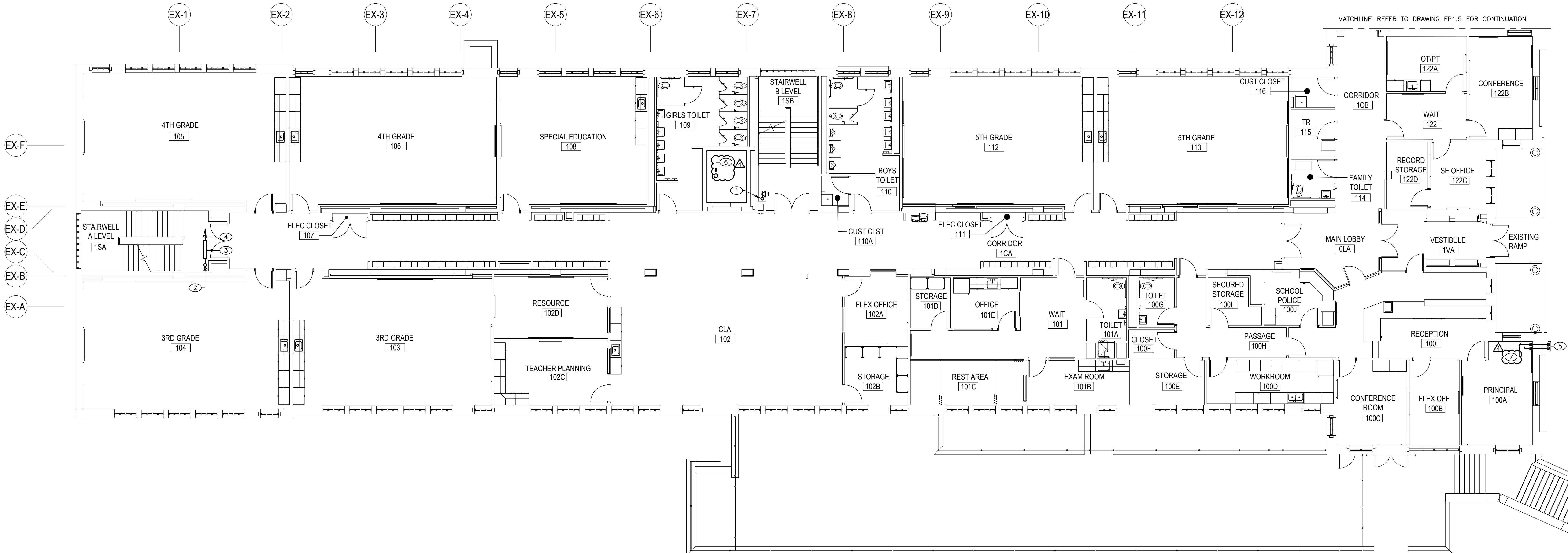
AS-BUILT REVISIONS

SUBMITTED BY:
CAD DWG FILE: SAA
DRAWN BY: SAA
CHECKED BY: SAA

PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

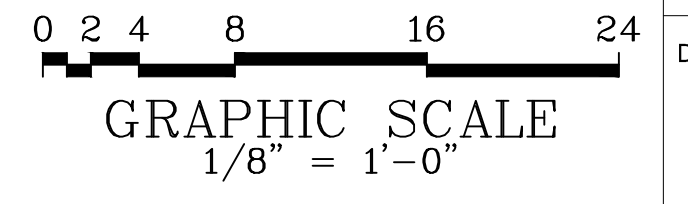
**FIRST FLOOR PLAN UNIT 'A'-
 NEW WORK-FIRE PROTECTION**

SCALE: AS NOTED
 DRAWING NO. **FP1.4**



**FIRST FLOOR PLAN UNIT 'A'-NEW WORK-
 FIRE PROTECTION**

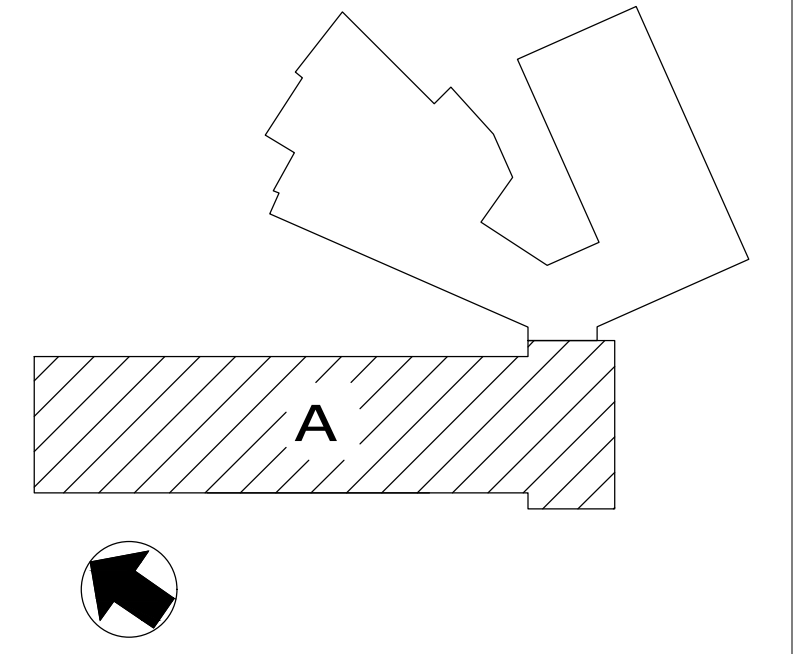
SCALE: 1/8"=1'-0"
 NOTES:
 1. PIPING MAINS SHOWN FOR PROPOSED GENERAL ROUTING AND SHOULD BE COORDINATED WITH ALL TRADES AND EX. CONDITIONS.



DRAWING NOTES (APPLY TO DRAWINGS FP1.6):

- ① 6" STANDPIPE DN.
- ② 6" COMBINATION SPRINKLER/STANDPIPE RISER DN.
- ③ FOR VALVING SEE DETAIL-COMBINATION SPRINKLER/STANDPIPE ON DRAWING FP5.1.
- ④ PIPING TO SPRINKLERS.
- ⑤ DRY PIPE SYSTEM PIPING UP AND DN.
- ⑥ DRY PIPE SYSTEM PIPING UP.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204

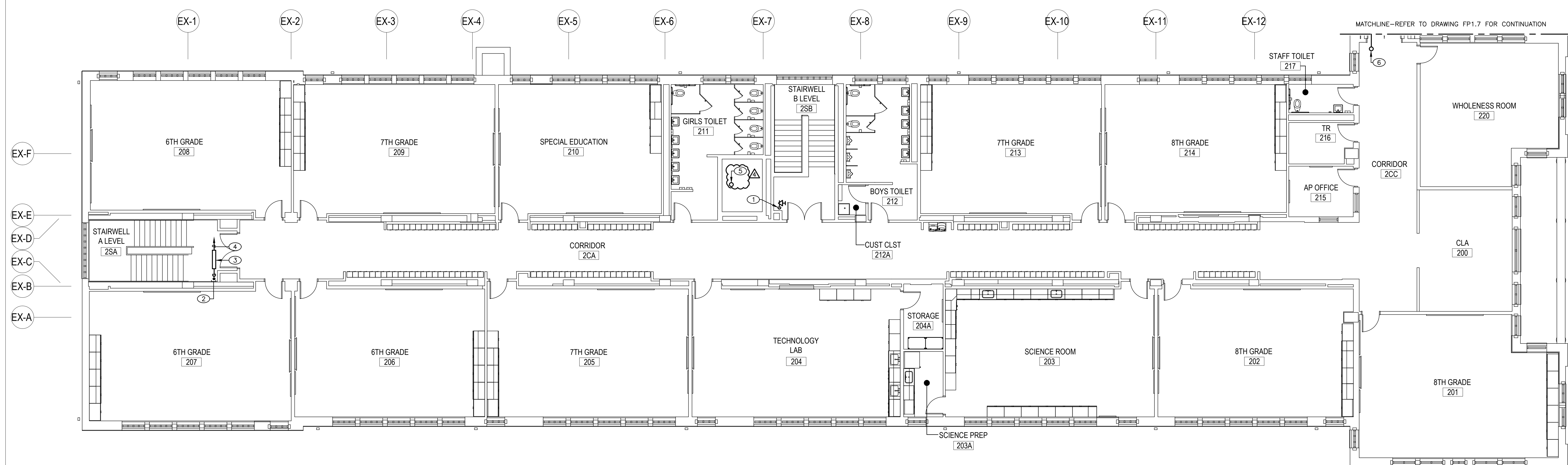


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 2020 EAST 32ND STREET, BALTIMORE,
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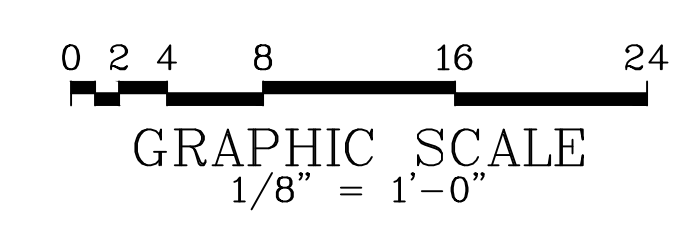
USING AGENCY APPROVAL

Name:	Date:	
Title:	MSA APPROVAL	
Project Manager:	Date:	
Chief of PM&D:	Date:	
MARK:	DATE:	DESCRIPTION:
	1/8/21	ADDENDUM NUMBER 4
	12/23/20	ADDENDUM NUMBER 3
	12/16/20	ADDENDUM NUMBER 2
	10/16/20	PROGRESS SET
	9/11/20	50% CD SUBMISSION
	7/10/20	100% DD SUBMISSION
		AS-BUILT REVISIONS
SUBMITTED BY:	CAD DWG FILE: SAA	
DRAWN BY:	SAA	
CHECKED BY:	SAA	
	PROJECT NO. BCS-02-004	
DATE:	NOVEMBER 16, 2020	
	SECOND FLOOR PLAN UNIT 'A'- NEW WORK-FIRE PROTECTION	
SCALE:	AS NOTED	
DRAWING NO.	FP1.6	



**SECOND FLOOR PLAN UNIT 'A'-NEW WORK-
 FIRE PROTECTION**

SCALE: 1/8"=1'-0"
 NOTES:
 1. PIPING MAINS SHOWN FOR PROPOSED GENERAL ROUTING AND SHOULD BE COORDINATED WITH ALL TRADES AND EX. CONDITIONS.

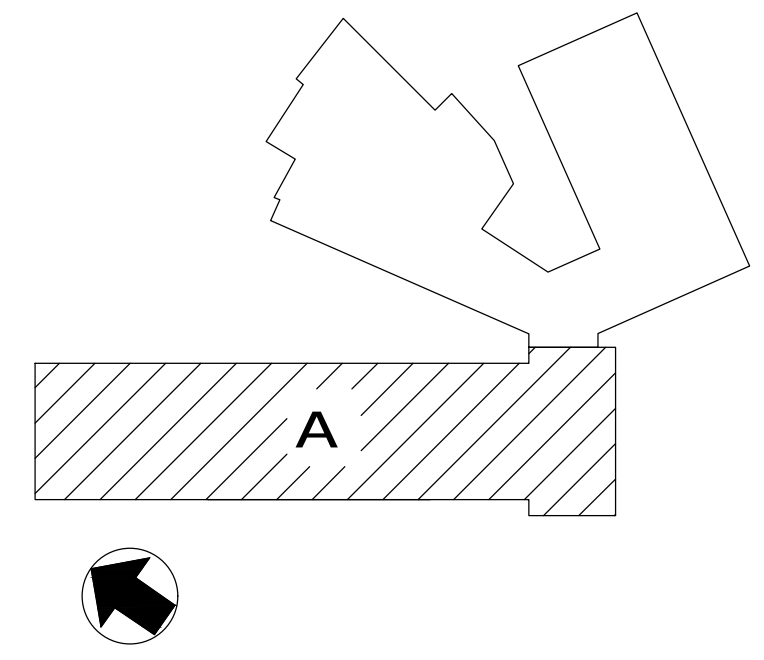


90% CONTRACT DOCUMENTS

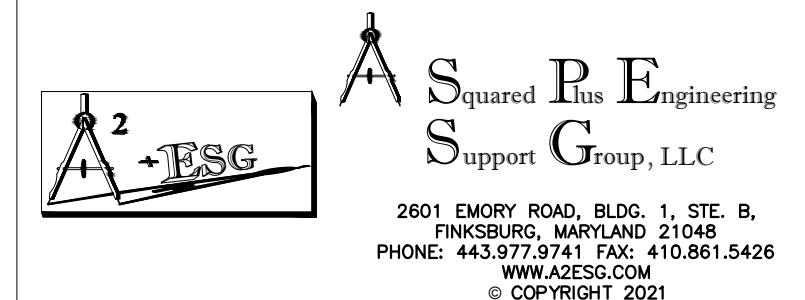
DRAWING NOTES (APPLY TO DRAWINGS P1.1):

- ① SAN UP.
- ② UP TO CO.
- ③ EX. 6" FOUNDATION DRAIN.
- ④ EX. 4" FOUNDATION DRAIN.
- ⑤ EX. 4" SW.
- ⑥ NEW DRAINS SHALL CONNECT TO EX. PIPING. CONFIRM EX. PIPE SIZES PRIOR TO INSTALLATION AND PURCHASING DRAINS.
- ⑦ SUDS ZONE. DO NOT CONNECT ANY FIXTURES WITHIN THIS AREA.

KEY PLAN



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PROPOSED NEW
**MONTEBELLO ELEMENTARY/
 MIDDLE SCHOOL**
 BALTIMORE CITY PUBLIC SCHOOLS
 2020 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____
 Title: _____
 Project Manager: _____ Date: _____
 Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
	1/8/21	ADDENDUM NUMBER 4
	12/23/20	ADDENDUM NUMBER 3
	12/16/20	ADDENDUM NUMBER 2
	10/16/20	PROGRESS SET
	9/11/20	50% CD SUBMISSION
	7/10/20	100% DD SUBMISSION

AS-BUILT REVISIONS

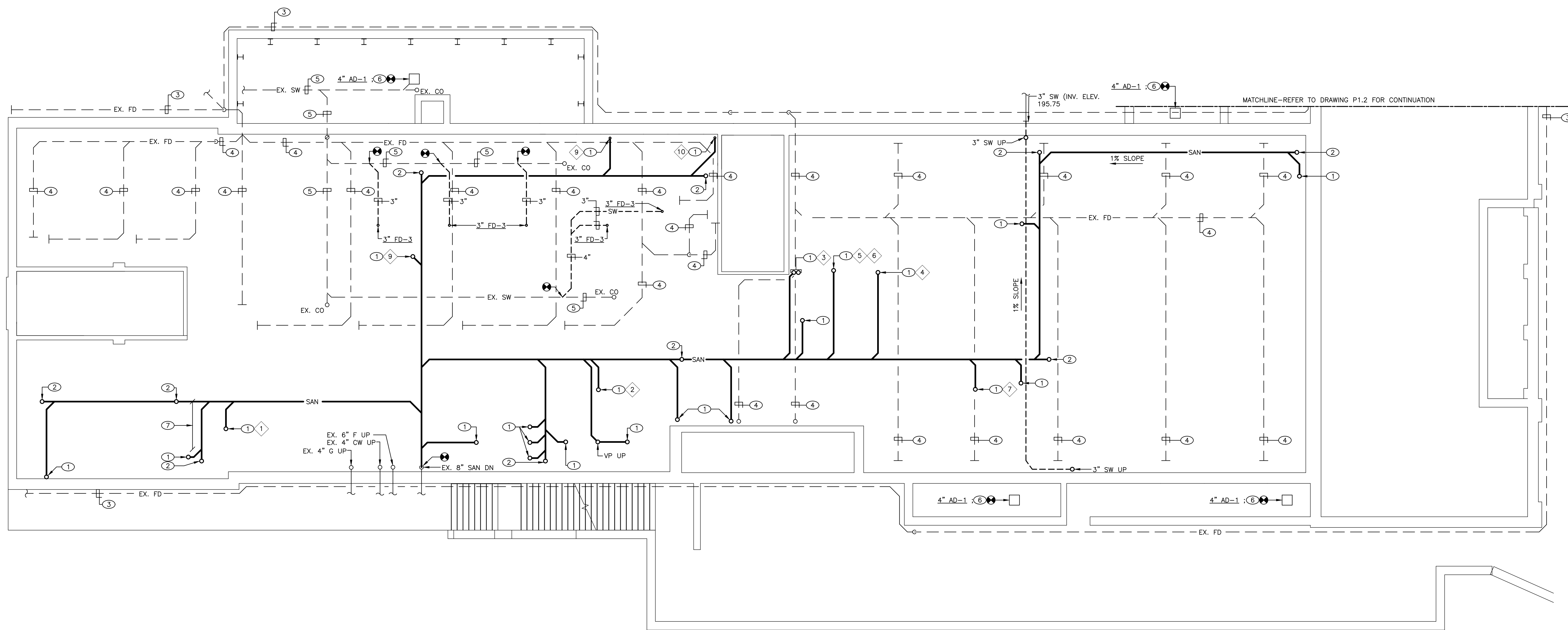
SUBMITTED BY: _____
 CAD DWG FILE: SAA
 DRAWN BY: SAA
 CHECKED BY: SAA

PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

FOUNDATION PLAN-
 NEW WORK-PLUMBING

SCALE: AS NOTED

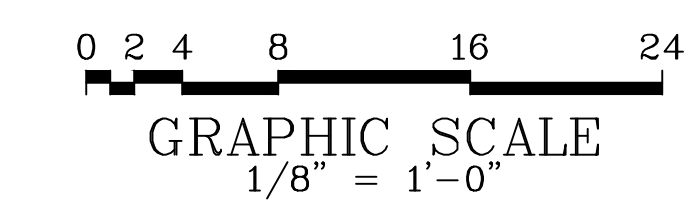
DRAWING NO. **P1.1**



FOUNDATION PLAN-NEW WORK-PLUMBING (NORTH)

SCALE: 1/8"=1'-0"

- 1. SEE SANITARY RISER DIAGRAM ON DRAWING P6.2, P6.3, P6.4, P6.5, AND P6.6 FOR PIPE SIZES.
- 2. COORDINATE PIPING ETC WITH EX CONDITIONS, OTHER DISCIPLINES AND NEW WORK.
- 3. SEE STORM WATER RISER DIAGRAM ON DRAWING P6.1 FOR PIPE SIZES.
- 4. SEE STORM WATER (OVERFLOW) RISER DIAGRAM ON DRAWING P6.1 FOR PIPE SIZES.

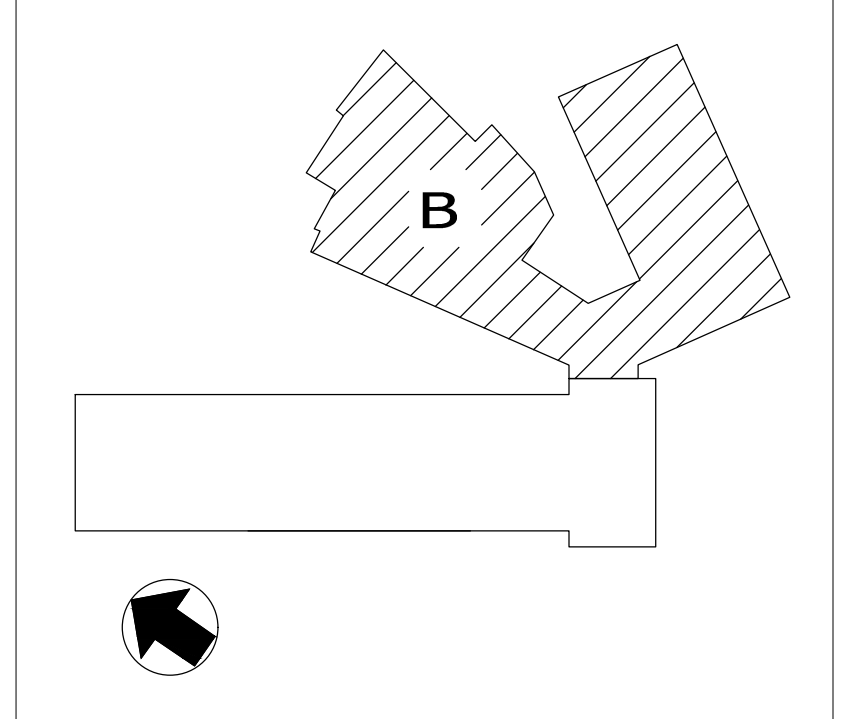


90% CONTRACT DOCUMENTS

DRAWING NOTES (APPLY TO DRAWINGS P1.2):

- ① EX. 6" FOUNDATION DRAIN TO REMAIN.
- ② FOR CONTINUATION SEE GROUND FLOOR PART PLAN-KITCHEN-NEW WORK-PLUMBING ON DRAWING P4.5.
- ③ EXTEND 5'-0" BEYOND BUILDING LINE. TRANSITION AND CONNECT TO PIPE PROVIDED UNDER ANOTHER DIVISION. COORDINATE LOCATION, SIZES, AND INVERTS PRIOR TO INSTALLATION.
- ④ FOR CONTINUATION SEE CIVIL DRAWINGS.
- ⑤ SEE DETAIL - ELEVATOR SUMP PIT ON DRAWING P5.1.
- ⑥ 4" SW UP.
- ⑦ UP TO 3" FD-3
- ⑧ SAN UP.
- ⑨ EX. 5" SAN.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204

Squared Plus Engineering Support Group, LLC
 2801 EMORY ROAD, BLDG. 1, STE. B,
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CAD DWG FILE: SAA

DRAWN BY: SAA

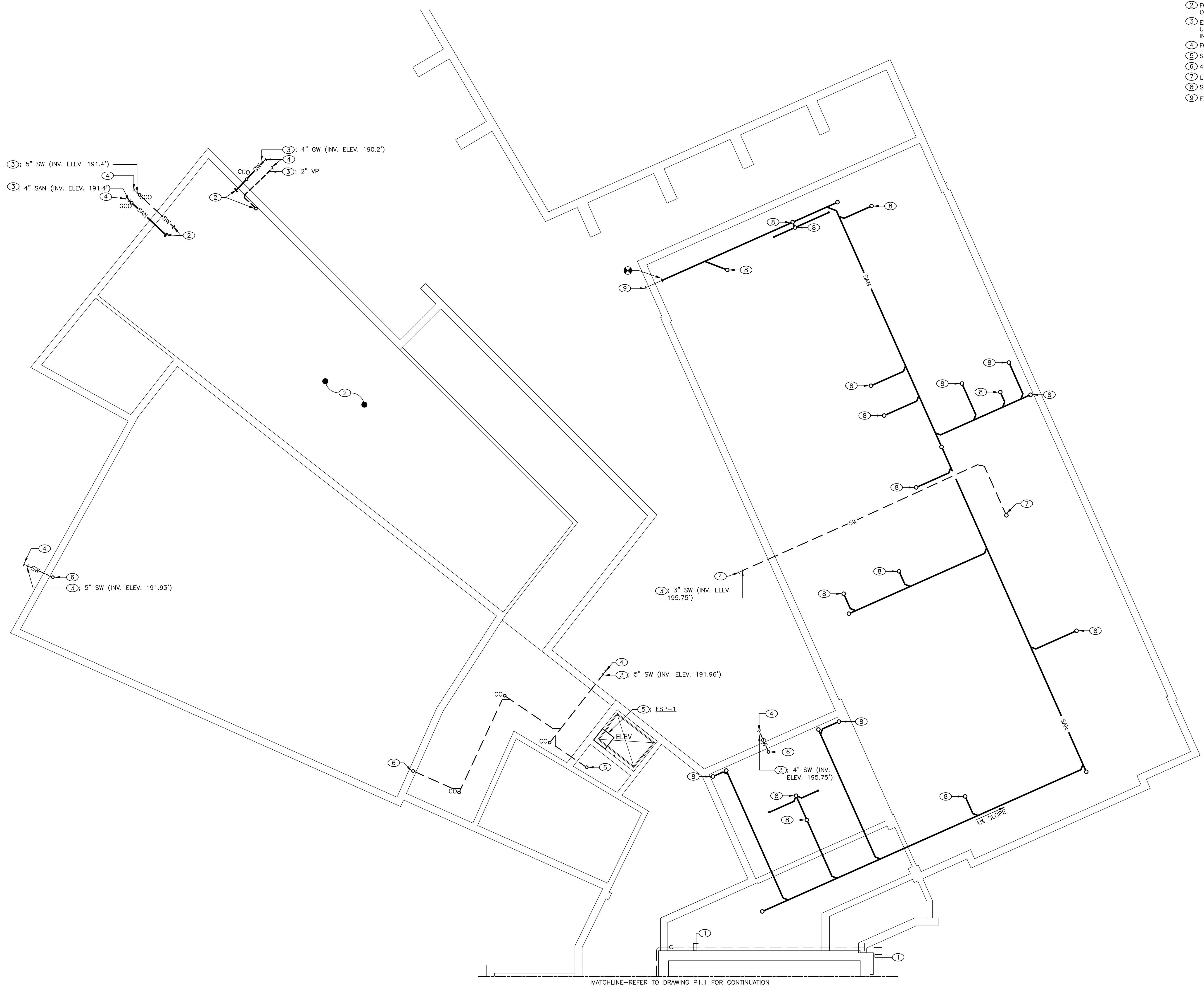
CHECKED BY: SAA

PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

**FOUNDATION PLAN-
 NEW WORK-PLUMBING**

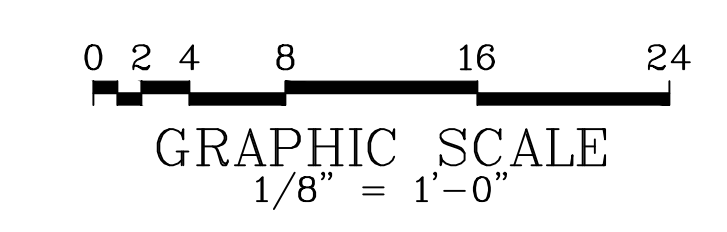
SCALE: AS NOTED
 DRAWING NO. _____

P1.2



FOUNDATION PLAN-NEW WORK-PLUMBING

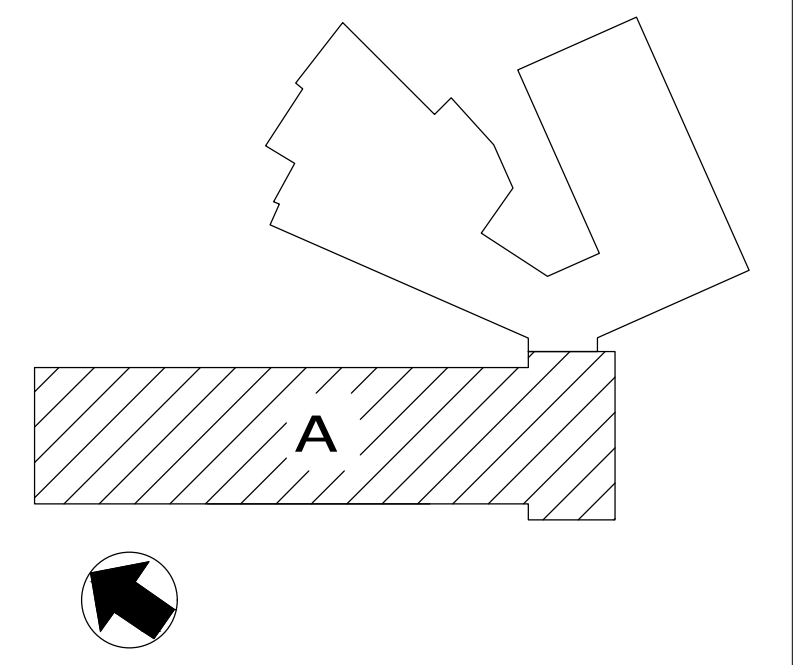
- SCALE: 1/8"=1'-0"
- 1. SEE SANITARY RISER DIAGRAM ON DRAWING P6.2, P6.3, P6.4, P6.5, AND P6.6 FOR PIPE SIZES.
 - 2. COORDINATE PIPING ETC WITH EX CONDITIONS, OTHER DISCIPLINES AND NEW WORK.
 - 3. SEE STORM WATER RISER DIAGRAM ON DRAWING P6.1 FOR PIPE SIZES.
 - 4. SEE STORM WATER (OVERFLOW) RISER DIAGRAM ON DRAWING P6.1 FOR PIPE SIZES.



DRAWING NOTES (APPLY TO DRAWINGS P1.3):

- ① SEE DETAIL - FLOW METER FITTING ON DRAWING P5.1.
- ② SAN UP.
- ③ SAN DN.
- ④ SAN UP AND DN.
- ⑤ SAN UP AND DN. VP UP.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204

Squared Plus Engineering Support Group, LLC
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 PHONE: 443.977.9741 FAX: 410.981.1426
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 BALTIMORE CITY PUBLIC SCHOOLS
 2020 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

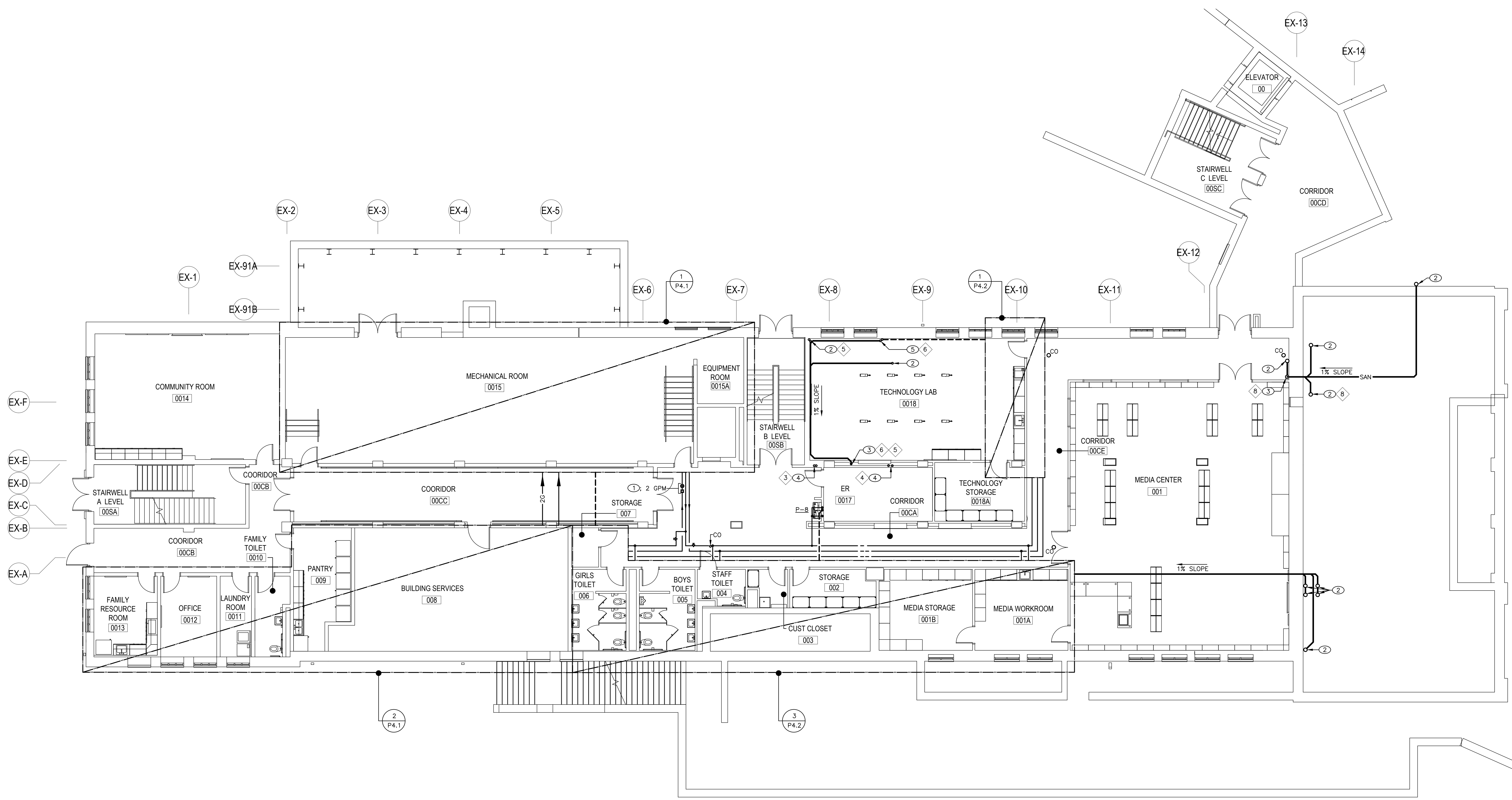
USING AGENCY APPROVAL

Name:	Date:
Title:	
MSA APPROVAL	
Project Manager:	Date:
Chief of PM&D:	Date:

1/8/21	ADDENDUM NUMBER 4
12/23/20	ADDENDUM NUMBER 3
12/16/20	ADDENDUM NUMBER 2
10/16/20	PROGRESS SET
9/11/20	50% CD SUBMISSION
7/10/20	100% DD SUBMISSION

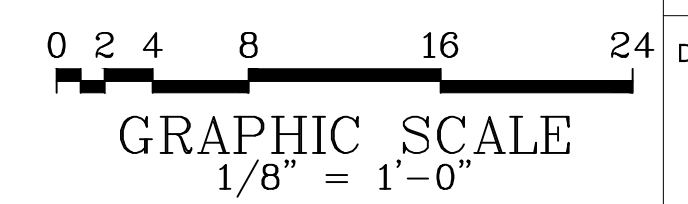
MARK	DATE	DESCRIPTION
AS-BUILT REVISIONS		
SUBMITTED BY:		
CAD DWG FILE: SAA		
DRAWN BY: SAA		
CHECKED BY: SAA		

PROJECT NO. BCS-02-004	
DATE:	NOVEMBER 16, 2020
BASEMENT FLOOR PLAN- NEW WORK-PLUMBING	
SCALE:	AS NOTED
DRAWING NO.	P1.3



BASEMENT FLOOR PLAN-NEW WORK-PLUMBING

- SCALE: 1/8"=1'-0"
1. SEE SANITARY RISER DIAGRAM ON DRAWING P6.2, P6.3, P6.4, P6.5, AND P6.6 FOR PIPE SIZES.
 2. SEE DOMESTIC WATER RISER DIAGRAM ON DRAWING P6.7, P6.8, P6.9, P6.10, AND P6.11 FOR PIPE SIZES.
 3. COORDINATE PIPING ETC WITH EX CONDITIONS, OTHER DISCIPLINES AND NEW WORK.
 4. SEE PLUMBING FIXTURE SCHEDULE ON DRAWING P7.1 FOR PIPE SIZES.
 5. SEE GAS RISER DIAGRAM ON DRAWING P6.12 FOR PIPE SIZES.

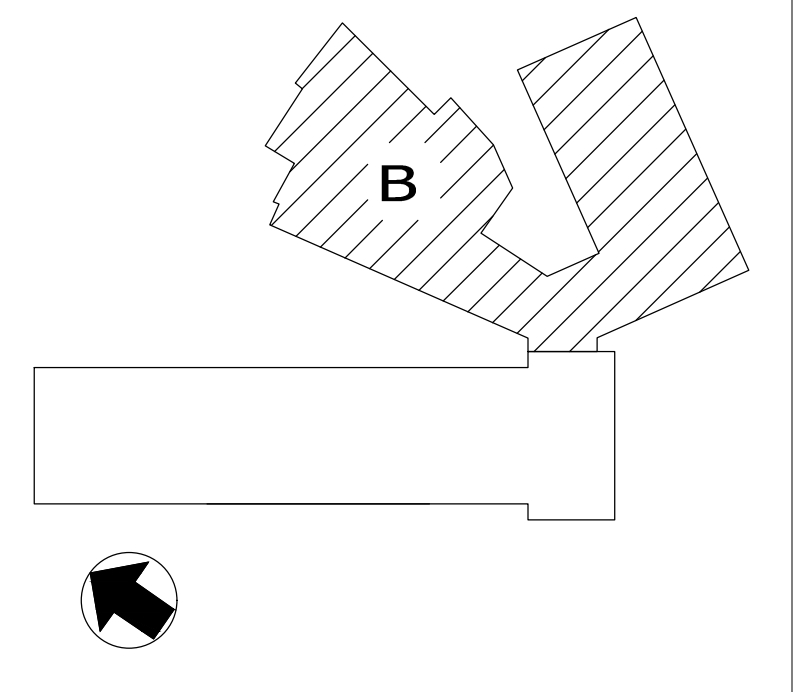


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DRAWING NOTES (APPLY TO DRAWINGS P1.5):

- ① ELEVATOR SUMP PUMP CONTROL PANEL SHALL BE LOCATED IN ACCESSIBLE LOCATION AND NOT ACCESSIBLE DUE TO TAMPERING FROM OCCUPANTS. PROVIDE ACCESS DOOR AS REQUIRED. COORDINATE LOCATION WITH OWNERS REPRESENTATIVE PRIOR TO INSTALLATION.
- ② FROM ELEVATOR SUMP PUMP.
- ③ 3" SW UP.
- ④ 4" SW DN.
- ⑤ 3" SW UP TO 3" RD-1.
- ⑥ 4" SW UP TO 4" RD-1.
- ⑦ PIPING SHALL NOT BE ROUTED IN STAIRWELL ENCLOSURE. PIPING TO BE LOCATED IN AREA THAT IS SEPARATE FROM STAIR ENCLOSURE.
- ⑧ 2G UP.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204



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**MONTEBELLO ELEMENTARY/
 MIDDLE SCHOOL**
 BALTIMORE CITY PUBLIC SCHOOLS
 2020 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____

Title: _____

Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

MSA APPROVAL

Name: _____ Date: _____

Title: _____

Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

DATE	DESCRIPTION
1/8/21	ADDENDUM NUMBER 4
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12/16/20	ADDENDUM NUMBER 2
10/16/20	PROGRESS SET
9/11/20	50% CD SUBMISSION
7/10/20	100% DD SUBMISSION

MARK	DATE	DESCRIPTION

AS-BUILT REVISIONS

SUBMITTED BY: _____

CAD DWG FILE: SAA

DRAWN BY: SAA

CHECKED BY: SAA

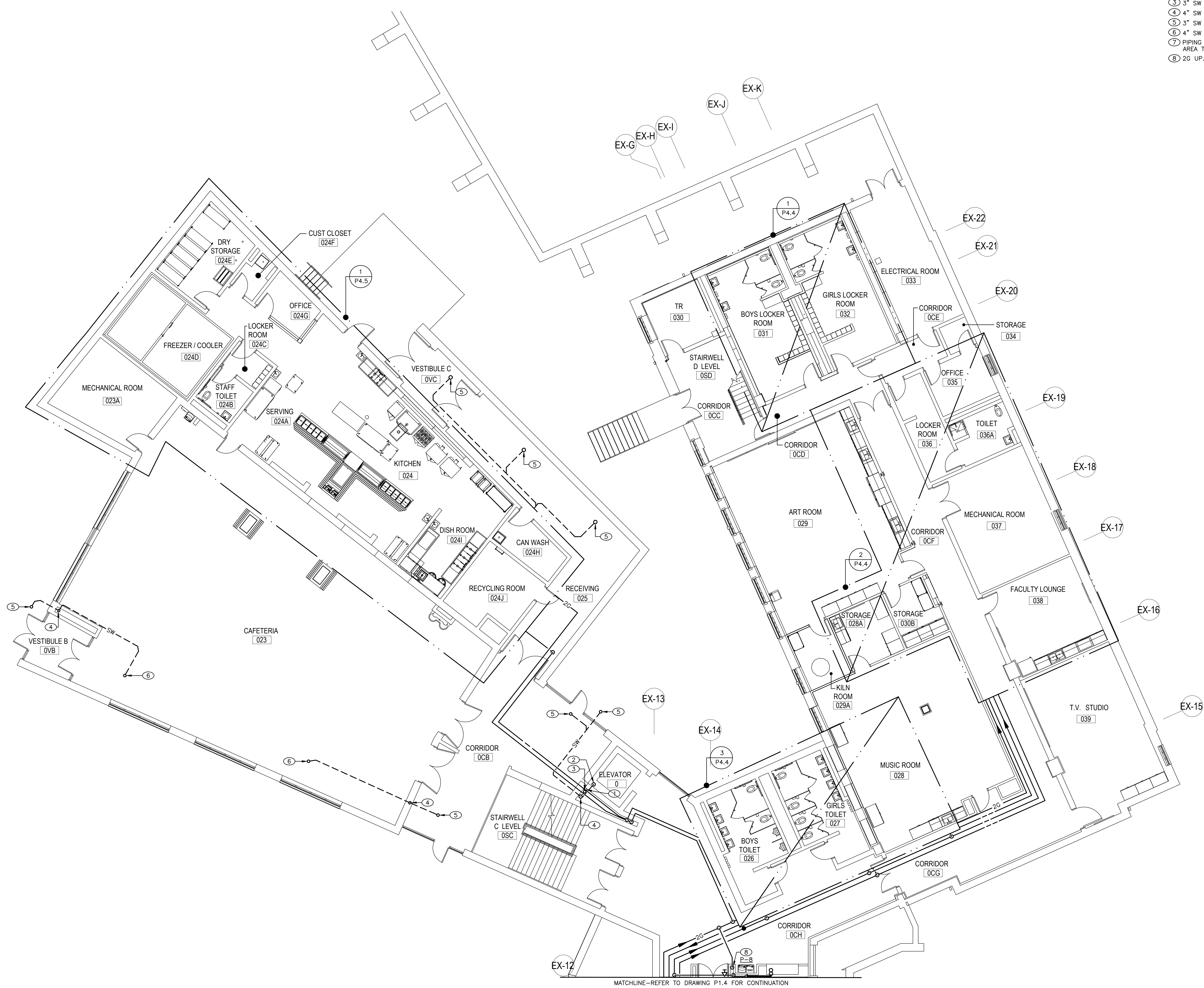
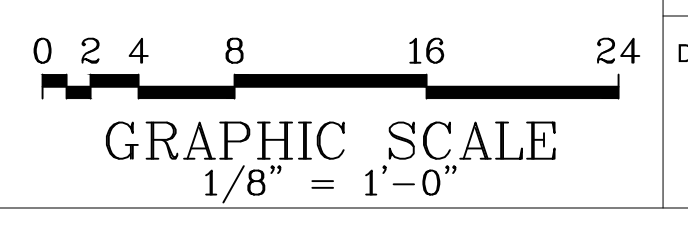
PROJECT NO. BCS-02-004

DATE: NOVEMBER 16, 2020

GROUND FLOOR PLAN-NEW WORK-PLUMBING

SCALE: AS NOTED

DRAWING NO. **P1.5**



GROUND FLOOR PLAN-NEW WORK-PLUMBING

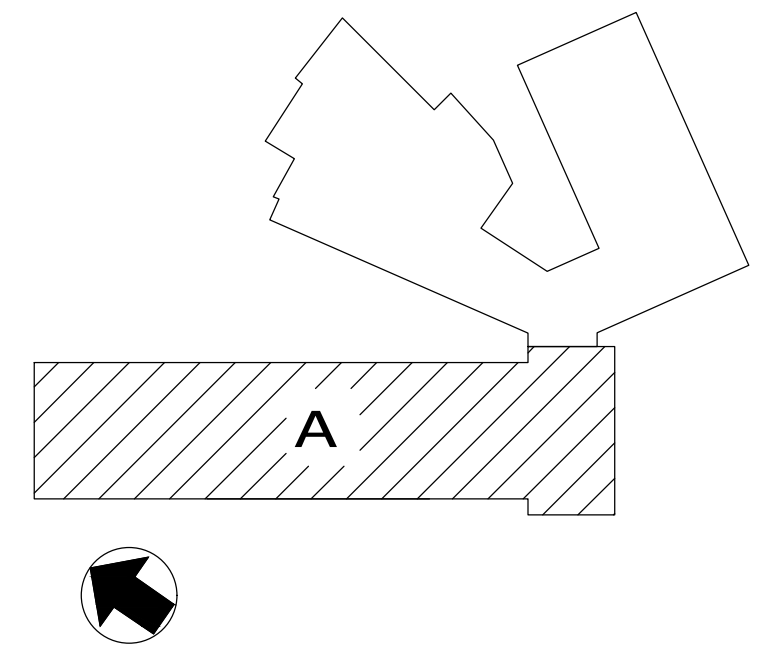
- SCALE: 1/8"=1'-0"
- NOTES:
1. SAN, DOMESTIC CW AND VP PIPING SHALL BE EXTENDED FROM NEW PLUMBING FIXTURES TO EX. SAN, EX. DOMESTIC CW AND EX. VP PIPING SYSTEM.
 2. DOMESTIC HW SHALL BE EXTENDED FROM NEW WATER HEATER TO NEW PLUMBING FIXTURES. DOMESTIC CW SHALL BE EXTENDED FROM EX. INCOMING SERVICE TO NEW PLUMBING FIXTURES.
 3. SEE SANITARY RISER DIAGRAM ON DRAWING P6.1, P6.2, P6.3, P6.4, P6.5, AND P6.6 FOR PIPE SIZES.
 4. SEE DOMESTIC WATER RISER DIAGRAM ON DRAWING P6.1, P6.7, P6.8, P6.9, P6.10, AND P6.11 FOR PIPE SIZES.
 5. COORDINATE PIPING ETC WITH EX. CONDITIONS, OTHER DISCIPLINES AND NEW WORK.
 6. SEE PLUMBING FIXTURE SCHEDULE ON DRAWING P7.1 FOR PIPE SIZES.
 7. SEE STORM WATER RISER DIAGRAM ON DRAWING P6.1 FOR PIPE SIZES.
 8. SEE STORM WATER (OVERFLOW) RISER DIAGRAM ON DRAWING P6.1 FOR PIPE SIZES.
 9. SEE GAS RISER DIAGRAM ON DRAWING P6.12 FOR PIPE SIZES.

MATCHLINE-REFER TO DRAWING P1.4 FOR CONTINUATION

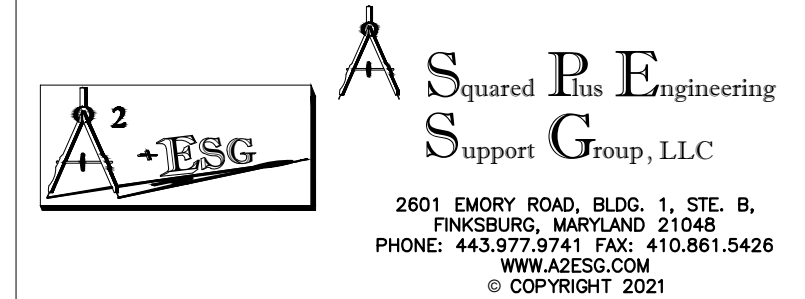
DRAWING NOTES (APPLY TO DRAWINGS P1.8):

① SEE DETAIL—FLOW METER FITTING ON DRAWING P5.1.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204



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PROPOSED NEW
**MONTEBELLO ELEMENTARY/
 MIDDLE SCHOOL**
 BALTIMORE CITY PUBLIC SCHOOLS
 2020 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____

Title: _____
MSA APPROVAL

Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

DATE	DESCRIPTION
1/8/21	ADDENDUM NUMBER 4
12/23/20	ADDENDUM NUMBER 3
12/16/20	ADDENDUM NUMBER 2
10/16/20	PROGRESS SET
9/11/20	50% CD SUBMISSION
7/10/20	100% DD SUBMISSION

MARK	DATE	DESCRIPTION
AS-BUILT REVISIONS		

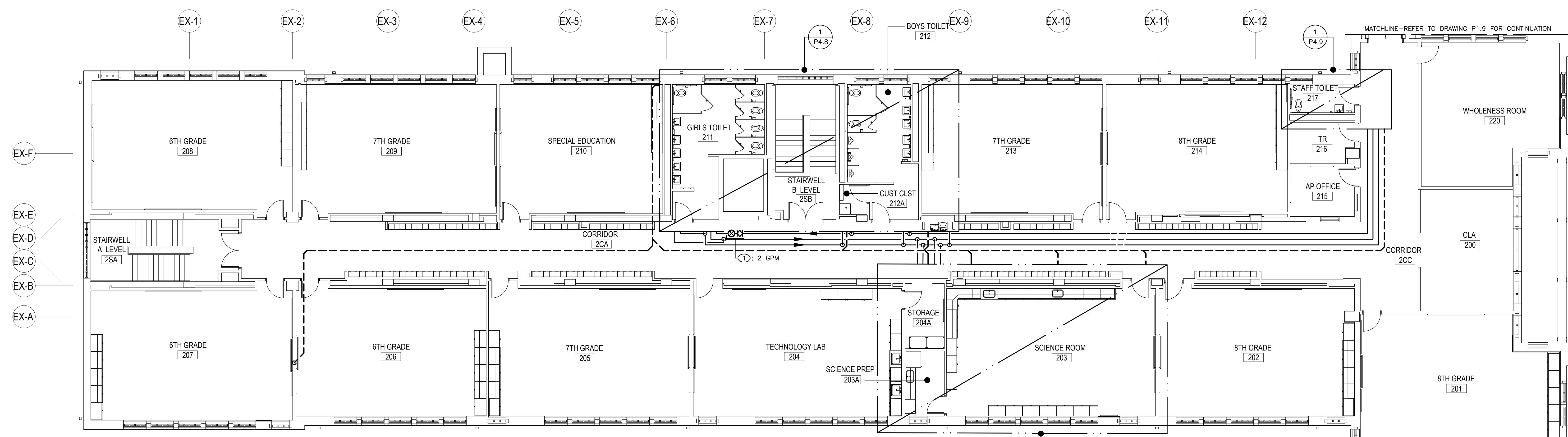
SUBMITTED BY: _____
 CAD DWG FILE: SAA
 DRAWN BY: SAA
 CHECKED BY: SAA

PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

**SECOND FLOOR PLAN-
 NEW WORK-PLUMBING**

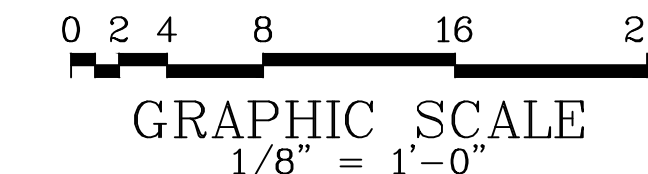
SCALE: AS NOTED

DRAWING NO. **P1.8**



SECOND FLOOR PLAN—NEW WORK—PLUMBING

- SCALE: 1/8"=1'-0"
- SEE SANITARY RISER DIAGRAM ON DRAWING P6.2, P6.3, P6.4, P6.5, AND P6.6 FOR PIPE SIZES.
 - SEE DOMESTIC WATER RISER DIAGRAM ON DRAWING P6.7, P6.8, P6.9, P6.10, AND P6.11 FOR PIPE SIZES.
 - COORDINATE PIPING ETC WITH EX CONDITIONS, OTHER DISCIPLINES AND NEW WORK.
 - SEE PLUMBING FIXTURE SCHEDULE ON DRAWING P7.1 FOR PIPE SIZES.

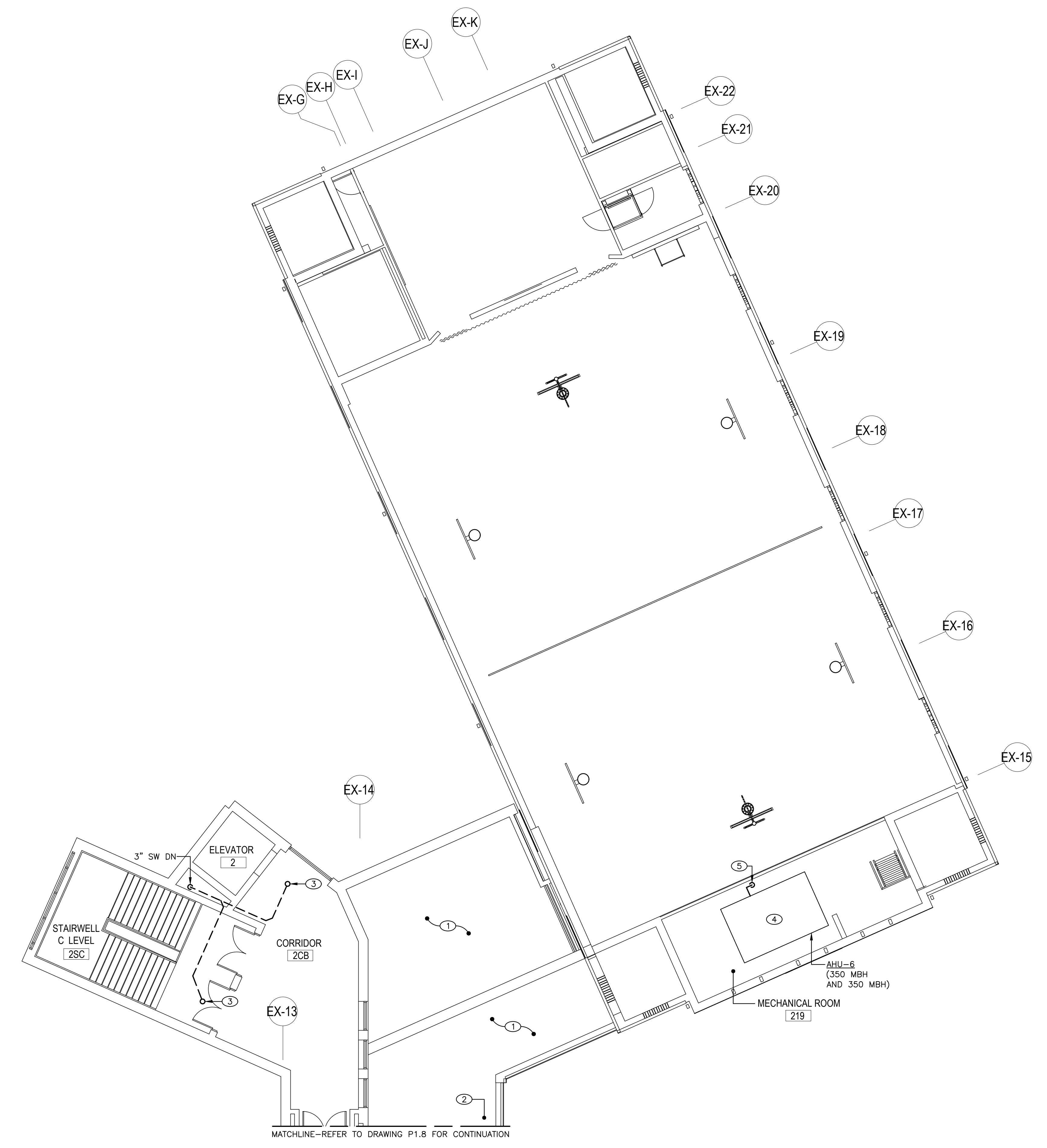
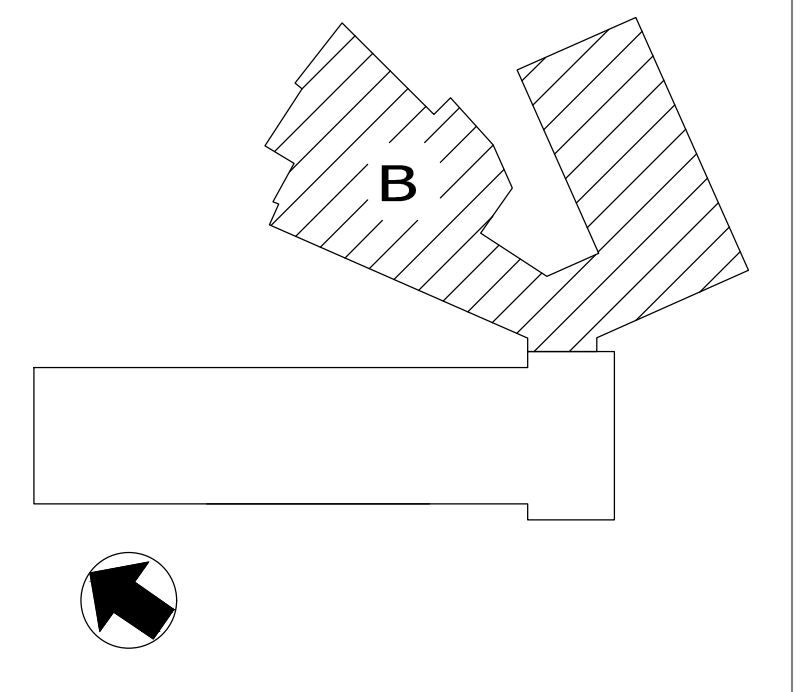


90% CONTRACT DOCUMENTS

DRAWING NOTES (APPLY TO DRAWINGS P1.9):

- ① SEE ROOF PLAN - NEW WORK - PLUMBING ON DRAWING P1.11.
- ② MODIFY EX. DOWNSPOUT AS PER ARCHITECTURAL DRAWING AND DISCHARGE ON NEW ROOF, WHERE APPLICABLE.
- ③ 3" SW UP TO 3" RD-1.
- ④ MECHANICAL EQUIPMENT (SHOWN FOR COORDINATION ONLY). COORDINATE CONNECTIONS AND ADJUST PRIOR TO INSTALLATION.
- ⑤ 2G DN.

KEY PLAN

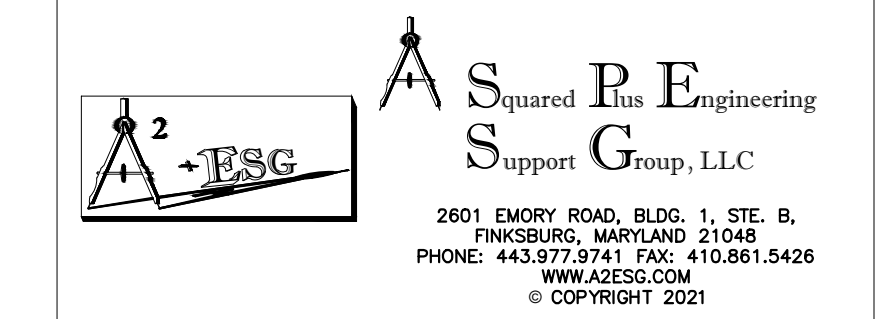


SECOND FLOOR PLAN-NEW WORK-PLUMBING

SCALE: 1/8"=1'-0"
 NOTES:
 1. SECONDARY "EMERGENCY" STORM WATER SHALL BE PROVIDED BY ARCHITECTURAL SCUPPERS UNLESS OTHERWISE NOTED.
 2. SEE STORM WATER RISER DIAGRAM ON DRAWING P6.12 FOR PIPE SIZES.



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PROPOSED NEW
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 2020 EAST 32ND STREET, BALTIMORE,
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Name:	Date:
Title:	
MSA APPROVAL	
Project Manager:	Date:
Chief of PM&D:	Date:

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AS-BUILT REVISIONS

SUBMITTED BY:

CAD DWG FILE: SAA

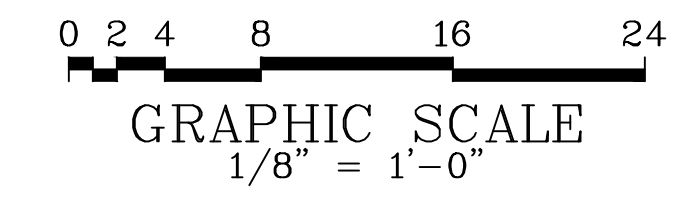
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PROJECT NO. BCS-02-004
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**SECOND FLOOR PLAN-
 NEW WORK-PLUMBING**

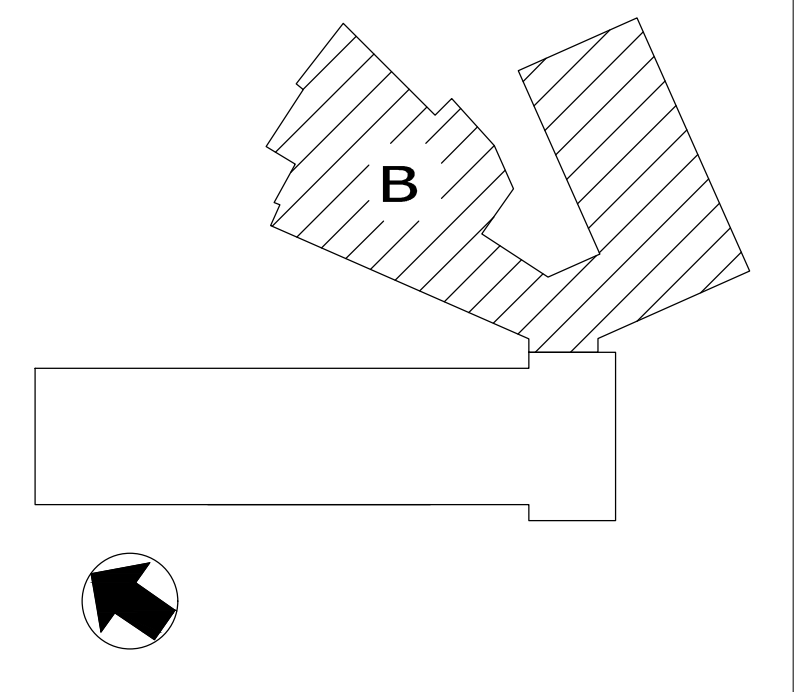
SCALE: AS NOTED
 DRAWING NO. **P1.9**



DRAWING NOTES (APPLY TO DRAWINGS P1.11):

- ① EQUIPMENT BY OTHERS (SHOWN FOR COORDINATION ONLY).
- ② ROOF HATCH (SHOWN FOR COORDINATION ONLY).
- ③ 3" CONCENTRIC VENT/COMBUSTION AIR.
- ④ EX. DOWNSPOUTS SHALL BE USED FOR STORM WATER SYSTEMS. SEE ARCHITECTURAL DRAWINGS FOR ADDITIONAL INFORMATION.
- ⑤ SEE DETAIL - VENT THROUGH ROOF ON DRAWING P5.2.
- ⑥ PROVIDE PIPE HOUSE FOR PIPES PENETRATING ROOF.
- ⑦ MECHANICAL EQUIPMENT (SHOWN FOR COORDINATION ONLY). COORDINATE CONNECTIONS AND ADJUST PRIOR TO INSTALLATION.
- ⑧ PROVIDE PIPE SIDE SW CONNECTION FOR ROOF DRAIN.

KEY PLAN



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 2020 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

Name:	Date:
Title:	
MSA APPROVAL	
Project Manager:	Date:
Chief of PM&D:	Date:

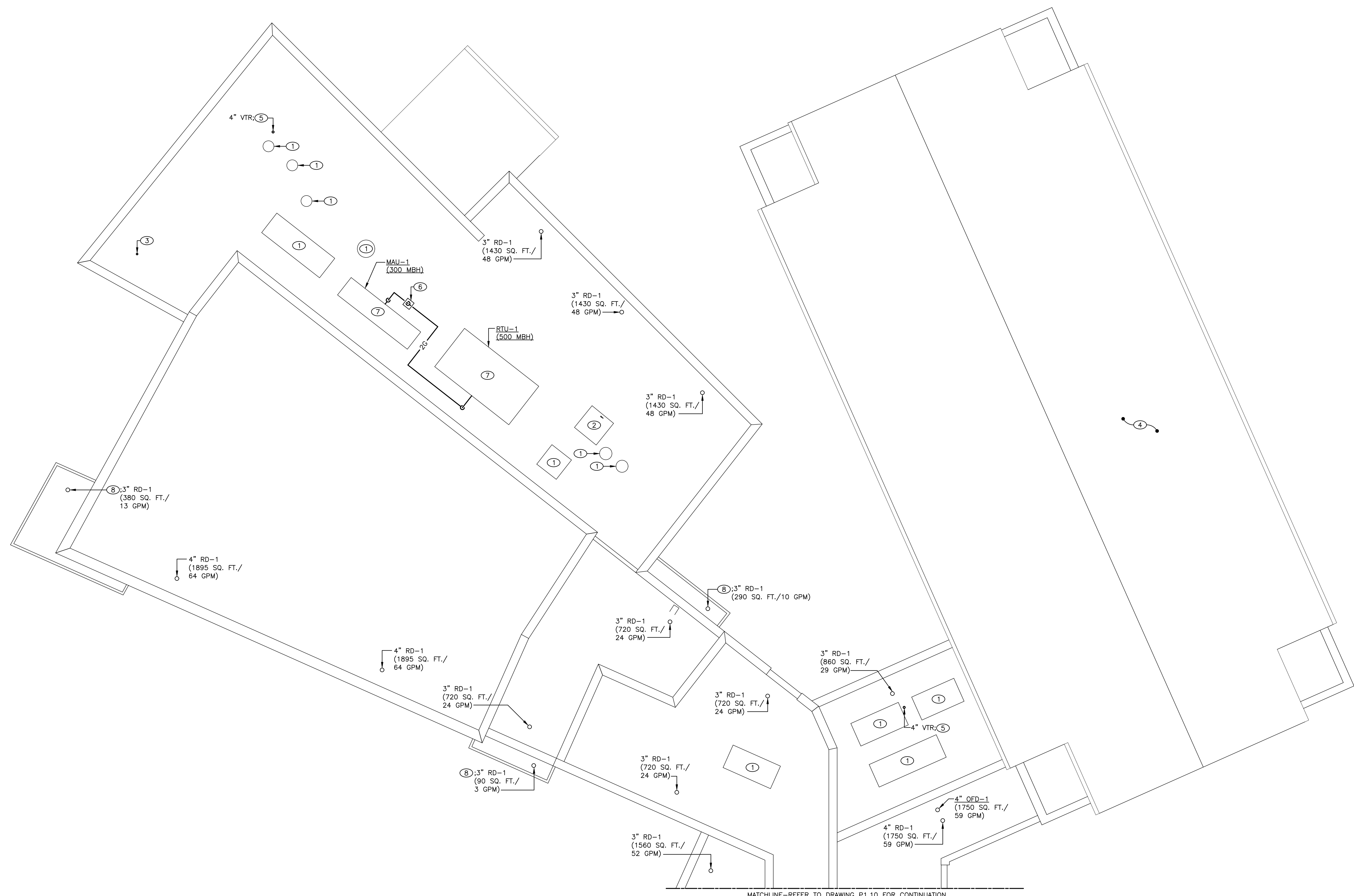
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	12/16/20	ADDENDUM NUMBER 2
	10/16/20	PROGRESS SET
	9/11/20	50% CD SUBMISSION
	7/10/20	100% DD SUBMISSION

AS-BUILT REVISIONS

SUBMITTED BY:	
CAD DWG FILE: SAA	
DRAWN BY: SAA	
CHECKED BY: SAA	
PROJECT NO. BCS-02-004	
DATE: NOVEMBER 16, 2020	

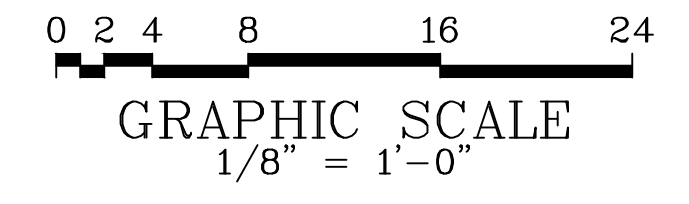
ROOF PLAN-NEW WORK-PLUMBING

SCALE: AS NOTED
 DRAWING NO. **P1.11**

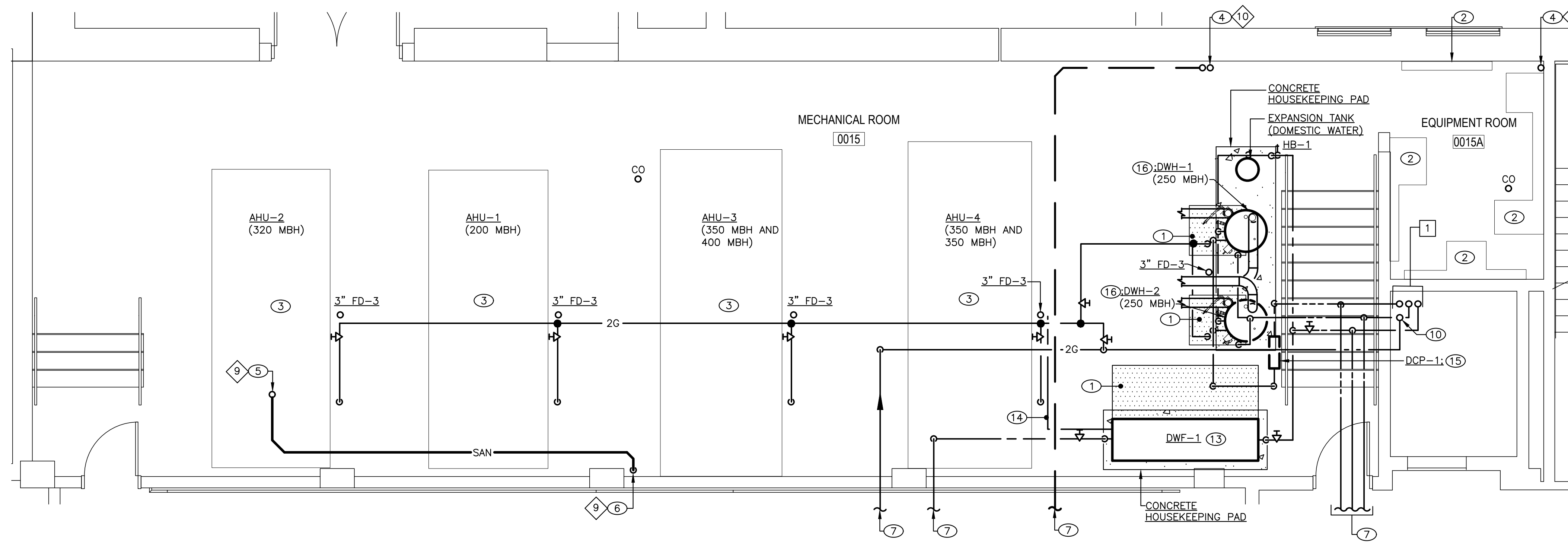


ROOF PLAN-NEW WORK-PLUMBING

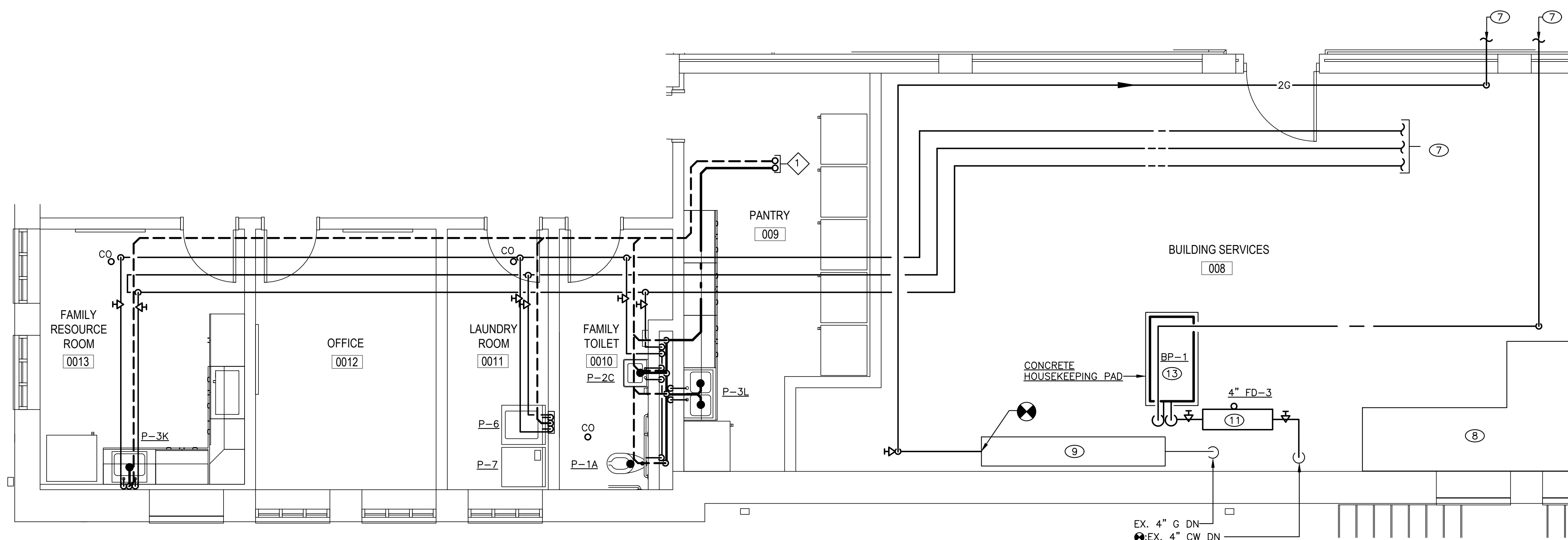
SCALE: 1/8"=1'-0"
 NOTES:
 1. SECONDARY "EMERGENCY" STORM WATER SHALL BE PROVIDED BY ARCHITECTURAL SCUPPERS UNLESS OTHERWISE NOTED.
 2. PROVIDE ROOF PIPE SUPPORTS AT EACH CHANGE OF DIRECTION AND 5'-0" ON CENTER.
 3. SEE GAS RISER DIAGRAM ON DRAWING P6.12 FOR PIPE SIZES.
 4. SEE STORM WATER RISER DIAGRAM ON DRAWING P6.1 FOR PIPE SIZES.
 5. SEE STORM WATER (OVERFLOW) RISER DIAGRAM ON DRAWING P6.1 FOR PIPE SIZES.



90% CONTRACT DOCUMENTS



1 BASEMENT PART PLAN—MECHANICAL ROOM—NEW WORK—PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.

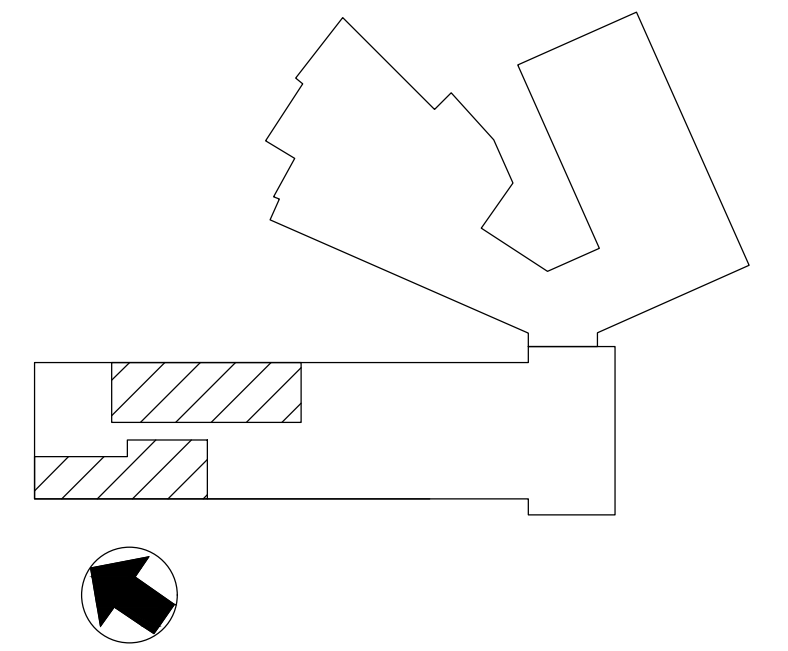


2 BASEMENT PART PLAN—BUILDING STORAGE—NEW WORK—PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.

DRAWING NOTES (APPLY TO DRAWINGS P4.1):

- ① EQUIPMENT SERVICE CLEARANCE (SHOWN FOR COORDINATION ONLY).
- ② ELECTRICAL EQUIPMENT (SHOWN FOR COORDINATION ONLY).
- ③ MECHANICAL EQUIPMENT (SHOWN FOR COORDINATION ONLY). COORDINATE CONNECTION AND ADJUST AS NEEDED PRIOR TO INSTALLATION.
- ④ SAN UP AND DN.
- ⑤ SAN UP.
- ⑥ SAN DN.
- ⑦ FOR CONTINUATION SEE BASEMENT FLOOR PLAN—NEW WORK—PLUMBING ON DRAWING P1.3.
- ⑧ FIRE PROTECTION INCOMING PIPING AND VALVING SHOWN FOR COORDINATION ONLY.
- ⑨ GAS PRESSURE REDUCING STATION WITH BYPASS AND GAS METER WITH REMOTE READER BY GAS PROVIDER (BGE). CONTRACTOR TO CONFIRM DEMARCATION LOCATION FOR THEIR CONNECTIONS.
- ⑩ 2G UP.
- ⑪ REDUCED PRESSURE BACKFLOW PREVENTER.
- ⑫ FOR CONTINUATION SEE BASEMENT PART PLAN—MAINTENANCE NEW WORK—PLUMBING ON DRAWING 4.2.
- ⑬ PROVIDE FULL SIZE BYPASS AND SHUTOFF VALVES.
- ⑭ ROUTE BACKWASH PIPE TO FLOOR DRAIN. PROVIDE FUNNEL ON DRAIN TO LIMIT SPILLAGE.
- ⑮ SEE DETAIL— IN LINE PUMP ON DRAWING P5.1.
- ⑯ SEE DETAIL— GAS FIRED WATER HEATERS ON DRAWING P5.3.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204



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PROPOSED NEW
 MONTEBELLO ELEMENTARY/
 MIDDLE SCHOOL
 BALTIMORE CITY PUBLIC SCHOOLS
 2020 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____

Title: **MSA APPROVAL**

Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
	1/8/21	ADDENDUM NUMBER 4
	12/23/20	ADDENDUM NUMBER 3
	12/16/20	ADDENDUM NUMBER 2
	10/16/20	PROGRESS SET
	9/11/20	50% CD SUBMISSION
	7/10/20	100% DD SUBMISSION

AS-BUILT REVISIONS

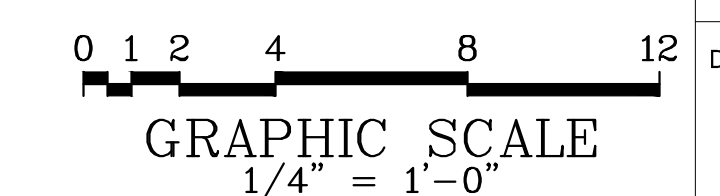
SUBMITTED BY:
 CAD DWG FILE: SAA
 DRAWN BY: SAA
 CHECKED BY: SAA

PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

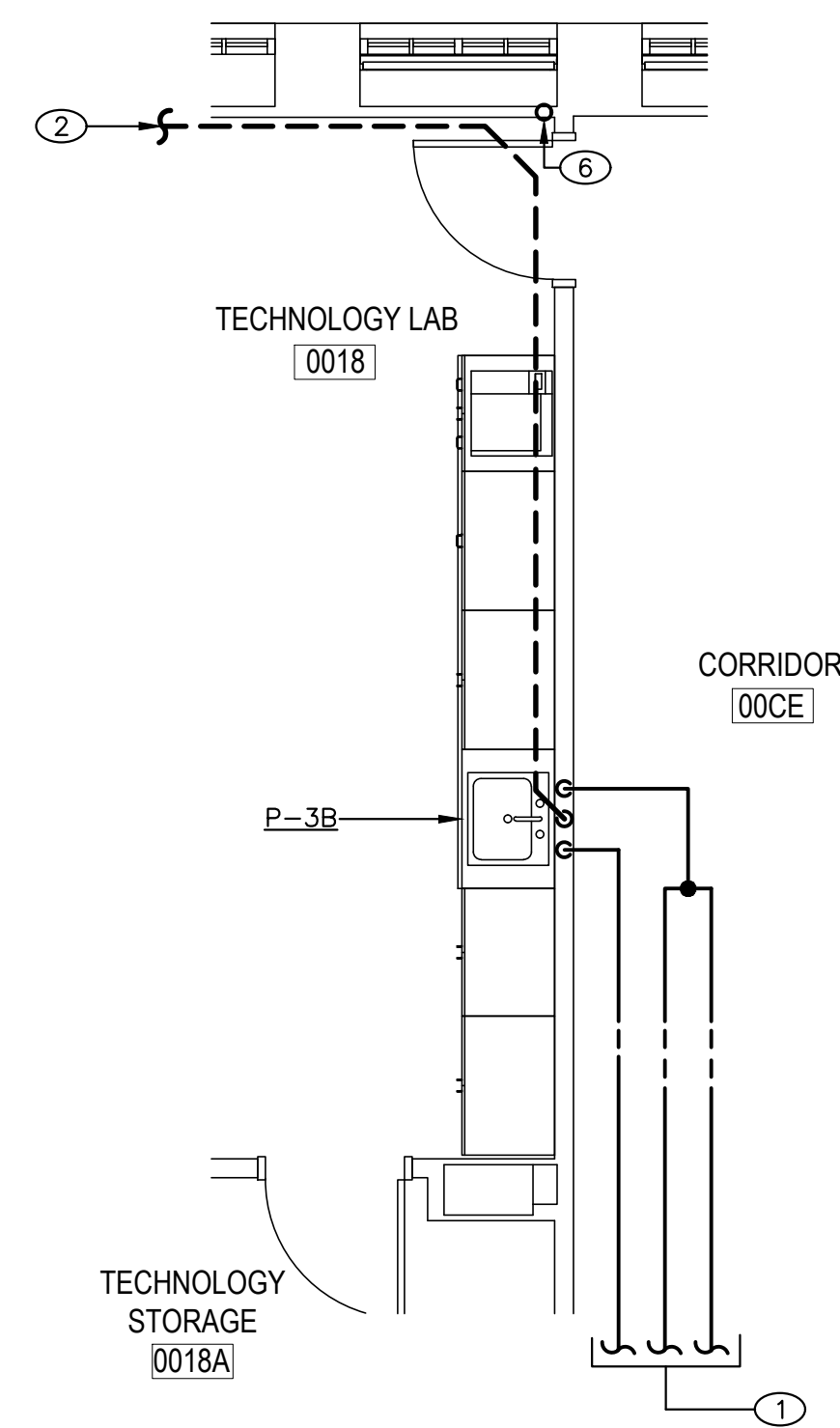
PART PLANS—
 NEW WORK—PLUMBING

SCALE: AS NOTED

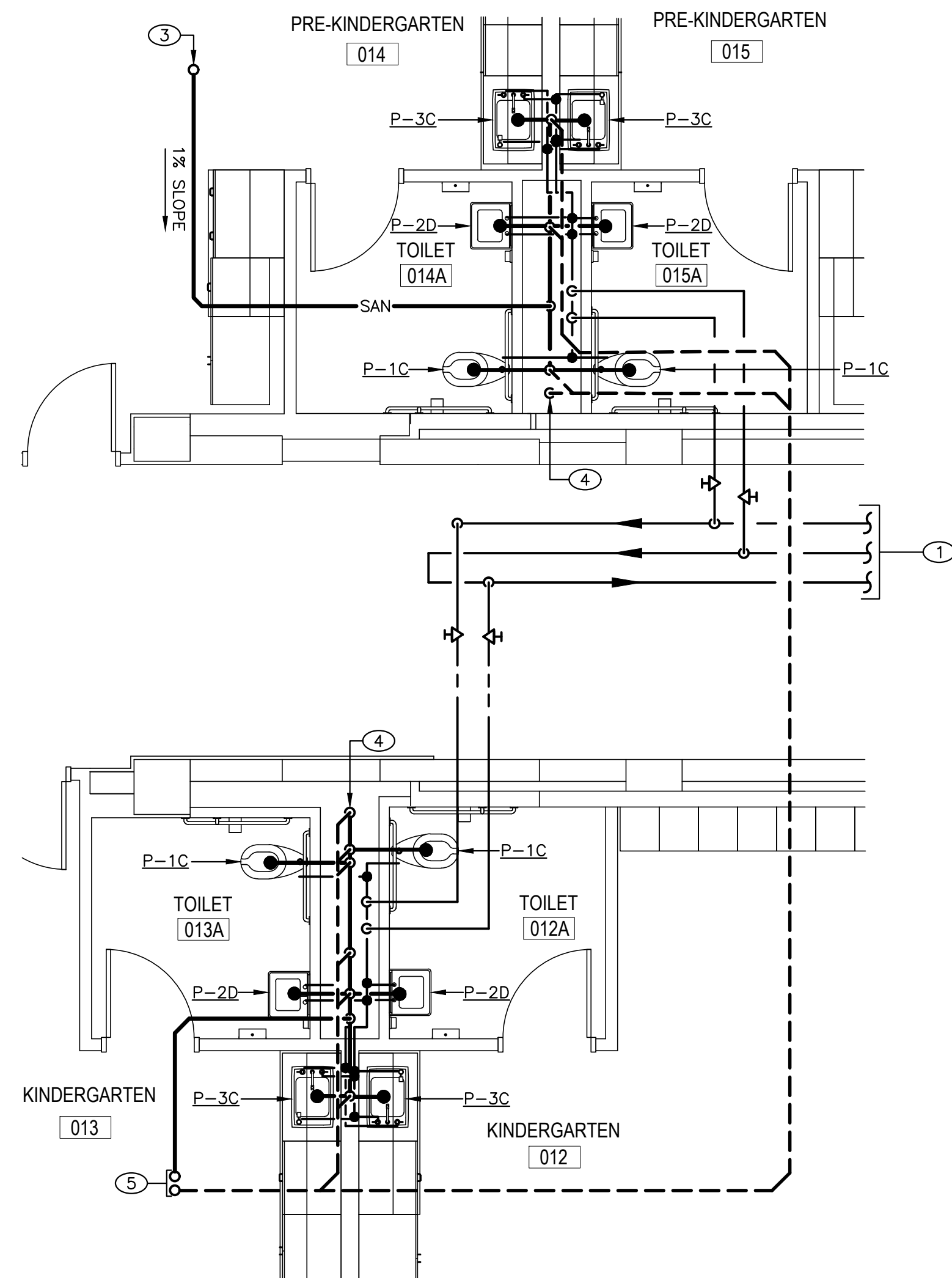
DRAWING NO. **P4.1**



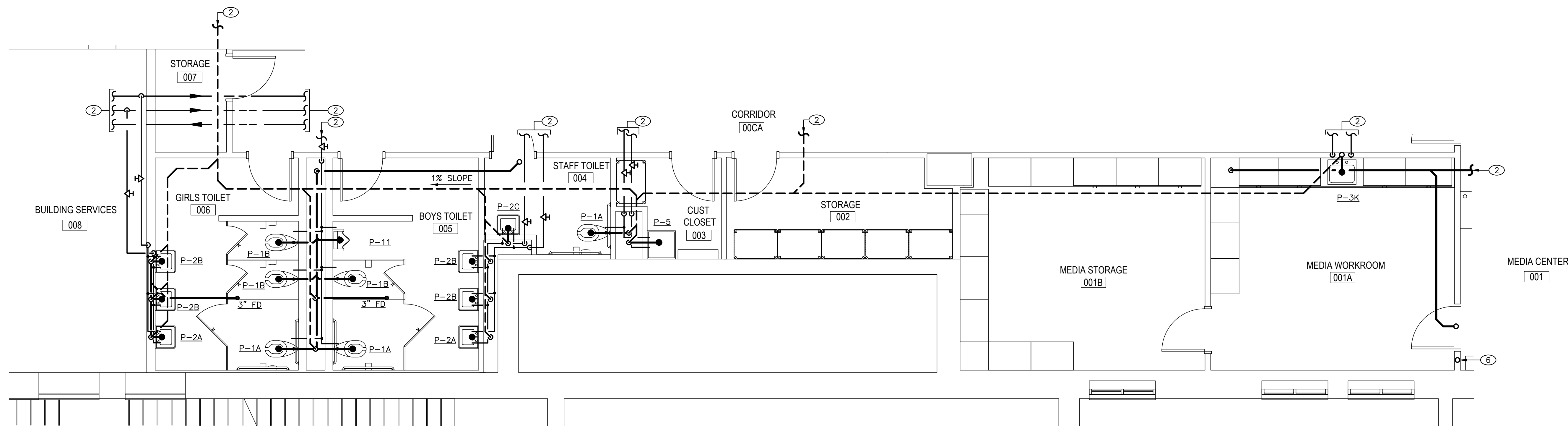
90% CONTRACT DOCUMENTS



1 BASEMENT PART PLAN—TECHNOLOGY CLASSROOM—NEW WORK—PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.



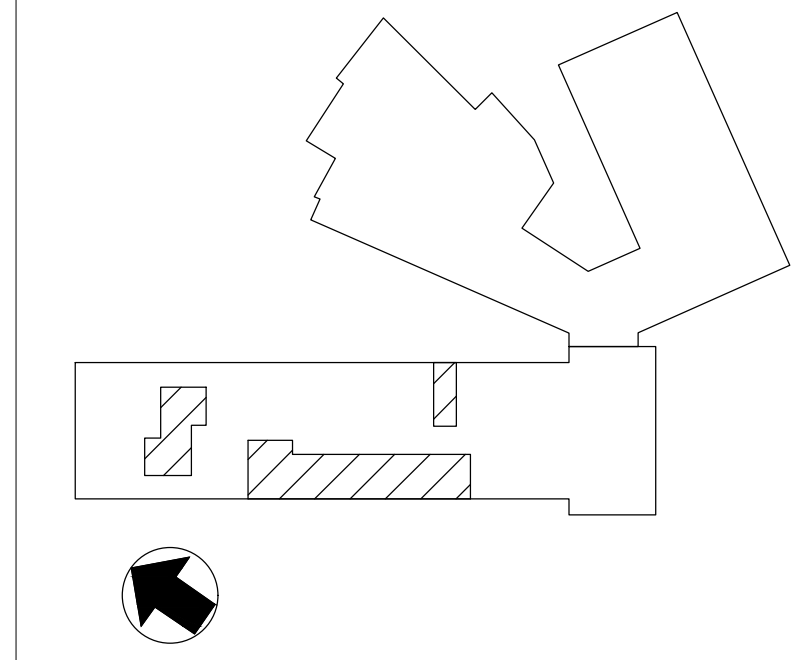
2 GROUND PART PLAN—PRE KINDERGARTEN/KINDERGARTEN CLASSROOMS—NEW WORK—PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.



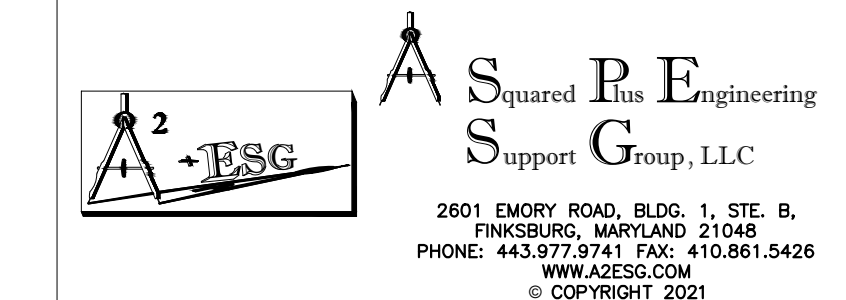
3 BASEMENT PART PLAN—MAINTENANCE LOCKER—NEW WORK—PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.

- DRAWING NOTES (APPLY TO DRAWINGS P4.2):**
- ① FOR CONTINUATION SEE GROUND FLOOR PLAN—NEW WORK—PLUMBING ON DRAWING P1.4.
 - ② FOR CONTINUATION SEE BASEMENT FLOOR PLAN—NEW WORK—PLUMBING ON DRAWING P1.3.
 - ③ SAN UP.
 - ④ SAN DN.
 - ⑤ SAN AND VP UP.
 - ⑥ CONDENSATE PIPING DN TO SW. PROVIDE BACKWATER VALVE. SEE MECHANICAL DRAWING FOR CONTINUATION OF PIPING AND SIZES.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204



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 2020 EAST 32ND STREET, BALTIMORE,
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 Project Manager: _____ Date: _____
 Chief of PM&D: _____ Date: _____

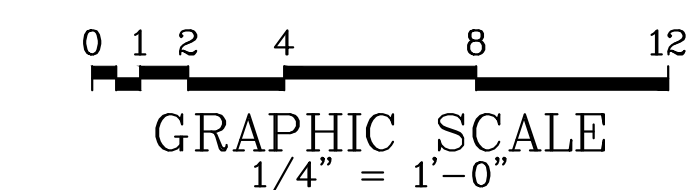
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	12/16/20	ADDENDUM NUMBER 2
	10/16/20	PROGRESS SET
	9/11/20	50% CD SUBMISSION
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AS-BUILT REVISIONS

SUBMITTED BY: _____
 CAD DWG FILE: SAA
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 PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

PART PLANS—NEW WORK—PLUMBING

SCALE: AS NOTED



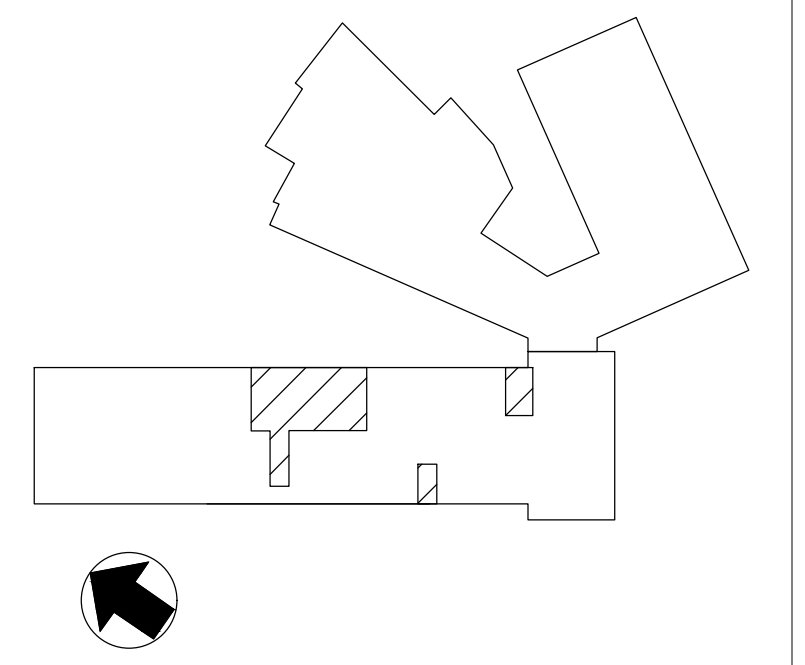
DRAWING NO. **P4.2**

90% CONTRACT DOCUMENTS

DRAWING NOTES (APPLY TO DRAWINGS P4.3):

- ① FOR CONTINUATION SEE GROUND FLOOR PLAN-NEW WORK-PLUMBING ON DRAWING P1.4.
- ② SEE DETAIL FLOW METER FITTING ON DRAWING P5.1.
- ③ SEE DETAIL-CHEMICAL DISPENSING PIPING ON DRAWING P5.1.
- ④ SAN UP.
- ⑤ 2" DN.
- ⑥ SAN DN.
- ⑦ SAN UP AND DN. VP UP AND DN.

KEY PLAN



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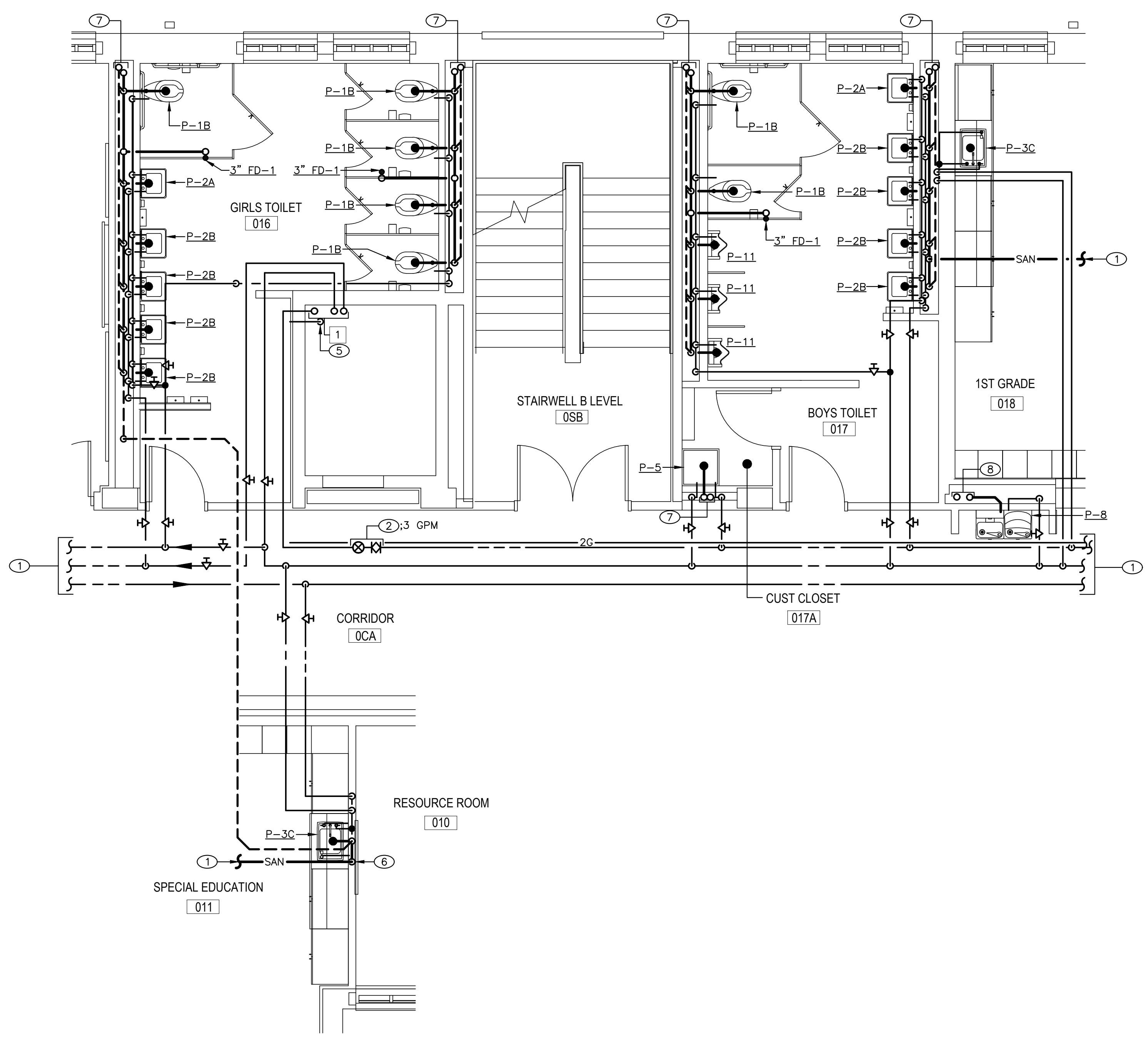
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AS-BUILT REVISIONS		

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 CAD DWG FILE: SAA
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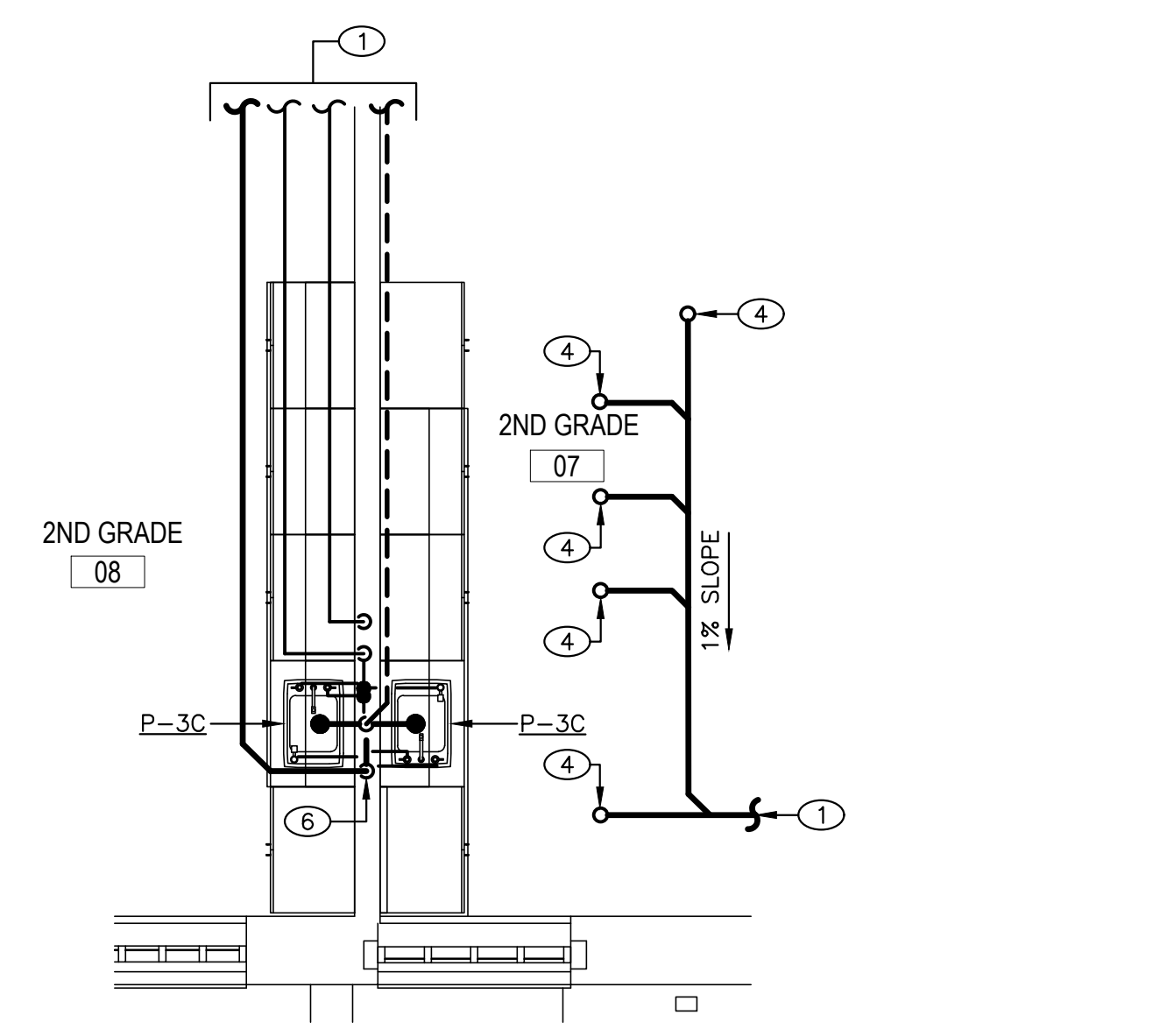
PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

**PART PLANS-
 NEW WORK-PLUMBING**

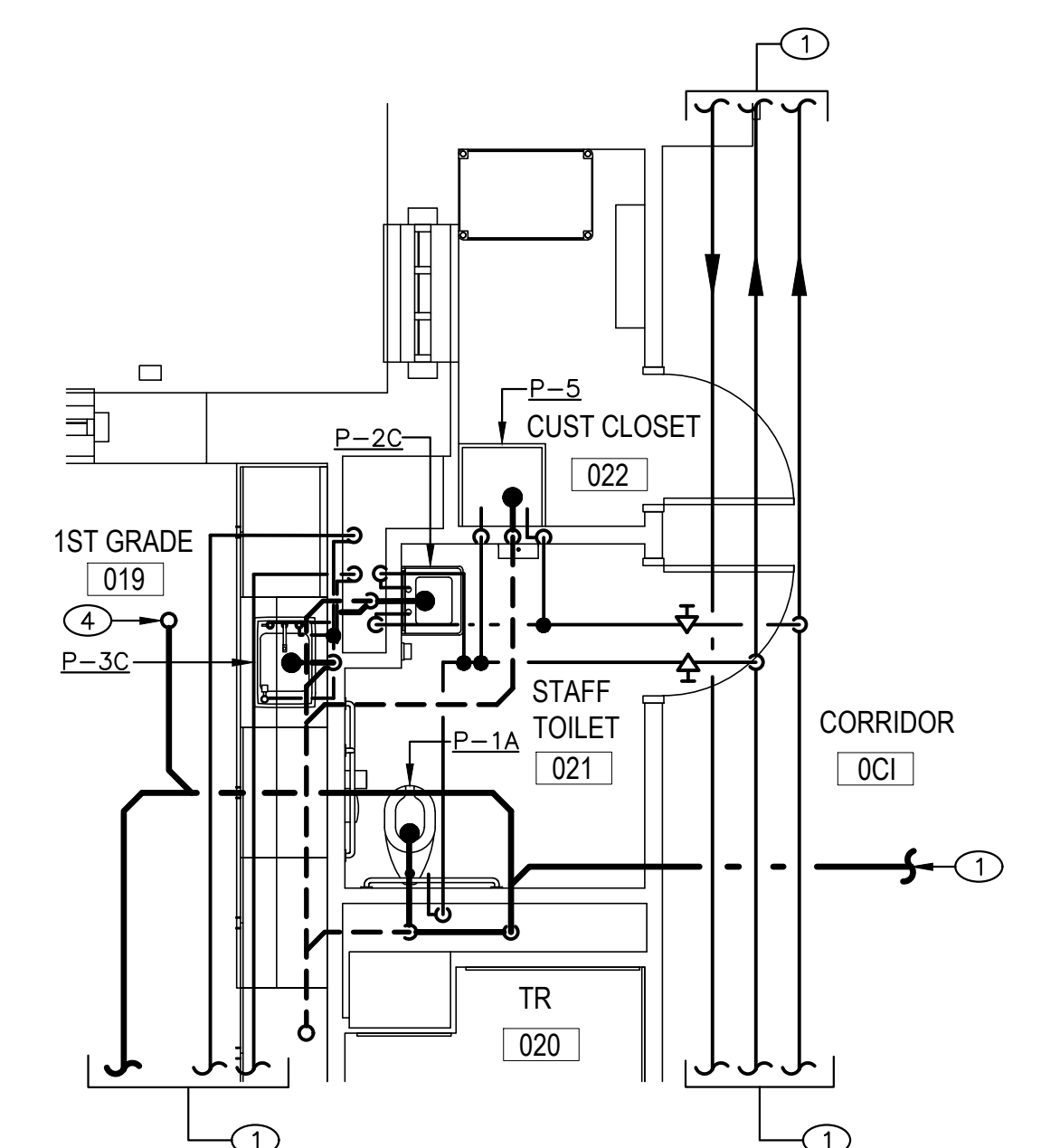
SCALE: AS NOTED
 DRAWING NO. **P4.3**



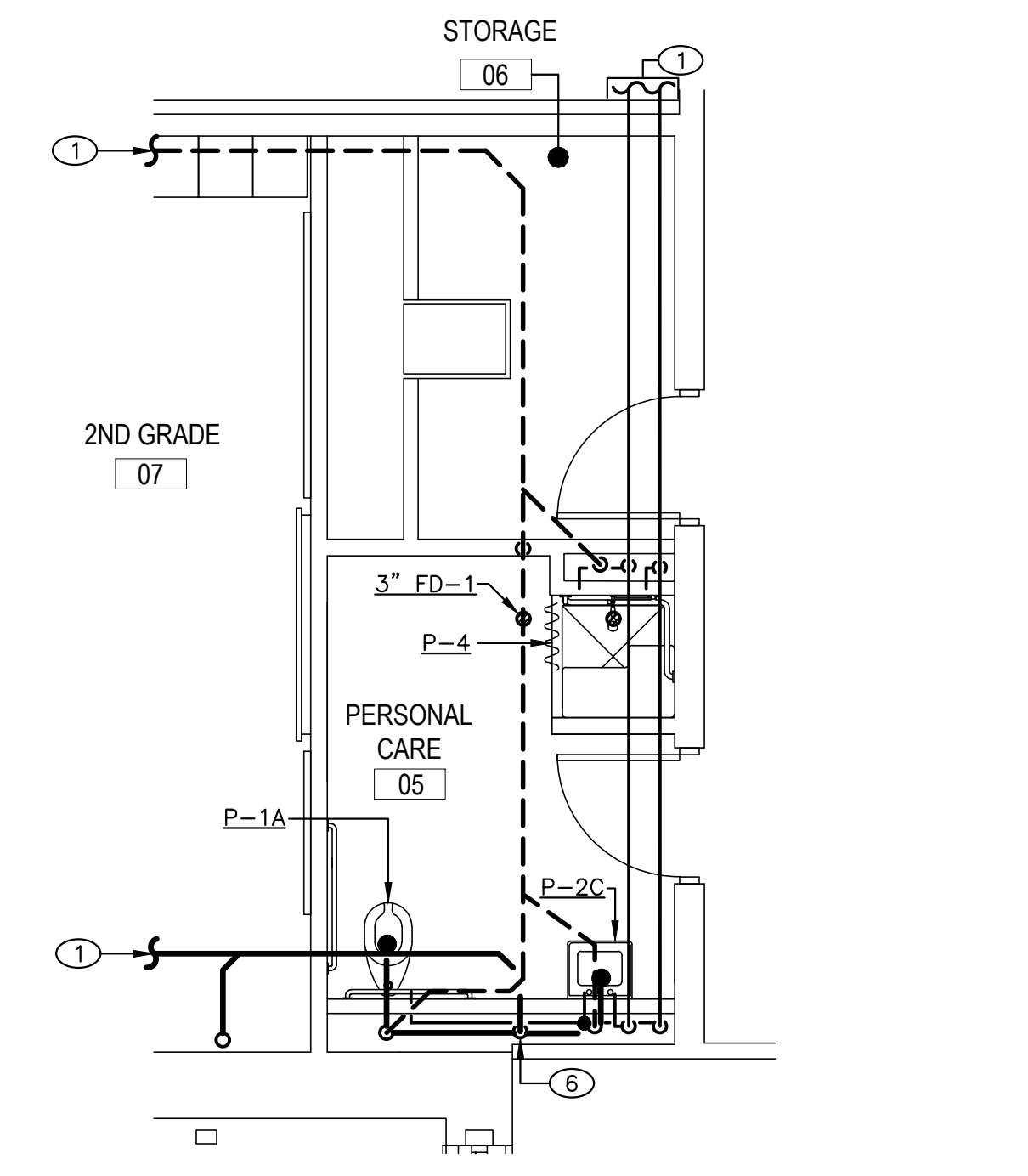
① GROUND PART PLAN-BOYS/GIRLS TOILETS-NEW WORK-PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.



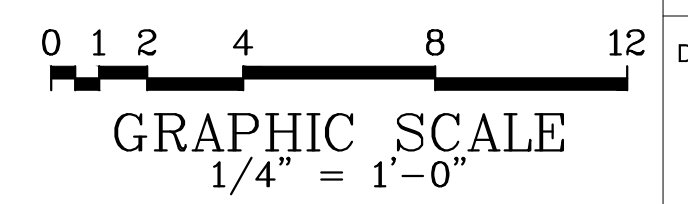
② GROUND PART PLAN-2ND GRADE CLASSROOM-NEW WORK-PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.



③ GROUND PART PLAN-TOILET ROOM NEAR TEACHER PLANNING-NEW WORK-PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.



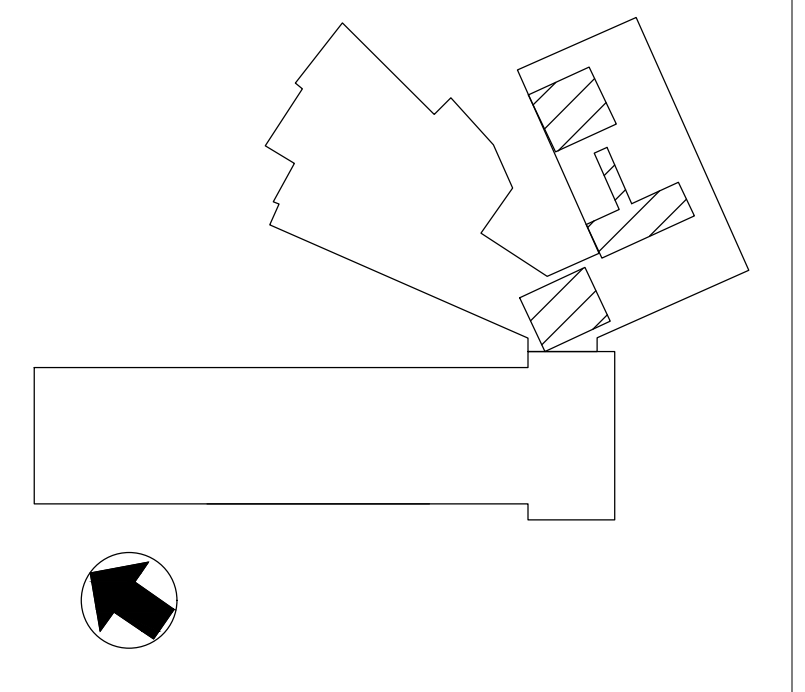
④ GROUND PART PLAN-PERSONAL CARE-NEW WORK-PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.



DRAWING NOTES (APPLY TO DRAWINGS P4.4):

- ① FOR CONTINUATION SEE GROUND FLOOR PLAN—NEW WORK—PLUMBING ON DRAWING P1.5.
- ② SEE DETAIL — DOWNSPOUT NOZZLE ON DRAWING P5.2. SEE ARCHITECTURAL DRAWINGS FOR DISCHARGE LOCATION AND HEIGHT.
- ③ PROVIDE SOLIDS INTERCEPTOR AT SINK. SEE DETAIL — TYPICAL SINK W/ TOP ACCESS FLOOR MOUNTED SOLIDS TRAP ON DRAWING P5.2.
- ④ SHOWN FOR COORDINATION ONLY. CONFIRM LOCATION OF CONNECTIONS PRIOR TO INSTALLATION.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204

Squared Plus Engineering Support Group, LLC
 3801 EMORY ROAD, BLDG. 1, STE. B,
 PINKSBORO, MARYLAND 21043
 PHONE: 443.877.9741 FAX: 410.861.4426
 WWW.AZ235G.COM
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 MARYLAND 21218

USING AGENCY APPROVAL

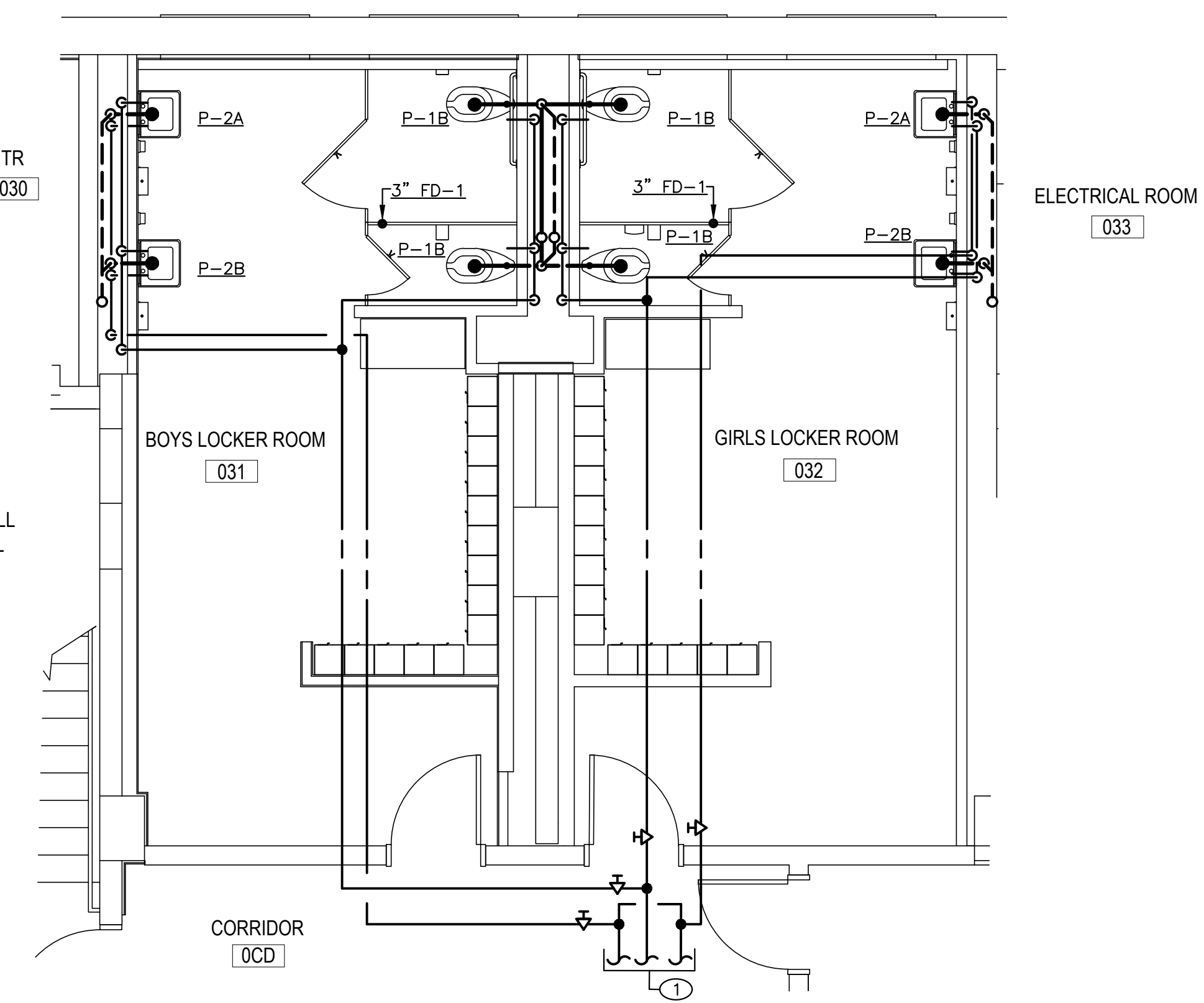
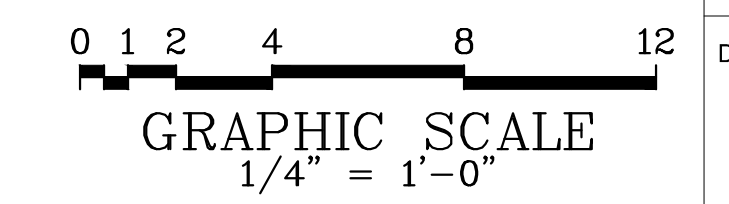
Name:	Date:
Title:	MSA APPROVAL
Project Manager:	Date:
Chief of PM&D:	Date:
MARK:	DATE:
DESCRIPTION:	

AS-BUILT REVISIONS

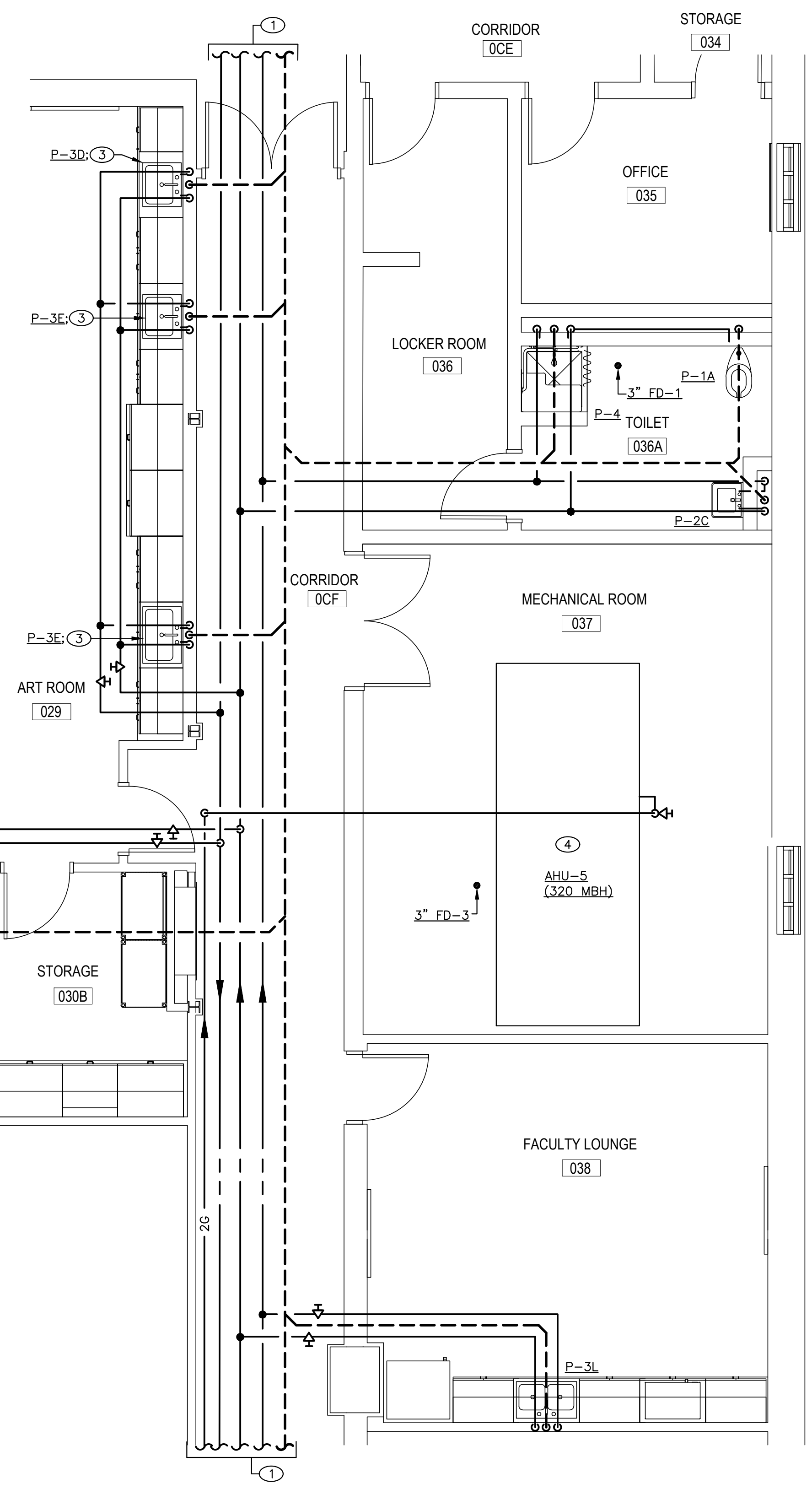
DATE	DESCRIPTION
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12/23/20	ADDENDUM NUMBER 3
12/16/20	ADDENDUM NUMBER 2
10/16/20	PROGRESS SET
9/11/20	50% CD SUBMISSION
7/10/20	100% DD SUBMISSION

PART PLANS—NEW WORK—PLUMBING

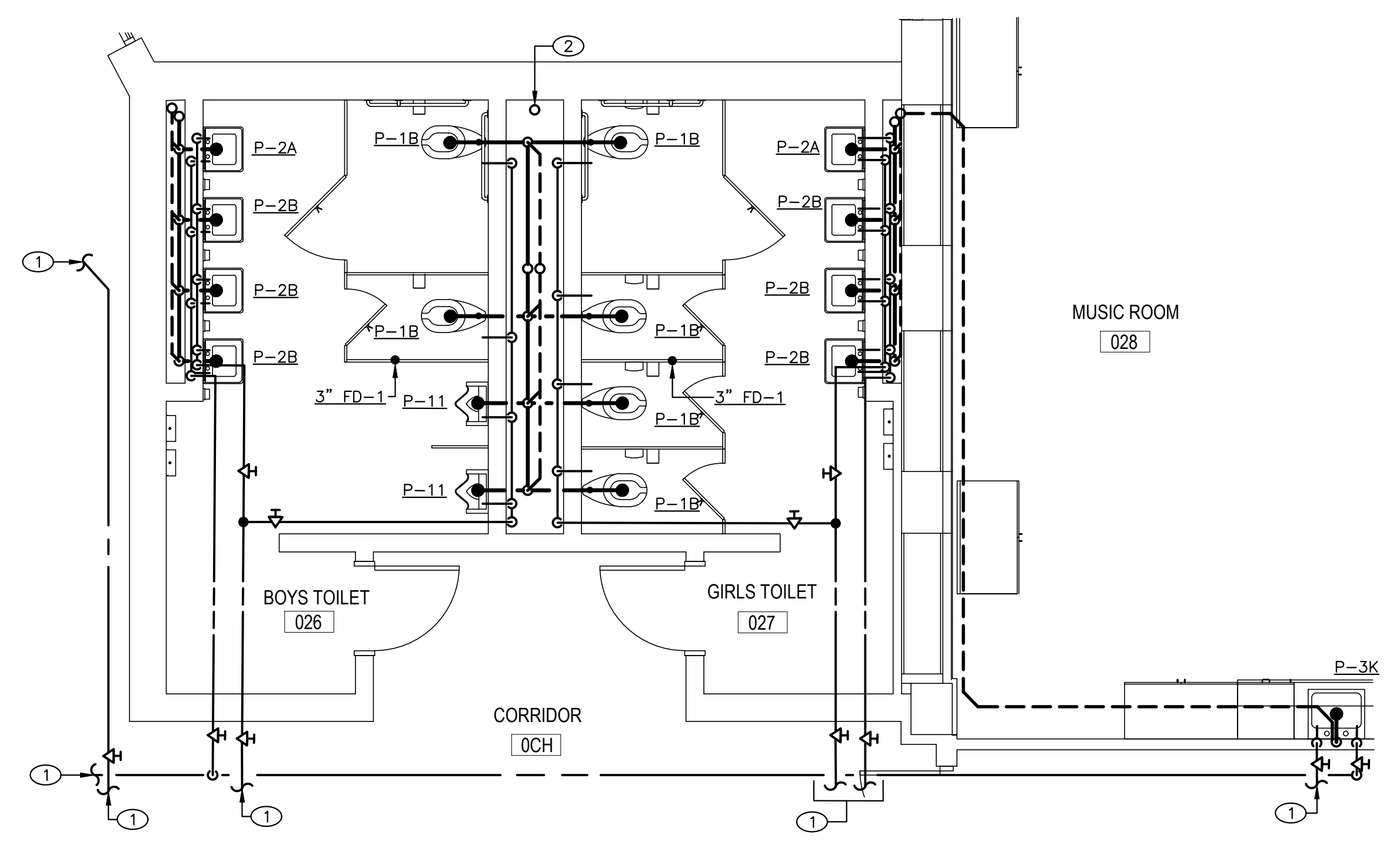
SCALE: AS NOTED
 DRAWING NO. **P4.4**



1 GROUND PART PLAN—CHANGING ROOMS—NEW WORK—PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.

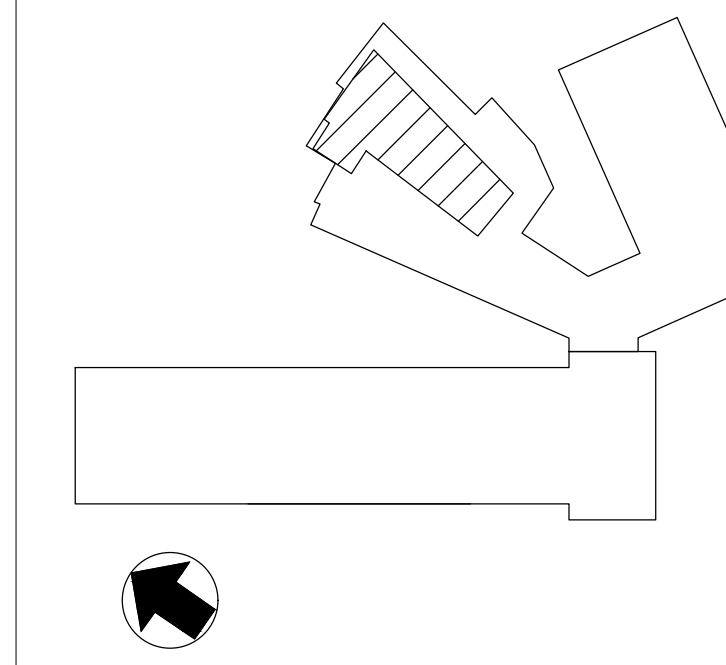


2 GROUND PART PLAN—ART ROOM—NEW WORK—PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.



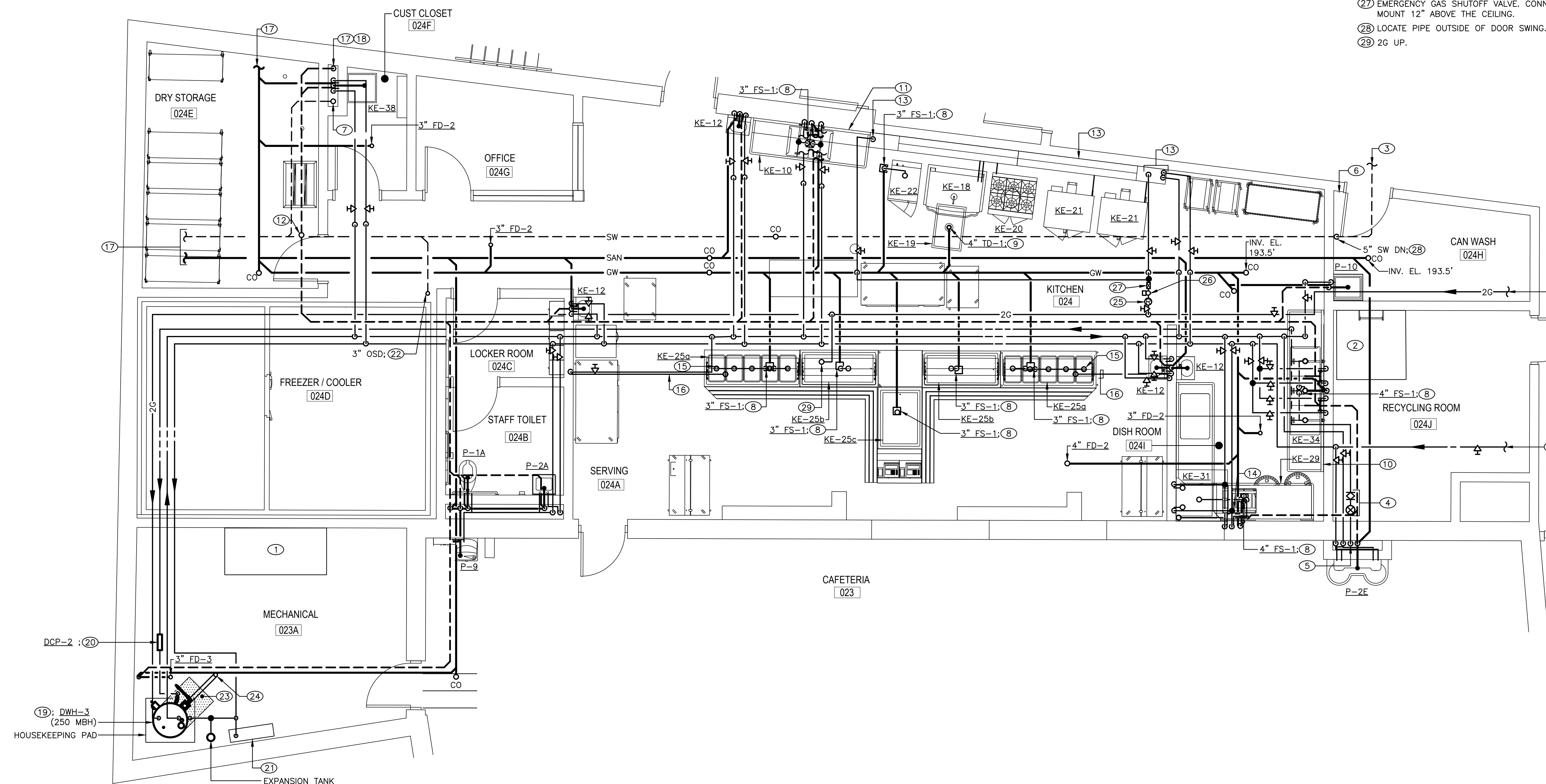
3 GROUND PART PLAN—BOYS/GIRLS TOILET ROOMS—NEW WORK—PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.

KEY PLAN



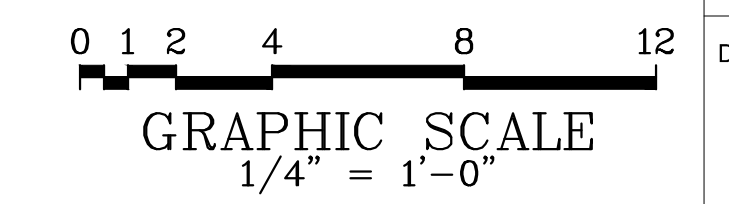
DRAWING NOTES (APPLY TO DRAWINGS P4.5):

- 1 ELECTRICAL EQUIPMENT (SHOWN FOR COORDINATION ONLY).
- 2 AREA ACCESS FOR ROOF HATCH ABOVE (SHOWN FOR COORDINATION ONLY).
- 3 FOR CONTINUATION SEE GROUND FLOOR PLAN-NEW WORK-PLUMBING ON DRAWING P1.5.
- 4 SEE DETAIL-FLOW METER FITTING ON DRAWING P5.1.
- 5 DOMESTIC WATER CIRCULATING PIPING SHALL CONNECT WITHIN 2 FEET OF FIXTURE.
- 6 SEE DETAIL-CAN WASHER INSTALLATION ON DRAWING P5.2.
- 7 CONDENSATE PIPING DN TO SW. PROVIDE BACKWATER VALVE. SEE MECHANICAL DRAWINGS FOR CONTINUATION OF PIPING AND SIZES. SEE DETAIL - CONDENSATE DRAIN TO STORM WATER ON DRAWING P5.2.
- 8 ROUTE DRAIN PIPING FROM EQUIPMENT TO FLOOR SINK VIA AIR GAP.
- 9 SEE FLOOR TROUGH DETAIL ON KITCHEN EQUIPMENT DRAWINGS.
- 10 SEE DETAIL-3 COMPARTMENT SINK CONNECTION ON DRAWING P5.2.
- 11 SEE DETAIL-2 COMPARTMENT SINK CONNECTION ON DRAWING P5.2.
- 12 4" VP UP TO 4" VTR.
- 13 SEE UTILITY RACEWAY ON KITCHEN EQUIPMENT DRAWINGS.
- 14 SEE HOSE REEL CONTROL PANEL DETAIL ON KITCHEN EQUIPMENT DRAWINGS.
- 15 SEE DRAIN VALVE DETAILS ON KITCHEN EQUIPMENT DRAWINGS.
- 16 ROUTE PIPING UNDER SLAB IN 2" PVC SLEEVE.
- 17 FOR CONTINUATION SEE FOUNDATION PLAN-NEW WORK-PLUMBING ON DRAWING P1.2.
- 18 2" VP FROM GREASE INTERCEPTOR.
- 19 SEE DETAIL - GAS FIRED WATER HEATER - KITCHEN ON DRAWING P5.3.
- 20 SEE DETAIL - IN-LINE PUMP ON DRAWING P5.1.
- 21 TRAP PRIMING STATION.
- 22 SEE DETAIL - OPEN SITE DRAIN WITH BACKWATER VALVE ON DRAWING P5.2.
- 23 PROVIDE EQUIPMENT SERVICE CLEARANCES. (SHOWN FOR COORDINATION ONLY)
- 24 3" CONCENTRIC VENT/COMBUSTION AIR (STAINLESS STEEL).
- 25 GAS PRESSURE REDUCING VALVE WITH VENT THROUGH ROOF. VERIFY PRESSURE REQUIREMENTS WITH/FOR EQUIPMENT PRIOR TO PURCHASING GAS REDUCING VALVE.
- 26 GAS SOLENOID VALVE INTERLOCK WITH HOOD EXHAUST FAN. PROVIDE WITH 1/4" BYPASS.
- 27 EMERGENCY GAS SHUTOFF VALVE. CONNECT TO EXHAUST HOOD FIRE SUPPRESSION SYSTEM. MOUNT 12" ABOVE THE CEILING.
- 28 LOCATE PIPE OUTSIDE OF DOOR SWING.
- 29 2G UP.



1 GROUND FLOOR PART PLAN-KITCHEN-NEW WORK-PLUMBING
 SCALE: 1/4"=1'-0" (FINISHED FLOOR ELEVATION: 195.46')

- NOTES:
1. SEE SANITARY RISER DIAGRAM - KITCHEN AND SANITARY (GREASE WASTE) RISER DIAGRAM - KITCHEN ON DRAWING P6.1 FOR PIPE SIZES.
 2. SEE DOMESTIC WATER RISER DIAGRAM - KITCHEN ON DRAWING P6.1 FOR PIPE SIZES.
 3. COORDINATE PIPING ETC WITH EX CONDITIONS, OTHER DISCIPLINES AND NEW WORK.
 4. SEE FOOD SERVICE EQUIPMENT ROUGH-IN SCHEDULE ON DRAWING P7.1 FOR INDIVIDUAL FIXTURE PIPE SIZES.
 5. SEE GAS RISER DIAGRAM ON DRAWING P6.12 FOR PIPE SIZES.
 6. SEE KITCHEN DRAWINGS FOR ADDITIONAL INFORMATION, ROUGH-IN LOCATION, AND DETAILS. COORDINATE LOCATIONS, SIZES, AND INVERTS PRIOR TO INSTALLATION.
 7. FLOOR DRAINS AND FLOOR SINKS SHALL BE FLUSH TO FLOOR.
 8. SANITARY DISCHARGE FROM FOOD SERVICE EQUIPMENT SHALL BE INDIVIDUALLY PIPED TO AN OPEN SITE DRAIN WITH A MINIMUM ONE INCH AIR GAP.
 9. PROVIDE WATER TEMPERATURE LIMITING DEVICES CONFORMING TO ASSE 1070 FOR EACH SINK.
 10. DRAIN LINES FROM FOOD SERVICE EQUIPMENT SHALL BE COPPER.
 11. ALL EXPOSED PIPING AND FITTINGS IN KITCHEN AREAS ABOVE SINKS AND COUNTERTOPS SHALL BE CHROME-PLATED OR STAINLESS STEEL.
 12. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.



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USING AGENCY APPROVAL

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 Project Manager: _____ Date: _____
 Chief of PM&D: _____ Date: _____

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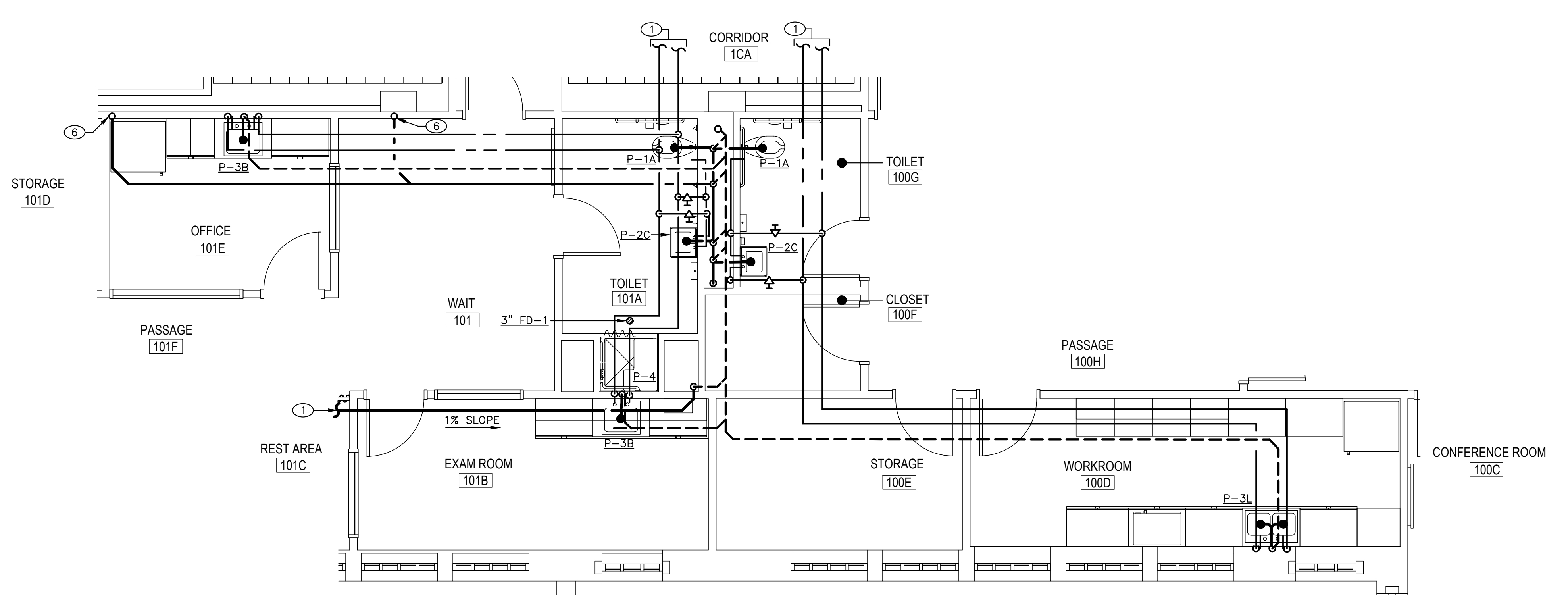
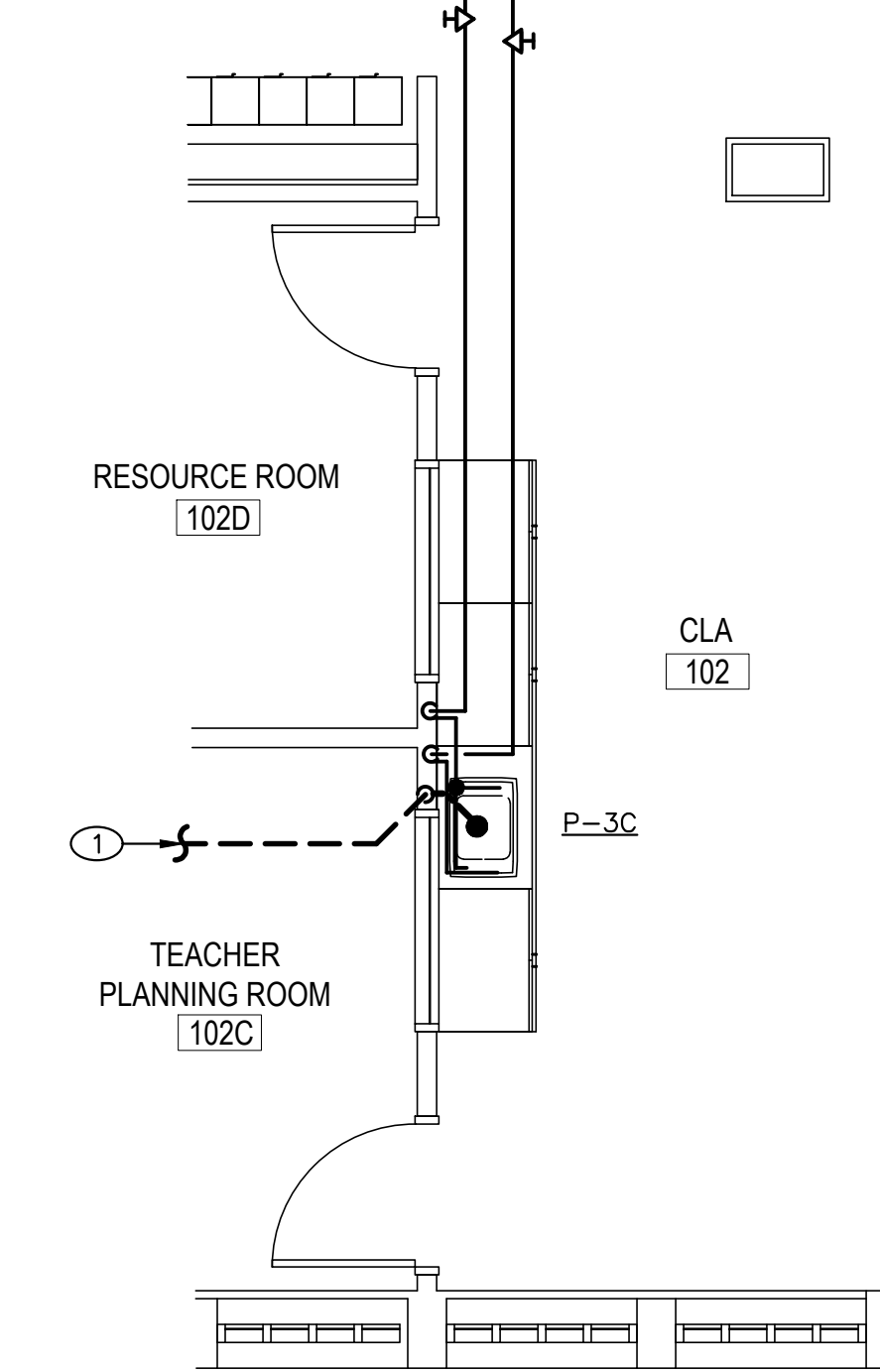
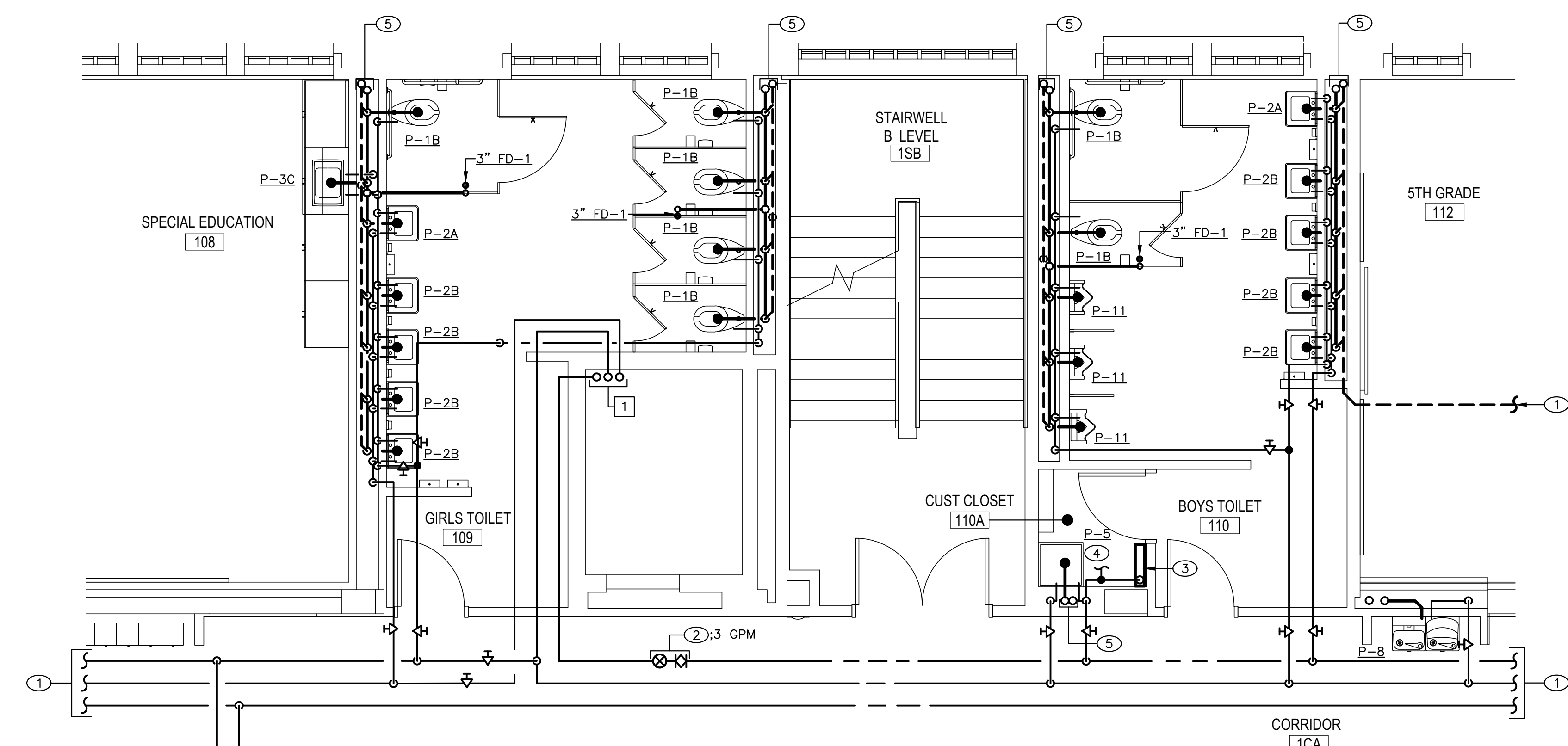
AS-BUILT REVISIONS

SUBMITTED BY: _____
 CAD DWG FILE: SAA
 DRAWN BY: SAA
 CHECKED BY: SAA
 PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020
 PART PLANS-
 NEW WORK-PLUMBING

SCALE: AS NOTED
 DRAWING NO. **P4.5**

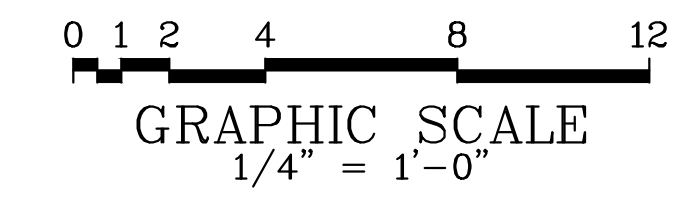
DRAWING NOTES (APPLY TO DRAWINGS P4.6):

- ① FOR CONTINUATION SEE FIRST FLOOR PLAN-NEW WORK-PLUMBING ON DRAWING P1.6.
- ② SEE DETAIL-FLOW METER FITTING ON DRAWING P5.1.
- ③ TRAP PRIMING STATION. SEE DETAIL-ELECTRIC TRAP PRIMER ON DRAWING P5.2.
- ④ SEE DETAIL-CHEMICAL DISPENSING PIPING ON DRAWING P5.1.
- ⑤ SAN UP AND DN; VP UP AND DN.
- ⑥ SAN UP.

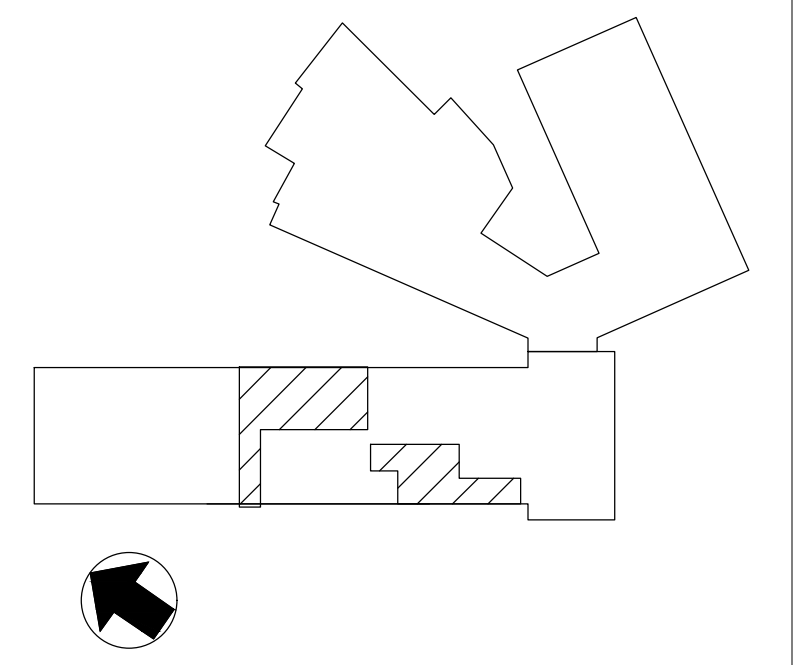


1 FIRST FLOOR PART PLAN-GIRLS/BOYS TOILET ROOM -NEW WORK-PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.

2 FIRST FLOOR PART PLAN-HEALTH -NEW WORK-PLUMBING
 SCALE: 1/4"=1'-0"
 NOTES:
 1. SEE FLOOR PLANS ON DRAWINGS P1.1 - P1.11 FOR ADDITIONAL NOTES.



KEY PLAN



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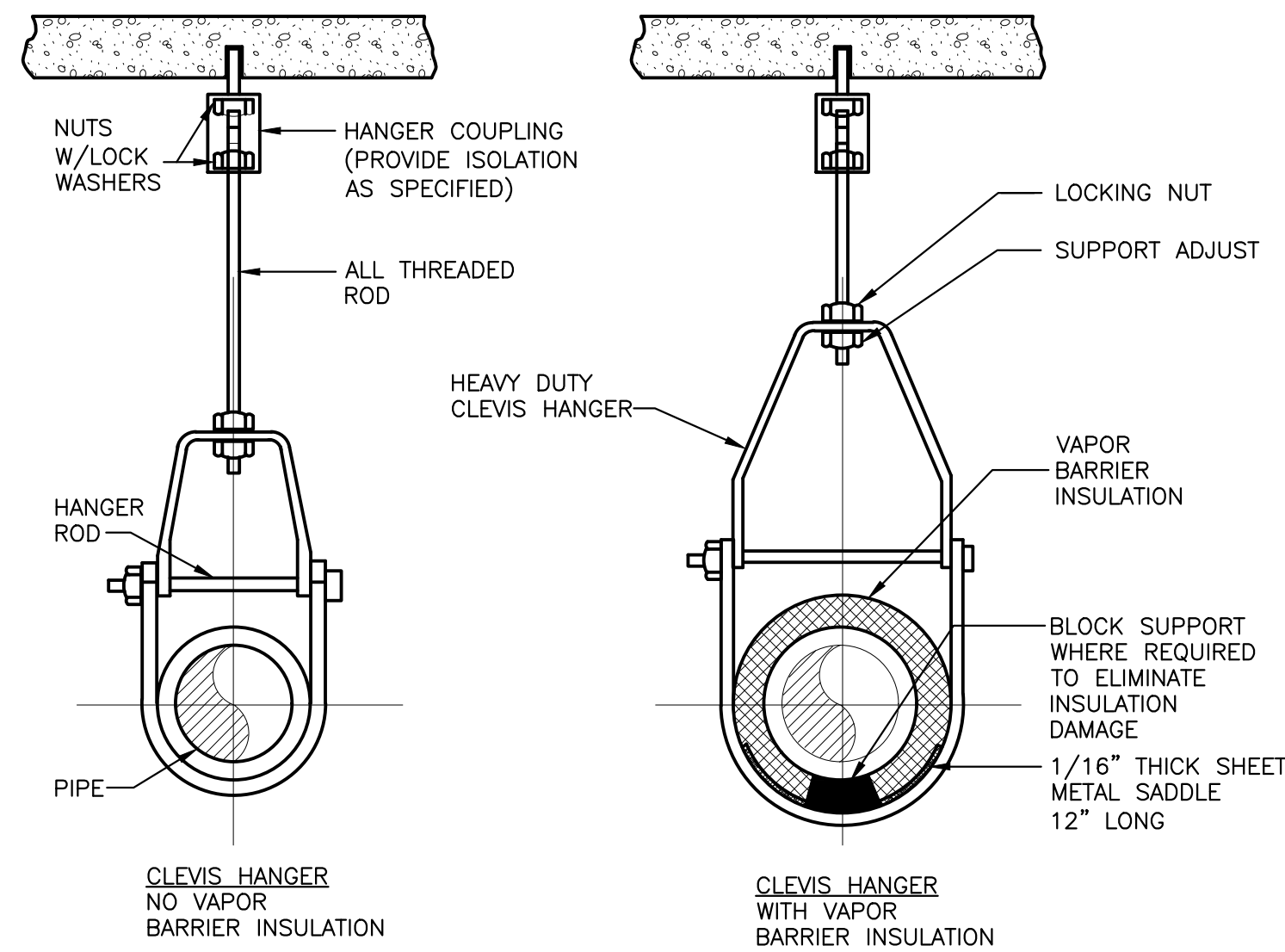
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SUBMITTED BY:
 CAD DWG FILE: SAA
 DRAWN BY: SAA
 CHECKED BY: SAA

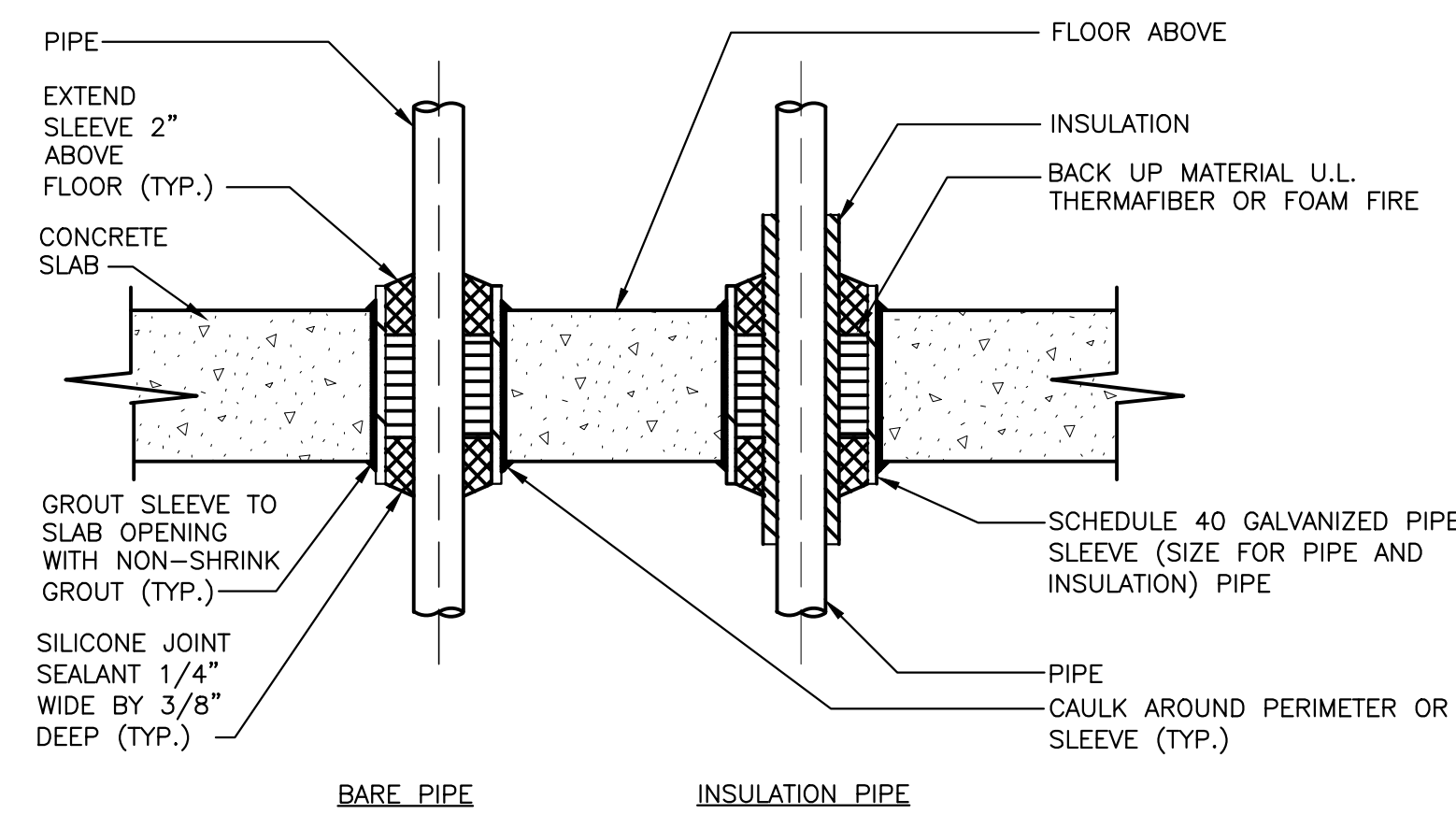
PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

PART PLANS-NEW WORK-PLUMBING

SCALE: AS NOTED
 DRAWING NO. **P4.6**

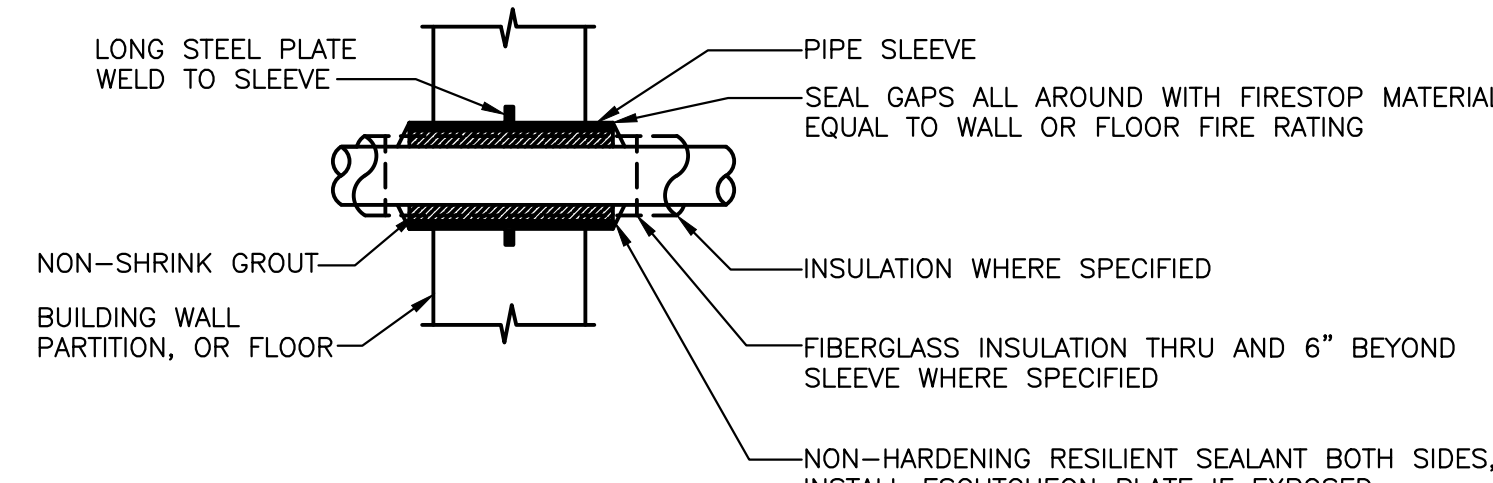


TYPICAL PIPE HANGER SUPPORTS
NOT TO SCALE



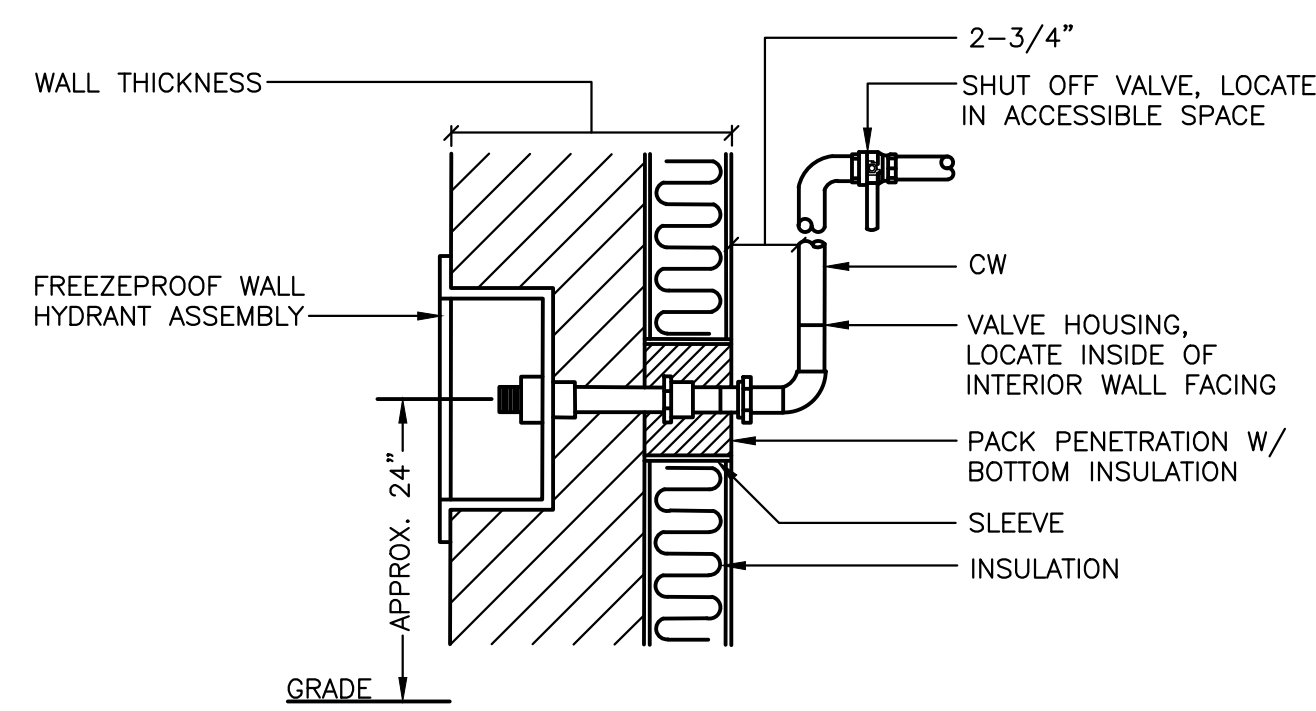
DETAIL-PIPE SLEEVE THROUGH FLOOR
NOT TO SCALE

- NOTES:
1. AT THE CONTRACTOR'S OPTION A U.L. LISTED/APPROVED FIRE STOP PIPE SLEEVE ASSEMBLY MAY BE SUBMITTED FOR APPROVAL.

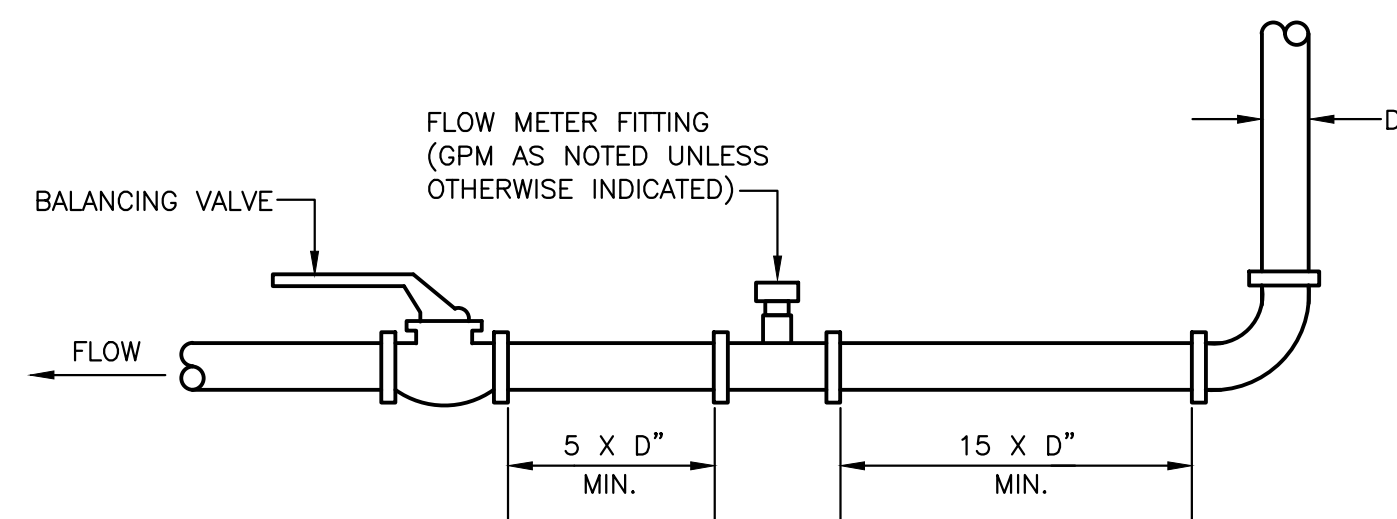


DETAIL-TYPICAL MASONRY WALL AND FLOOR PENETRATION
NOT TO SCALE

- NOTES:
1. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

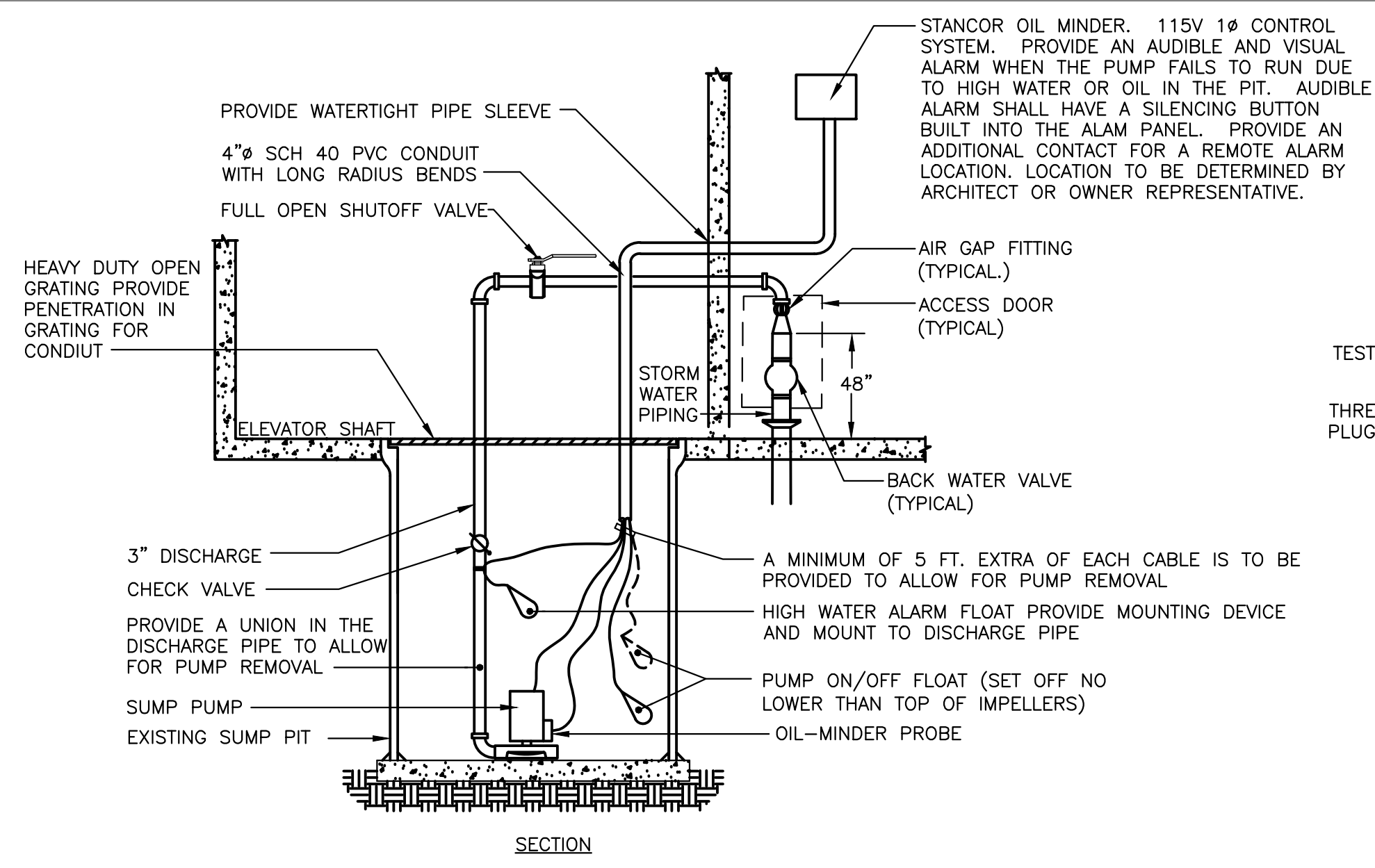


DETAIL-FREEZEPROOF WALL HYDRANT
NOT TO SCALE



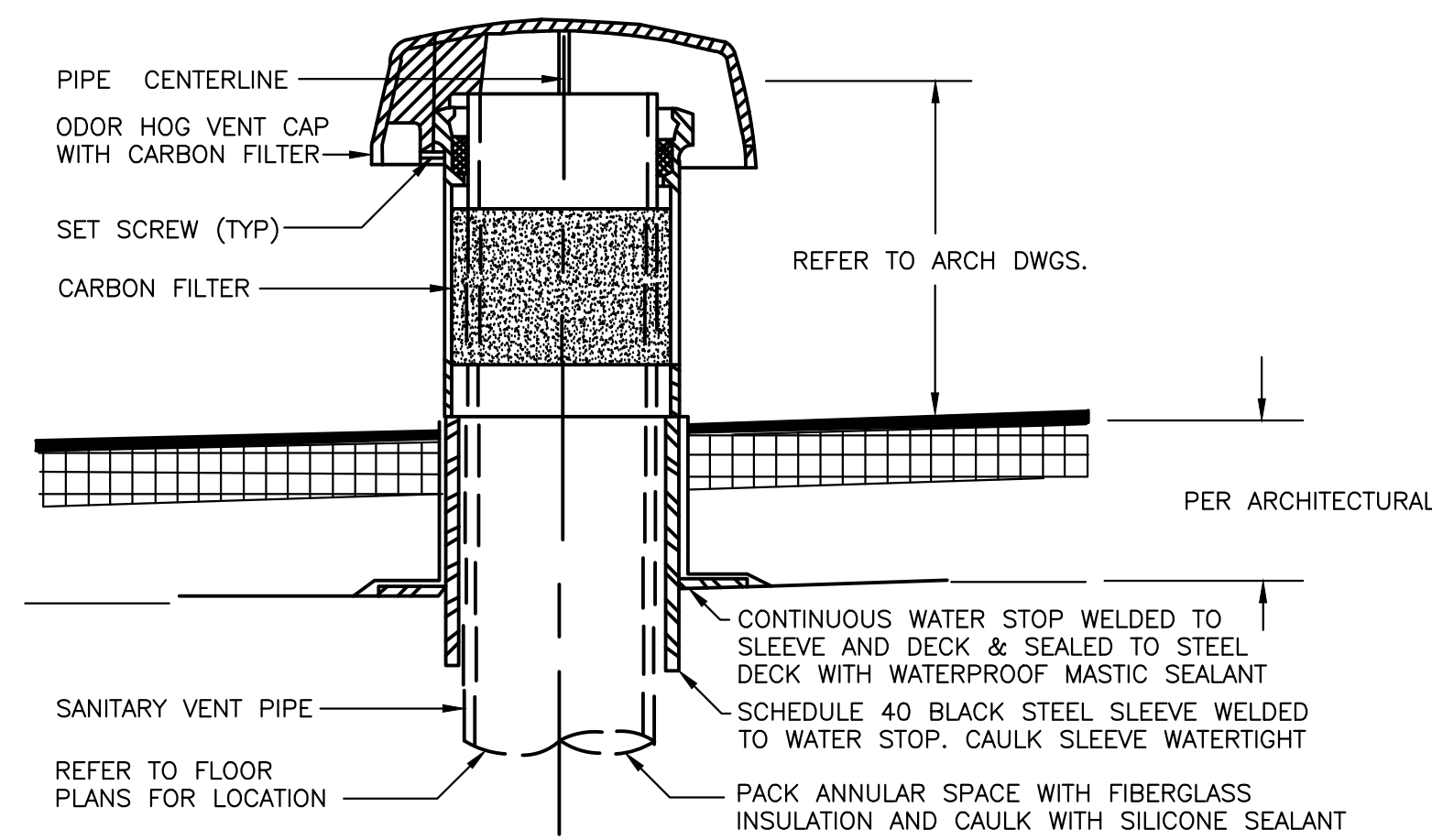
DETAIL-FLOW METER FITTING
NOT TO SCALE

- NOTES:
1. ADJUST (IF NEEDED) TO ACCOMMODATE GPM.



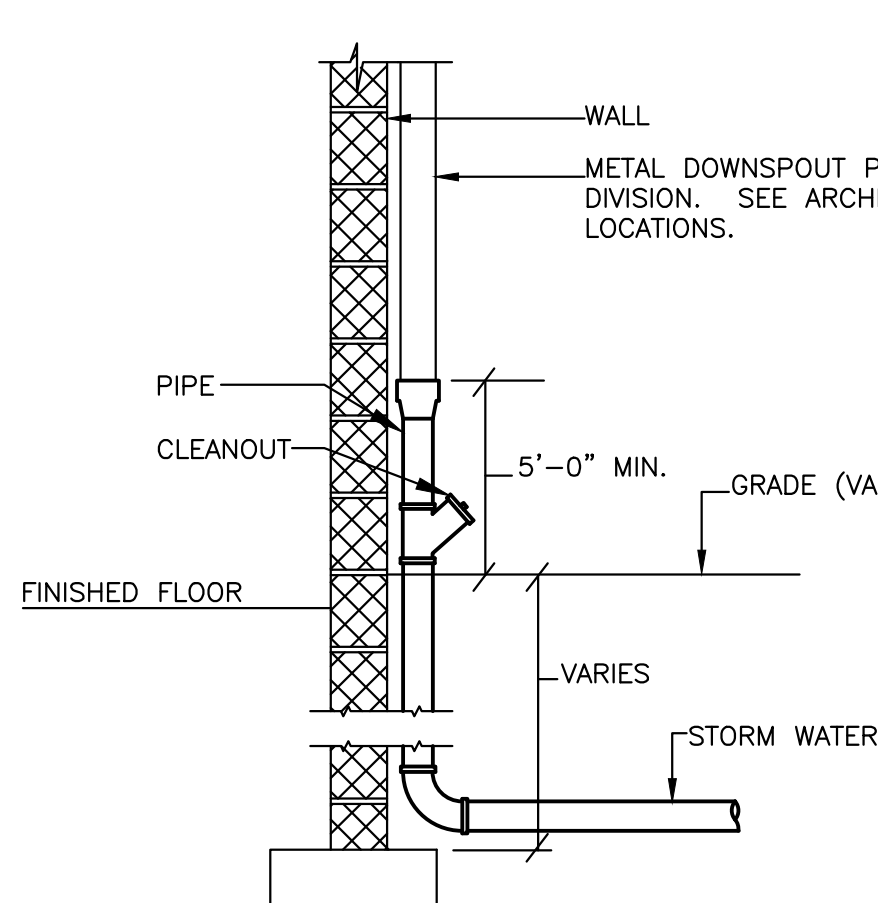
DETAIL-ELEVATOR SUMP PIT
NOT TO SCALE

- NOTES:
1. CONTROL/ALARM PANEL AND MERCURY TUBE SUBMERS-A-BULB SWITCHES PROVIDED UNDER DIVISION 22, WIRING PROVIDED UNDER DIVISION 26.



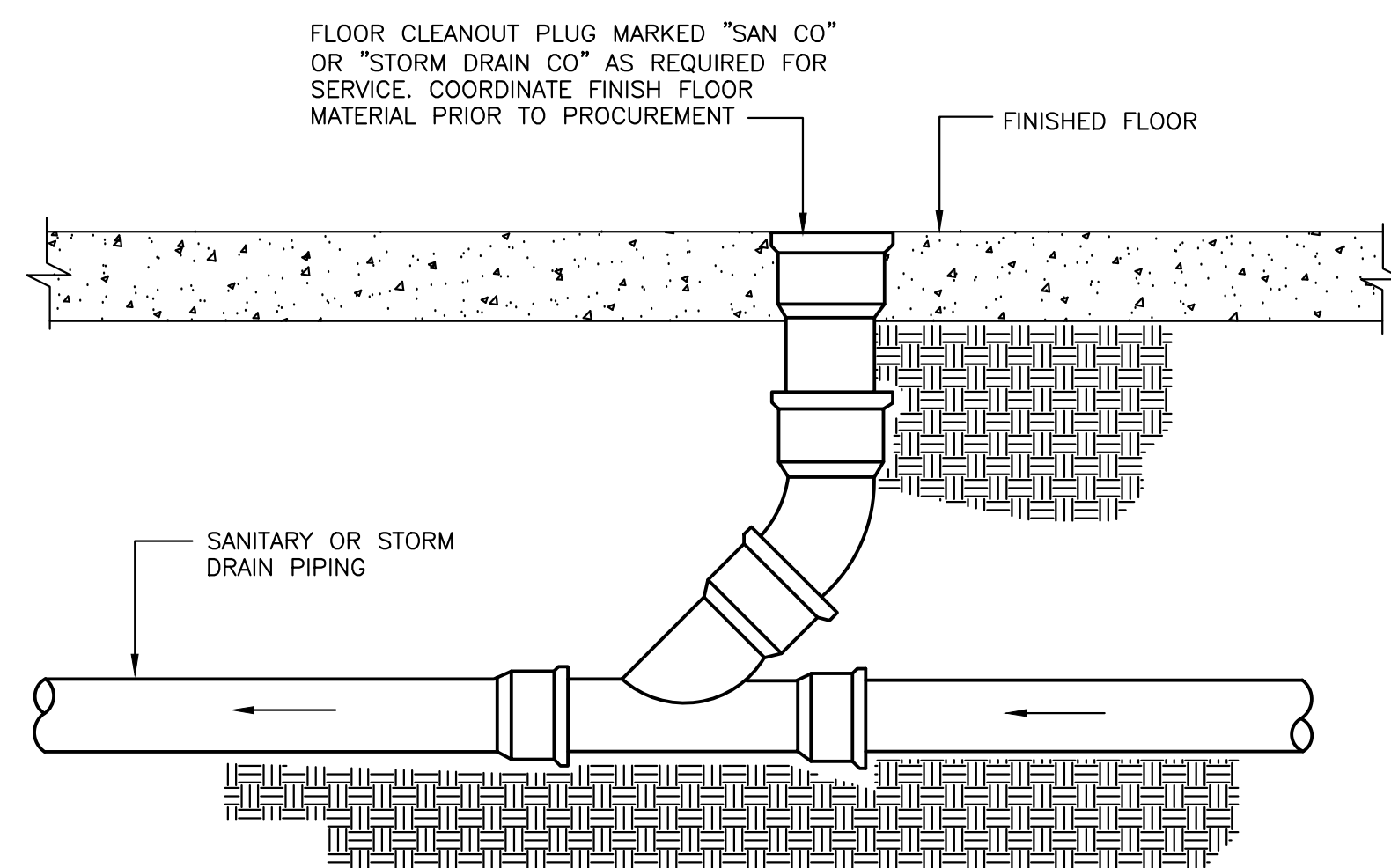
DETAIL-TYPICAL ODOR REDUCING VENT CAP
NOT TO SCALE

- NOTES:
1. PROVIDE FOR ALL SANITARY VENTS

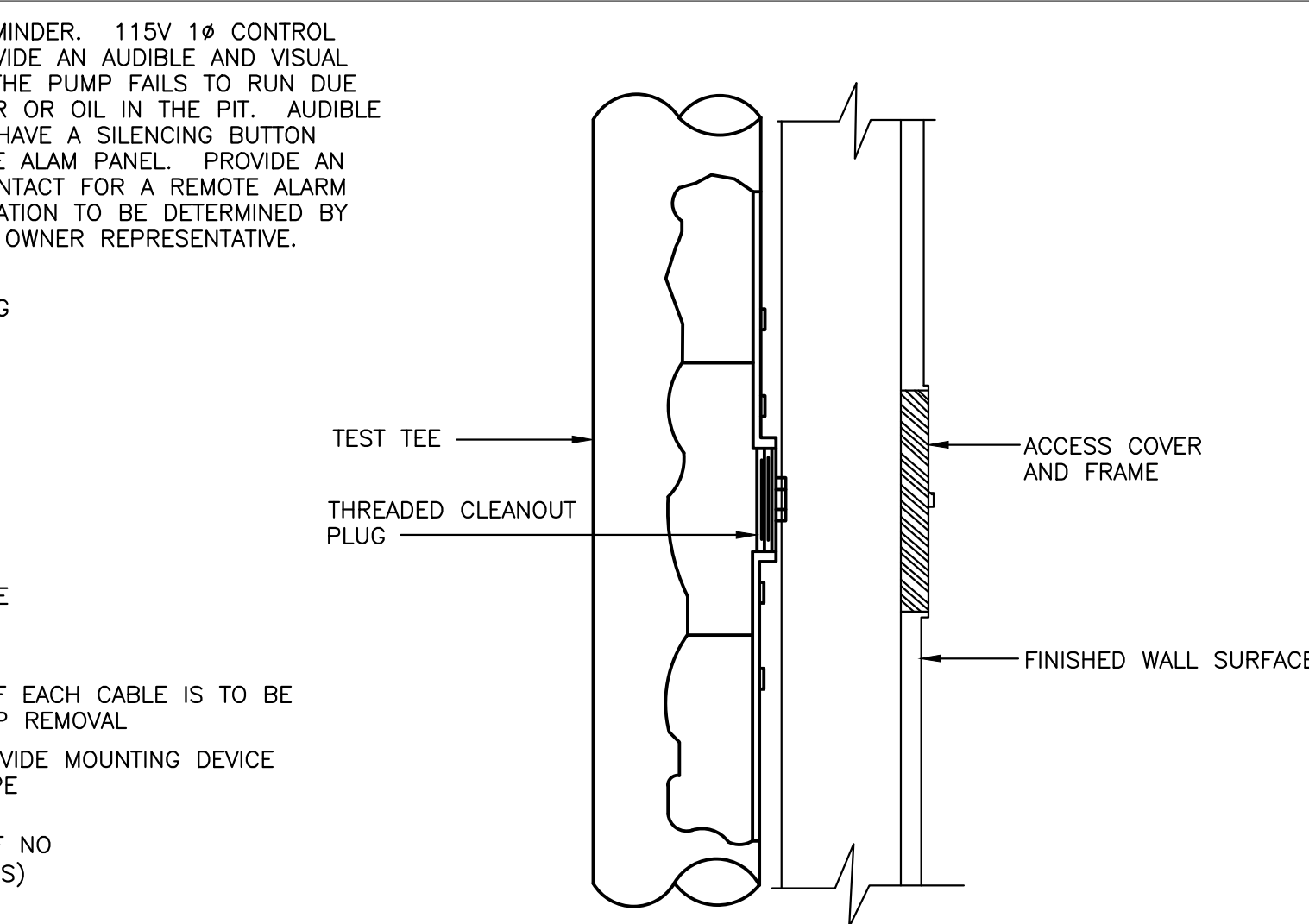


DETAIL-DOWNSPOUT BOOT
NOT TO SCALE

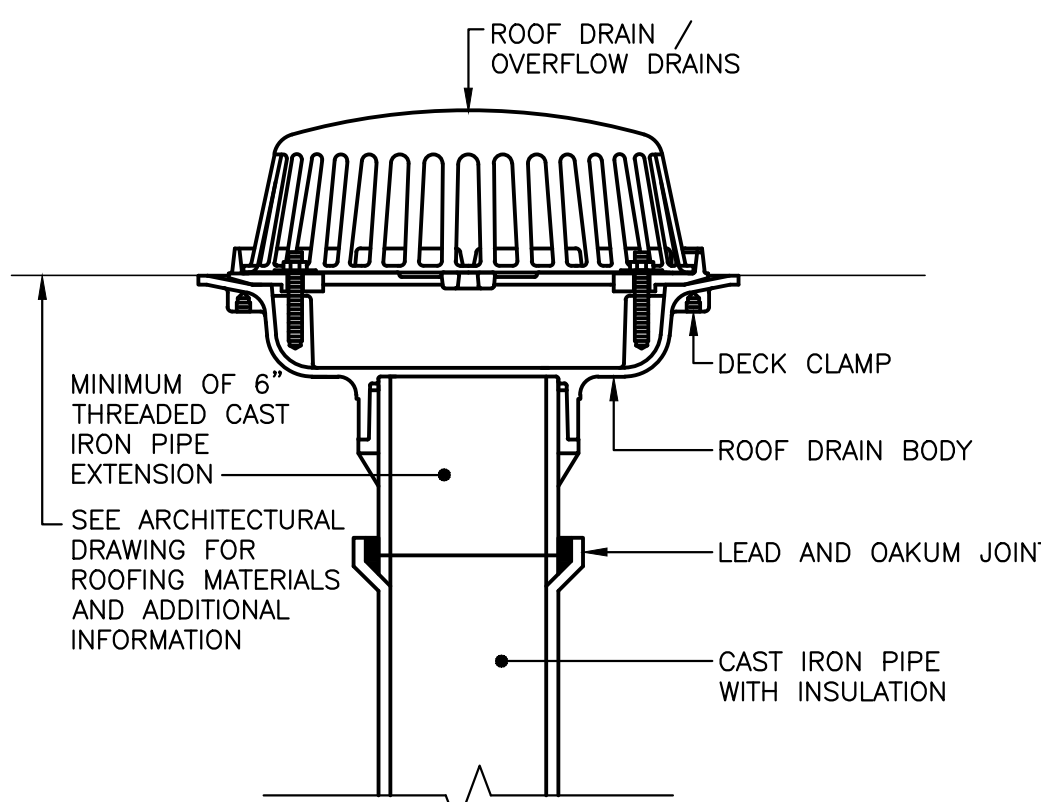
- NOTES:
1. SEE CIVIL PLANS FOR STORM WATER PIPE SIZES AND ADDITIONAL NOTES.



DETAIL-TYPICAL FLOOR CLEANOUT
NOT TO SCALE

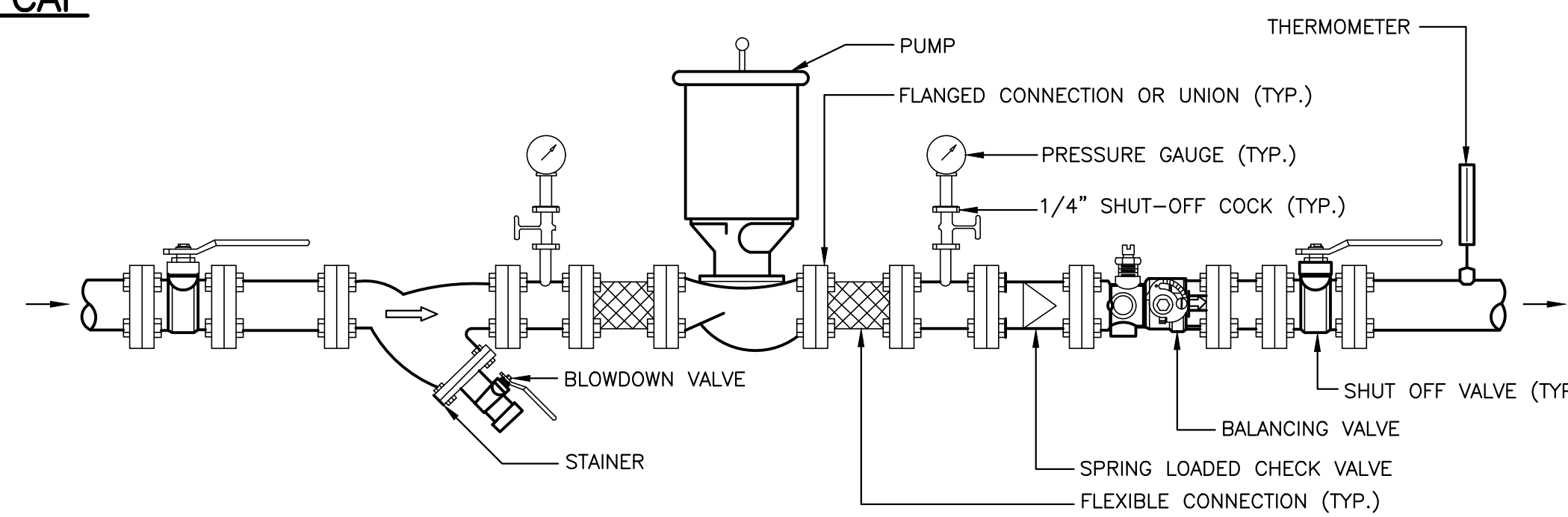


DETAIL-TYPICAL INTERIOR WALL CLEANOUT WITH ACCESS COVER
NOT TO SCALE

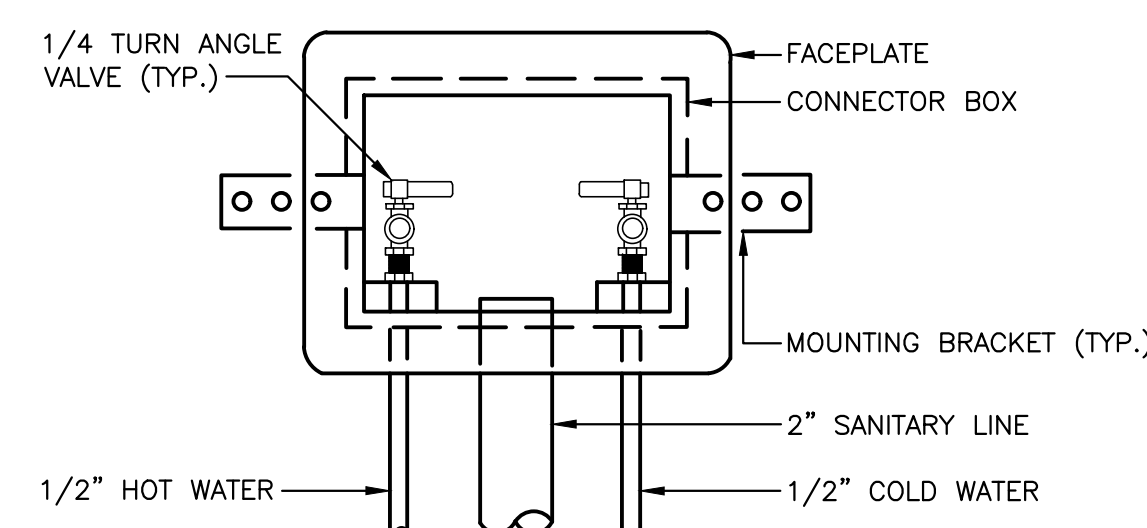


DETAIL - ROOF DRAIN
NOT TO SCALE

- NOTES:
1. PROVIDE 8'-0" SQUARE FOOT TAMPED ROOF AREA AT EACH DRAIN. COVER AREA WITH BASE FLASHING UNLESS OTHERWISE NOTED.
2. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.
3. FIRST PIPE HANGER SHALL BE AS CLOSE AS POSSIBLE TO ELBOW.
4. APPLIES TO ALL ROOF AND OVERFLOW DRAINS.

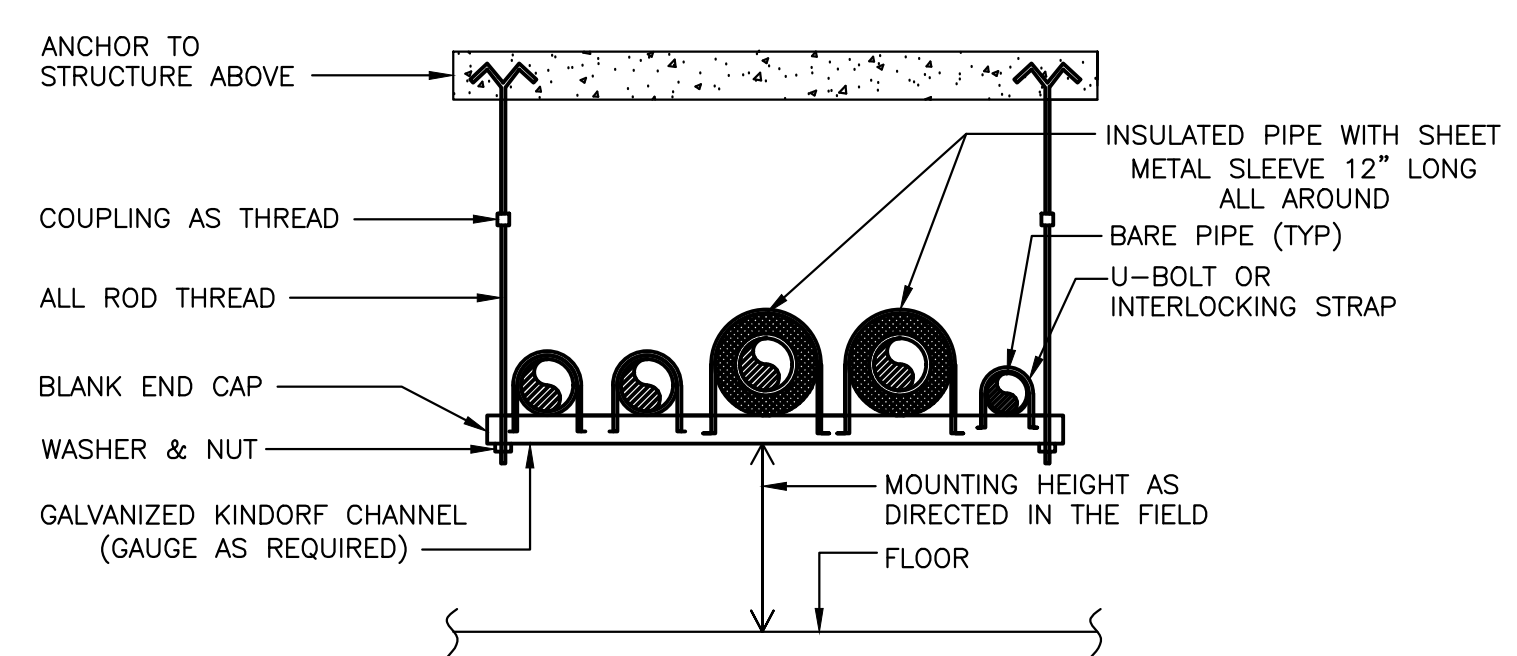


DETAIL- INLINE PUMP
NOT TO SCALE



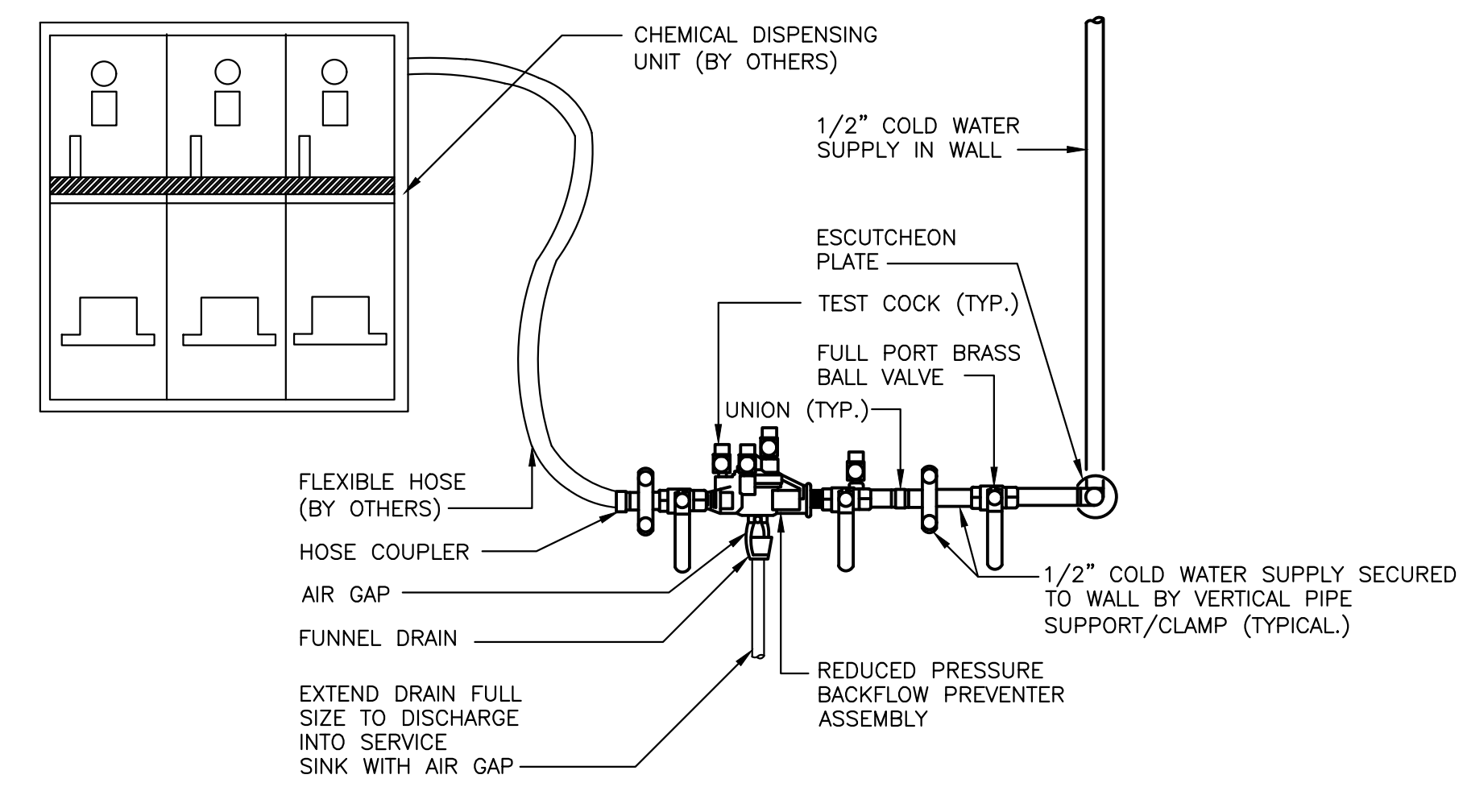
DETAIL-TYPICAL CLOTHES WASHER CONNECTOR BOX
NOT TO SCALE

- NOTES:
1. CONTRACTOR SHALL PROVIDE AN UP FEED OR DOWN FEED WASHING MACHINE BOX AS INDICATED ON DRAWINGS.
2. PROVIDE VACUUM BREAKERS ON WATER CONNECTIONS

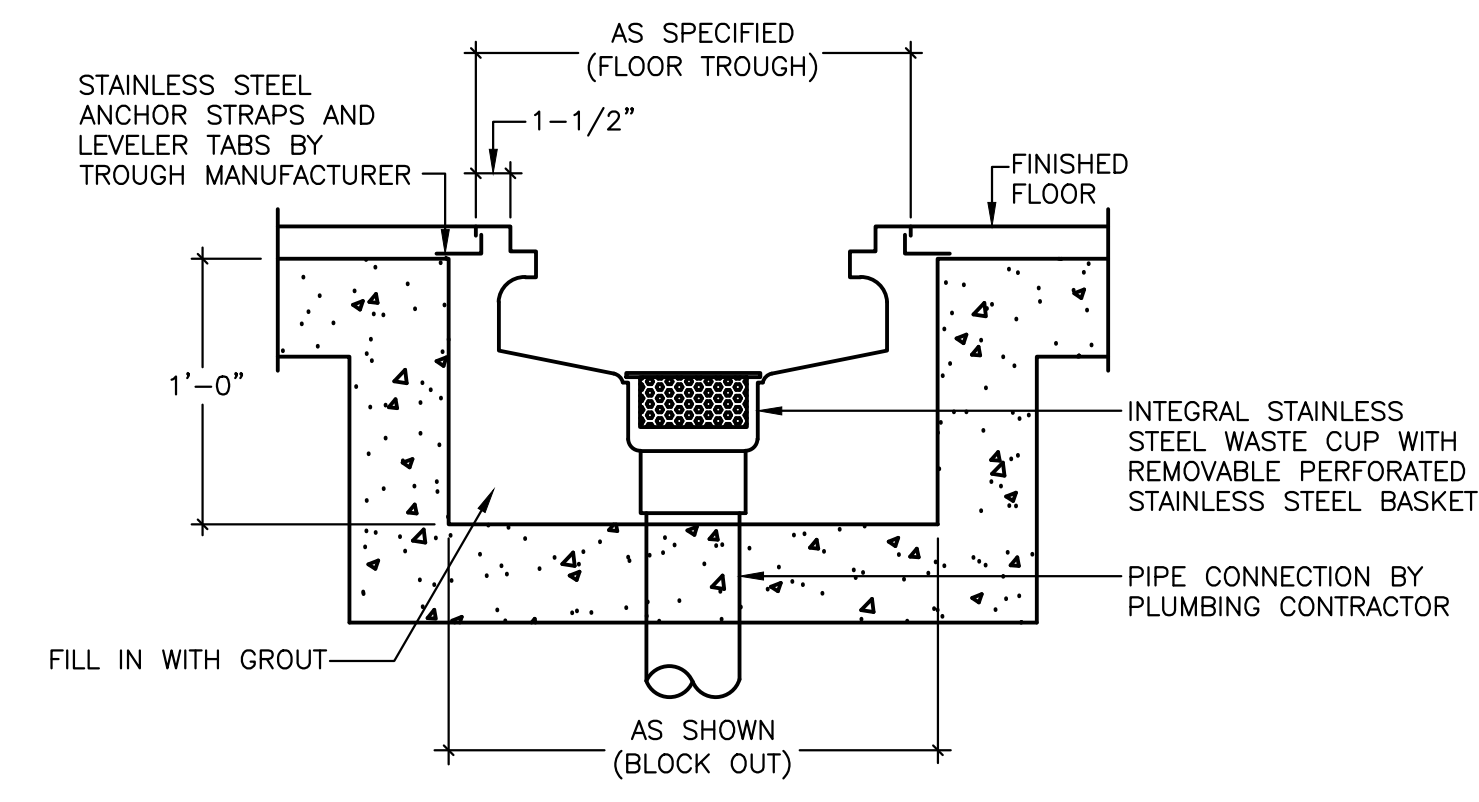


DETAIL-TRAPEZE PIPE SUPPORT
NOT TO SCALE

- NOTES:
1. ALL PIPING SUPPORT SYSTEM COMPONENTS SHALL HAVE A NON-CORROSIVE METAL FINISH, GALV-KRON OR EQUAL

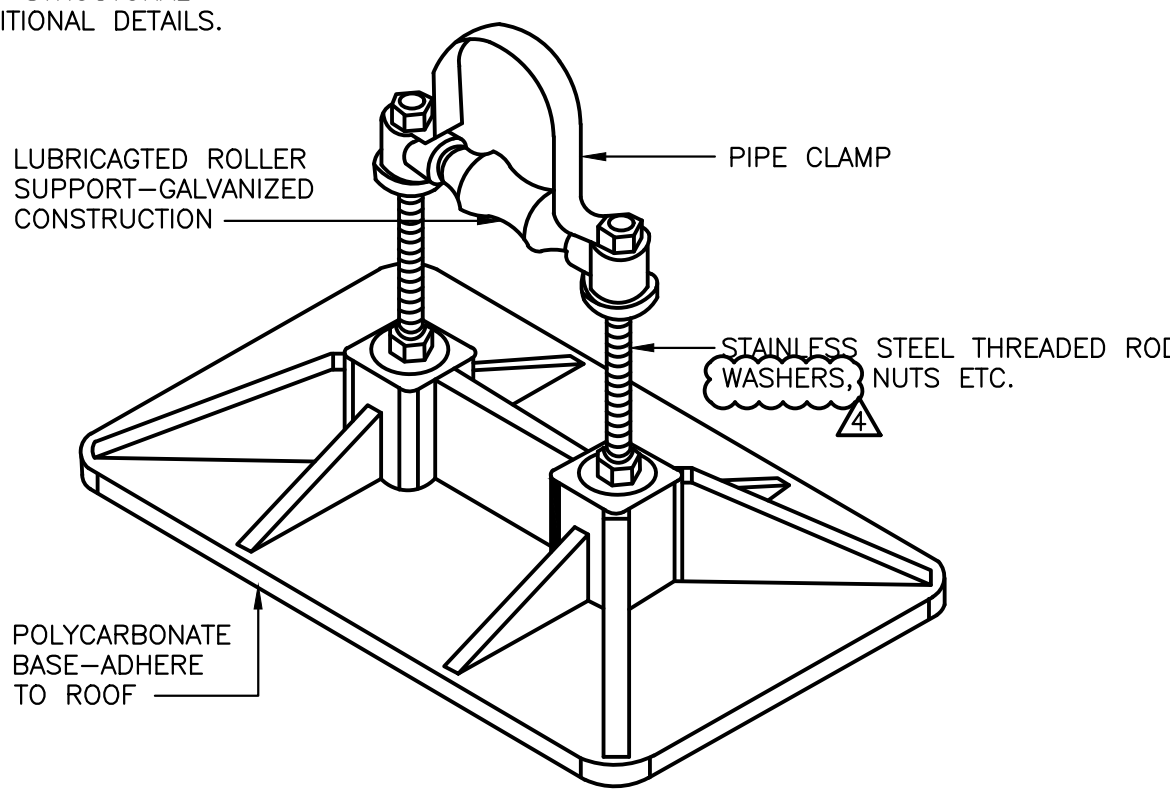


DETAIL-TYPICAL CHEMICAL DISPENSING PIPING
NOT TO SCALE

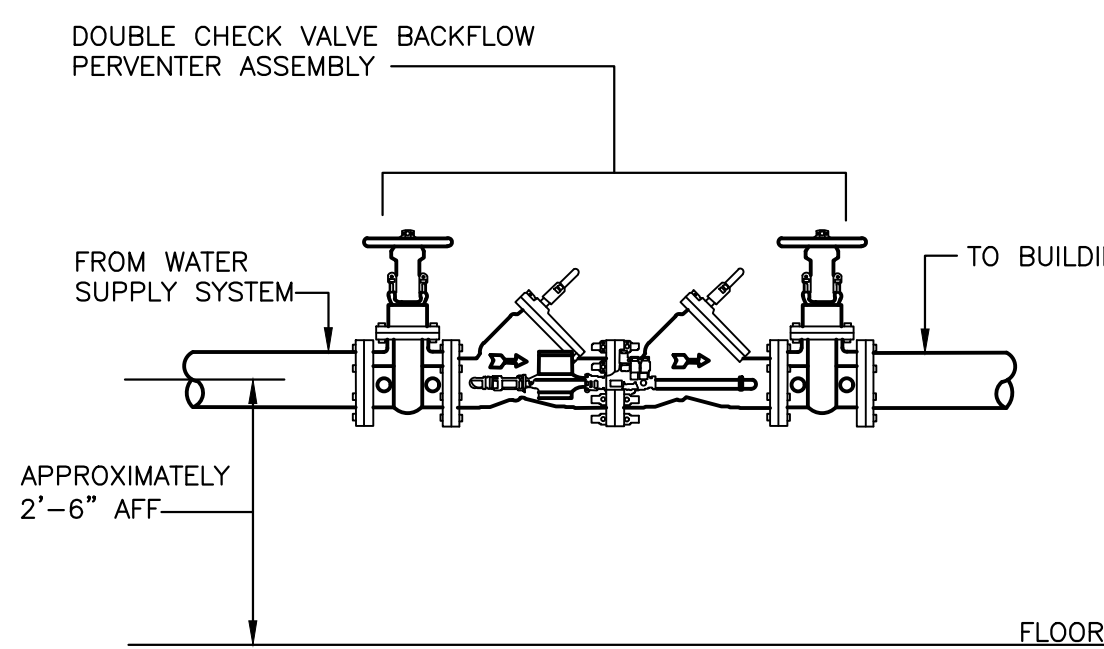


DETAIL-FLOOR TROUGH
NOT TO SCALE

- NOTES:
1. TROUGH FURNISHED BY KITCHEN EQUIPMENT CONTRACTOR. INSTALLED BY PLUMBING CONTRACTOR. SEE ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR ADDITIONAL DETAILS.

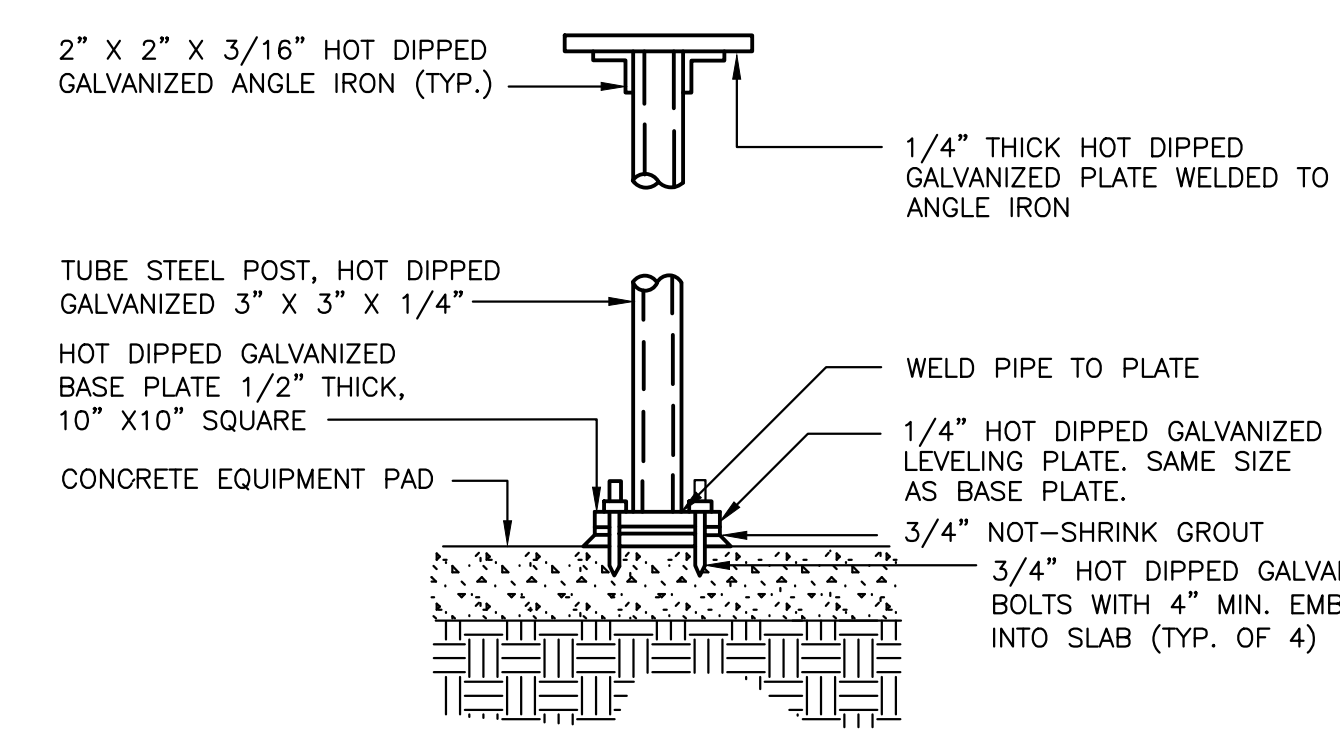


DETAIL-TYPICAL PIPING ON ROOF SUPPORT
NOT TO SCALE



DETAIL- BACKFLOW PREVENTER ASSEMBLY FOR INCOMING DOMESTIC WATER
NOT TO SCALE

- NOTES:
1. PROVIDE FLOOR PIPE SUPPORTS.
2. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.



DETAIL-TYPICAL FLOOR MOUNT PIPE SUPPORT
NOT TO SCALE

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
100 WEST ROAD, SUITE 402
TOWSON, MD 21204



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HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 36773, EXPIRATION DATE: 01-21-23

PROPOSED NEW
MONTEBELLO ELEMENTARY/
MIDDLE SCHOOL
BALTIMORE CITY PUBLIC SCHOOLS
2020 EAST 32ND STREET, BALTIMORE,
MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____

Title: _____
MSA APPROVAL

Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
1/8/21		ADDENDUM NUMBER 4
12/23/20		ADDENDUM NUMBER 3
12/16/20		ADDENDUM NUMBER 2
10/16/20		PROGRESS SET
9/11/20		50% CD SUBMISSION
7/10/20		100% DD SUBMISSION

AS-BUILT REVISIONS

SUBMITTED BY: _____
CAD DWG FILE: SAA

DRAWN BY: SAA
CHECKED BY: SAA

PROJECT NO. BCS-02-004
DATE: NOVEMBER 16, 2020

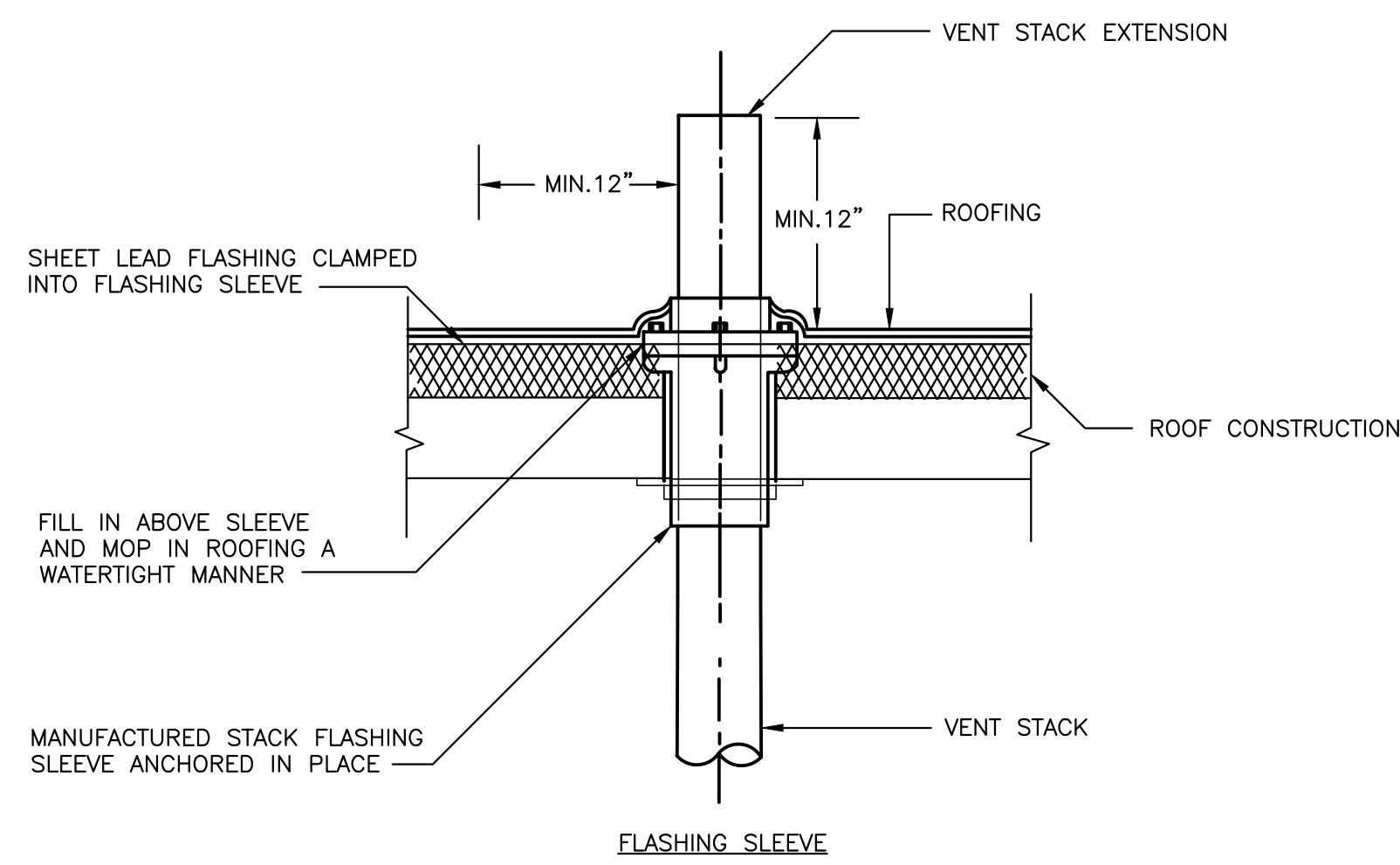
PLUMBING DETAILS

SCALE: AS NOTED

DRAWING NO. _____

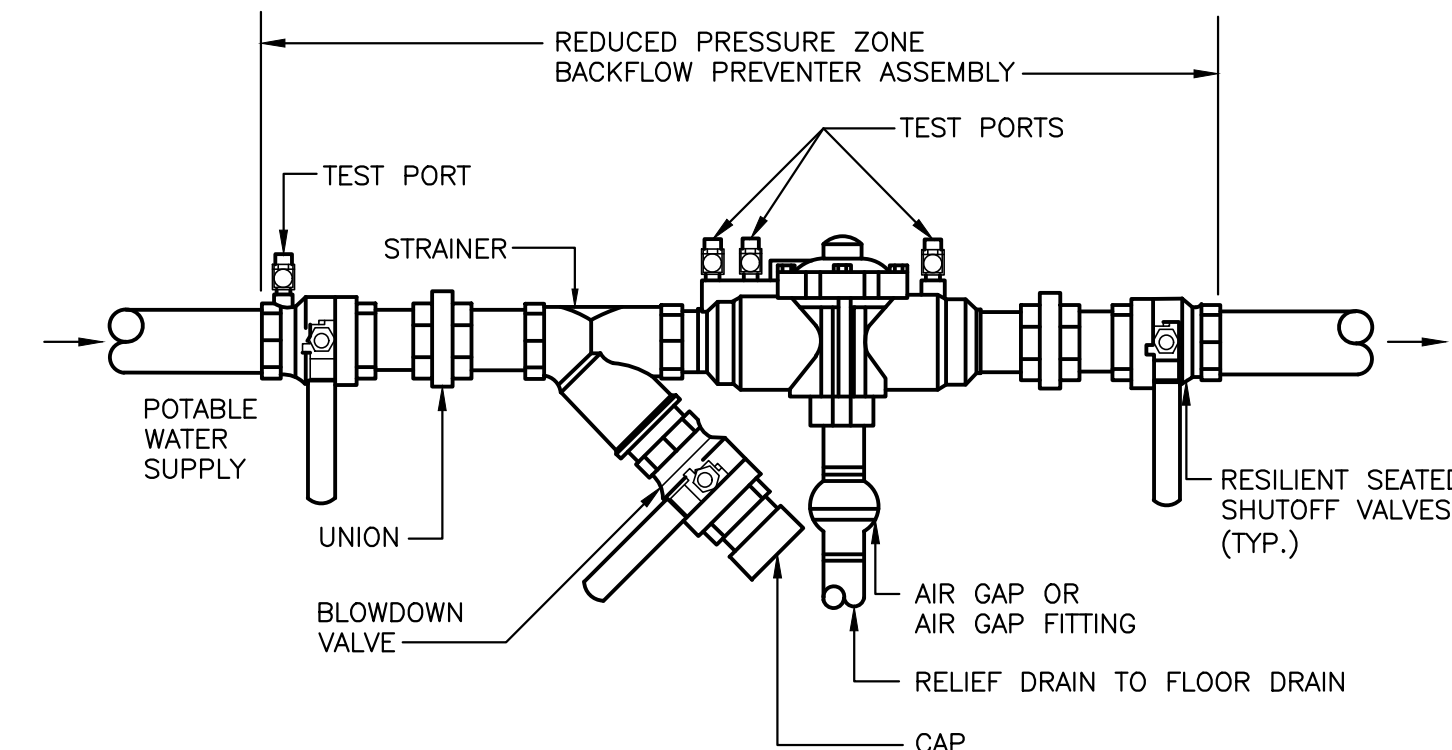
P5.1

90% CONTRACT DOCUMENTS



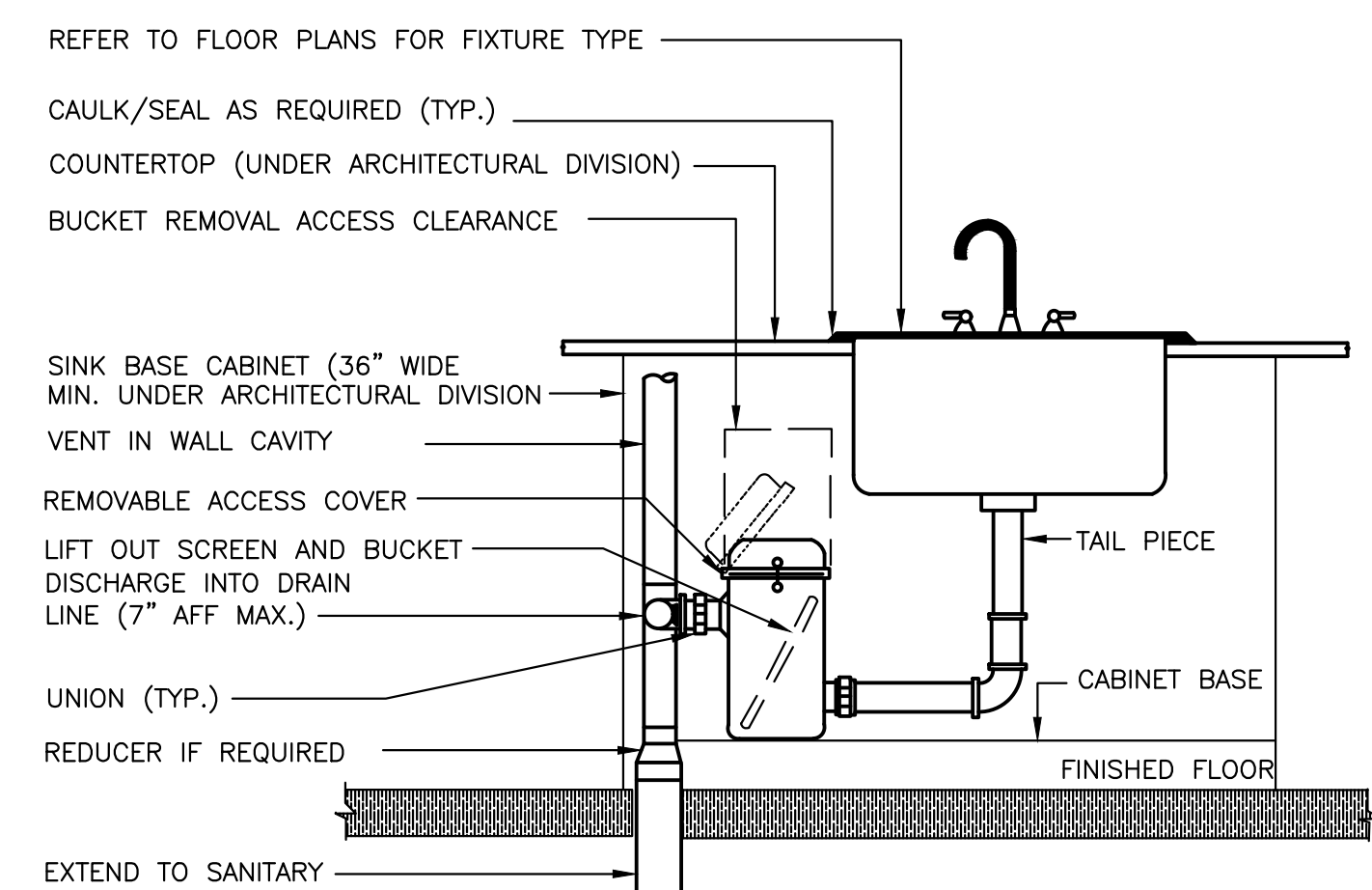
DETAIL-VENT THROUGH ROOF

NOT TO SCALE
 NOTES:
 1. REFER TO ARCHITECTURAL DRAWINGS AND DETAILS FOR ROOF CONSTRUCTION.
 2. VENT STACK OUTLET TO BE 10 FT.(MIN.) FROM ANY WALL OR STRUCTURE AND/OR 3 FT. ABOVE STRUCTURE.



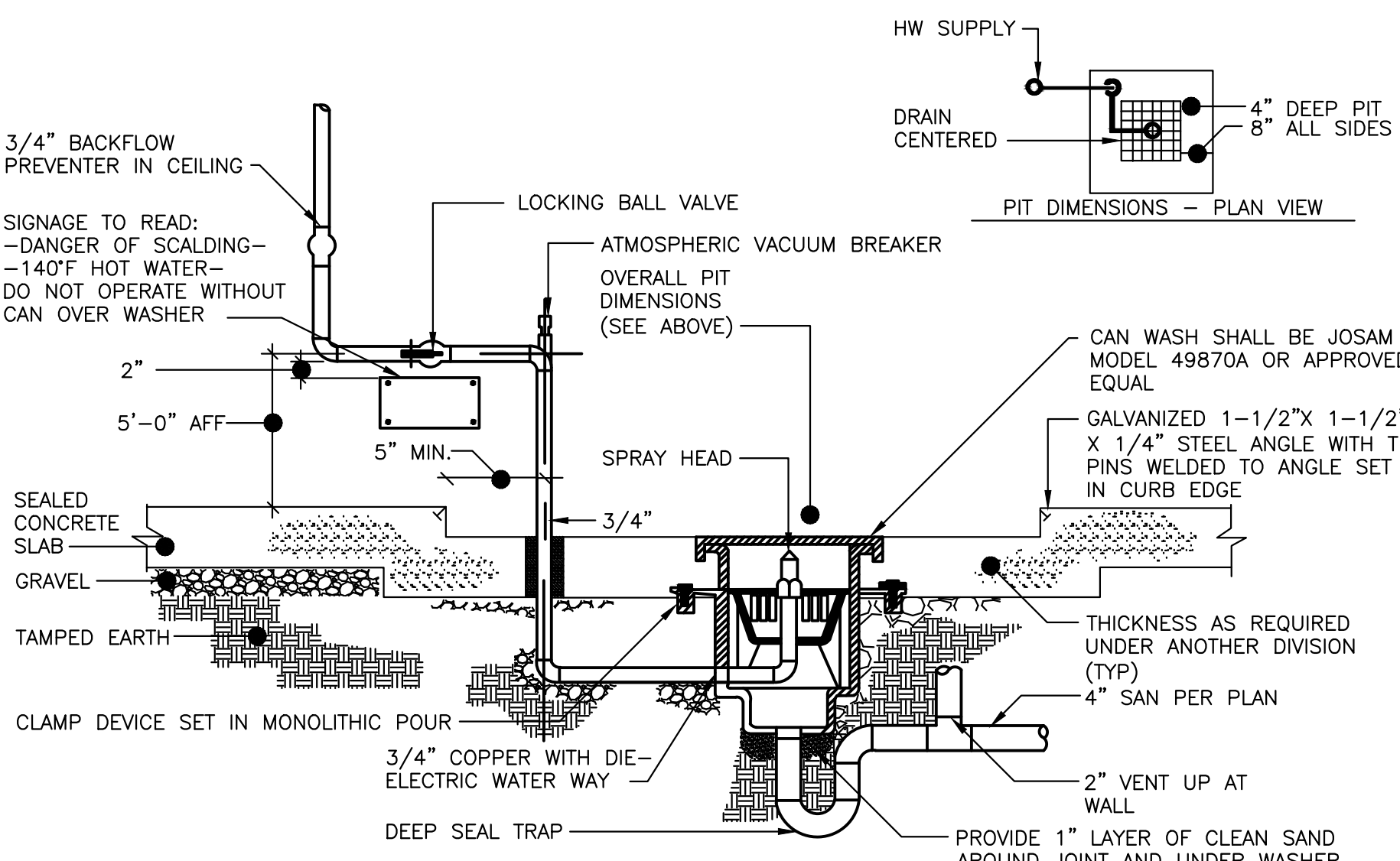
DETAIL-RPZ BACKFLOW PREVENTER - 2" AND BELOW

NOT TO SCALE
 NOTES:
 1. REDUCED PRESSURE ZONE PRINCIPLE BACKFLOW PREVENTION DEVICES MUST BE INSTALLED BETWEEN 12" AND 48" ABOVE THE FLOOR OR OTHER WORKING SURFACE TO PROVIDE SUFFICIENT ACCESS FOR PERIODIC TESTING AND MAINTENANCE.



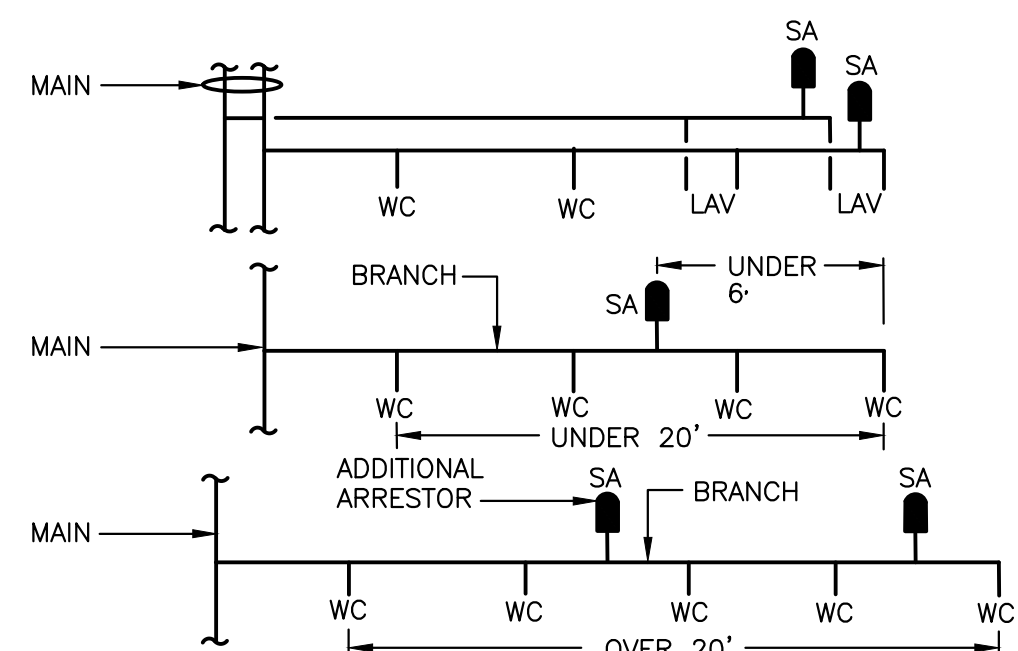
DETAIL-TYPICAL SINK W/ TOP ACCESS FLOOR MOUNTED SOLIDS TRAP

NOT TO SCALE



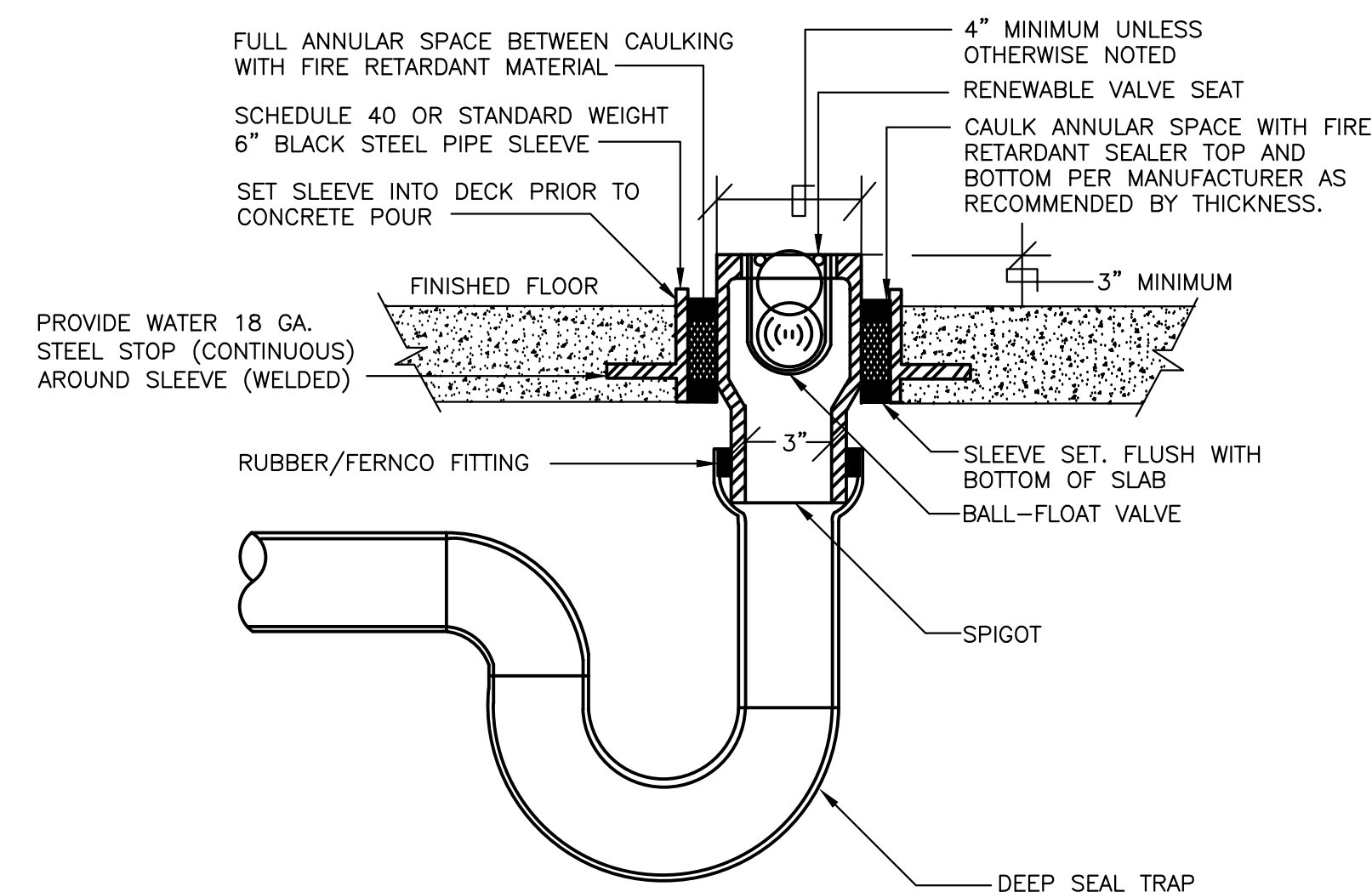
DETAIL-CAN WASHER INSTALLATION

NOT TO SCALE
 NOTES:
 1. SIGN SHALL BE MINIMUM OF 8" H X 12" W WITH 1" HIGH LETTERING ENGRAVED ON RED PHENOLIC PLASTIC WITH WHITE CORE



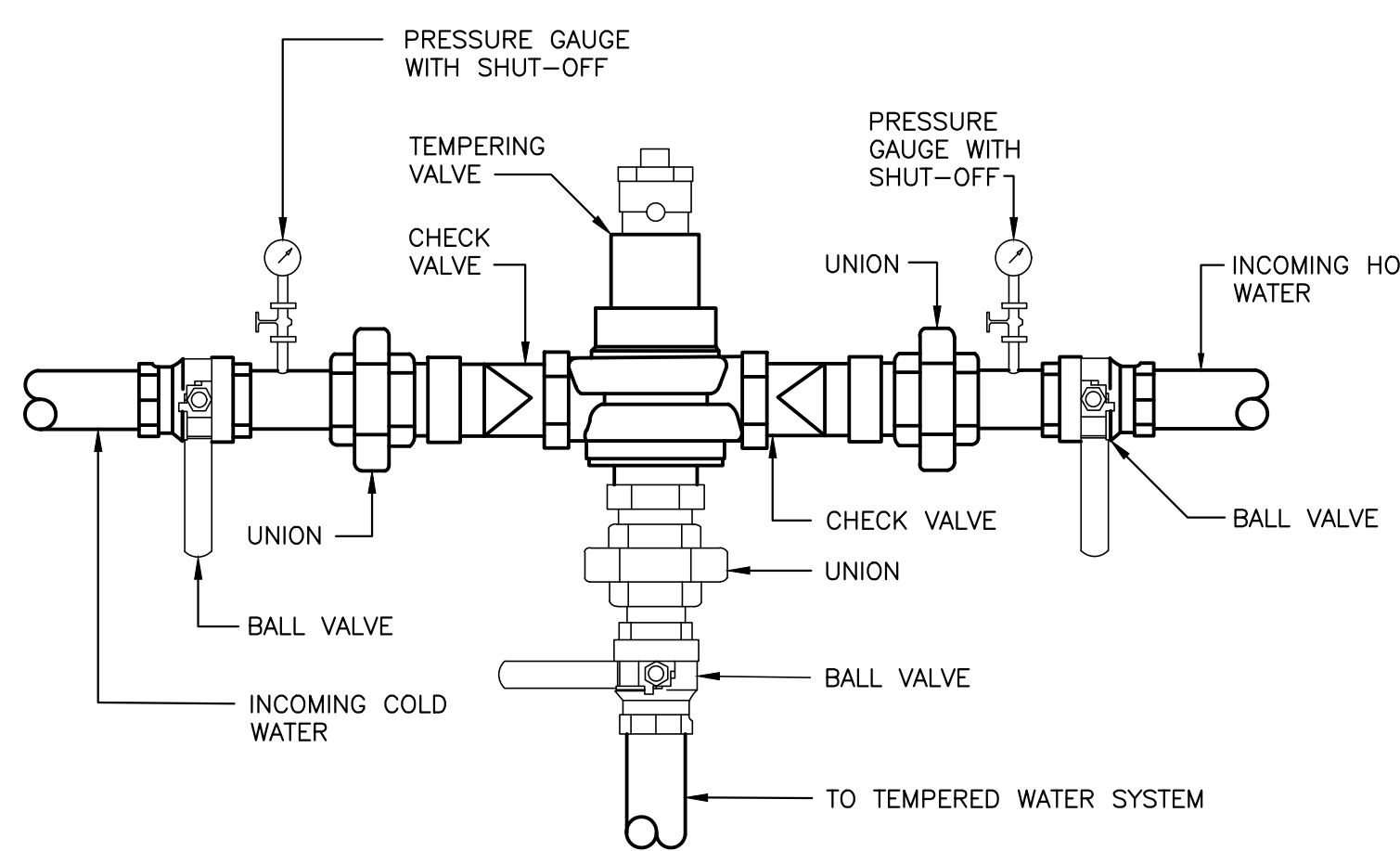
DETAIL-WATER HAMMER ARRESTOR

NOT TO SCALE
 NOTES:
 1. SHOCK ARRESTORS SHALL BE INSTALLED ON ALL BRANCH PIPING SERVING PLUMBING FIXTURES, QUICK-CLOSING VALVES, EQUIPMENT, OR WALL HYDRANTS/HOSE BIBBS.
 2. BRANCH PIPES WITH A DEVELOPED LENGTH OF 25' OR LESS MAY HAVE ARRESTORS REDUCED BY ONE SIZE.
 3. BRANCH PIPES WITH A DEVELOPED LENGTH OF 75' OR GREATER SHALL BE INCREASED ONE SIZE.
 4. STOP VALVE AND SHOCK ARRESTORS SHALL BE ACCESSIBLE THROUGH A SINGLE ACCESS DOOR.
 5. SHOCK ARRESTORS SHALL BE CERTIFIED BY THE PLUMBING AND DRAINAGE INSTITUTE (PDI).
 6. WHEN WORKING WATER PRESSURE EXCEEDS 65 PSI USE NEXT LARGEST SIZE.
 7. MAXIMUM PIPING LENGTH COVERED BY ONE ARRESTOR SHALL BE 20 LINEAR FT.
 8. ALL INSTALLATIONS AS DIRECTED BY MANUFACTURER.



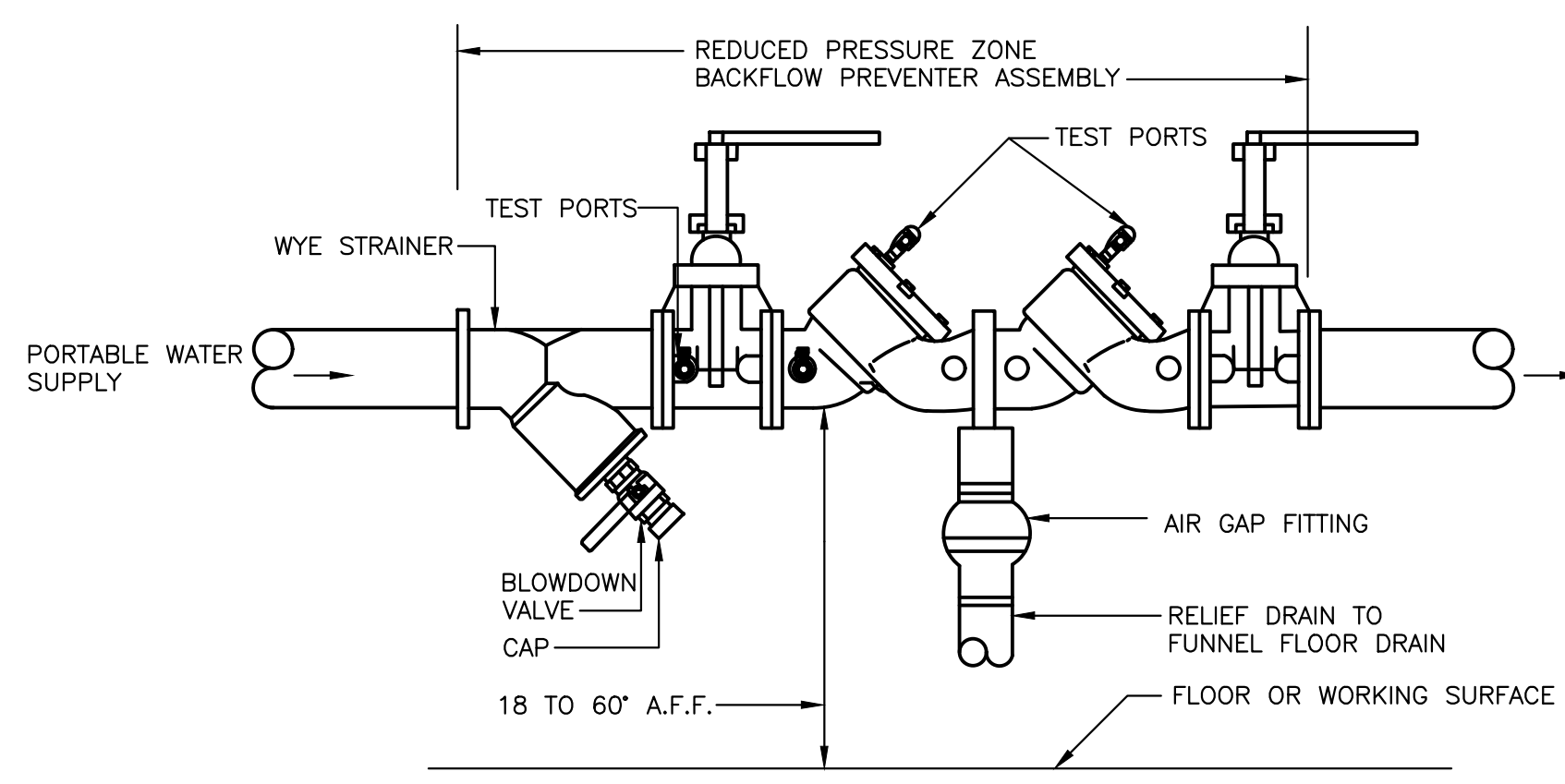
DETAIL-OPEN SITE DRAIN WITH BACKWATER VALVE

NOT TO SCALE



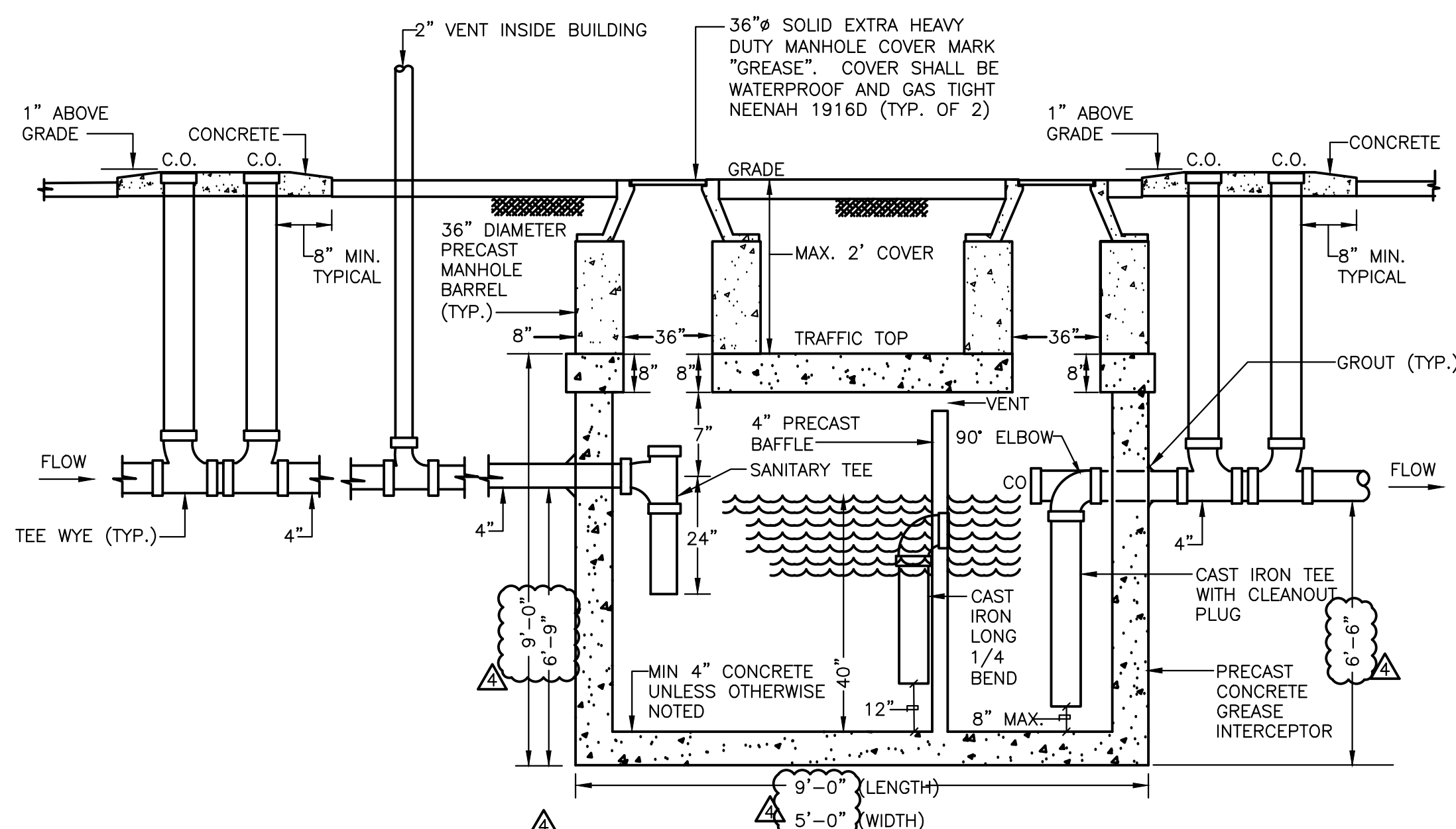
DETAIL-TEMPERING VALVE PIPING

NOT TO SCALE



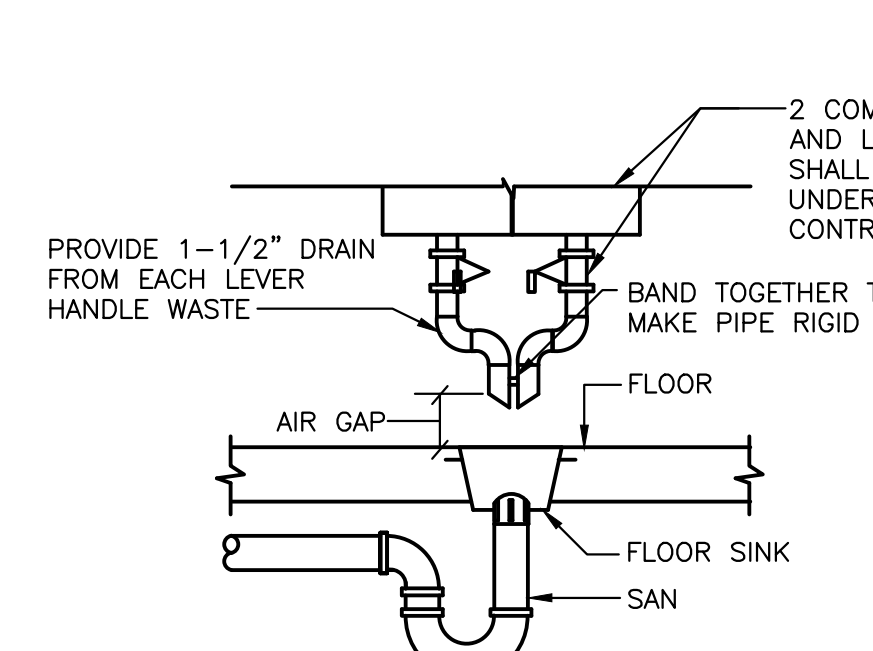
DETAIL-RPZ BACKFLOW PREVENTER (ABOVE 2")

NOT TO SCALE
 NOTES:
 1. REDUCED PRESSURE ZONE PRINCIPLE BACKFLOW PREVENTION DEVICES MUST BE INSTALLED BETWEEN 12" AND 48" ABOVE THE FLOOR OR OTHER WORKING SURFACE TO PROVIDE SUFFICIENT ACCESS FOR PERIODIC TESTING AND MAINTENANCE.



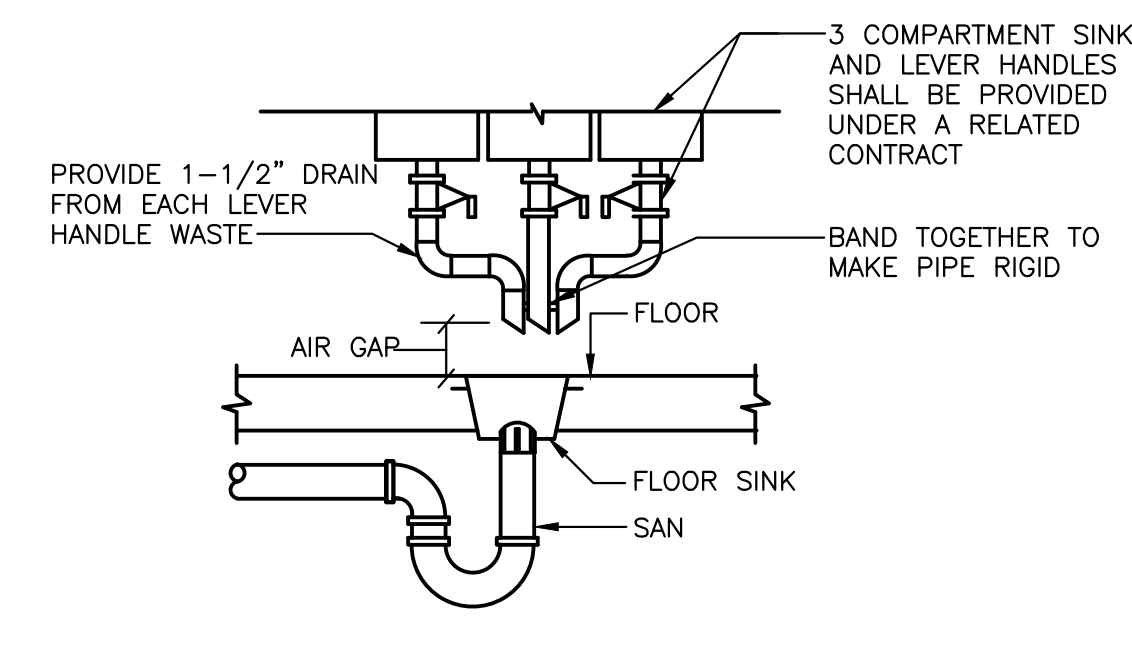
DETAIL-1500 GALLON GREASE INTERCEPTOR

NOT TO SCALE
 NOTES:
 1. CONCRETE STRENGTH (F_c)=5,000 PSI @ 28 DAYS. DENSITY=150 pcf.
 2. REINFORCING PER ASTM A-631; GRADE 60
 3. WALLS, BASE AND TOP SLAB DESIGNED FOR HS-20 LOADING FOR UNDERGROUND PRECAST CONCRETE WITH 30% IMPACT.
 4. CONTRACTOR SHALL OBTAIN APPROVAL AND COMPLY WITH REQUIREMENTS OF LOCAL OFFICIALS PRIOR TO INSTALLATION.
 5. SIZED BASED ON 30 MINUTE RETENTION TIME.
 6. PROVIDE BACKWATER VALVE.
 7. MESH PER ASTM A-185 GRADE 65.



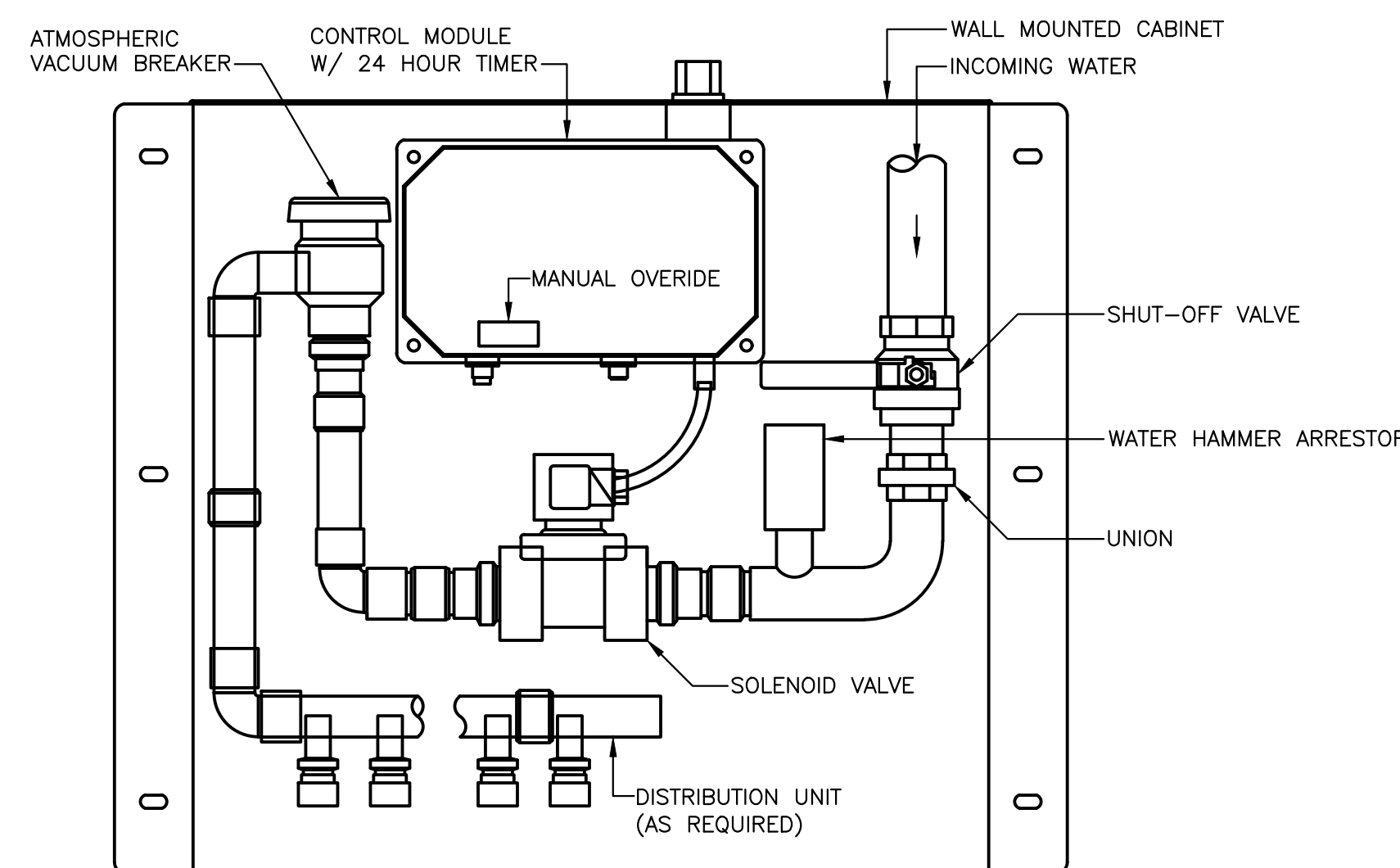
DETAIL-2 COMPARTMENT SINK CONNECTION

NOT TO SCALE



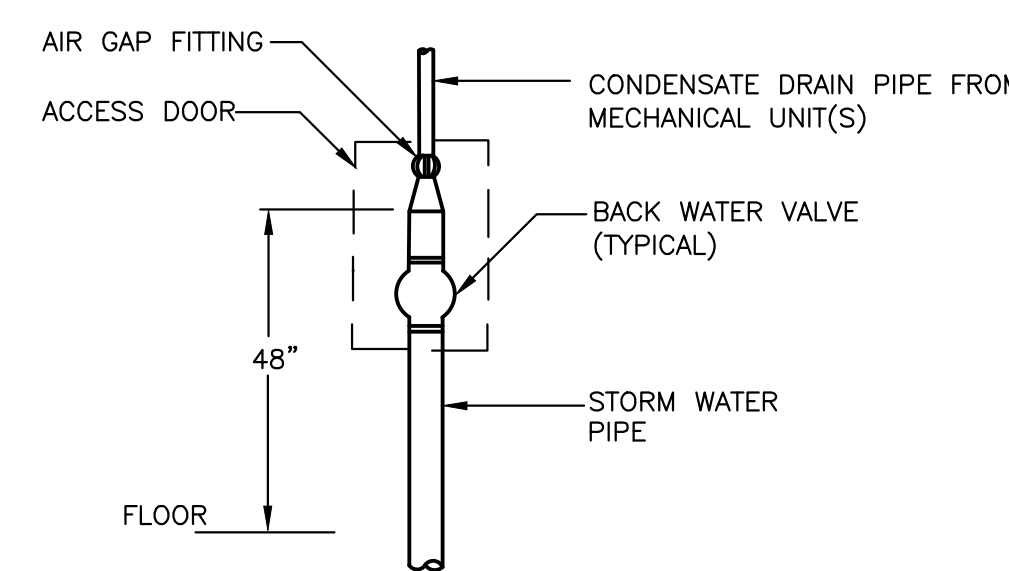
DETAIL-3 COMPARTMENT SINK CONNECTION

NOT TO SCALE



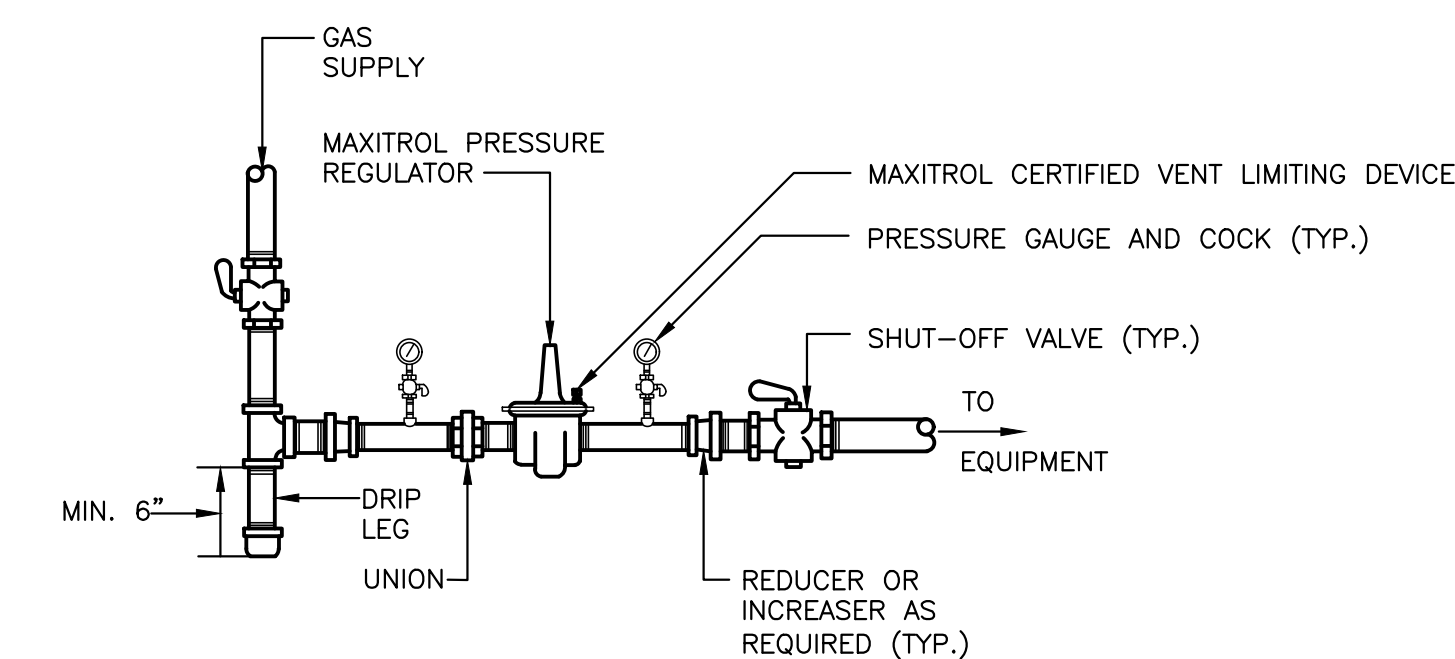
DETAIL-ELECTRIC TRAP PRIMER

NOT TO SCALE
 NOTES:
 1. SINGLE POINT ELECTRICAL CONNECTION
 2. CALIBRATED MANIFOLD FOR EQUAL WATER DISTRIBUTION.
 3. TOTAL NUMBER OF OUTLETS SHALL BE DETERMINED BY THE NUMBER OF FLOOR DRAINS AND FLOOR SINKS PRIMED WITHIN THE IMMEDIATE AREA. BOTTOM OF TRAP PRIMING STATION SHALL BE 60" MINIMUM ABOVE FINISHED FLOOR.
 4. TRAP PRIMING LINES SHALL BE INSULATED FROM TRAP PRIMING STATION TO RECEPTOR.



DETAIL-CONDENSATE DRAIN TO STORM WATER

NOT TO SCALE
 NOTES:
 1. CONDENSATE PIPING SIZES ARE INDICATED ON MECHANICAL DRAWINGS.



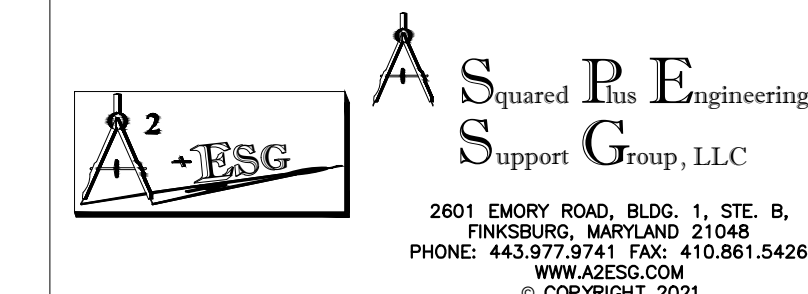
DETAIL-GAS PRESSURE REDUCING STATION

NOT TO SCALE
 NOTES:
 1. PROVIDE MAXITROL CERTIFIED VENT LIMITING DEVICE ON ALL PRESSURE REGULATORS INSTALLED INDOORS. VENT LIMITING DEVICE HAS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND HAS TO COMPLY WITH ANSI Z21.18. PROVIDE MAXITROL CERTIFIED VENT PROTECTOR ON ALL PRESSURE REGULATORS INSTALLED OUTDOORS. VENT PROTECTOR HAS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
 2. MAXITROL PRESSURE REGULATOR LABELED FOR UTILIZATION WITH AN APPROVED VENT LIMITING DEVICE.

DETAIL-DOWNSPOUT NOZZLE

NOT TO SCALE

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204



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 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 38773, EXPIRATION DATE: 01-21-23

PROPOSED NEW
 MONTEBELLO ELEMENTARY/
 MIDDLE SCHOOL
 BALTIMORE CITY PUBLIC SCHOOLS
 2020 EAST 32ND STREET, BALTIMORE,
 MARYLAND 21218

USING AGENCY APPROVAL

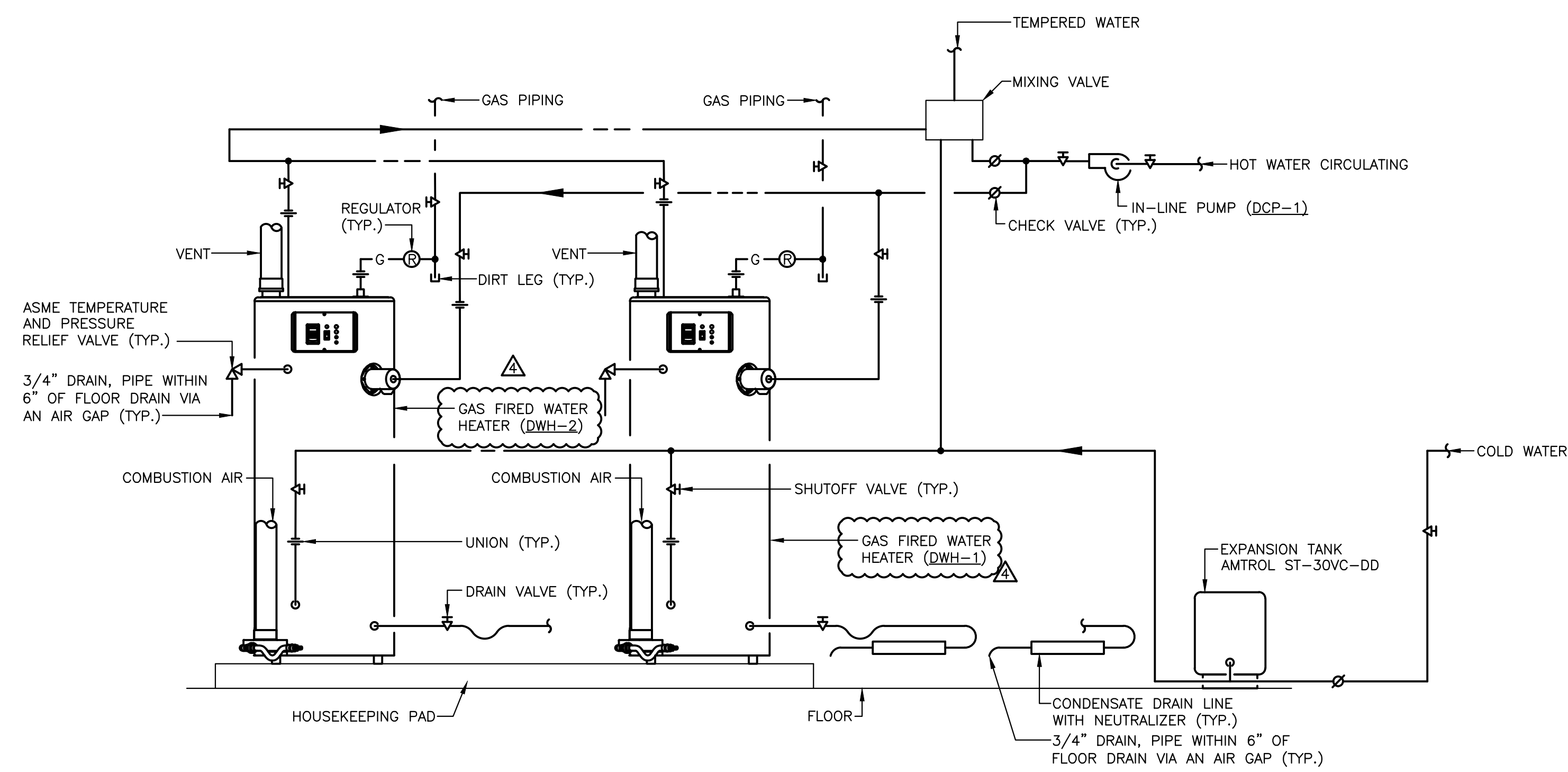
Name: _____ Date: _____
 Title: _____
 MSA APPROVAL
 Project Manager: _____ Date: _____
 Chief of PM&D: _____ Date: _____

DATE	DESCRIPTION
1/8/21	ADDENDUM NUMBER 4
12/23/20	ADDENDUM NUMBER 3
12/16/20	ADDENDUM NUMBER 2
10/16/20	PROGRESS SET
9/11/20	50% CD SUBMISSION
7/10/20	100% DD SUBMISSION

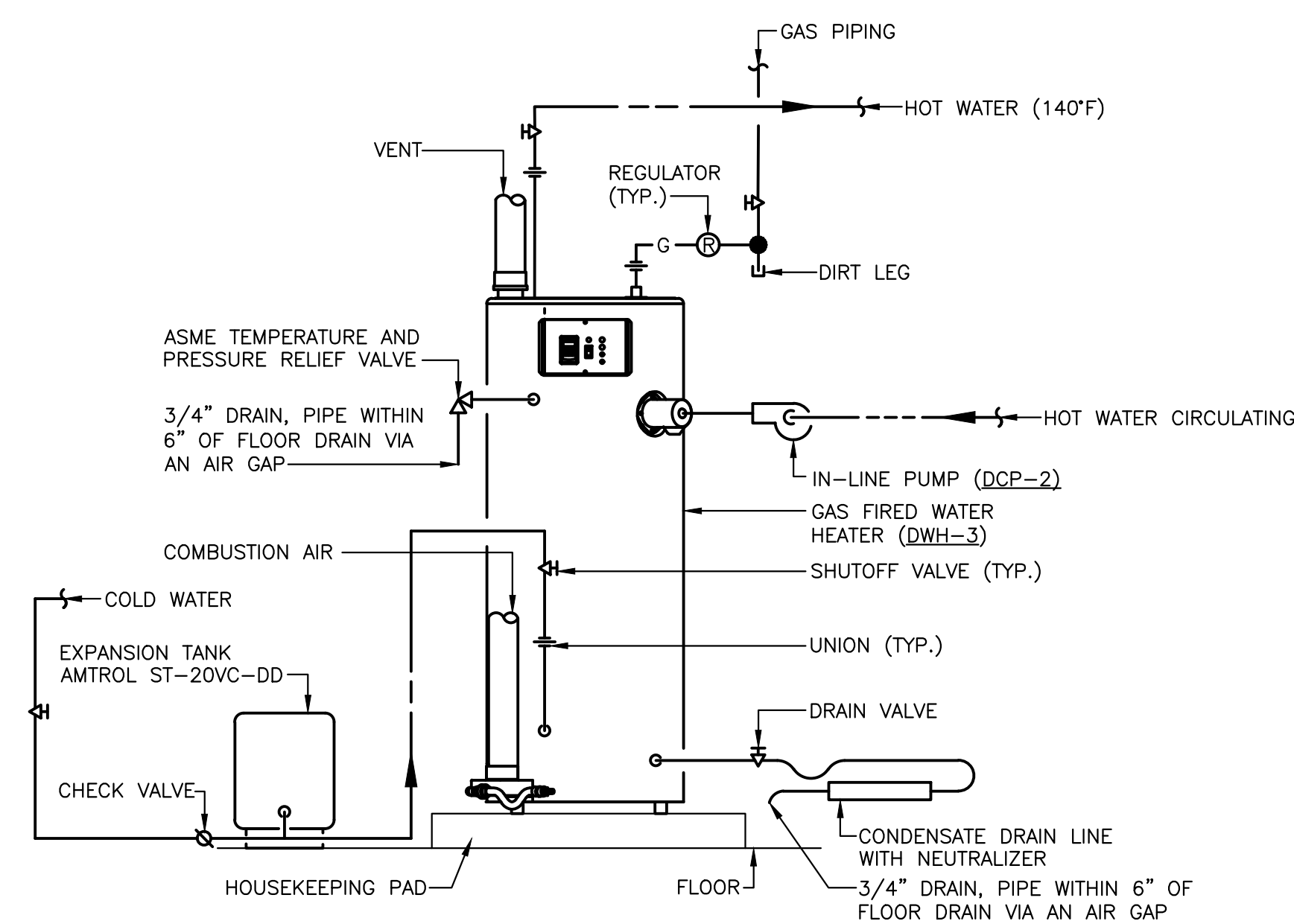
AS-BUILT REVISIONS
 SUBMITTED BY: _____
 CAD DWG FILE: SAA
 DRAWN BY: SAA
 CHECKED BY: SAA
 PROJECT NO. BCS-02-004
 DATE: NOVEMBER 16, 2020

DETAILS
 SCALE: AS NOTED
 DRAWING NO. **P5.2**

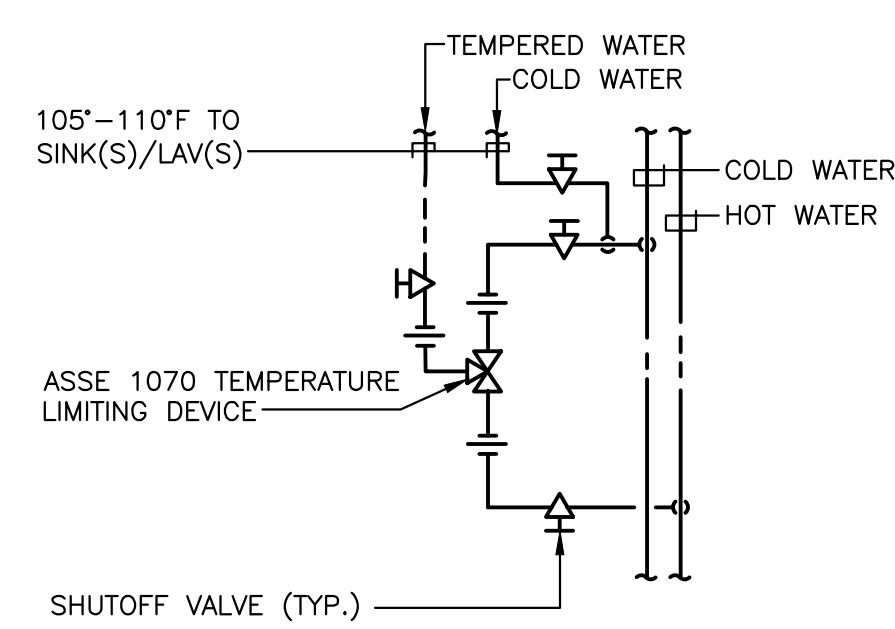
90% CONTRACT DOCUMENTS



DETAIL-GAS FIRED WATER HEATERS
NOT TO SCALE



DETAIL-GAS FIRED WATER HEATER-KITCHEN
NOT TO SCALE



DETAIL-TEMPERATURE LIMIT DEVICE

- NOTES:
1. PROVIDE TEMPERATURE LIMIT DEVICE FOR ALL SINKS AND LAVATORIES.
 2. CONCEAL TEMPERATURE LIMITING DEVICE IN CABINET, WHERE CABINET IS PROVIDED, BEHIND LAV OR SINK GUARDS AND PROVIDE ACCESS.
 3. SECURE TO WALL WITH INTEGRAL WALL BRACKET.

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
100 WEST ROAD, SUITE 402
TOWSON, MD 21204



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PROPOSED NEW
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MIDDLE SCHOOL
BALTIMORE CITY PUBLIC SCHOOLS
2020 EAST 32ND STREET, BALTIMORE,
MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____

Title: _____
MSA APPROVAL

Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

1/8/21 ADDENDUM NUMBER 4

12/23/20 ADDENDUM NUMBER 3

12/16/20 ADDENDUM NUMBER 2

10/16/20 PROGRESS SET

9/11/20 50% CD SUBMISSION

7/10/20 100% DD SUBMISSION

MARK DATE DESCRIPTION

AS-BUILT REVISIONS

SUBMITTED BY:

CAD DWG FILE: SAA

DRAWN BY: SAA

CHECKED BY: SAA

PROJECT NO. BCS-02-004

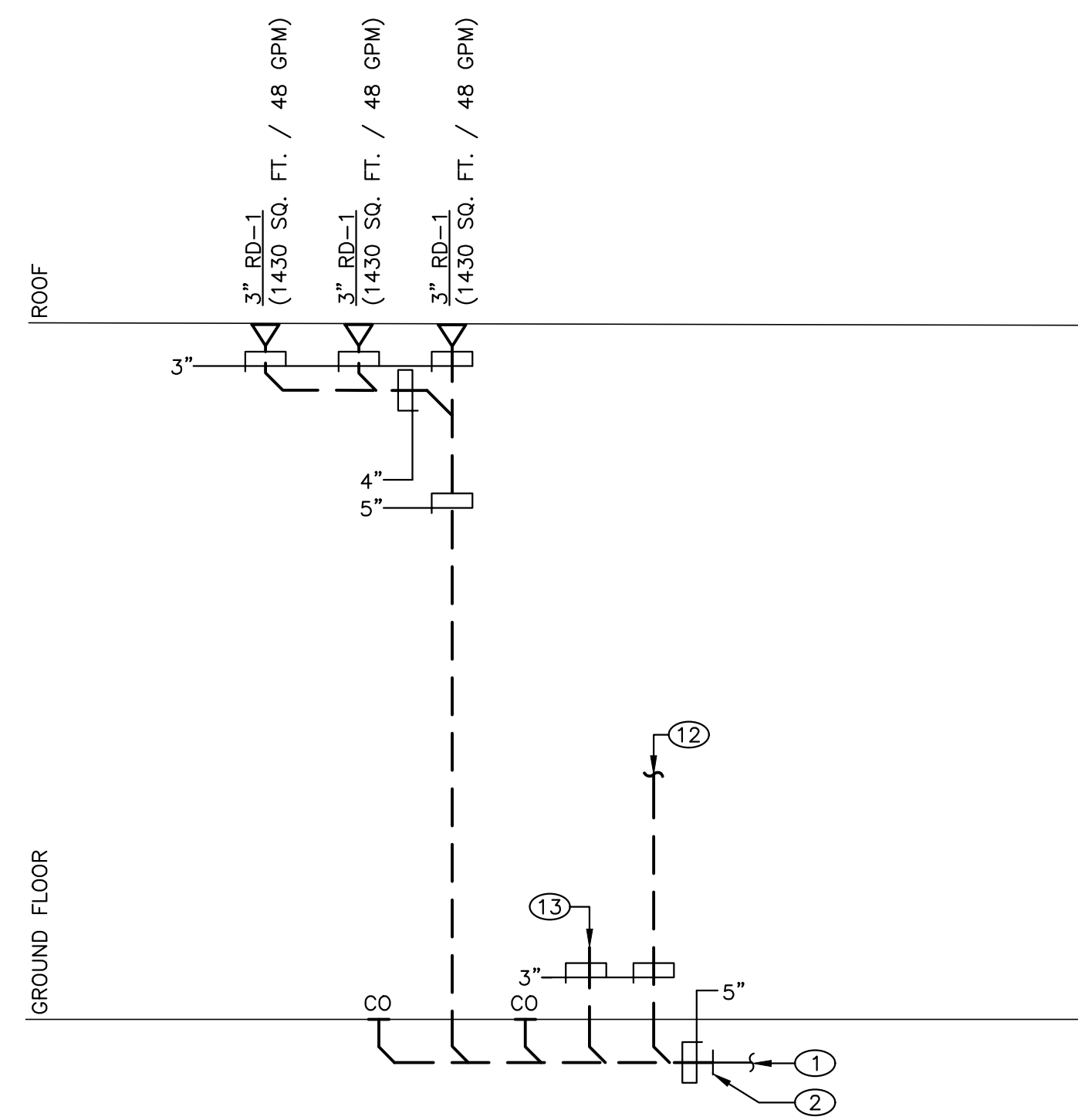
DATE: NOVEMBER 16, 2020

PLUMBING DETAILS

SCALE: AS NOTED

DRAWING NO.

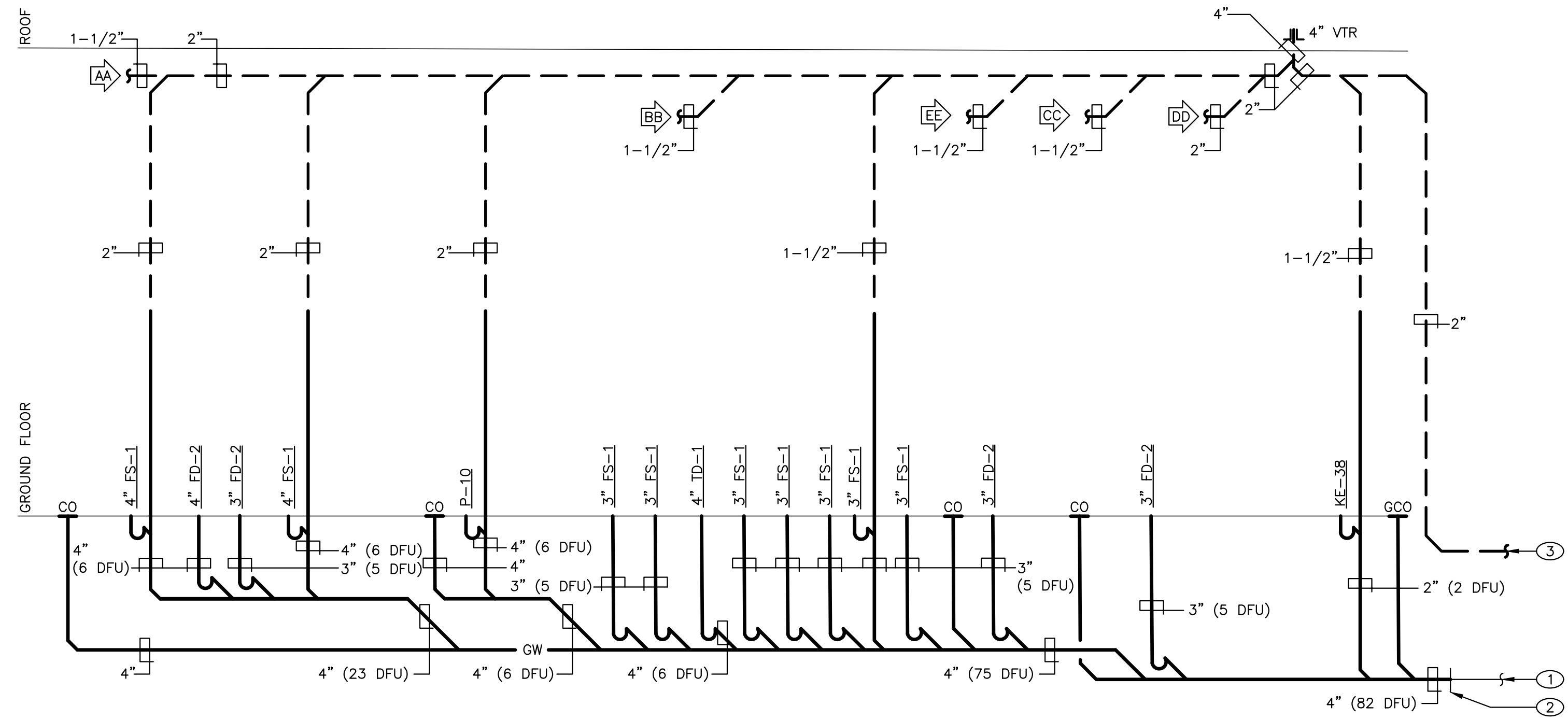
P5.3



STORM WATER RISER DIAGRAM - KITCHEN
NOT TO SCALE

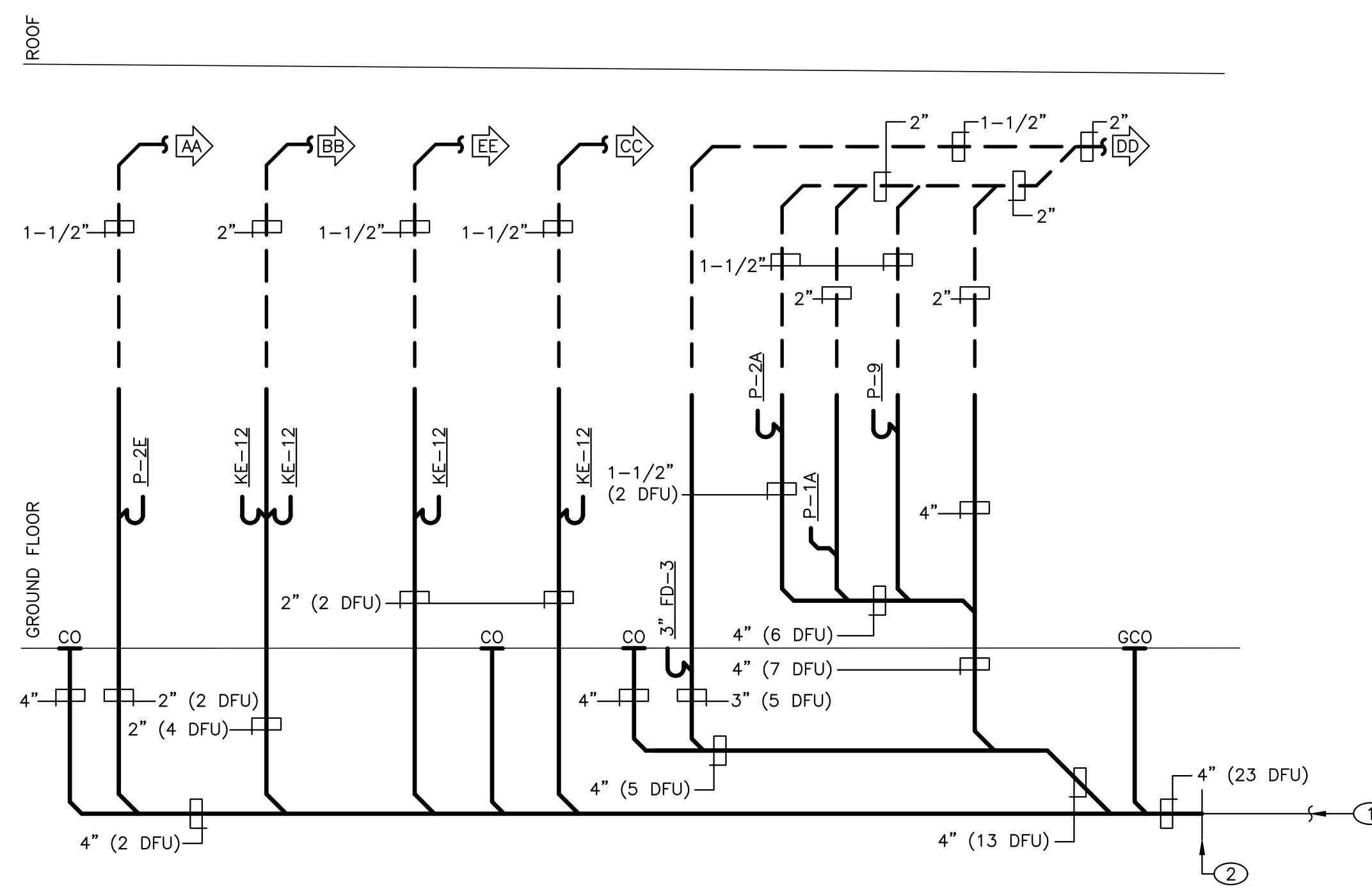
DRAWING NOTES (APPLY TO DRAWINGS P6.1):

1. FOR CONTINUATION SEE CIVIL DRAWINGS.
2. EXTEND 5'-0" BEYOND BUILDING LINE. TRANSITION AND CONNECT TO PIPE PROVIDED UNDER ANOTHER DIVISION. COORDINATE LOCATION, SIZES, AND INVERTS PRIOR TO INSTALLATION.
3. VP FROM GREASE INTERCEPTOR.
4. SEE DETAIL - GAS FIRED WATER HEATER - KITCHEN ON DRAWING P5.3.
5. SEE DETAIL - INLINE PUMP ON DRAWING P5.1.
6. TRAP PRIMING STATION.
7. ROUTE PIPING UNDER SLAB IN 2" PVC SLEEVE.
8. SEE DETAIL - FLOW METER FITTING ON DRAWING P5.1.
9. SEE DETAIL - DOWNSPOUT NOZZLE ON DRAWING P5.2.
10. TO CHEMICAL DISPENSING PIPING. SEE DETAIL - CHEMICAL DISPENSING PIPING ON P5.1.
11. FOR CONTINUATION SEE DOMESTIC WATER RISER DIAGRAM ON DRAWING P6.9.
12. CONDENSATE DRAIN PIPING DN TO SW. SEE MECHANICAL DRAWINGS FOR CONTINUATION OF CONDENSATE DRAIN PIPING AND SIZES. SEE DETAIL - CONDENSATE DRAIN TO STORM WATER ON DRAWING P5.2.
13. SEE DETAIL - OPEN SITE DRAIN WITH BACKWATER VALVE ON DRAWING P5.2.



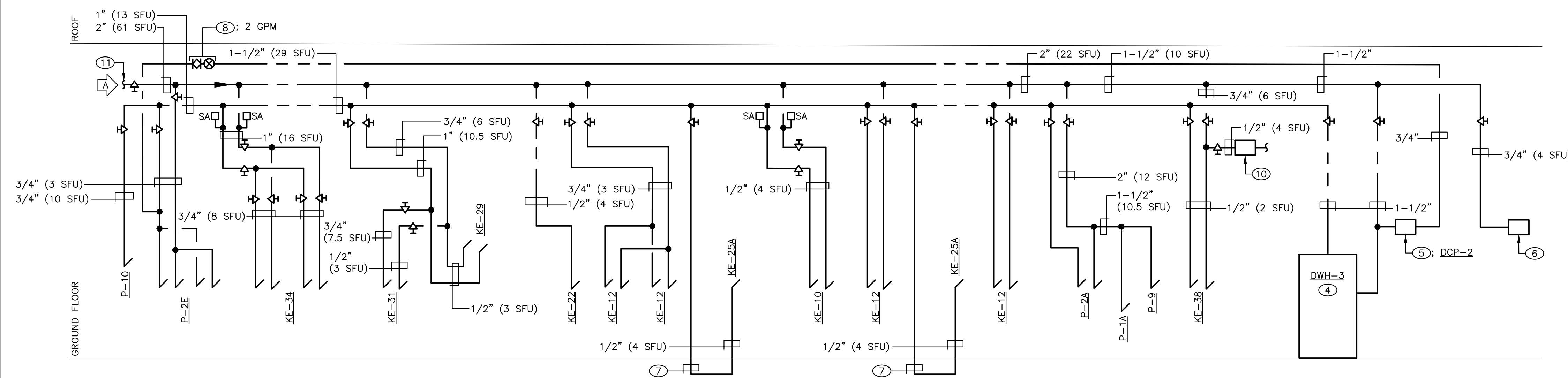
SANITARY (GREASE WASTE) RISER DIAGRAM - KITCHEN
NOT TO SCALE

- NOTES:
1. SEE PLUMBING FIXTURE SCHEDULE AND FOOD SERVICE EQUIPMENT ROUGH-IN SCHEDULE FOR INDIVIDUAL FIXTURE PIPE SIZES.



SANITARY RISER DIAGRAM - KITCHEN
NOT TO SCALE

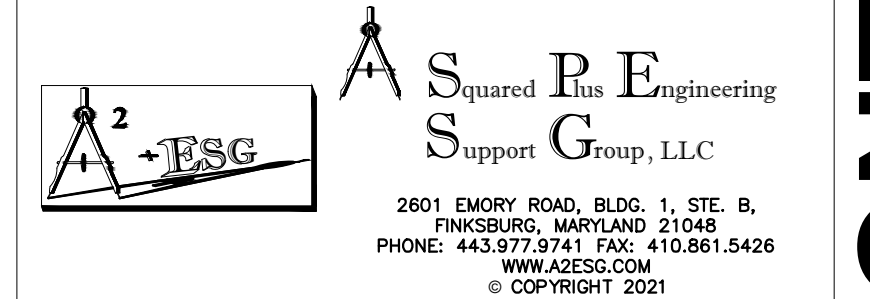
- NOTES:
1. SEE PLUMBING FIXTURE SCHEDULE FOR INDIVIDUAL FIXTURE PIPE SIZES.



DOMESTIC WATER RISER DIAGRAM - KITCHEN
NOT TO SCALE

- NOTES:
1. PROVIDE SHUTOFF VALVES TO HOT AND COLD WATER CONNECTIONS TO EACH FIXTURE(S).
 2. PROVIDE WATER TEMPERATURE LIMITING DEVICES CONFORMING TO ASSE 1070 FOR EACH SINK AND LAVATORY.
 3. PROVIDE WATER HAMMER ARRESTERS IN WATER PIPING ACCORDING TO PDI-WH201.
 4. DOMESTIC WATER CIRCULATING PIPING SHALL CONNECT WITHIN 2 FEET OF FIXTURE.
 5. SEE PLUMBING FIXTURE SCHEDULE FOR INDIVIDUAL FIXTURE PIPE SIZES.

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PROPOSED NEW
MONTEBELLO ELEMENTARY/
MIDDLE SCHOOL
BALTIMORE CITY PUBLIC SCHOOLS
2020 EAST 32ND STREET, BALTIMORE,
MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____

Title: _____
MSA APPROVAL

Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
	1/8/21	ADDENDUM NUMBER 4
	12/23/20	ADDENDUM NUMBER 3
	12/16/20	ADDENDUM NUMBER 2
	10/16/20	PROGRESS SET
	9/11/20	50% CD SUBMISSION
	7/10/20	100% DD SUBMISSION

AS-BUILT REVISIONS

SUBMITTED BY: _____

CAD DWG FILE: SAA

DRAWN BY: SAA

CHECKED BY: SAA

PROJECT NO. BCS-02-004

DATE: NOVEMBER 16, 2020

PLUMBING RISER DIAGRAMS

SCALE: AS NOTED

DRAWING NO. **P6.1**

90% CONTRACT DOCUMENTS

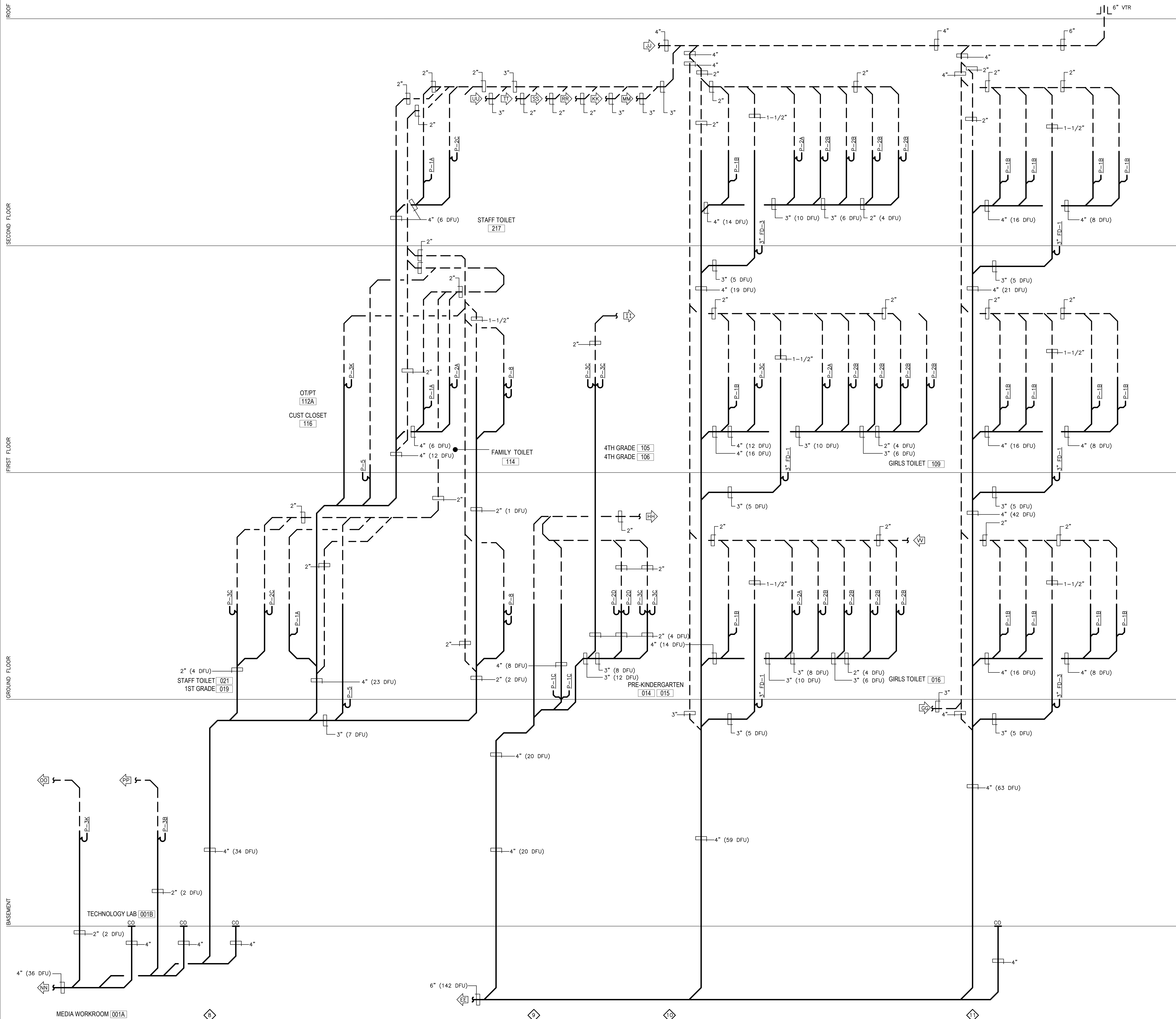
ROOF

SECOND FLOOR

FIRST FLOOR

GROUND FLOOR

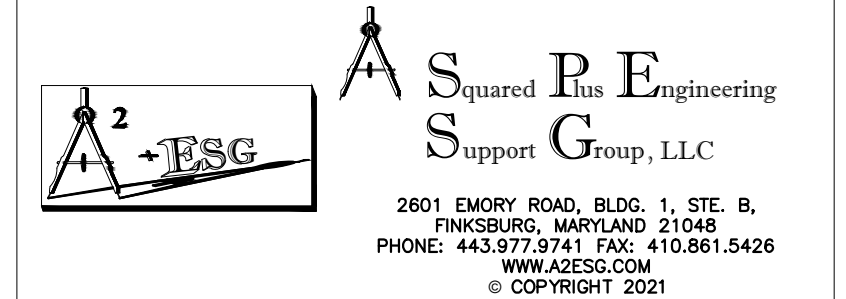
BASEMENT



SANITARY RISER DIAGRAM

NOT TO SCALE
 NOTES:
 1. SEE PLUMBING FIXTURE SCHEDULE FOR INDIVIDUAL FIXTURE PIPE SIZES.

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
 TOWSON, MD 21204



PROFESSIONAL CERTIFICATION:
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME,
 AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF
 THE STATE OF MARYLAND, LICENSE NO. 38773, EXPIRATION DATE: 01-21-23

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DATE: NOVEMBER 16, 2020

SANITARY RISER DIAGRAMS

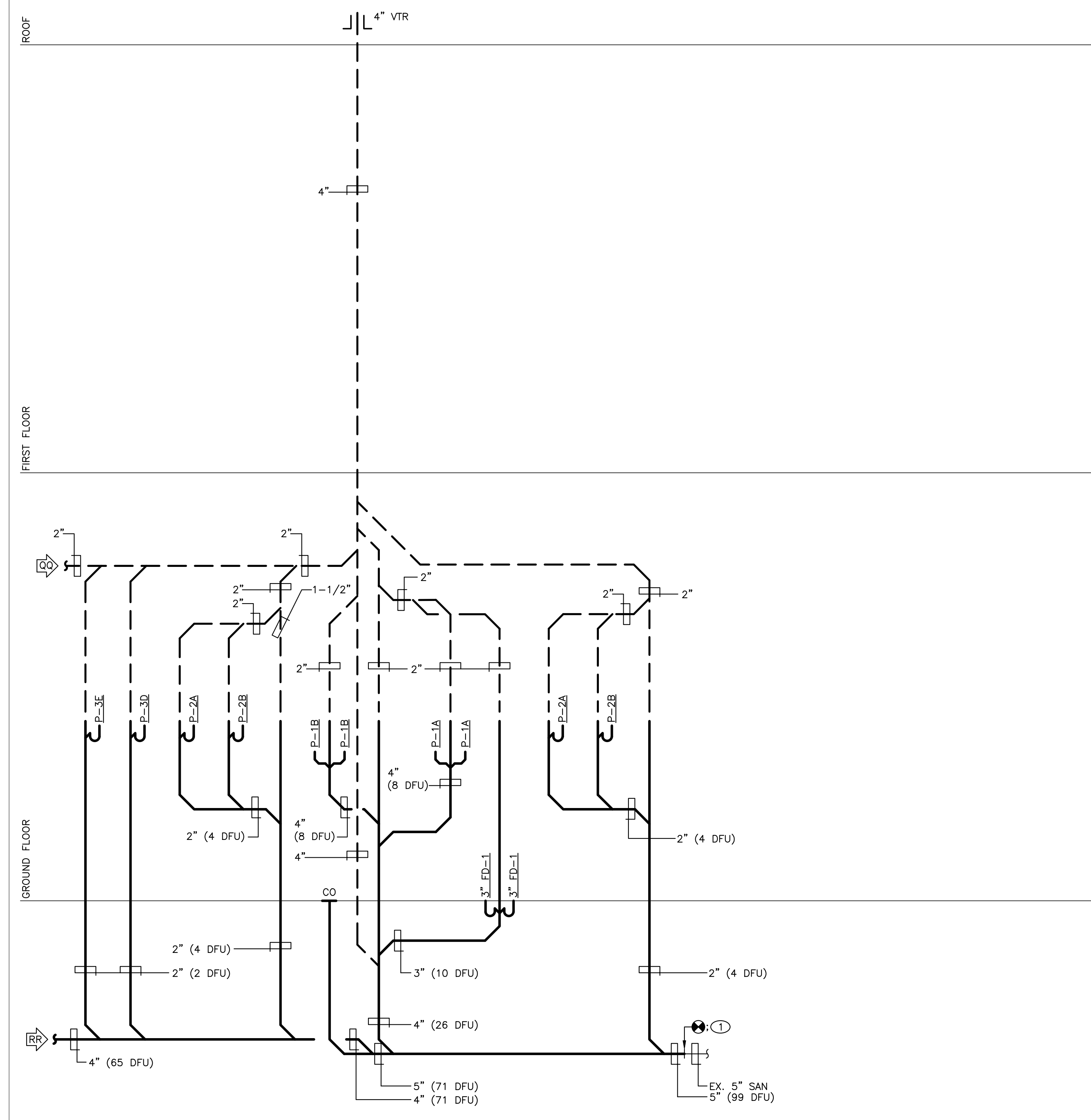
SCALE: AS NOTED

DRAWING NO. **P6.4**

90% CONTRACT DOCUMENTS

DRAWING NOTES (APPLY TO DRAWINGS P6.6):

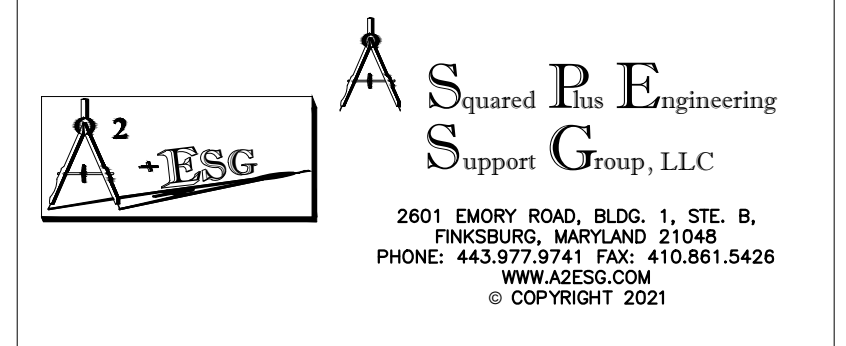
① COORDINATE LOCATION, SIZES, AND INVERTS PRIOR TO INSTALLATION.



SANITARY RISER DIAGRAM

NOT TO SCALE
 NOTES:
 1. SEE PLUMBING FIXTURE SCHEDULE FOR INDIVIDUAL FIXTURE PIPE SIZES.

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 2020 EAST 32ND STREET, BALTIMORE,
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Project Manager:	Date:
Chief of PM&D:	Date:

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AS-BUILT REVISIONS

SUBMITTED BY:	
CAD DWG FILE: SAA	
DRAWN BY: SAA	
CHECKED BY: SAA	
PROJECT NO. BCS-02-004	
DATE: NOVEMBER 16, 2020	
SANITARY RISER DIAGRAMS	
SCALE: AS NOTED	

DRAWING NO. **P6.6**

90% CONTRACT DOCUMENTS

PLUMBING FIXTURE SCHEDULE table with columns: DESIG, DESCRIPTION, SAN, VENT, CW, HW, TEPID, SFU, DFU, GPM, REMARKS. Includes fixtures like Water Closet, Lavatory, Sink, Shower, Service Sink, Domestic Clothes Washer, Domestic Clothes Dryer, Water Cooler.

PLUMBING FIXTURE SCHEDULE table with columns: DESIG, DESCRIPTION, SAN, VENT, CW, HW, TEPID, SFU, DFU, GPM, REMARKS. Includes fixtures like Water Cooler and Bottle Fill, Can Washer, Urinal.

FOOD SERVICE EQUIPMENT ROUGH-IN SCHEDULE table with columns: KE DESIG, DESCRIPTION, CW, HW, INDIRECT WASTE, DIRECT WASTE, GAS (MBH), REMARKS. Includes equipment like Cooler Refrigeration System, Freezer Refrigeration System, Prep Sink, Hand Sink, Utility Raceway, Tilting Skillet, Floor Trough, Range/Oven, Convection Oven, Convection Steamer, Hot Food Counter, Cold Food Counter, Salad Counter, Soiled Dish Table, Dish Machine, Condensate Canopy, Pot Washing Sink, Mop Sink.

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS 100 WEST ROAD, SUITE 402 TOWSON, MD 21204



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10/16/20 PROGRESS SET

9/11/20 50% CD SUBMISSION

7/10/20 100% DD SUBMISSION

MARK DATE DESCRIPTION

AS-BUILT REVISIONS

SUBMITTED BY:

CAD DWG FILE: SAA

DRAWN BY: SAA

CHECKED BY: SAA

PROJECT NO. BCS-02-004

DATE: NOVEMBER 16, 2020

PLUMBING SCHEDULES

SCALE: AS NOTED

DRAWING NO. P7.1

GAS FIRED WATER HEATER SCHEDULE							
DWH DESIG.	SERVING	STORAGE CAPACITY (GALLONS)	RECOVERY RATE 100 DEGREE RISE (GPH)	GAS INPUT (MBH)	CONTROL CIRCUIT VOLT-PH	MANUFACTURER	NOTES
1,2	BUILDING	100	233	250	120-1	PVI CONQUEST 25 L 100 A-GCL	140°F WATER FROM WATER HEATER TO MAIN MIXING VALVE (PVI DIGITEMP V23, 16 GPM AT 5 PSI DROP, 120°F). PROVIDE ASSE 1070 MIXING VALVES AT EACH SINK AND LAVATORY (105°F)
3	KITCHEN	100	233	250	120-1	PVI CONQUEST 25 L 100 A-GCL	140°F WATER FROM WATER HEATER. PROVIDE ASSE 1070 MIXING VALVES AT EACH SINK AND LAVATORY (105°F)

NOTES:
 1. PROVIDE HEAT TRAPS AND CONDENSATE DRAIN LINE NEUTRALIZERS.
 2. INSTALL PER MANUFACTURER'S REQUIREMENTS.
 3. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

ELEVATOR SUMP PUMP SCHEDULE								
DESIG	SERVING	GPM	HEAD (FT. HD)	RPM	TYPE	ELECTRICAL		BASIS OF DESIGN MANUFACTURER
						HP	VOLT-PH	
ESP-1	ELEVATOR	50	10	3600	SUBMERSIBLE	2	208-1	STANCOR SV-200

NOTES:
 1. PROVIDE SUMP PIT (24"WIDE X 24"LONG X 36" DEEP). REMOTE ALARM (LOCATE IN MAIN LOBBY UNLESS OTHER DIRECTED PER OWNER'S REPRESENTATIVE) AND JUNCTION BOX WITH LOCKABLE PUMP DISCONNECT SWITCH.
 2. INSTALL PER MANUFACTURER'S REQUIREMENTS.
 3. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

DOMESTIC WATER PUMP SCHEDULE							
DCP DESIG.	SERVING	GPM	HEAD (FT.HD)	RPM	TYPE	ELECTRIC HP,VOLTS-PH	MANUFACTURER
1	DOMESTIC WATER RECIRCULATING	10	21	3450	IN-LINE	1/6,120-1	TACO 2420
2	DOMESTIC WATER RECIRCULATING	2	12	3250	IN-LINE	1/25, 120-1	TACO 008-BC6

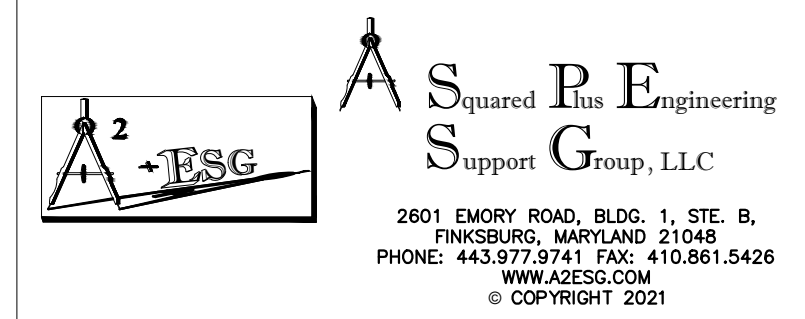
NOTES:
 1. INSTALL PER MANUFACTURER'S REQUIREMENTS.
 2. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

DOMESTIC WATER FILTER SCHEDULE							
DWF DESIG.	SERVING	GPM	PRE-FILTER	CARBON BLOCK FILTER	TYPE	MAX PD (PSI)	MANUFACTURER
1	BUILDING	160	5 MICRONS	0.5 MICRONS	IN-LINE	10	FILTRINE LEADMISER IL160-PFTM-0.5L

NOTES:
 1. INSTALL PER MANUFACTURER'S REQUIREMENTS.
 2. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

DOMESTIC WATER BOOSTER TRIPLEX PUMPS (VFD) SYSTEM WITH TANK SCHEDULE:
 GRUNDFOS CMBE 15-1,
 PUMP 1: 3 HP@480V/3 PHASE, 50 GPM, 45 PSI
 PUMP 2: 5 HP@480V/3 PHASE, 50 GPM, 45 PSI
 PUMP 3: 5 HP@480V/3 PHASE, 50 GPM, 45 PSI
 SYSTEMS SHALL HAVE PRE-ASSEMBLED, PRE-WIRED, SINGLE POINT ELECTRICAL CONNECTION, ALL STARTERS (VFDS) AND DISCONNECTING MEANS, TANK, CONTROL PANEL. BMS SHALL MONITOR SYSTEM WITH ALARMS, THE SYSTEM SEQUENCE SHALL BE AS PER MANUFACTURER CONTROL SEQUENCE. PIPE RELIEF TO CLOSET FLOOR DRAIN VIA AIR GAP. SECURE TO CONCRETE PAD WITH VIBRATION ISOLATION. INSTALL PER MANUFACTURER'S REQUIREMENTS. SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
 100 WEST ROAD, SUITE 402
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9/11/20	50% CD SUBMISSION
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MARK: _____ DATE: _____ DESCRIPTION: _____

AS-BUILT REVISIONS

SUBMITTED BY: _____

CAD DWG FILE: SAA

DRAWN BY: SAA

CHECKED BY: SAA

PROJECT NO. BCS-02-004

DATE: NOVEMBER 16, 2020

PLUMBING SCHEDULES

SCALE: AS NOTED

DRAWING NO. **P7.2**

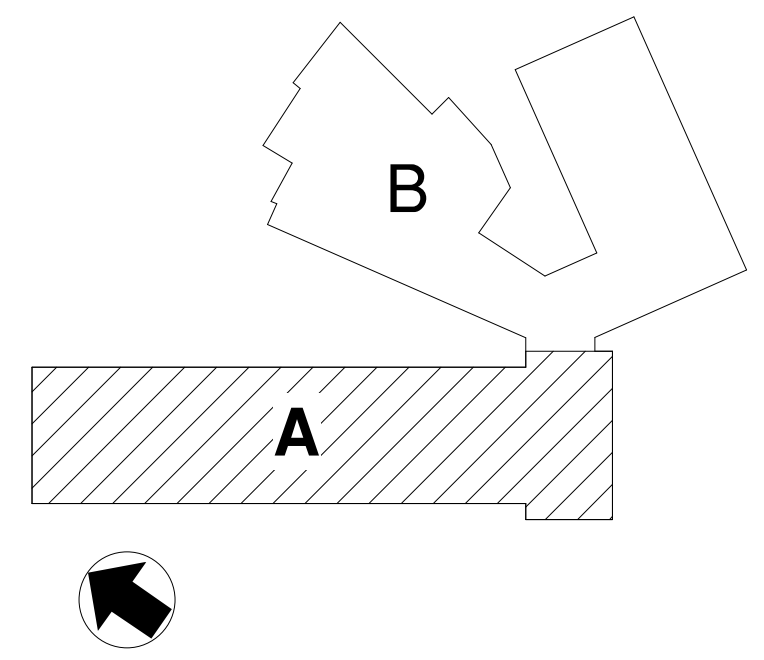
GENERAL NOTES:

1. EACH BRANCH CIRCUIT SELECTOR BOX (BC) REQUIRES AN ELECTRICAL CONNECTION CIRCUIT TO THE NEAREST ADJACENT VREF WITH (2) #12 @ 3/4" C. PROVIDE WITH 208V, 20A RATED MOTOR TOGGLE SWITCH ADJACENT TO BC.
2. ALL RECEPTACLES SHALL BE TAMPER PROOF RESISTANT TYPE.
3. EXTERIOR OUTLETS SHALL BE PROVIDED WITH LOCKABLE CABINET ENCLOSURE.

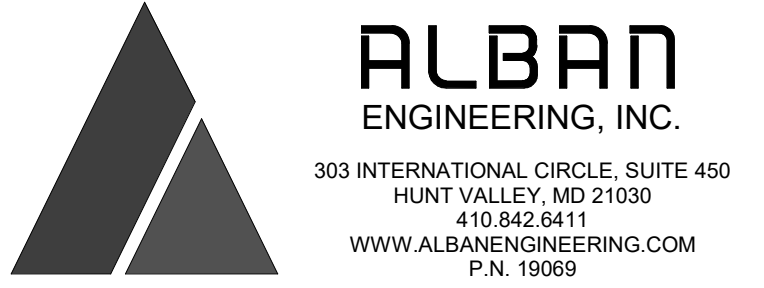
DRAWING NOTES:

- 1 NEMA LS-20R. MOUNT ON RACK/CABLE TRAY.
- 2 CONNECT TO FIRE ALARM AND DETECTION SYSTEM WALL MOUNTED EXPANDER CONTROL AND POWER SUPPLY PANEL.
- 3 CORD REEL WITH GUARD RECEPTACLE. REFER TO DETAIL 5/6.3 FOR ADDITIONAL INFORMATION.
- 4 NEMA 6-30R.
- 5 MAKE CONNECTION TO DRY PIPE SYSTEM AIR COMPRESSOR. REFER TO FIRE PROTECTION DRAWINGS FOR EXACT LOCATION.
- 6 MAKE CONNECTION TO TRAP PRIMING STATION. REFER TO PLUMBING DRAWINGS FOR EXACT LOCATION.
- 7 MOUNT TO SUIT INTRUSION PANEL. COORDINATE EXACT LOCATION WITH OWNER.
- 8 POWER SUPPLY FOR SECURITY SYSTEM.
- 1 MOUNT RECEPTACLE HORIZONTAL IN TOE KICK.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
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 TOWSON, MD 21204



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Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
4	01/08/21	Addendum #4
2	12/16/20	Addendum #2

AS-BUILT REVISIONS

SUBMITTED BY: _____

CAD DWG FILE: Alban

DRAWN BY: Alban

CHECKED BY: Alban

PROJECT NO. BCS-02-004

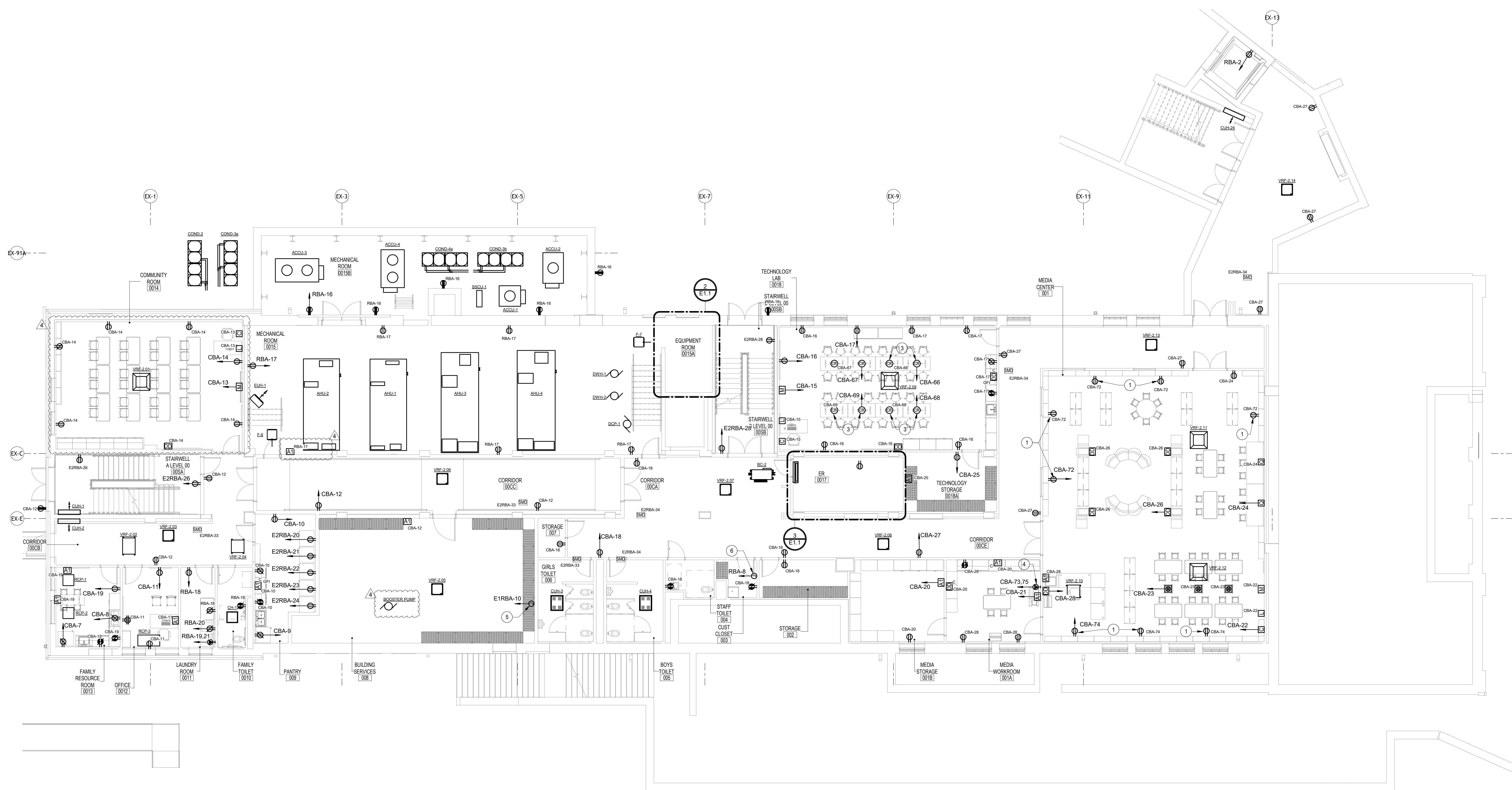
DATE: NOVEMBER 16, 2020

BASEMENT FLOOR PLAN UNIT 'A' - ELECTRICAL

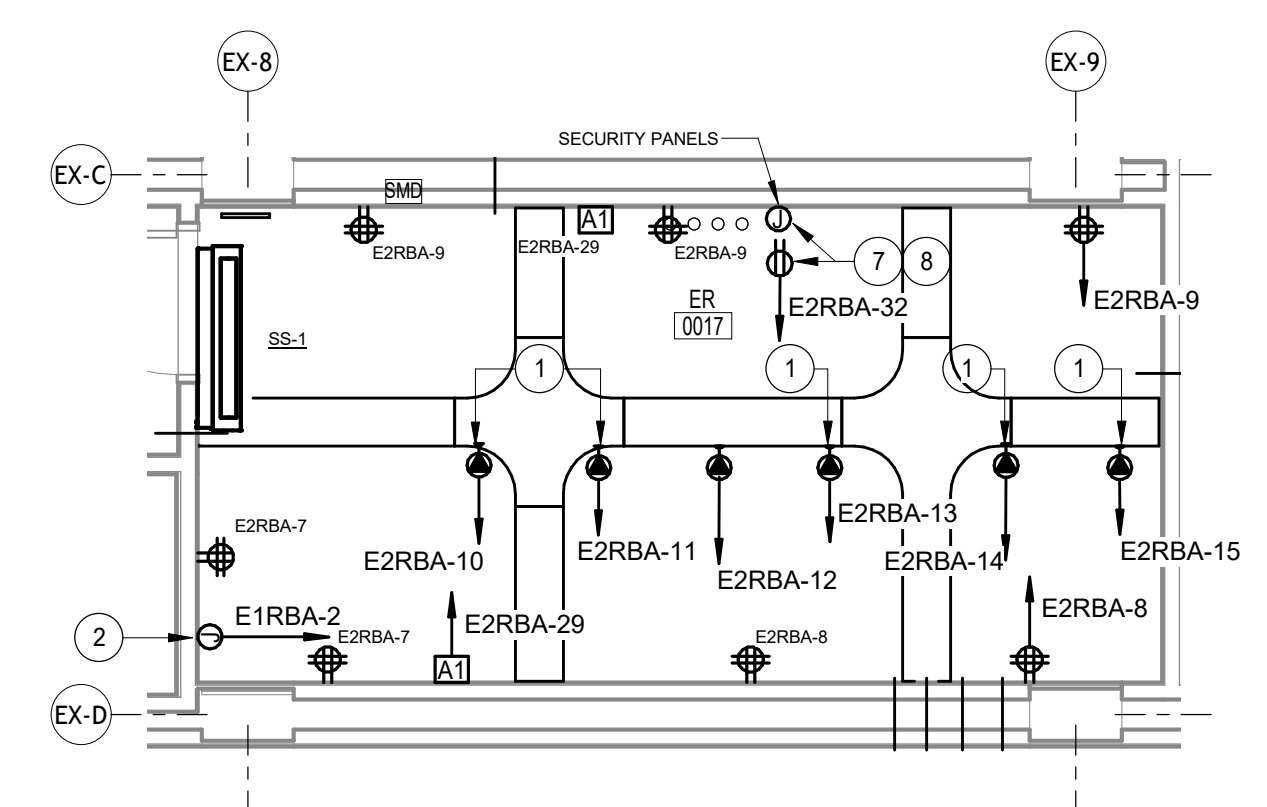
SCALE: As indicated

DRAWING NO.

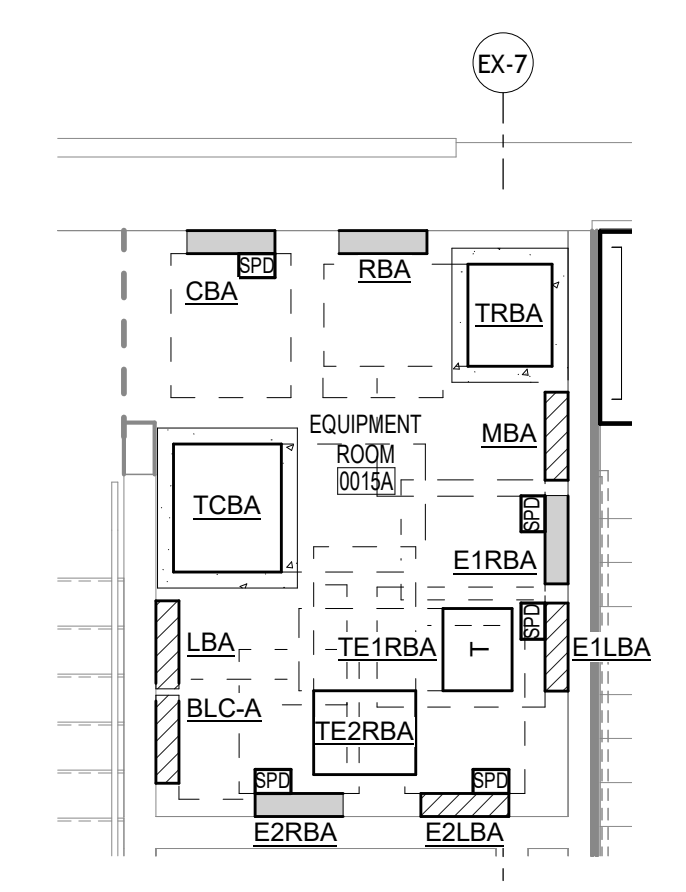
E1.1



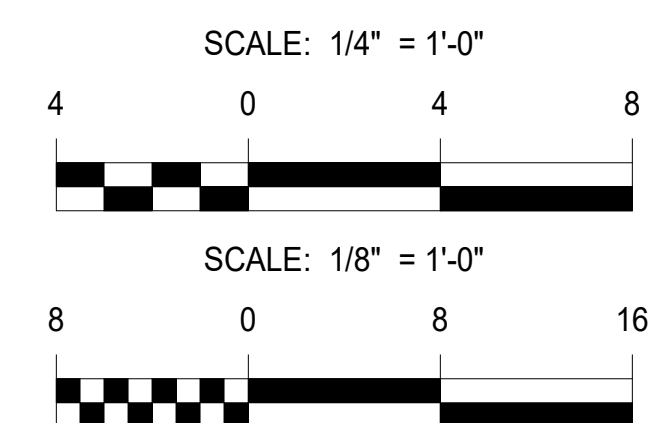
BASEMENT FLOOR PLAN UNIT 'A' - ELECTRICAL
 1/8" = 1'-0"



3 PART PLAN - TELECOM 0017
 E1.1 1/4" = 1'-0"

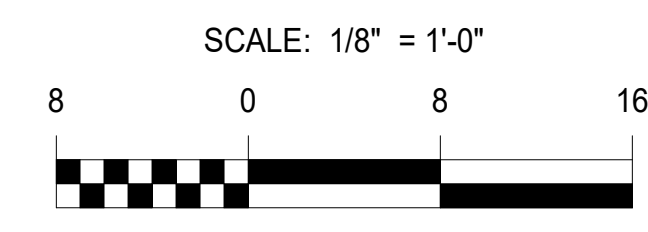


2 PART PLAN - BASEMENT ELECTRICAL ROOM
 E1.1 1/4" = 1'-0"





FIRST FLOOR PLAN UNIT 'B' - ELECTRICAL
1/8" = 1'-0"



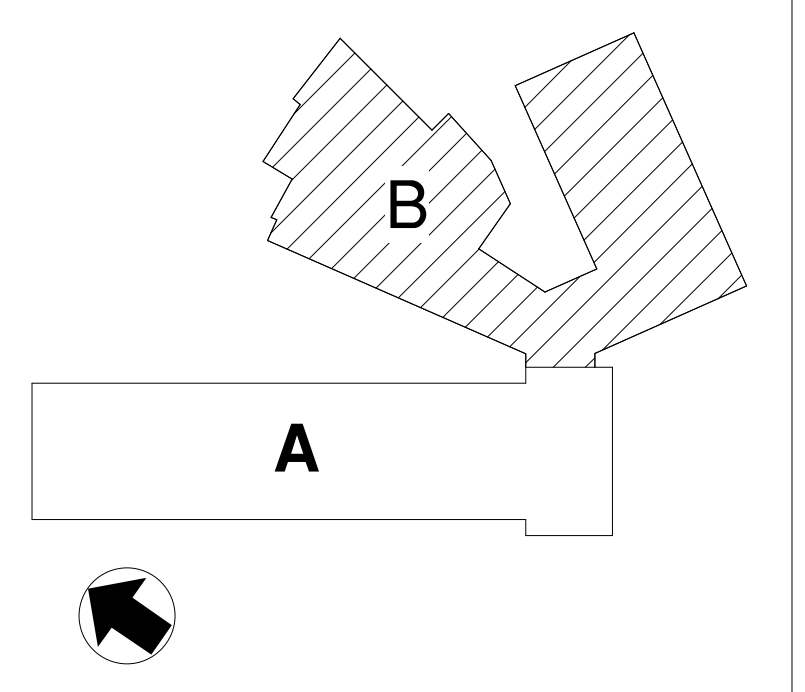
GENERAL NOTES:

1. ALL RECEPTACLES SHALL BE TAMPER PROOF RESISTENT TYPE.
2. EXTERIOR OUTLETS SHALL BE PROVIDED WITH LOCKABLE CABINET ENCLOSURE.

DRAWING NOTES:

1. NEMA L14-20P TWISTED LOCK PLUG WITH 6'-1.5 SJO CORD FROM WINCH TO 4-POLE TWIST LOCK RECEPTACLE IN 4" SQUARE JUNCTION BOX (FURNISHED BY OTHERS) INSTALLED BY EC WITHIN 3'-0" OF WINCH.
2. (3)#12-#12GW-3/4" C TO GYM CONTROL PANEL.
3. JUNCTION BOX FOR GYM CONTROL PANEL. COORDINATE LOCATION WITH OWNER. COORDINATE NUMBER OF CONNECTIONS REQUIRED WITH APPROVED SYSTEM PRIOR TO ROUGH-IN.
4. GYM CONTROL KEYPAD. CONNECT TO GYM CONTROL PANELS VIA (3)# 14GA WIRE AND RJ-45 CABLE.
5. CIRCUIT THROUGH GYM CONTROL PANELS INDICATED BY NOTE 3.
6. MAKE CONNECTION TO PROJECTOR SCREEN AND PROVIDE ALL CONTROL WIRING, CONDUIT AND CONNECTIONS BETWEEN PROJECTOR SCREEN AND WALL CONTROL PAD. COORDINATE LOCATION OF WALL CONTROL WITH OWNER.
7. WALL MOUNTED REAR PROJECTOR. COORDINATE EXACT LOCATION IN FIELD.
8. SCOREBOARD JUNCTION BOX VERIFY HEIGHT AND LOCATION WITH ARCHITECTURAL DRAWING.
9. MOTORIZED SHADES CONTROL PANEL.
10. WIRING PER MANUFACTURERS RECOMMENDATIONS DOWN TO SHADES CONTROL PANEL.
11. MOTORIZED SHADES CONTROL SWITCH.
12. WIRING PER MANUFACTURERS RECOMMENDATIONS UP TO SHADES.
13. PROVIDE 1P-20A ENCLOSED CIRCUIT BREAKER FOR WHEELCHAIR LIFT. COORDINATE FINAL LOCATION WITH OWNER.
14. MOUNT ABOVE ACCESSIBLE CEILING.
15. CONTROLLED RECEPTACLE CONTROLLED BY CK4 ROOM CONTROLLER FOR AUTOMATIC SHUTOFF BASED ON BAS SYSTEM.

KEY PLAN



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MARK DATE DESCRIPTION

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SUBMITTED BY:

CAD DWG FILE: Author

DRAWN BY: Author

CHECKED BY: Checker

PROJECT NO. BCS-02-004

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FIRST FLOOR PLAN UNIT 'B' -
ELECTRICAL

SCALE: 1/8" = 1'-0"

DRAWING NO. **E1.5**

90% CONSTRUCTION DOCUMENTS

LIGHTING FIXTURE SCHEDULE

TYPE	DESCRIPTION	MANUFACTURER	MODEL	VOLTS	LAMPS	MAX. ALLOCATE D WATTAGE	MOUNTING	REMARKS	DLC Yes/No
A	2w x 41 x 3-1/2" RECESSED DUAL CHAMBER VOLUMETRIC STYLE LED LUMINAIRE WITH 22 GAUGE CRS HOUSING, FROSTED RIBBED ACRYLIC SHIELDING, ONE-PIECE DIFFUSERS, ALL PARTS PAINTED AFTER FABRICATION, 80+ CRI MIN., INTEGRAL 0-10V DIMMING DRIVER, ROOM SIDE ACCESS TO ALL COMPONENTS, AND WHITE FINISH.	H.E. WILLIAMS [METALUX] [LSI]	HET G.2.4.L50/840.A.x.DIM.UNV SERIES [ACCORD SERIES] [ASC SERIES]	277 V	LED, 4000k, ~5000ms	38.0 W	CEILING, RECESSED		Yes
A2	SAME AS TYPE 'A' EXCEPT 2x2 AND LUMEN VARIATION.			277 V	LED, 4000k, ~3800ms	31.0 W	CEILING, RECESSED		Yes
B	2w x 41 x 3-1/2" VOLUMETRIC STYLE LED LUMINAIRE WITH 22 GAUGE CRS HOUSING, HINGED FLAT EXTRUDED ALUM. DOOR FRAME WITH OPTICAL ASSEMBLY, DIFFUSE POLY CARONBATE LENS, RETANGULAR ACRYLIC CENTER SPINE, ALL PARTS PAINTED AFTER FABRICATION, IC RATED, LISTED FOR DAMP LOCATIONS, INTEGRAL 0-10v. DIMMING DRIVER, 80+ CRI MIN. AND WHITE FINISH.	H.E. WILLIAMS [CORELITE] [PINNACLE LIGHTING]	HET G.2.Z.L38/840.A.x.DIM.UNV SERIES [L38 SERIES] [L38.2 SERIES]	277 V	LED, 4000k, ~5500ms	48.0 W	CEILING, RECESSED		Yes
B1	SAME AS TYPE 'B' EXCEPT 1'x4' AND LUMEN VARIATION.			277 V	LED, 4000k, ~4700ms	49.0 W	CEILING, RECESSED		Yes
B2	SAME AS TYPE 'B' EXCEPT 2'x2' AND LUMEN VARIATION.			277 V	LED, 4000k, ~4000ms	38.0 W	CEILING, RECESSED		Yes
B2H	SAME AS TYPE 'B' EXCEPT 2'x2' AND LUMEN VARIATION.			277 V	LED, 4000k, ~5000ms	49.0 W	CEILING, RECESSED		Yes
C3	NOMINAL 36"dia x 4"th SURFACE ROUND STYLE LED LUMINAIRE WITH ALUM. CONSTRUCTION (WELDED FOR SEAMLESS FINISH), 1/4" TRIM, ROOM SIDE MAINTENANCE FOR ALL COMPONENTS, 90+ CRI MIN., INTEGRAL 0-10v. DIMMING DRIVER, ALUM. TOP COVER, SINGLE PIECE DIFFUSE FULLY LUMINOUS SATINE LENSING AND FINISH PER ARCHITECT.	PINNACLE LIGHTING [CORONET LIGHTING] [DAYCALITE]	F36D.A.940MO.S.U.OL2.1.0.(finish).x.x.SERIES [PRD SERIES] [EQUATOR SERIES]	277 V	LED, 4000k, ~7000ms	78.0 W	CEILING, SURFACE		
C3L	SAME AS TYPE 'C3' EXCEPT IN LUMEN VARIATION.			277 V	LED, 4000k, ~4200ms	46.0 W	CEILING, SURFACE		
C4	SAME AS TYPE 'C3' EXCEPT 4"dia AND LUMEN OUTPUT.			277 V	LED, 4000k, ~8300ms	85.0 W	CEILING, SURFACE		
D	NOMINAL 6"dia x 5-1/2" RECESSED DOWNLIGHT STYLE LED LUMINAIRE WITH SPUN ALUM. REFLECTOR (SEMI SPECULAR), LENSED UPPER OPTICAL CHAMBER, INTEGRAL 0-10v. DIMMING DRIVER, 80+ CRI MIN., IC RATED, MEDIUM DISTRIBUTION AND WHITE TRIM.	PORTFOLIO [H.E. WILLIAMS] [INDY]	LDB6.15.x.D010 and EUGB.1020.80.40 and 6L.B.M.2.H.SERIES [RDR SERIES] [L6 SERIES]	277 V	LED, 4000k, ~1500ms	16.0 W	CEILING, RECESSED		Yes
EW	NOMINAL 6" w x 3" x 4" VAPORITITE INDUSTRIAL STYLE LED LUMINAIRE WITH 80+ CRI MIN., COMPRESSION MOLDED NON CONDUCTIVE NON CORROSIVE SELF EXTINGUISHING FIBERGLASS HOUSING, POURED CONTINUOUS GASKETING, IN-LINE THERMOFORMED LOW PROFILE DIFFUSER (50% DR ACRYLIC, SMOOTH WHITE FINISH), STAINLESS STEEL LATCHES, INTEGRAL NON DIMMING DRIVER, IP65/66/67 RATED, UL LISTED FOR WET LOCATIONS AND RATED FOR WALL MOUNTING IN HORIZONTAL OR VERTICAL ORIENTATION.	MERCURY LIGHTING [ECSO SERIES] [METALUX] [V73 SERIES]	L701.4.3400.40K.ASW.1%.UNI.SSL.x.SERIES [ECSO SERIES] [V73 SERIES]	120 V	LED, 4000k, 3419ms	33.0 W	WALL, SURFACE, [TOP AND BOTTOM OF ELEVATOR SHAFT]	REFER TO LFS NOTE No. 5 AND 6.	Yes
F	2w x 41 x 2-1/2" (INCLUDING DRIVER) FLAT PANEL STYLE LED LUMINAIRE WITH SEAM WELDED DIE FORMED ALUM. HOUSING, EDGE-LIT PMMA LIGHT GUIDE PANEL, INTEGRAL 0-10v DIMMING DRIVER, 80+ CRI MIN., UNIFORM LENS ILLUMINATION, LISTED FOR DAMP LOCATIONS AND WHITE FINISH.	METALUX [LSI] [COLUMBIA]	24FP3840HE SERIES [SFP SERIES] [CST SERIES]	277 V	LED, 4000k, 3780ms	29.0 W	CEILING, RECESSED		Yes
F1	SAME AS TYPE 'F' EXCEPT 1'x4' AND LUMEN VARIATION.			277 V	LED, 4000k, 3176ms	25.0 W	CEILING, RECESSED		Yes
F2	SAME AS TYPE 'F' EXCEPT 2'x2' AND LUMEN VARIATION.			277 V	LED, 4000k, ~333ms	30.0 W	CEILING, RECESSED		Yes
F2L	SAME AS TYPE 'F2' EXCEPT IN LUMEN VARIATION.			277 V	LED, 4000k, ~2900ms	20.0 W	CEILING, RECESSED		Yes
G	NOMINAL 17"dia x 18" (MAX) ACRYLIC HIGH BAY STYLE LED LUMINAIRE WITH ROUND EXTRUDED ALUM. HOUSING, 80+ CRI MIN., INJECTION MOLDED ACRYLIC PRISMATIC REFRACTORS, CLEAR CONICAL PRISMATIC ACRYLIC BOTTOM LENS (SPRING LOADED CLAMP BAND ATTACHMENT), INTEGRAL 0-10v DIMMING DRIVER, SURGE PROTECTION, WIRE GUARD AND U.L. LISTED FOR DAMP LOCATIONS.	LSI [VENTURE] [PREMISE LIGHTING]	AUL.5.LED.S5.NW.UJE.ACS22CPA.GWT SERIES [H8 SERIES] [H84 SERIES]	277 V	LED, 4000k, ~17,000ms	132.0 W	CEILING, SURFACE	RIGID PENDANT WITH BALL JOINT SWIVEL. REFER TO LFS NOTE No. 15.	Yes
H4x6	NOMINAL 36" w x 4" x 4" RECTANGULAR PATTERN RECESSED LINEAR STYLE LED LUMINAIRE WITH EXTRUDED ALUM. TRIM, 18 GAUGE CRS HOUSING, IC RATED, DAMP LOCATION LISTED, INTEGRAL 0-10v. DIMMING DRIVER, 80+ CRI MIN., ROOM SIDE MAINTENANCE FOR ALL COMPONENTS, DIFFUSE SNAP-IN ACRYLIC LENS, ILLUMINATED CORNERS AND WHITE FINISH.	PINNACLE LIGHTING [NEORAY] [FINELITE]	EV3D.A.940HO.12"x.U.OL1.1.0.W.SERIES [S123DR SERIES] [HP2 SERIES]	277 V	LED, 4000k, 750ms PER FOOT	182.0 W	CEILING, RECESSED DRYWALL OVERLAP FLANGE REQUIRED.	WATTAGE INDICATED IS FOR ENTIRE SYSTEM. REFER TO LFS NOTE No. 3.	Yes
H8	NOMINAL 36" w x 4" x 4" RECESSED LINEAR STYLE LED LUMINAIRE WITH EXTRUDED ALUM. TRIM, 18 GAUGE CRS HOUSING, IC RATED, DAMP LOCATION LISTED, INTEGRAL 0-10v. DIMMING DRIVER, 90+ CRI MIN., ROOM SIDE MAINTENANCE FOR ALL COMPONENTS, DIFFUSE SNAP-IN ACRYLIC LENS AND WHITE FINISH.	PINNACLE LIGHTING [NEORAY] [FINELITE]	EV3D.A.940HO.8"x.U.OL1.1.0.W.SERIES [S123DR SERIES] [HP2 SERIES]	277 V	LED, 4000k, 750ms PER FOOT	73.0 W	CEILING, RECESSED DRYWALL OVERLAP FLANGE REQUIRED.	WATTAGE INDICATED IS FOR A 8'-0" LENGTH. REFER TO LFS NOTE No. 3.	Yes
H12	SAME AS 'H8' EXCEPT 12' LONG.			277 V	LED, 4000k, 750ms PER FOOT	110.0 W	CEILING, RECESSED DRYWALL OVERLAP FLANGE REQUIRED.	WATTAGE INDICATED IS FOR A 12'-0" LENGTH. REFER TO LFS NOTE No. 3.	Yes
H24	SAME AS 'H8' EXCEPT 24' LONG.			277 V	LED, 4000k, 750ms PER FOOT	219.0 W	CEILING, RECESSED DRYWALL OVERLAP FLANGE REQUIRED.	WATTAGE INDICATED IS FOR A 24'-0" LENGTH. REFER TO LFS NOTE No. 3.	Yes
H32	SAME AS 'H8' EXCEPT 32' LONG.			277 V	LED, 4000k, 750ms PER FOOT	292.0 W	CEILING, RECESSED DRYWALL OVERLAP FLANGE REQUIRED.	WATTAGE INDICATED IS FOR A 32'-0" LENGTH. REFER TO LFS NOTE No. 3.	Yes
K	NOMINAL 13"dia x 20" CYLINDER STYLE LED LUMINAIRE WITH ALUM. CONSTRUCTION, WIDE DISTRIBUTION (55deg), INTEGRAL 0-10v. DIMMING DRIVER, MATTE BLACK TRIM, MATTE BLACK FINISH, 90+ CRI MIN., AND RIGID STEM SUSPENSION (FIELD ADJUSTABLE/RETREADABLE STEM).	SPECTRUM LIGHTING [PORTFOLIO] [PATHWAY LIGHTING]	C1320XT.80L.40HK.WD.DS10X.x.TMB.x.MB.SERIES [LSR88 SERIES] [C085L879V SERIES]	277 V	LED, 4000k, ~7000ms DELIVERED	95.0 W	RIGID STEM WITH BOTTOM OF LUMINAIRE 2" ABOVE PROCENIUM. REFER TO LFS NOTE No. 13.	REFER TO LFS NOTE No. 8.	Yes
M	NOMINAL 3" w x 3-1/2" x 4" LENSED STRIP STYLE LED LUMINAIRE WITH CRS HOUSING, END CAPS (WELDED INTO PLACE), INTEGRAL 0-10v DIMMING DRIVER, SNAP IN PLACE EXTRUDED HIGH TRANSMISSION ROUNDED ACRYLIC LENS (WITH LINEAR RIBBING), 80+ CRI MIN ALL PARTS PAINTED AFTER FABRICATION AND WHITE FINISH.	MERCURY LIGHTING [LSI] [METALUX]	LV4.4.3800.40K.HTA.1%.UNI.SERIES [LCL SERIES] [4.SNLD SERIES]	277 V	LED, 4000k, 3821ms	32.0 W	CEILING, SURFACE		Yes
MW	SAME AS TYPE 'M' EXCEPT WALL MOUNTED.			277 V	LED, 4000k, 3821ms	32.0 W	WALL, SURFACE AT 7'-6" A.F.F. OR ABOVE DOOR/ON DOOR HEADER		Yes
N8	SAME AS TYPE 'NW' EXCEPT 8' LONG AND LUMEN VARIATION.	FAIL-SAFE [MERCURY LIGHTING] [PACO LIGHTING]	HVL12.8.LD4.2.LO.40.UNV.C.[STEP-DIM].1.IP63.SERIES [L24W SERIES] [PUCS-A SERIES]	277 V	LED, 4000k, ~5300ms PER FOUR FOOT LENGTH	96.0 W	CEILING, SURFACE	WATTAGE INDICATED IS FOR A 8'-0" LENGTH.	Yes
NW	NOMINAL 12" w x 4" x 4" VANDAL RESISTANT STYLE LED LUMINAIRE WITH 18 GAUGE STEEL CONSTRUCTION, ONE-PIECE EXTRUDED CLEAR INTERNALLY RIBBED, .135" THICK POLYCARBONATE LENSING, INTEGRAL STEP-DIM DRIVER [-40%], LISTED FOR DAMP LOCATIONS, IP63 RATED, 80+ CRI MIN. AND WHITE FINISH.	FAIL-SAFE [MERCURY LIGHTING] [PACO LIGHTING]	HVL12.4.LD4.1.STD.40.UNV.C.[STEP-DIM].1.IP63.SERIES [PUCS-A SERIES]	277 V	LED, 4000k, ~3600ms	34.0 W	WALL, SURFACE AT 8'-0" ABOVE STAIR LANDING		Yes
P	2.75"dia x 5.5" DECORATIVE PENDANT STYLE LED LUMINAIRE WITH 0-10v. DIMMING DRIVER (WITHIN CANOPY/DEEP J-BOX), CRS CANOPY CONSTRUCTION, 90+ CRI MIN., CLEAR BUBBLE GLASS DIFFUSER, LISTED FOR DAMP LOCATIONS, FIELD ADJUSTABLE/CUTTABLE BRAIDED CORD SUSPENSION AND SATIN NICKEL FINISH (AS BASIS OF DESIGN, ALL FINISHES SHALL BE REVIEWED AND APPROVED BY ARCHITECT AT SHOP DRAWING LEVEL).	OXYGEN LIGHTING [OR APPROVED EQUALS]	3-68-24 SERIES	277 V	LED, 3500k, ~400ms	7.0 W	8'-10" A.F.F. TO BOTTOM OF LUMINAIRE. REFER TO LFS NOTE No. 13.	PROVIDE UNIT PRICING, REFER TO LFS NOTE No. 14. REFER TO GENERAL NOTE No. 14.	No
R4	NOMINAL 5" w x 6" x 4" RECESSED LINEAR STYLE LED LUMINAIRE WITH EXTRUDED ALUM. TRIM, 20 GAUGE CRS HOUSING, IC RATED, DAMP LOCATION LISTED, INTEGRAL 0-10v. DIMMING DRIVER, 80+ CRI MIN., ROOM SIDE MAINTENANCE, DIFFUSE SNAP-IN ACRYLIC LENS AND WHITE FINISH.	PINNACLE LIGHTING [NEORAY] [FINELITE]	EV6.A.840HO.4"x.U.OL2.1.0.W.SERIES [S123DR SERIES] [HP6 SERIES]	277 V	LED, 4000k, 788ms PER FOOT	36.0 W	CEILING, RECESSED DRYWALL OVERLAP FLANGE REQUIRED.	WATTAGE INDICATED IS FOR A 4'-0" LENGTH. REFER TO LFS NOTE No. 3.	Yes
R6	SAME AS TYPE 'R4' EXCEPT 6'-0" LONG.			277 V	LED, 4000k, 788ms PER FOOT	54.0 W	CEILING, RECESSED DRYWALL OVERLAP FLANGE REQUIRED.	WATTAGE INDICATED IS FOR A 6'-0" LENGTH. REFER TO LFS NOTE No. 3.	Yes
R8	SAME AS TYPE 'R4' EXCEPT 8'-0" LONG.			277 V	LED, 4000k, 788ms PER FOOT	72.0 W	CEILING, RECESSED DRYWALL OVERLAP FLANGE REQUIRED.	WATTAGE INDICATED IS FOR A 8'-0" LENGTH. REFER TO LFS NOTE No. 3.	Yes
R10	SAME AS TYPE 'R4' EXCEPT 10'-0" LONG.			277 V	LED, 4000k, 788ms PER FOOT	90.0 W	CEILING, RECESSED DRYWALL OVERLAP FLANGE REQUIRED.	WATTAGE INDICATED IS FOR A 10'-0" LENGTH. REFER TO LFS NOTE No. 3.	Yes
R12	SAME AS TYPE 'R4' EXCEPT 12'-0" LONG.			277 V	LED, 4000k, 788ms PER FOOT	108.0 W	CEILING, RECESSED DRYWALL OVERLAP FLANGE REQUIRED.	WATTAGE INDICATED IS FOR A 12'-0" LENGTH. REFER TO LFS NOTE No. 3.	Yes
R14	SAME AS TYPE 'R4' EXCEPT 14'-0" LONG.			277 V	LED, 4000k, 788ms PER FOOT	126.0 W	CEILING, RECESSED DRYWALL OVERLAP FLANGE REQUIRED.	WATTAGE INDICATED IS FOR A 14'-0" LENGTH. REFER TO LFS NOTE No. 3.	Yes
R20	SAME AS TYPE 'R4' EXCEPT 20'-0" LONG.			277 V	LED, 4000k, 788ms PER FOOT	180.0 W	CEILING, RECESSED DRYWALL OVERLAP FLANGE REQUIRED.	WATTAGE INDICATED IS FOR A 20'-0" LENGTH. REFER TO LFS NOTE No. 3.	Yes
SD	NOMINAL 6"dia x 5-1/2" (6" MAX. DEPTH) RECESSED DOWNLIGHT STYLE LED LUMINAIRE WITH SPUN ALUM. REFLECTOR (SEMI SPECULAR), LENSED UPPER OPTICAL CHAMBER, INTEGRAL 0-10v. DIMMING DRIVER, 80+ CRI MIN., IP66 RATED, IC RATED, MEDIUM DISTRIBUTION AND WHITE TRIM.	PORTFOLIO [H.E. WILLIAMS] [INDY]	LDB6.20.x.D010 and EUGB.1020.80.40 and 6L.B.M.2.H.IP66.SERIES [RDR SERIES] [L6 SERIES]	277 V	LED, 4000k, 2000ms	22.0 W	CANOPY, RECESSED		No
SP	NOMINAL 13"dia x 30" TEAR DROP STYLE LED LUMINAIRE WITH TYPE 3 DISTRIBUTION, INTEGRAL 0-10v. DIMMING DRIVER, ALUM. CONSTRUCTION, POLYCARBONATE LENSING, HOUSE SIDE SHIELD, 70+ CRI MIN., AND FINISH PER ARCHITECT.	PENCO [HADCO] [STERNBERG]	XCAL1.ACS.30W4K.U.3.CS.N.N.BK.SERIES	277 V	LED, 4000k, ~3700ms	32.0 W	DECORATIVE CHAIN SUSPENSION AT ~12'-0" A.F.F. (TOP OF GLASS LEVEL WITH TOP OF ARCH). REFER TO LFS NOTE No. 16.	REFER TO LFS NOTE No. 1.	Yes
SW2	NOMINAL 20" w x 6" x 13" WALL MOUNTED LED LUMINAIRE WITH TYPE 2 DISTRIBUTION, B1-U0-G1 MAX BUG RATING, 70+ CRI MIN., THREE PIECE DIE-CAST ALUM. HOUSING (CONTOURED LOW PROFILE SHAPE), STAINLESS STEEL HARDWARE, GALVANIZED STEEL UNIVERSAL WALL MOUNTING PLATE, TWO STAGE SURGE PROTECTION INCLUDING SEPARATE SURGE PROTECTION BUILT INTO DRIVER, U.L. LISTED FOR WET LOCATIONS, IP65 RATED, INTEGRAL 0-10v DIMMING DRIVER AND FINISH PER ARCHITECT.	LSI [MCGRAW EDISON] [LITHONIA]	XWM.2.LED.3L.40.UE.(finish).DIM.SERIES [CALLEON SERIES] [D SERIES]	277 V	LED, 4000k, ~3000ms DELIVERED	23.0 W	WALL, SURFACE (VARIOUS HEIGHTS A.F.G.). REFER TO LFS NOTE No. 1.		No
SW4	SAME AS TYPE 'SW2' EXCEPT WITH TYPE 4 DISTRIBUTION			277 V	LED, 4000k, ~3000ms DELIVERED	23.0 W	WALL, SURFACE (VARIOUS HEIGHTS A.F.G.). REFER TO LFS NOTE No. 1.		No
SWD	12"dia x 22" TEAR DROP STYLE LED LUMINAIRE WITH TYPE 3 DISTRIBUTION, INTEGRAL 0-10v. DIMMING DRIVER, ALUM. CONSTRUCTION, POLYCARBONATE LENSING, HOUSE SIDE SHIELD, 70+ CRI MIN., DECORATIVE CAST ALUM. SCROLL ARM AND FINISH PER ARCHITECT.	PENCO [HADCO] [STERNBERG]	XW1.ACS.30W4K.U.3.CS.N.N.BK.SERIES.PLA121.SG.WM.IVN.PEN.BK.SERIES [ARM]	277 V	LED, 4000k, ~3700ms	32.0 W	WALL, SURFACE (VARIOUS HEIGHTS A.F.G.). REFER TO LFS NOTE No. 1.	REFER TO DETAIL FOR ADDITIONAL INFORMATION.	
T	NOMINAL 2" SQUARE DUAL CIRCUIT LINE VOLTAGE TRACK WITH 0.07" THICK EXTRUDED ALUM. HOUSING, PRE-PUNCHED MOUNTING SLOTS, FLAT COPPER BUS BARS, TWO DEDICATED NEUTRAL BUS BARS, INTEGRAL WIRING CHANNEL, GROUNDING BUS BAR, BLACK FINISH, U.L. LISTED AND REFER TO PLANS FOR EXACT CONTINUOUS LENGTHS REQUIRED.	LIGHTING SERVICES INC. [CONTECH LIGHTING]	322 SERIES [E2CD SERIES]	120 V	N/A		STEM SUSPENDED AT 2'-0" ABOVE PROCENIUM INCLUDING ATTACHED PROCENIUM(S)	REFER TO LFS NOTE No. 10 AND 11. PROVIDE UNIT PRICING.	
T1	NOMINAL 4"dia x 10" CYLINDER SHAPED LED TRACK HEAD WITH INTEGRAL DIMMING DRIVER (ELV DOWN TO 5%), FIELD INTERCHANGABLE OPTICS, 20deg DISTRIBUTION (WIDE FIELD ANGLE), BLACK POLYCARBONATE ACCESSORY CARTRIDGE (HOLDS TWO FILTERS/LENSES), ALUM. CONSTRUCTION AND 83+ CRI MIN.	LIGHTING SERVICES INC. [CONTECH LIGHTING]	LX2044.119.23-83.30.M2.00-TE.120.B.SERIES [NCTL84 SERIES]	120 V	LED, 3000K, 2300ms	19.0 W	DUAL CIRCUIT TRACK	REFER TO LFS NOTE No. 9. ENERGY STAR RATING REQUIRED. PROVIDE UNIT PRICING.	Yes
X	LED EXIT SIGNAGE WITH TWO PIECE THICK WALL HEAVY DUTY DIE CAST ALUM. ALLOY CONSTRUCTION, REMOVABLE FRONT STENCIL FACE (WITH OVERLAPPING LIGHT SEAL), FIELD SELECTABLE CHEVRONS, LOW PROFILE UNIVERSAL CANOPY, INJECTION MOLDED INTERNAL CAVITY REFLECTOR, COLOR OF LETTERS PER A.H.J., (GREEN SHALL BE BASIS OF DESIGN) AND FINISH PER ARCHITECT.	EVENLITE [ASTRALITE] [EMERG-LITE]	CCDS.AC.x.x.SERIES [CA SERIES] [PRESTIGE DX SERIES]	277 V	LED	5.0 W	UNIVERSAL		
XG	SAME AS TYPE 'X' EXCEPT WITH ADDITIONAL WIRE GUARD NOT ATTACHED TO EXIT SIGNAGE.			277 V	LED	5.0 W	WALL, SURFACE AT 8'-0" A.F.F./ABOVE DOOR		
XP	LED EXIT SIGNAGE WITH POLYCARBONATE CONSTRUCTION, 1-3/4" THICKNESS (SINGLE OR DOUBLE FACE), UNIVERSAL MOUNTING, UL924 LISTED, BLACK HOUSING, AC ONLY OPERATION, FIELD SELECTABLE VOLTAGE AND COLOR OF LETTERS PER AUTHORITY HAVING JURISDICTION.	EVENLITE [ASTRALITE] [EMERG-LITE]	TLX.AC.SERIES [LCA SERIES] [PREM SERIES]	277 V	LED	5.0 W	WALL, SURFACE AT 8'-0" A.F.F./ABOVE DOOR		

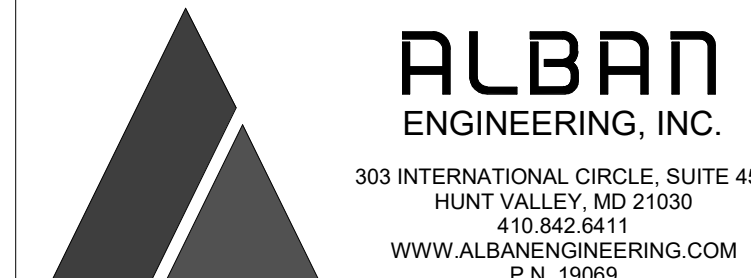
LIGHT FIXTURE SCHEDULE NOTES:

- COORDINATE ALL WALL PACK MOUNTING HEIGHTS AND LOCATIONS WITH ARCHITECT AND ARCHITECTURAL ELEVATIONS PRIOR TO ROUGH-IN.
- U.O.N. ON THE DRAWINGS, WITHIN RESTROOMS AND LOCKER ROOMS, LOCATE TYPE 'R' SERIES LUMINAIRE 18" OFF OF WALL TO CENTER OF UNIT. VERIFY ALL LOCATIONS/OFFSETS FROM WALL WITH ARCHITECT, MANUFACTURER MOUNTING RECOMMENDATIONS AND ALL OTHER TRADES PRIOR TO ROUGH-IN.
- RECESSED, SURFACE OR SUSPENDED LINEAR RUNS UP TO 8FT IN LENGTH SHALL BE PROVIDED AS ONE CONTINUOUS HOUSING. LENSING SHALL BE ONE CONTINUOUS LENS FOR ANY RUN UP TO 8FT IN LENGTH. THERE WILL BE NO GAP OR LIGHT LEAK WHERE TWO LENSES MERGE TOGETHER. NO MORE THAN 1/32" MAXIMUM SPACING BETWEEN END OF HOUSING AND LENS.
- LUMINAIRE DOES NOT HAVE TO BE DLC LISTED. SUBMIT LM-79 AND LM-80 REPORTS WITH ASSOCIATED SHOP DRAWING FOR ENERGY REBATE SUBMISSION DOCUMENTATIONS.
- MOUNT AT TOP AND BOTTOM OF ELEVATOR SHAFT. LUMINAIRE IS RATED FOR WALL/SURFACE MOUNTING IN THE VERTICAL OR HORIZONTAL ORIENTATION. COORDINATE EXACT MOUNTING LOCATIONS WITH ELEVATOR MANUFACTURER/EQUIPMENT PRIOR TO ROUGH-IN.
- BASIS OF DESIGN LUMINAIRE PROVIDES DRIVER AS UNIVERSAL VOLTAGE. 120V CONNECTION REQUIRED FOR ELEVATOR SHAFT APPLICATIONS. PROVIDE 277V CONNECTION FOR ALL OTHER APPLICATIONS.
- FIELD VERIFY ALL SUSPENSION LENGTHS WITH ARCHITECT PRIOR TO TRIMMING OF SUSPENSION CABLES.
- VERIFY ALL MOUNTING HEIGHTS TO BOTTOM OF LUMINAIRE AND MOUNTING STYLE WITH ARCHITECT PRIOR TO ROUGH-IN. COORDINATE ALL LOCATIONS WITH PROJECTOR SCREEN, STAGE CURTAIN AND ALL OTHER TRADES PRIOR TO ROUGH-IN.
- IN ADDITION, PROVIDE THE FOLLOWING LENSES: 5X50 SPREAD LENS - QUANTITY OF 10 45x45 BEAM SOFTNER - QUANTITY OF 10 RED GLASS LENS - QUANTITY OF 20 BLUE GLASS LENS - QUANTITY OF 20 GREEN GLASS LENS - QUANTITY OF 20 AMBER GLASS LENS - QUANTITY OF 20 FIELD INTERCHANGABLE OPTICS, 40deg - QUANTITY OF 20
- PROVIDE ALL APPURTENANCES FOR A COMPLETE SYSTEM.
- EACH CIRCUIT OF DUAL CIRCUIT TRACK SHALL BE VIA CURRENT LIMITING PANEL (3 AMP PER TRACK CIRCUIT), REFER TO DETAIL FOR ADDITIONAL INFORMATION.
- NO DIMMING FUNCTION REQUIRED. REFER TO GENERAL NOTE No. 1.
- FIELD COORDINATE EXACT MOUNTING HEIGHT AND LOCATIONS WITH ARCHITECT AND ALL OTHER TRADES PRIOR TO ROUGH-IN.
- PROVIDE WRITTEN DOCUMENTATION OF UNIT PRICING (PER LUMINAIRE, LUMP SUM NUMBER WILL NOT BE ACCEPTED) WITH SHOP DRAWING SUBMITTAL.
- MOUNT AS HIGH AS POSSIBLE. CONTRACTOR SHALL COORDINATE ALL REQUIREMENTS WITH STRUCTURE AND ARCHITECTURAL ELEMENTS TO PROVIDE REQUIRED SUPPORT AND MAINTAIN CEILING'S FIRE RATING.
- PROVIDE AIRCRAFT CABLE STYLE WEATHER TIES (4 PER LUMINAIRE). ALL ANCHORING POINTS AND STYLES TO BE FIELD COORDINATED WITH ARCHITECT PRIOR TO ROUGH-IN.

GENERAL NOTES:

- PROVIDE ALL 0-10V DIMMING DRIVERS PREWIRED WITH ISOLATE LEADS. WHEN A DIMMING DRIVER IS PROVIDED BUT ONLY CALLED FOR STATIC OPERATION, CAP 0-10V LEADS AND LEAVE IN PLACE, ENSURE LUMINAIRE STILL OPERATES AT 100% OUTPUT.
- COORDINATE LIGHTING FIXTURES INDICATED ON DRAWINGS WITH ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATIONS. VERIFY CEILING CONSTRUCTION IN ALL AREAS WITH ARCHITECTURAL DRAWINGS AND PROVIDE ALL MOUNTING FRAMES/HARDWARE AS REQUIRED FOR A COMPLETE INSTALLATION SUITABLE FOR THE CEILING TYPE.
- IN SPRINKLERED AREAS, MAINTAIN ADEQUATE SPACING BETWEEN FIXTURES AND SPRINKLER HEADS PER COUNTY FIRE MARSHAL REQUIREMENTS.
- ALL LOW VOLTAGE, CLASS 2 WIRING FROM A REMOTE POWER SUPPLY TO LUMINAIRE SHALL BE IN CONDUIT WHEN LOCATED ABOVE CEILING OR WITHIN WALLS.
- ALL DIMMING DRIVERS OR DIMMING BALLASTS SHALL BE COORDINATED WITH DIMMER/DIMMING SYSTEM TO ENSURE FLICKER FREE DIMMING DOWN TO 10% UNLESS SPECIFIED TO LOWER PERCENTAGE IN LIGHT FIXTURE SCHEDULE.
- COORDINATE ALL EXIT SIGN MOUNTING POINTS WITH ARCHITECTURAL DRAWINGS, MILLWORK DRAWINGS AND ALL OTHER TRADES PRIOR TO ROUGH-IN. SUBMIT PROPOSED CONDUIT ROUTING AND MOUNTING STYLE TO ARCHITECT FOR ALL EXIT SIGNAGE BEING MOUNTED TO WINDOW MULLIONS PRIOR TO ROUGH-IN.
- MODEL NUMBERS ARE FOR REFERENCE ONLY. SUBMIT SHOP DRAWINGS BASED ON ENTIRE SCHEDULE AND DRAWING INFORMATION.
- PROVIDE ALL DRIVERS AS UNIVERSAL VOLTAGE.
- UNLESS SPECIFICALLY NOTED OTHERWISE, ALL INTERIOR LIGHT FIXTURES SHALL BE DLC OR ENERGY STAR LISTED. SUBMIT RECORD OF EACH FIXTURE'S ACTIVE LISTING WITH ASSOCIATED SHOP DRAWING.
- RECESSED, SURFACE OR SUSPENDED LINEAR RUNS UP TO 8FT IN LENGTH SHALL BE PROVIDED AS ONE CONTINUOUS HOUSING. LENSING SHALL BE ONE CONTINUOUS LENS FOR ANY RUN UP TO 8FT IN LENGTH. THERE WILL BE NO GAP OR LIGHT LEAK WHERE TWO LENSES MERGE TOGETHER. NO MORE THAN 1/32" MAXIMUM SPACING BETWEEN END OF HOUSING AND LENS.
- SUBMIT FACTORY DRAWINGS ON ALL LINEAR RUNS (RECESSED, SURFACE AND PENDANT VARIATIONS) INDICATING EACH ROOM APPLIED IN INCLUDING EACH VARIATION OF RUN.
- FOR ALL ADJUSTABLE AIRCRAFT CABLE SUSPENSION APPLICATIONS, FIELD VERIFY EXACT MOUNTING HEIGHT WITH ARCHITECT AFTER PRELIMINARY INSTALLATION. DO NOT TRIM EXCESS CABLE UNTIL FINAL MOUNTING HEIGHT IS VERIFIED AND LOCKED IN PLACE.
- FOR ALL LINEAR RUNS, REFER TO SPECIFICATION SECTION 285119.3.2-D.
- REFER TO SPECIFICATION SECTION 26.51.19 FOR ADDITIONAL INFORMATION ON LIGHT FIXTURES, EXTRA MATERIALS, FINAL CLEANING AND SUBSTITUTION PROCESS.

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
100 WEST ROAD, SUITE 402
TOWSON, MD 21204



PROPOSED NEW
MONTEBELLO ELEMENTARY/ MIDDLE SCHOOL
 BALTIMORE CITY PUBLIC SCHOOLS
 2020 EAST 32ND STREET, BALTIMORE, MARYLAND 21218

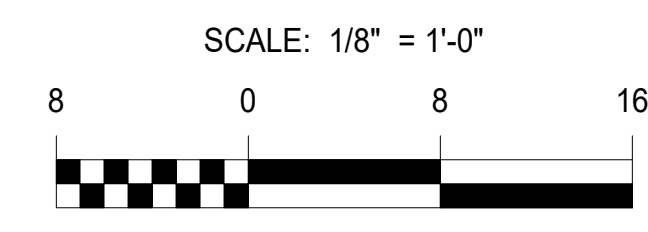
USING AGENCY APPROVAL

Name:	Date:	
Title:	MSA APPROVAL	
Project Manager:	Date:	
Chief of PM&D:	Date:	
4	01/08/21	Addendum #1
2	12/16/20	Addendum #2
MARK:	DATE:	DESCRIPTION:
AS-BUILT REVISIONS		
SUBMITTED BY:		
CAD DWG FILE: Author		
DRAWN BY: Author		
CHECKED BY: Checker		
PROJECT NO. BCS-02-004		
DATE: NOVEMBER 16, 2020		
LIGHT FIXTURE SCHEDULE		
SCALE:		
DRAWING NO. E2.0		

90% CONSTRUCTION DOCUMENTS



GROUND FLOOR PLAN UNIT 'B' - LIGHTING
1/8" = 1'-0"



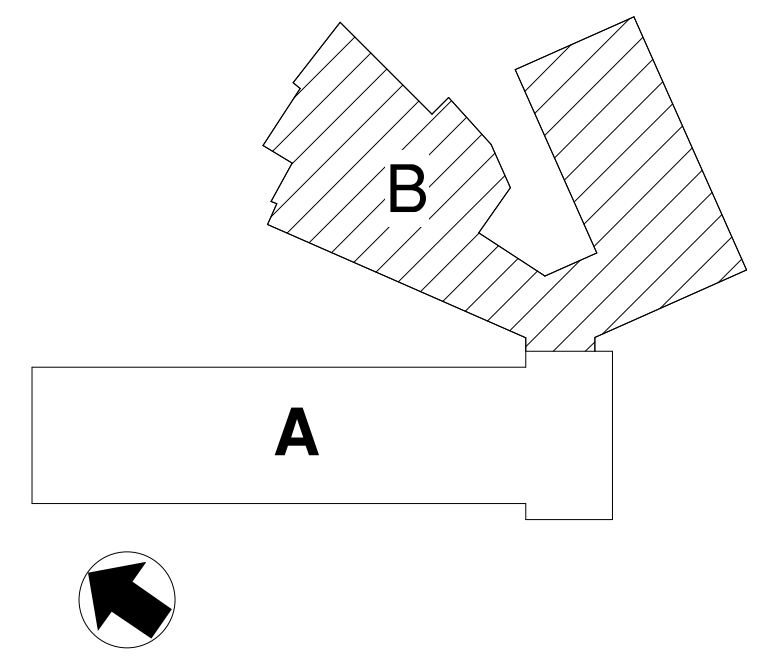
GENERAL NOTES:

1. CONNECT ALL EXIT SIGNAGE IN UNIT 'B' TO CIRCUIT E1LGB-13.
2. UNLESS OTHERWISE NOTED, ALL EXIT SIGNAGE INDICATED SHALL BE TYPE 'X'.

DRAWING NOTES:

1. FOR DISPLAY CASE POWER, PROVIDE SINGLE POLE TOGGLE SWITCH FOR LOCAL DISCONNECTING MEANS. COORDINATE EXACT SWITCH LOCATION (INTEGRAL TO DISPLAY CASE OR ABOVE ACCESSIBLE CEILING IN NEMA 1 ENCLOSURE) PRIOR TO ROUGH-IN. LIGHTING FOR DISPLAY CASE SHALL BE BY DISPLAY CASE MANUFACTURER. CONNECT TO CIRCUIT RGB-40 VIA BLC-B.
2. LOCATE TYPE 'R10' LIGHT FIXTURE HERE IN LIEU OF STANDARD 18" OFFSET.

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
100 WEST ROAD, SUITE 402
TOWSON, MD 21204



PROPOSED NEW
MONTEBELLO ELEMENTARY/
MIDDLE SCHOOL
BALTIMORE CITY PUBLIC SCHOOLS
2020 EAST 32ND STREET, BALTIMORE,
MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____

Title: **MSA APPROVAL**

Project Manager: _____ Date: _____

Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
4	01/08/21	Addendum #4
2	12/16/20	Addendum #2

AS-BUILT REVISIONS

SUBMITTED BY: _____

CAD DWG FILE: Author

DRAWN BY: Author

CHECKED BY: Checker

PROJECT NO. BCS-02-004

DATE: NOVEMBER 16, 2020

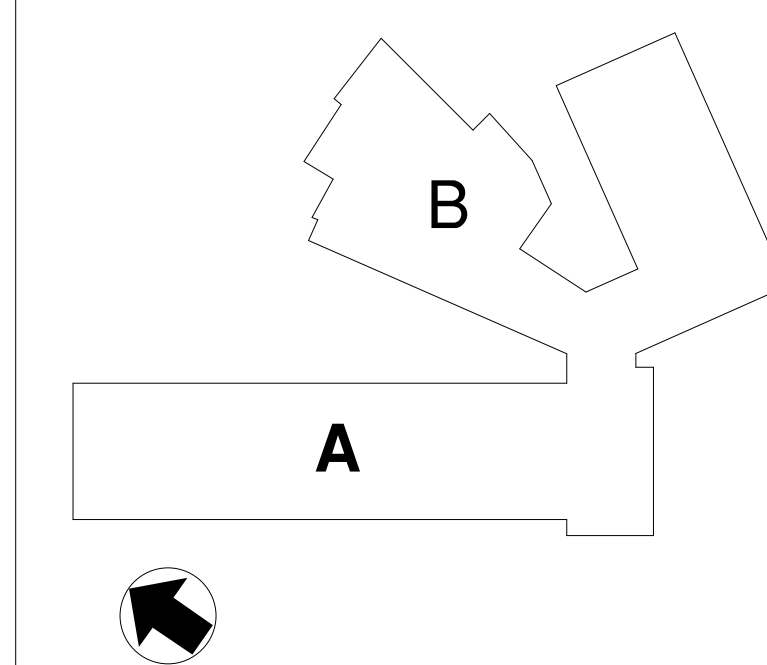
GROUND FLOOR PLAN UNIT 'B' - LIGHTING

SCALE: 1/8" = 1'-0"

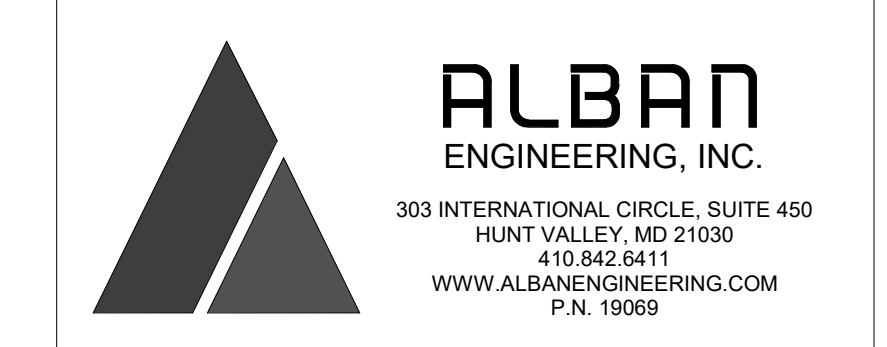
DRAWING NO. **E2.3**

90% CONSTRUCTION DOCUMENTS

KEY PLAN



CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
100 WEST ROAD, SUITE 402
TOWSON, MD 21204



PROPOSED NEW
MONTEBELLO ELEMENTARY/
MIDDLE SCHOOL
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4	01/08/21	Addendum #4
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SUBMITTED BY: _____
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PROJECT NO. BCS-02-004
DATE: NOVEMBER 16, 2020
PART PLAN - KITCHEN - ELECTRICAL
SCALE: As indicated
DRAWING NO. **E4.1**

DRAWING NOTES:

- 1. EXTEND CONDUIT UP THRU PITCH POCKET IN ROOF CURB.
- 2. PROVIDE 3P-30A F/SS (FUSED PER MANUFACTURERS NAME PLATE DATA) IN NEMA 4X ENCLOSURE (STAINLESS STEEL).
- 3. CAT 5 CABLE TO MANAGER OFFICE FOR TEMPERATURE MONITORING. BY E.C.
- 4. RUN ALL CONDUIT ABOVE WALK-IN CLG. SEE LIGHT FIXTURE DETAIL THIS SHEET.
- 5. NEMA 6-20R. VERIFY WITH KITCHEN CONTRACTOR.
- 6. NEMA 6-50R. VERIFY WITH KITCHEN CONTRACTOR.
- 7. EDWARD 55-4GS SIGNALING BELL OR APPROVED EQUAL. PROVIDE CONTROL POWER XFMR AND MAKE ALL CONNECTIONS.
- 8. CONTROL STATION FOR MOTORIZED DOOR. COORDINATE EXACT LOCATION WITH OWNER.

GENERAL NOTES:

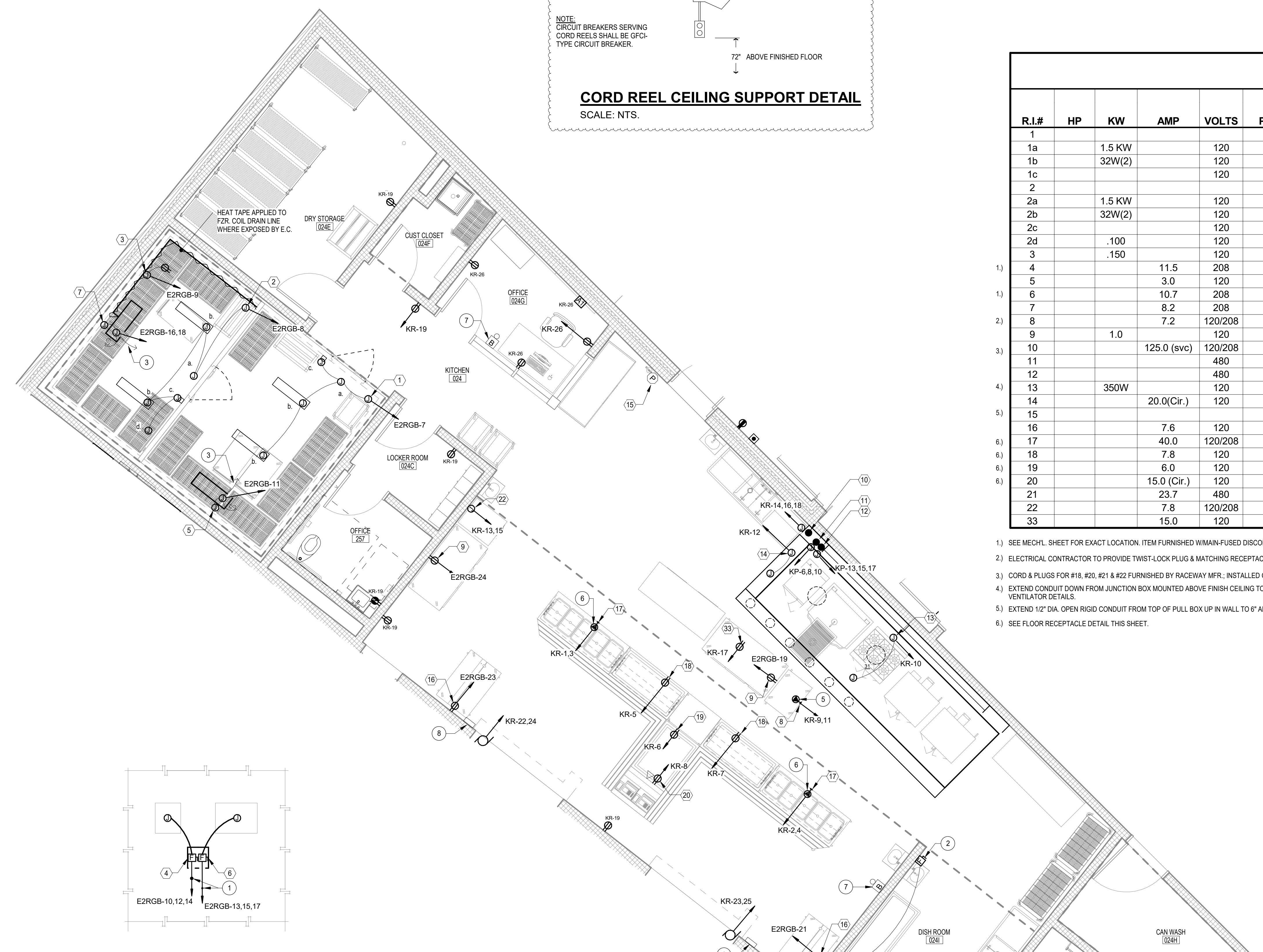
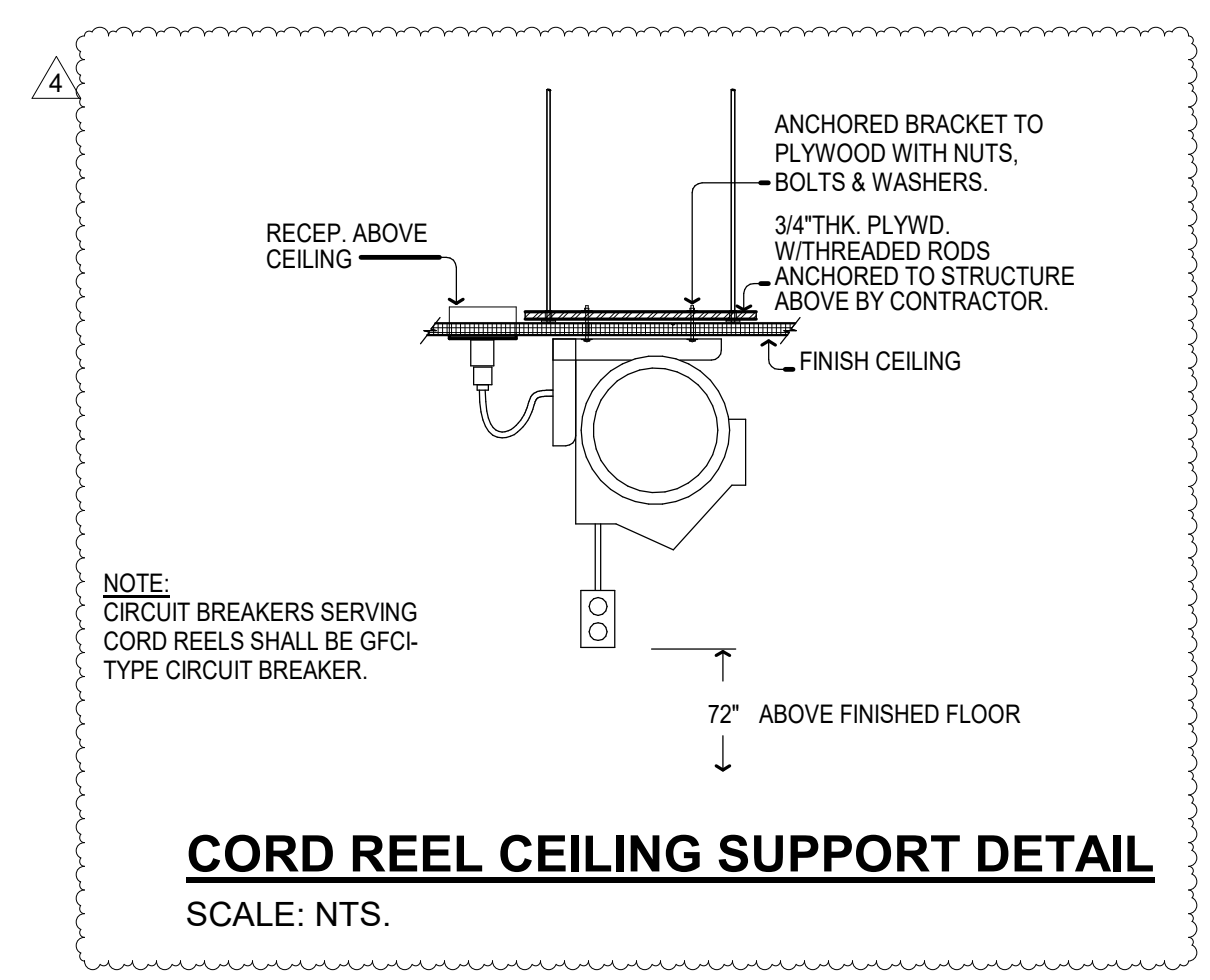
- 1. ALL SINGLE PHASE, 15 AND 20 AMPERE RECEPTACLES INSTALLED IN KITCHEN SHALL HAVE GROUND-FAULT CIRCUIT INTERRUPTER PROTECTION.
- 2. REFER TO MECHANICAL EQUIPMENT CONNECTION SCHEDULE ON DRAWING ET-5 FOR ADDITIONAL INFORMATION.

R.I.#	HP	KW	AMP	VOLTS	PH	R.I. HGT. A.F.F.	DESCRIPTION	E.Q. NO.	E.C. TO PROVIDE			
									CORD & PLUG	RECEP.	DISC.	J.B.
1						114"	BRANCH TO:	2				o
1a		1.5 KW		120	1		DOOR LIGHT, HEATER, ALARM	2				
1b		32W(2)		120	1		L.E.D. LIGHT FIXTURE(2)	2				
1c				120	1		AIR SHIELD	2				o
2						114"	BRANCH TO:	2				o
2a		1.5 KW		120	1		DOOR LIGHT, HEATER, ALARM	2				
2b		32W(2)		120	1		L.E.D. LIGHT FIXTURE(2)	2				
2c				120	1		AIR SHIELD	2				o
2d		.100		120	1		HEATED RELIEF PORT	2				
3		.150		120	1		DRAIN LINE HEAT TAPE RECEP.	2		o		o
4			11.5	208	3	STUB	COOLER COMPRESSOR RACK	3				o
5			3.0	120	1		COOLER BLOWER COIL	3				o
6			10.7	208	3	STUB	FREEZER COMPRESSOR RACK	4				o
7			8.2	208	1	114"	FREEZER BLOWER COIL	4				o
8			7.2	120/208	1	D.F.A.	PASS-THRU HEATED CABINET, RECEP.	14	o			o
9		1.0		120	1	STUB	REFRIGERATED WORKTOP RECEP.	15		o		
10			125.0 (svc)	120/208	3	D.F.A.	UTILITY RACEWAY	16				o
11				480	3	D.F.A.	VENTILATOR EXHAUST CONTROL PANEL	17				o
12				480	3	D.F.A.	VENTILATOR MAKE-UP-AIR CONTROL PANEL	17				o
13				120	1	114"	VENTILATOR CONTROLLER	17				o
14				120	1	108"	FIRE PROTECTION SYSTEM	17				o
15				48"			HEXAGON J-BOX, FIRE PULL	17				o
16			7.6	120	1	48"	MILK COOLER RECEP.	24		o		
17			40.0	120/208	1	STUB	HOT FOOD COUNTER RECEP.	25a		o		
18			7.8	120	1	STUB	COLD FOOD COUNTER RECEP.	25b		o		
19			6.0	120	1	STUB	SALAD COUNTER RECEP.	25c		o		
20			15.0 (Cir.)	120	1	STUB	CASH REGISTER RECEP.	26		o		
21			23.7	480	3	12"	DISHMACHINE-BOOSTER HEATER	31				o
22			7.8	120/208	1	88"	REACH-IN HEATED CABINET RECEP.	39	o			
33			15.0	120	1	@CLG.	RETRACTABLE CORD REEL RECEP.	43		o		

- 1. SEE MECH. SHEET FOR EXACT LOCATION. ITEM FURNISHED W/MAIN-FUSED DISCONNECT SWITCH.
- 2. ELECTRICAL CONTRACTOR TO PROVIDE TWIST-LOCK PLUG & MATCHING RECEPTACLE. SEE DETAIL THIS SHEET.
- 3. CORD & PLUGS FOR #18, #21 & #22 FURNISHED BY RACEWAY MFR.; INSTALLED ON EQUIPMENT BY E.C. SEE SHEET K-6 FOR FURTHER RACEWAY DETAILS.
- 4. EXTEND CONDUIT DOWN FROM JUNCTION BOX MOUNTED ABOVE FINISH CEILING TO CONTROL PANEL BY E.C. SEE SHEET K-502 FOR FURTHER VENTILATOR DETAILS.
- 5. EXTEND 1/2" DIA. OPEN RIGID CONDUIT FROM TOP OF PULL BOX UP IN WALL TO 6" ABOVE FINISH CLG. BY E.C.
- 6. SEE FLOOR RECEPTACLE DETAIL THIS SHEET.

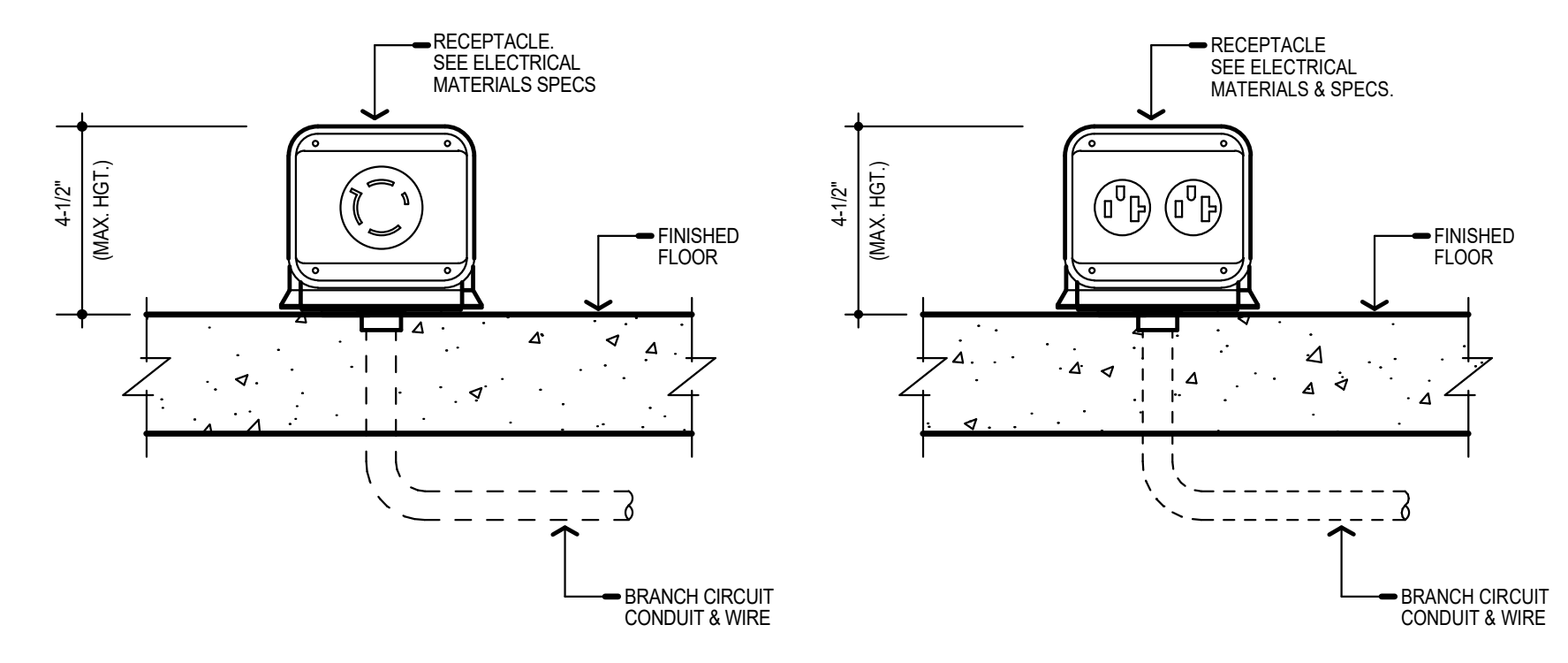
KITCHEN EQUIPMENT CONNECTION SCHEDULE NOTES:

- 1. ALL OUTLETS AND CONNECTIONS SHOWN RELATE TO FOOD SERVICE AND FIXTURES ONLY. SEE KITCHEN FOODSERVICE AND ENGINEERING PLANS FOR ADDITIONAL ELECTRICAL REQUIREMENTS.
- 2. ELECTRICAL SYSTEM IS DESIGNED FOR 208/120V, 3PH, 4W.
- 3. THIS PLAN SHOW INTENDED ROUGH-IN OUTLET TYPES, LOCATIONS AND HEIGHTS, AS WELL AS CONNECTION POSITIONS AND LOAD REQUIREMENTS. DIMENSIONS SHOWN ARE FROM FINISHED FLOOR/WALLS. VERIFY FINISH WALL/PARTITION LOCATIONS WITH ARCHITECTURAL DRAWINGS.
- 4. ALL ELECTRICAL WORK FOR FABRICATED FOODSERVICE EQUIPMENT SHALL BE COMPLETELY WIRED BY THE FABRICATION CONTRACTOR TO A COMMON JUNCTION BOX, PULL BOX OR CONTROL PANEL ON THE EQUIPMENT IN AN ACCESSIBLE POSITION. FINAL CONNECTIONS TO EQUIPMENT PULL BOX/JUNCTION BOX AND ALL ELECTRICAL WORK FROM PANELBOARDS SHALL BE BY ELECTRICAL CONTRACTOR.
- 5. ELECTRICAL CONTRACTOR SHALL PERFORM FINAL CONNECTIONS TO ALL FOODSERVICE EQUIPMENT.
- 6. ALL CONDUIT, PIPING AND/OR SIMILAR CONSTRUCTION, LOCATED OUTSIDE WALL, MUST BE INSTALLED SUCH THAT SPACE BETWEEN WALL AND CONDUIT IS MINIMUM 3/4".
- 7. ELECTRICAL CONTRACTOR OR EQUIVALENT, SHALL FURNISH AND INSTALL THE FOLLOWING:
 - 7.1 ALL PLUGS AND CORDS AS NOTED ON SCHEDULE. ALL CORDS SHALL BE NEMA RATED AND UL APPROVED FOR MANUFACTURED AND FABRICATED EQUIPMENT.
 - 7.2 ALL ELECTRICAL OUTLETS, SWITCHES, COVERPLATES, JUNCTION BOXES, ETC NOT BUILT INTO FIXTURES OR EQUIPMENT. ALL OUTLETS, JUNCTION BOXES, ETC.
 - 7.3 DISCONNECTS OR OTHER DEVICES AS REQUIRED BY CODE.
 - 7.4 SHUNT-TRIP CIRCUIT BREAKERS OR DISCONNECTS FOR FIRE CONTROL SYSTEM SHUT-OFF OF FOODSERVICE EQUIPMENT BENEATH HOODS/VENTILATORS AS REQUIRED BY LOCAL CODES AND NFPA 96 (LATEST EDITION).
- 8. WHERE REQUIRED THE ELECTRICAL CONTRACTOR SHALL PROVIDE WIRING AND CONDUIT. INSTALL ELECTRICAL COMPONENTS PROVIDED BY K.E.C. AND INTERWIRE BETWEEN THE FOLLOWING:
 - 8.1 WALK-IN COOLER/FREEZER LIGHT (CONDUIT SHALL BE RUN ABOVE COMPARTMENT CEILING)
 - 8.2 REMOTE REFRIGERATION SYSTEMS TO EVAPORATOR COILS.
 - 8.3 KITCHEN EXHAUST HOODS/VENTILATORS TO FIRE CONTROL SYSTEM AND SHUT-OFFS
 - 8.4 CONTROL PANELS TO WATER-TYPE VENTILATORS AND EXHAUST SUPPLY FANS PER MANUFACTURER'S INSTRUCTIONS.
- 9. REVIEW AND PROVIDE/INSTALL ALL ADDITIONAL REQUIRED CONDUIT, WIRING, DISCONNECTS, ETC. INDICATED ON FOODSERVICE PLANS FOR ANY TYPE OF EQUIPMENT OR SYSTEM DESIGNED FOR THIS PROJECT NOT INDICATED IN THIS DRAWING.
- 10. ALL RECEPTACLES SHALL BE GFCI TYPE UNLESS OTHERWISE NOTED.

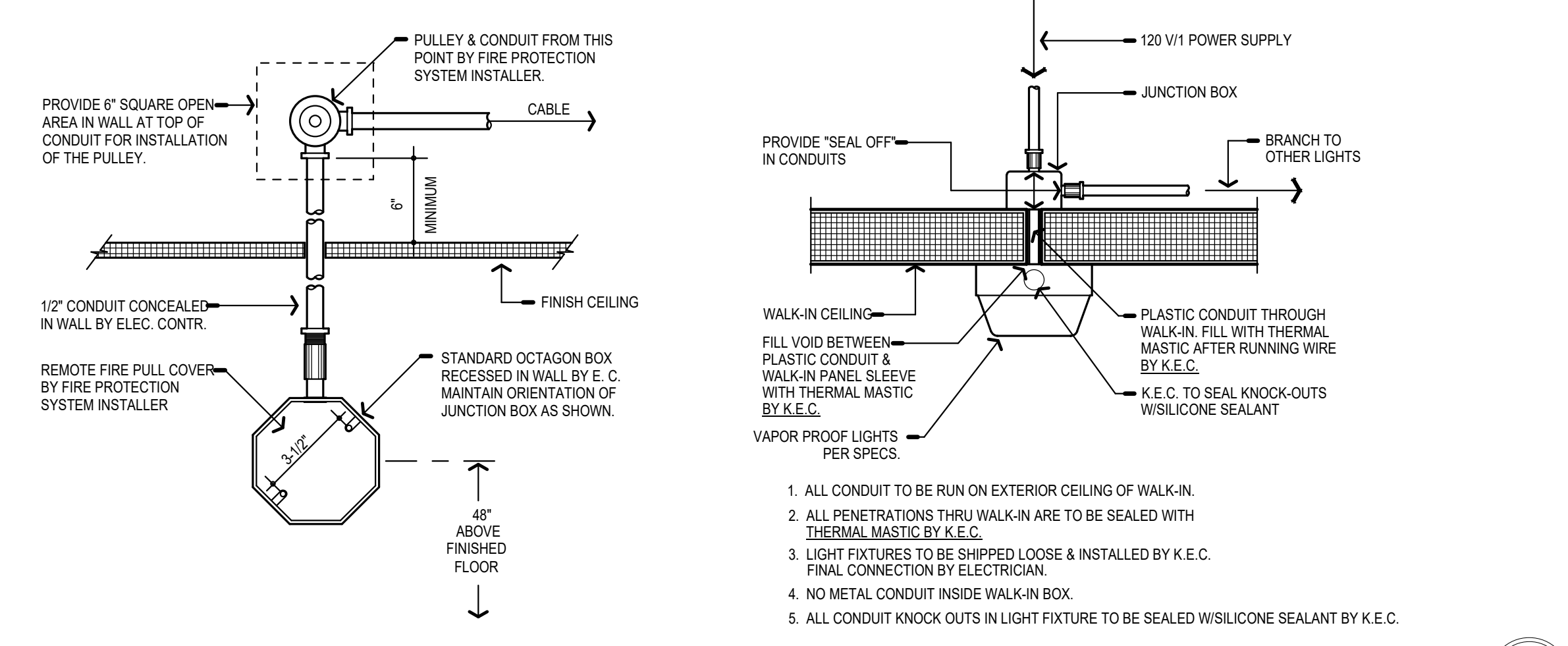


PART PLAN - COMPRESSOR RACKS
1/4" = 1'-0"

PART PLAN - KITCHEN
1/4" = 1'-0"

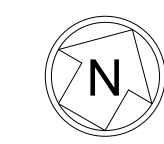
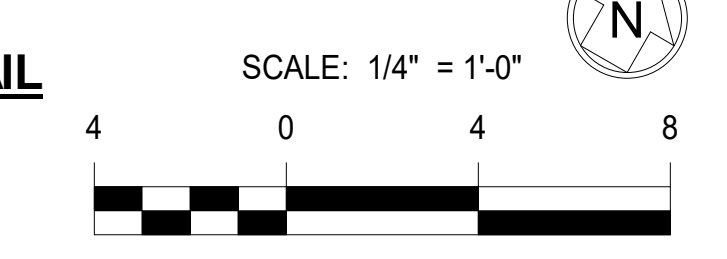


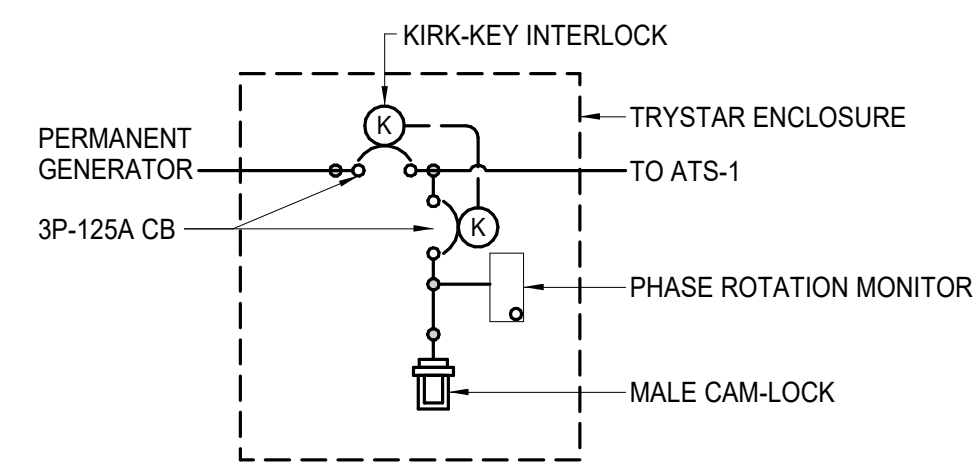
FLOOR RECEPTACLE DETAIL
SCALE: NTS.



REMOTE FIRE PROTECTION PULL STATION DETAIL
SCALE: NTS.

WALK-IN LIGHT INSTALLATION DETAIL
SCALE: NTS.





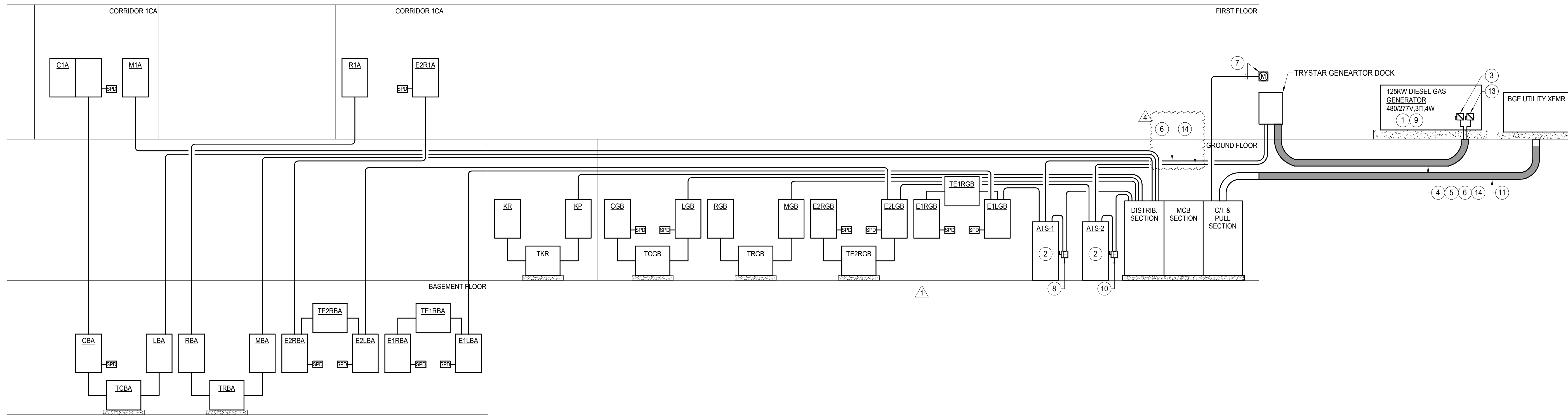
2 GENERATOR DOCK
E5.1 SCALE = NONE

GENERAL NOTES:

1. REFER TO PANEL SCHEDULES FOR ADDITIONAL INFORMATION.
2. PROVIDE TRANSFORMER PRIMARY DISCONNECTS, WHERE INDICATED, SIZED TO MATCH (OR EXCEED) THE RATING OF THE PRIMARY CB INDICATED ON THE DRY TYPE TRANSFORMER SCHEDULE.
3. CONTRACTOR SHALL REDUCE FEEDER SIZE (IF REQUIRED) WITHIN 5'-0" OF EQUIPMENT TO ACCOMMODATE LUG SIZES.
4. PROVIDE #4 CIRCUIT PANELS IN A SINGLE-SECTION INTERIOR.
5. PROVIDE PLACARD POSTING THE AVAILABLE FAULT CURRENT AT THE MAIN SERVICE.
6. ALL FEEDERS ARE SIZED AS COPPER CONDUCTORS. ALUMINUM CONDUCTORS SHALL BE PERMITTED AS (VE) FOR FEEDERS #4 OR LARGER. ALUMINUM IS PERMITTED FOR FEEDERS TO PANELBOARDS ONLY. COPPER SHALL BE USED FOR MECHANICAL EQUIPMENT.

DRAWING NOTES:

- 1 MOUNT GENERATOR CIRCUIT BREAKERS WITHIN GENERATOR ENCLOSURE.
- 2 4P-125A, 42KA WITHSTAND (MINIMUM RATINGS).
- 3 3P-125A-ECB.
- 4 GENERATOR DUCTBANK #1.
- 5 GENERATOR DUCTBANK #2.
- 6 (4) #1 + #6GW - 1-1/2"C.
- 7 1-1/4"C - COORDINATE MOUNTING OF METER ON EXTERIOR OF THE BUILDING WITH ARCHITECT AND BGE.
- 8 3P-200A-F/SS (FUSED AT 125A) SHALL SERVE EMERGENCY LIFE-SAFETY LOADS.
- 9 4R13X ALTERNATOR.
- 10 3P-200A-F/SS (FUSED AT 150A) SHALL SERVE EMERGENCY OPTIONAL STANDBY LOADS.
- 11 SECONDARY DUCTBANK.
- 12 4R13X ALTERNATOR.
- 13 3P-150A-ECB.
- 14 (4) #1/0 + #6GW - 1-1/2"C.



SCHEMATIC POWER RISER DIAGRAM
SCALE: NONE

XFMR	KVA	PRIMARY			PRIMARY WIRING	SECONDARY WIRING	SECONDARY			NEUTRAL/CASE GND	REMARKS	MOUNTING DESCRIPTION
		VOLTAGE	φ	CB			VOLTAGE	φ	CB			
TCBA	112.5	480 V	3	225 A	(3) #4/0 + #4GW - 2"C	2 SETS (5-250KCMIL + #1/0 SSBJ - 2 1/2"C)	208/120 V	3	400	#1/0	K-13 RATED	FLOOR
TCGB	30	480 V	3	60 A	(3) #4 + #10GW - 1"C	(4) #1 + 250KCMIL + #6 SSBJ - 2"C	208/120 V	3	100 A	#6	K-13 RATED	FLOOR
TE1RBA	15	480 V	3	30 A	(3) #10 + #10GW - 3/4"C	(4) #4 + #8 SSBJ - 1 1/4"C	208/120 V	3	60 A	#8		SUSPENDED
TE1RGB	15	480 V	3	30 A	(3) #10 + #10GW - 3/4"C	(4) #4 + #8 SSBJ - 1 1/4"C	208/120 V	3	60 A	#8		SUSPENDED
TE2RBA	45	480 V	3	90 A	(3) #2 + #8GW - 1 1/4"C	(4) #3/0 + #4 SSBJ - 2"C	208/120 V	3	150 A	#4		SUSPENDED
TE2RGB	45	480 V	3	90 A	(3) #2 + #8GW - 1 1/4"C	(4) #3/0 + #4 SSBJ - 2"C	208/120 V	3	150 A	#4		FLOOR
TKR	75	480 V	3	150 A	(3) #3/0 + #4GW - 2"C	(4) #4/0 + #2 SSBJ - 2 1/2"C	208/120 V	3	225 A	#2		FLOOR
TRBA	45	480 V	3	90 A	(3) #2 + #8GW - 1 1/4"C	(4) #3/0 + #4 SSBJ - 2"C	208/120 V	3	150 A	#4		FLOOR
TRGB	75	480 V	3	150 A	(3) #3/0 + #4GW - 2"C	(4) #4/0 + #2 SSBJ - 2 1/2"C	208/120 V	3	225 A	#2		FLOOR

Switchboard: MSB

Location: ELECTRICAL ROOM 033
Supply From: BGE UTILITY XFMR
Mounting: FREE-STANDING
Enclosure: Type 2

Volts: 480/277 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 65 KAIC
Mains Rating: 2500 A
MCB Rating: 2500A (100% RATED)*

Notes:

PROVIDE THE FOLLOWING PROVISIONAL SPACES: (2) 3P-225, (3) 3P-100A

CKT	CIRCUIT DESCRIPTION	P	FRAME	CB	WIRE SIZE	LOAD	REMARKS
MSB-1	SPD	3	100 A	30 A	(4) #10 + #10GW - 3/4"C	0.3 kVA	
MSB-2	PANELBOARD E1LGB (VIA ATS-1)	3	250 A	125 A	(4) #1 + #6GW - 1-1/2"C	28.8 kVA	
MSB-3	PANELBOARD E2LGB (VIA ATS-2)	3	250 A	150 A	(4) #1/0 + #6GW - 1-1/2"C	100.1 kVA	
MSB-4	PANELBOARD LGB	3	100 A	100 A	(4) #1 + #6GW - 1-1/2"C	37.9 kVA	
MSB-5	PANELBOARD MCB	3	800 A	700 A	2 SETS-(4) 500KCMIL + #1/0GW - 3"C	410.1 kVA	
MSB-6	PANELBOARD MBA	3	800 A	800 A	3 SETS-(4) 300KCMIL + #1/0GW - 2-1/2"C	433.7 kVA	
MSB-7	PANELBOARD LBA	3	400 A	400 A	2 SETS-(4) #3/0 + #3GW - 2"C	213.0 kVA	
MSB-8	PANELBOARD KP	3	250 A	225 A	(4) #4/0 + #4GW - 2-1/2"C	85.6 kVA	
MSB-9	PANELBOARD M1A	3	250 A	125 A	(4) #1 + #6GW - 1-1/2"C	45.4 kVA	
MSB-10	SPARE	3	--	225 A	--	0.0 kVA	
MSB-11	SPARE	3	--	100 A	--	0.0 kVA	
MSB-12	ELEVATOR - 480v CONNECTION	3	100 A	25 A	(3) #10 + #10GW - 3/4"C	16.7 kVA	
MSB-13							
MSB-14							
MSB-15							
MSB-16							
MSB-17							
MSB-18							
MSB-19							
MSB-20							
Total Conn. Load:						1371.1 kVA	

Legend:

*PROVIDE GROUND FAULT PROTECTION
+PROVIDE EFMS (ENERGY REDUCTION MAINTENANCE SWITCH)

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals
MOTOR -	0.0 kVA	0.00%	0.0 kVA	
MECHANICAL -	848.7 kVA	100.00%	848.7 kVA	Total Conn. Load: 1371.1 kVA
REC -	265.5 kVA	51.88%	137.8 kVA	Total Est. Demand: 1237.5 kVA
LTG -	40.4 kVA	100.00%	40.4 kVA	Total Conn.: 1649 A
KITCHEN -	16.5 kVA	65.00%	10.7 kVA	Total Est. Demand: 1489 A

Notes:

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PROJECT NO. BCS-02-004

DATE: NOVEMBER 16, 2020

SCHEMATIC POWER RISER DIAGRAM

SCALE: 1/8" = 1'-0"

DRAWING NO.

E5.1

90% CONSTRUCTION DOCUMENTS

Branch Panel: C1A													
LOCATION: CBA			VOLTAGE: 120/208 Wye			A.I.C. RATING: 10 KAIC							
SUPPLY FROM: CBA			PHASE: 3			MAINS RATING: 225 A							
MOUNTING: Surface			WIRES: 4			MCB RATING: 225 A							
						NEUTRAL RATING: 200%							
Notes:													
CKT	CIRCUIT	WIRE SIZE	P	CB	A	B	C	CB	P	WIRE SIZE	CIRCUIT	CKT	
C1A-1													
C1A-3	SPD	(4) #10 + #10GW - 3/4"	3	30 A	0.1 kVA	1.0 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - SPECIAL EDUCATION 108	C1A-4
C1A-5										20 A	1 (2) #12 + #12GW - 3/4"	REC - SPECIAL EDUCATION 108	C1A-6
C1A-7	REC - SPECIAL EDUCATION 108	(2) #12 + #12GW - 3/4"	1	20 A	1.0 kVA	1.2 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - 4TH GRADE 106	C1A-8
C1A-9	REC - 4TH GRADE 106	(2) #12 + #12GW - 3/4"	1	20 A		1.0 kVA	1.2 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - 4TH GRADE 106	C1A-10
C1A-11	REC - 4TH GRADE 105	(2) #12 + #12GW - 3/4"	1	20 A			1.2 kVA	1.2 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - 4TH GRADE 105	C1A-12
C1A-13	REC - 4TH GRADE 105	(2) #12 + #12GW - 3/4"	1	20 A	1.2 kVA	1.2 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - 5TH GRADE 112	C1A-14
C1A-15	REC - 5TH GRADE 112	(2) #12 + #12GW - 3/4"	1	20 A		1.2 kVA	1.2 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - 5TH GRADE 113	C1A-16
C1A-17	REC - 5TH GRADE 113	(2) #12 + #12GW - 3/4"	1	20 A			1.2 kVA	1.2 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - 5TH GRADE 113	C1A-18
C1A-19	REC - 3RD GRADE 104	(2) #12 + #12GW - 3/4"	1	20 A	1.2 kVA	1.0 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - 3RD GRADE 104	C1A-20
C1A-21	REC - 3RD GRADE 104	(2) #12 + #12GW - 3/4"	1	20 A		1.2 kVA	1.2 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - 3RD GRADE 103	C1A-22
C1A-23	REC - 3RD GRADE 103	(2) #12 + #12GW - 3/4"	1	20 A			1.2 kVA	1.0 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - 3RD GRADE 103	C1A-24
C1A-25	REC - TEACHER PLANNING RM...	(2) #12 + #12GW - 3/4"	1	20 A	1.2 kVA	0.8 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - TEACHER PLANNING RM...	C1A-26
C1A-27	REC - RESOURCE ROOM 102D	(2) #12 + #12GW - 3/4"	1	20 A		0.8 kVA	0.8 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - RESOURCE ROOM 102D	C1A-28
C1A-29	REC - RESOURCE ROOM 102D	(2) #12 + #12GW - 3/4"	1	20 A			0.8 kVA	1.6 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - ROOM 102B, 102	C1A-30
C1A-31	REC - CLA 102	(2) #12 + #12GW - 3/4"	1	20 A	0.8 kVA	1.2 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - FLEX OFFICE 102A	C1A-32
C1A-33	REC - OFFICE 101E	(2) #12 + #12GW - 3/4"	1	20 A		0.5 kVA	1.2 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - OFFICE 101E	C1A-34
C1A-35	REC - EXAM ROOM 101B	(2) #12 + #12GW - 3/4"	1	20 A			1.2 kVA	1.4 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - PRINCIPAL 100A	C1A-36
C1A-37	REC - PRINCIPAL 100A	(2) #12 + #12GW - 3/4"	1	20 A	0.8 kVA	1.0 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - RECEPTION 100	C1A-38
C1A-39	REC - RECEPTION 100	(2) #12 + #12GW - 3/4"	1	20 A		0.8 kVA	1.4 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - ROOM 100E, 100H, 100G, 100	C1A-40
C1A-41	REC - CONFERENCE ROOM 100C	(2) #12 + #12GW - 3/4"	1	20 A			1.2 kVA	1.6 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - CONFERENCE ROOM 100C	C1A-42
C1A-43	REC - WORKROOM 100D	(2) #12 + #12GW - 3/4"	1	20 A	0.5 kVA	1.2 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - WORKROOM 100D	C1A-44
C1A-45	REC - WORKROOM 100D	(2) #12 + #12GW - 3/4"	1	20 A		0.4 kVA	1.6 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - ROOM 122D, 122C	C1A-46
C1A-47	REC - OT/PT 122A	(2) #12 + #12GW - 3/4"	1	20 A			1.6 kVA	1.2 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - CONFERENCE 122B	C1A-48
C1A-49	REC - CONFERENCE 122B	(2) #12 + #12GW - 3/4"	1	20 A	1.4 kVA	1.2 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - 6TH GRADE 208	C1A-50
C1A-51	REC - 6TH GRADE 208	(2) #12 + #12GW - 3/4"	1	20 A		1.0 kVA	1.2 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - 6TH GRADE 208	C1A-52
C1A-53	REC - 7TH GRADE 209	(2) #12 + #12GW - 3/4"	1	20 A			1.2 kVA	1.2 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - 7TH GRADE 209	C1A-54
C1A-55	REC - 7TH GRADE 209	(2) #12 + #12GW - 3/4"	1	20 A	1.0 kVA	1.2 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - SPECIAL EDUCATION 210	C1A-56
C1A-57	REC - SPECIAL EDUCATION 210	(2) #12 + #12GW - 3/4"	1	20 A		1.2 kVA	1.2 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - SPECIAL EDUCATION 210	C1A-58
C1A-59	REC - 7TH GRADE 213	(2) #12 + #12GW - 3/4"	1	20 A			1.2 kVA	1.2 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - 7TH GRADE 213	C1A-60
C1A-61	REC - 7TH GRADE 213	(2) #12 + #12GW - 3/4"	1	20 A	1.0 kVA	1.2 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - 8TH GRADE 214	C1A-62
C1A-63	REC - 8TH GRADE 214	(2) #12 + #12GW - 3/4"	1	20 A		1.2 kVA	1.2 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - 8TH GRADE 214	C1A-64
C1A-65	REC - 6TH GRADE 207	(2) #12 + #12GW - 3/4"	1	20 A			1.2 kVA	1.0 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - 6TH GRADE 207	C1A-66
C1A-67	REC - 6TH GRADE 207	(2) #12 + #12GW - 3/4"	1	20 A	1.2 kVA	1.2 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - 6TH GRADE 206	C1A-68
C1A-69	REC - 6TH GRADE 206	(2) #12 + #12GW - 3/4"	1	20 A		1.2 kVA	1.0 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - 6TH GRADE 206	C1A-70
C1A-71	REC - 7TH GRADE 205	(2) #12 + #12GW - 3/4"	1	20 A			1.2 kVA	1.2 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - 7TH GRADE 205	C1A-72
C1A-73	REC - 7TH GRADE 205	(2) #12 + #12GW - 3/4"	1	20 A	1.2 kVA	1.2 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - 8TH GRADE 202	C1A-74
C1A-75	REC - 8TH GRADE 202	(2) #12 + #12GW - 3/4"	1	20 A		1.2 kVA	1.0 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - 8TH GRADE 202	C1A-76
C1A-77	REC - 8TH GRADE 201	(2) #12 + #12GW - 3/4"	1	20 A			1.2 kVA	1.2 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - 8TH GRADE 201	C1A-78
C1A-79	REC - 8TH GRADE 201	(2) #12 + #12GW - 3/4"	1	20 A	1.4 kVA	1.6 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - WHOLENESS ROOM 220	C1A-80
C1A-81	REC - WHOLENESS ROOM 220	(2) #12 + #12GW - 3/4"	1	20 A		1.8 kVA	0.2 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - SCIENCE PREP 203A	C1A-82
C1A-83	REC - SCIENCE ROOM 203	(2) #12 + #12GW - 3/4"	1	20 A			1.6 kVA	1.2 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - ROOM 203, 203A	C1A-84
C1A-85	REC - SCIENCE ROOM 203	(2) #12 + #12GW - 3/4"	1	20 A	1.2 kVA	1.2 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - SCIENCE ROOM 203	C1A-86
C1A-87	REC - TECHNOLOGY LAB 204	(2) #12 + #12GW - 3/4"	1	20 A		1.2 kVA	1.2 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - TECHNOLOGY LAB 204	C1A-88
C1A-89	REC - TECHNOLOGY LAB 204	(2) #12 + #12GW - 3/4"	1	20 A			0.8 kVA	1.0 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - CLA 200	C1A-90
C1A-91	REC - AP OFFICE 215	(2) #12 + #12GW - 3/4"	1	20 A	1.2 kVA	1.2 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - SCHOOL POLICE 100I	C1A-92
C1A-93	REC - FLEX OFF 100B	(2) #12 + #12GW - 3/4"	1	20 A		1.4 kVA	0.1 kVA			20 A	2 (2) #12 + #12GW - 3/4"	REC - WORKROOM 100D	C1A-94
C1A-95	COPPER - RECORD STORAGE 122D	(2) #12 + #12GW - 3/4"	1	20 A			0.4 kVA	0.1 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - Room 116, 114, 122	C1A-98
C1A-97	REC - WAIT 101	(2) #12 + #12GW - 3/4"	2	20 A	1.8 kVA	1.2 kVA				20 A	1 (2) #12 + #12GW - 3/4"		C1A-100
C1A-99	REC - RECORD STORAGE 122D	(2) #12 + #12GW - 3/4"	2	20 A		0.1 kVA							C1A-102
C1A-101													C1A-104
C1A-103													C1A-106
C1A-105													C1A-108
C1A-107													C1A-110
C1A-109													C1A-112
C1A-111													C1A-114
C1A-113													C1A-116
C1A-115	SPARE	--	1	20 A	0.0 kVA	0.0 kVA				20 A	1 --	SPARE	C1A-118
C1A-117	SPARE	--	1	20 A		0.0 kVA	0.0 kVA			20 A	1 --	SPARE	C1A-120
C1A-119	SPARE	--	1	20 A			0.0 kVA	0.0 kVA		20 A	1 --	SPARE	C1A-122
C1A-121	SPARE	--	1	20 A	0.0 kVA	0.0 kVA				20 A	1 --	SPARE	C1A-124
C1A-123	SPARE	--	1	20 A		0.0 kVA	0.0 kVA			20 A	1 --	SPARE	C1A-126
C1A-125	SPARE	--	1	20 A			0.0 kVA	0.0 kVA		20 A	1 --	SPARE	
Legend:													
LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANELBOARD TOTALS									
MOTOR -	0.0 kVA	0.00%	0.0 kVA	Total Conn. Load: 107.1 kVA									
REC -	107.1 kVA	54.67%	58.5 kVA	Total Est. Demand: 58.5 kVA									
MECHANICAL -	0.0 kVA	0.00%	0.0 kVA	Total Conn.: 297 A									
LTG -	0.0 kVA	0.00%	0.0 kVA	Total Est. Demand.: 162 A									
KITCHEN -	0.0 kVA	0.00%	0.0 kVA										

Branch Panel: CBA													
LOCATION: EQUIPMENT ROOM 0015A			VOLTAGE: 120/208 Wye			A.I.C. RATING: 10 KAIC							
SUPPLY FROM: TCBA			PHASE: 3			MAINS RATING: 400 A							
MOUNTING: Surface			WIRES: 4			MCB RATING: 400 A							
						NEUTRAL RATING: 200%							
Notes:													
CKT	CIRCUIT	WIRE SIZE	P	CB	A	B	C	CB	P	WIRE SIZE	CIRCUIT	CKT	
CBA-1					0.1 kVA	38.2 kVA				225 A	3 (4) #10 + #10GW - 2-1/2"	PANELBOARD C1A	CBA-2
CBA-3	SPD	(4) #10 + #10GW - 3/4"	3	30 A		0.1 kVA	33.0 kVA			225 A	3 (4) #10 + #10GW - 2-1/2"	PANELBOARD C1A	CBA-4
CBA-5								0.1 kVA	35.9...				CBA-6
CBA-7	REC - FAMILY RES. ROOM 0013	(2) #12 + #12GW - 3/4"	1	20 A	1.0 kVA	1.5 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - FAMILY RES. ROOM 0013	CBA-8
CBA-9	REC - PANTRY 009	(2) #12 + #12GW - 3/4"	1	20 A		1.0 kVA	1.0 kVA			20 A	1 (2) #12 + #12GW - 3/4"	REC - PANTRY 009	CBA-10
CBA-11	REC - OFFICE 0012	(2) #12 + #12GW - 3/4"	1	20 A			1.2 kVA	1.4 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - CORRIDOR 00CC	CBA-12
CBA-13	REC - COMMUNITY ROOM 0014	(2) #12 + #12GW - 3/4"	1	20 A	1.2 kVA	1.6 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - COMMUNITY ROOM 0014	CBA-14
CBA-15	REC - TECHNOLOGY LAB 0018	(2) #12 + #12GW - 3/4"	1	20 A			1.2 kVA	1.2 kVA		20 A	1 (2) #12 + #12GW - 3/4"	REC - TECHNOLOGY LAB 0018	CBA-16
CBA-17	REC - TECHNOLOGY LAB 0018	(2) #12 + #12GW - 3/4"	1	20 A				1.4 kVA	1.4 kVA	20 A	1 (2) #12 + #12GW - 3/4"	REC - CORR 00CA	CBA-18
CBA-19	REC - FAMILY RES. ROOM 0013	(2) #12 + #12GW - 3/4"	1	20 A	1.4 kVA	1.4 kVA				20 A	1 (2) #12 + #12GW - 3/4"	REC - ROOM 001B, 001A	CBA-20
CBA-21	REC - MEDIA WORKROOM 001												

Branch Panel: E2R1A

LOCATION: ELEC CLOSET 111
SUPPLY FROM: E2RBA
MOUNTING: Surface

VOLTAGE: 120/208 Wye
PHASE: 3
WIRES: 4

A.I.C. RATING: 10 KAIC
MAINS RATING: 100 A
MCB RATING: 60 A
NEUTRAL RATING: 100%

Notes:

Table with columns: CKT, CIRCUIT, WIRE SIZE, P, CB, A, B, C, CB, P, WIRE SIZE, CIRCUIT, CKT. Lists various electrical circuits and their specifications.

Legend:

Table with columns: LOAD CLASSIFICATION, CONNECTED LOAD, DEMAND FACTOR, ESTIMATED DEMAND, PANELBOARD TOTALS. Summarizes load data for the panel.

Branch Panel: E2RGB

LOCATION: ELECTRICAL ROOM 033
SUPPLY FROM: TE2RGB
MOUNTING: Surface

VOLTAGE: 120/208 Wye
PHASE: 3
WIRES: 4

A.I.C. RATING: 10 KAIC
MAINS RATING: 225 A
MCB RATING: 150 A
NEUTRAL RATING: 100%

Notes:

Table with columns: CKT, CIRCUIT, WIRE SIZE, P, CB, A, B, C, CB, P, WIRE SIZE, CIRCUIT, CKT. Lists various electrical circuits and their specifications.

Legend:

Table with columns: LOAD CLASSIFICATION, CONNECTED LOAD, DEMAND FACTOR, ESTIMATED DEMAND, PANELBOARD TOTALS. Summarizes load data for the panel.

Branch Panel: KR

LOCATION: MECHANICAL ROOM 023A
SUPPLY FROM: TKR
MOUNTING: Surface

VOLTAGE: 120/208 Wye
PHASE: 3
WIRES: 4

A.I.C. RATING: 10 KAIC
MAINS RATING: 225 A
MCB RATING: 225 A
NEUTRAL RATING: 100%

Notes:

* PROVIDE SHUNT TRIP BREAKER

Table with columns: CKT, CIRCUIT, WIRE SIZE, P, CB, A, B, C, CB, P, WIRE SIZE, CIRCUIT, CKT. Lists various electrical circuits and their specifications.

Legend:

Table with columns: LOAD CLASSIFICATION, CONNECTED LOAD, DEMAND FACTOR, ESTIMATED DEMAND, PANELBOARD TOTALS. Summarizes load data for the panel.

Branch Panel: E2RBA

LOCATION: EQUIPMENT ROOM 0015A
SUPPLY FROM: TE2RBA
MOUNTING: Surface

VOLTAGE: 120/208 Wye
PHASE: 3
WIRES: 4

A.I.C. RATING: 10 KAIC
MAINS RATING: 225 A
MCB RATING: 150 A
NEUTRAL RATING: 100%

Notes:

Table with columns: CKT, CIRCUIT, WIRE SIZE, P, CB, A, B, C, CB, P, WIRE SIZE, CIRCUIT, CKT. Lists various electrical circuits and their specifications.

Legend:

Table with columns: LOAD CLASSIFICATION, CONNECTED LOAD, DEMAND FACTOR, ESTIMATED DEMAND, PANELBOARD TOTALS. Summarizes load data for the panel.

Branch Panel: KP

LOCATION: MECHANICAL ROOM 023A
SUPPLY FROM: MSB
MOUNTING: Surface

VOLTAGE: 480/277 Wye
PHASE: 3
WIRES: 4

A.I.C. RATING: 22 KAIC
MAINS RATING: 250 A
MCB RATING: 225 A
NEUTRAL RATING: 100%

Notes:

Table with columns: CKT, CIRCUIT, WIRE SIZE, P, CB, A, B, C, CB, P, WIRE SIZE, CIRCUIT, CKT. Lists various electrical circuits and their specifications.

Legend:

Table with columns: LOAD CLASSIFICATION, CONNECTED LOAD, DEMAND FACTOR, ESTIMATED DEMAND, PANELBOARD TOTALS. Summarizes load data for the panel.

Branch Panel: LBA

LOCATION: EQUIPMENT ROOM 0015A
SUPPLY FROM: MSB
MOUNTING: Surface

VOLTAGE: 480/277 Wye
PHASE: 3
WIRES: 4

A.I.C. RATING: 22 KAIC
MAINS RATING: 400 A
MCB RATING: 400 A
NEUTRAL RATING: 100%

Notes:

* VIA BLC-A. ** 0-10v. WIRING REQUIRED.

Table with columns: CKT, CIRCUIT, WIRE SIZE, P, CB, A, B, C, CB, P, WIRE SIZE, CIRCUIT, CKT. Lists various electrical circuits and their specifications.

Legend:

Table with columns: LOAD CLASSIFICATION, CONNECTED LOAD, DEMAND FACTOR, ESTIMATED DEMAND, PANELBOARD TOTALS. Summarizes load data for the panel.

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
100 WEST ROAD, SUITE 402
TOWSON, MD 21204



PROPOSED NEW MONTEBELLO ELEMENTARY/ MIDDLE SCHOOL
BALTIMORE CITY PUBLIC SCHOOLS
2020 EAST 32ND STREET, BALTIMORE, MARYLAND 21218

USING AGENCY APPROVAL

Name: Date:

MSA APPROVAL

Project Manager: Date:

Chief of PM&D: Date:

Table with columns: MARK, DATE, DESCRIPTION. Revision table for the document.

4 01/08/21 Addendum #4

AS-BUILT REVISIONS

SUBMITTED BY:

CAD DWG FILE: Author

DRAWN BY: Author

CHECKED BY: Checker

PROJECT NO. BCS-02-004

DATE: NOVEMBER 16, 2020

PANELBOARD SCHEDULES

SCALE:

DRAWING NO.

E7.3

Branch Panel: LGB

LOCATION: ELECTRICAL ROOM 033
SUPPLY FROM: MSB
MOUNTING: Surface

VOLTAGE: 480/277 Wye
PHASE: 3
WIRES: 4

A.I.C. RATING: 35 kAIC
MAINS RATING: 225 A
MCB RATING: 100 A
NEUTRAL RATING: 100%

Notes:
* VIA BLC-B. ** 0-10v. WIRING REQUIRED.

CKT	CIRCUIT	WIRE SIZE	P	CB	A	B	C	CB	P	WIRE SIZE	CIRCUIT	CKT
LGB-1					0.1 kVA	9.3 kVA						LGB-2
LGB-3	SPD	(4) #10 + #10GW - 3/4"C	3	30 A		0.1 kVA	9.7 kVA			60 A 3	REFER TO XFMR SCHED. (CGB)	LGB-4
LGB-5							0.1 kVA	7.5 kVA				LGB-6
LGB-7	LTG - GRD. FLR. CORRIDORS *	2#12 + #12GW - 3/4"C	1	20 A	1.1 kVA	1.4 kVA				20 A 1	2#12 + #12GW - 3/4"C	LGB-8
LGB-9	LTG - 1st FLR. CORRIDORS *	2#12 + #12GW - 3/4"C	1	20 A		0.4 kVA	0.1 kVA			20 A 1	2#12 + #12GW - 3/4"C	LGB-10
LGB-11	LTG - GYMNASIUM	2#12 + #12GW - 3/4"C	1	20 A			2.3 kVA					LGB-12
LGB-13												LGB-14
LGB-15												LGB-16
LGB-17												LGB-18
LGB-19												LGB-20
LGB-21												LGB-22
LGB-23												LGB-24
LGB-25												LGB-26
LGB-27	(E)LTG - 1st FLR. CORRIDORS *	2#12 + #12GW - 3/4"C	1	20 A		1.0 kVA	1.0 kVA			20 A 1	2#12 + #12GW - 3/4"C	LGB-28
LGB-29	(E)LTG - BLDG. FACADE UNIT. B *	2#12 + #12GW - 3/4"C	1	20 A			3.0 kVA	3.0 kVA		20 A 1	2#12 + #12GW - 3/4"C	LGB-30
LGB-31	SPARE	--	--	1 20 A	0.0 kVA	0.0 kVA				20 A 1	--	LGB-32
LGB-33	SPARE	--	--	1 20 A	0.0 kVA	0.0 kVA				20 A 1	--	LGB-34
LGB-35	SPARE	--	--	1 20 A	0.0 kVA	0.0 kVA				20 A 1	--	LGB-36
LGB-37	SPARE	--	--	1 20 A	0.0 kVA	0.0 kVA				20 A 1	--	LGB-38
LGB-39	SPARE	--	--	1 20 A	0.0 kVA	0.0 kVA				20 A 1	--	LGB-40
LGB-41	SPARE	--	--	1 20 A	0.0 kVA	0.0 kVA				20 A 1	--	LGB-42
Total Connected Load:					37.9	11.8 kVA	12.3 kVA	13.8 kVA				

Legend:

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANELBOARD TOTALS
MOTOR -	0.0 kVA	0.00%	0.0 kVA	Total Conn. Load: 37.9 kVA
REC -	26.8 kVA	68.66%	18.4 kVA	Total Est. Demand: 29.5 kVA
MECHANICAL -	0.0 kVA	100.00%	0.0 kVA	Total Conn.: 46 A
LTG -	3.0 kVA	100.00%	3.0 kVA	Total Est. Demand: 35 A
KITCHEN -	0.0 kVA	0.00%	0.0 kVA	

Branch Panel: M1A

LOCATION: ELECTRICAL ROOM 033
SUPPLY FROM: MSB
MOUNTING: Surface

VOLTAGE: 480/277 Wye
PHASE: 3
WIRES: 4

A.I.C. RATING: 22 kAIC
MAINS RATING: 225 A
MCB RATING: 100 A
NEUTRAL RATING: 100%

Notes:

CKT	CIRCUIT	WIRE SIZE	P	CB	A	B	C	CB	P	WIRE SIZE	CIRCUIT	CKT
M1A-1					2.2 kVA	2.2 kVA						M1A-2
M1A-3	CUH-15	(3) #12+ #12GW - 3/4"C	3	15 A		2.2 kVA	2.2 kVA			15 A 3	(3) #12+ #12GW - 3/4"C	M1A-4
M1A-5							2.2 kVA	2.2 kVA				M1A-6
M1A-7					3.2 kVA	2.2 kVA						M1A-8
M1A-9	CUH-23	(3) #12+ #12GW - 3/4"C	3	15 A		3.2 kVA	2.2 kVA			15 A 3	(3) #12+ #12GW - 3/4"C	M1A-10
M1A-11							3.2 kVA	2.2 kVA				M1A-12
M1A-13					2.2 kVA	3.2 kVA						M1A-14
M1A-15	CUH-21	(3) #12+ #12GW - 3/4"C	3	15 A		2.2 kVA	3.2 kVA			15 A 3	(3) #12+ #12GW - 3/4"C	M1A-16
M1A-17							2.2 kVA	3.2 kVA				M1A-18
M1A-19												M1A-20
M1A-21												M1A-22
M1A-23												M1A-24
M1A-25												M1A-26
M1A-27												M1A-28
M1A-29												M1A-30
M1A-31	SPARE	--	--	1 20 A	0.0 kVA	0.0 kVA				20 A 1	--	M1A-32
M1A-33	SPARE	--	--	1 20 A	0.0 kVA	0.0 kVA				20 A 1	--	M1A-34
M1A-35	SPARE	--	--	1 20 A	0.0 kVA	0.0 kVA				20 A 1	--	M1A-36
M1A-37	SPARE	--	--	1 20 A	0.0 kVA	0.0 kVA				20 A 1	--	M1A-38
M1A-39	SPARE	--	--	1 20 A	0.0 kVA	0.0 kVA				20 A 1	--	M1A-40
M1A-41	SPARE	--	--	1 20 A	0.0 kVA	0.0 kVA				20 A 1	--	M1A-42
Total Connected Load:					45.4	15.1 kVA	15.1 kVA	15.1 kVA				

Legend:

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANELBOARD TOTALS
MOTOR -	0.0 kVA	0.00%	0.0 kVA	Total Conn. Load: 45.4 kVA
REC -	0.0 kVA	0.00%	0.0 kVA	Total Est. Demand: 45.4 kVA
MECHANICAL -	45.4 kVA	100.00%	45.4 kVA	Total Conn.: 55 A
LTG -	0.0 kVA	0.00%	0.0 kVA	Total Est. Demand: 55 A
KITCHEN -	0.0 kVA	0.00%	0.0 kVA	

Branch Panel: MBA

LOCATION: EQUIPMENT ROOM 0015A
SUPPLY FROM: MSB
MOUNTING: Surface

VOLTAGE: 480/277 Wye
PHASE: 3
WIRES: 4

A.I.C. RATING: 22 kAIC
MAINS RATING: 800 A
MCB RATING: 800 A
NEUTRAL RATING: 100%

Notes:

CKT	CIRCUIT	WIRE SIZE	P	CB	A	B	C	CB	P	WIRE SIZE	CIRCUIT	CKT
MBA-1					10.7...	7.1 kVA						MBA-2
MBA-3	PANELBOARD RBA (VIA XFMR TRBA)	REFER TO XFMR SCHED.	3	90 A		14.3 kVA	7.1 kVA			35 A 3	(3) #8 + #10GW - 3/4"C	MBA-4
MBA-5							15.4 kVA	7.1 kVA				MBA-6
MBA-7					9.2 kVA	24.4 kVA						MBA-8
MBA-9	AHU-2	(3) #6 + #10GW - 3/4"C	3	50 A		9.2 kVA	24.4 kVA			110 A 3	(3) #2 + #8GW - 1-1/4"C	MBA-10
MBA-11							9.2 kVA	24.4...				MBA-12
MBA-13					18.6...	3.2 kVA						MBA-14
MBA-15	AHU-4	(3) #3 + #8GW - 1"C	3	80 A		18.6 kVA	3.2 kVA			15 A 3	(3) #12+ #12GW - 3/4"C	MBA-16
MBA-17							18.6 kVA	3.2 kVA				MBA-18
MBA-19					3.2 kVA	2.2 kVA						MBA-20
MBA-21	CUH-2	(3) #12+ #12GW - 3/4"C	3	15 A		3.2 kVA	2.2 kVA			15 A 3	(3) #12+ #12GW - 3/4"C	MBA-22
MBA-23							3.2 kVA	2.2 kVA				MBA-24
MBA-25					2.2 kVA	2.2 kVA						MBA-26
MBA-27	CUH-4	(3) #12+ #12GW - 3/4"C	3	15 A		2.2 kVA	2.2 kVA			15 A 3	(3) #12+ #12GW - 3/4"C	MBA-28
MBA-29							2.2 kVA	2.2 kVA				MBA-30
MBA-31					2.2 kVA	3.2 kVA						MBA-32
MBA-33	CUH-6	(3) #12+ #12GW - 3/4"C	3	15 A		2.2 kVA	3.2 kVA			15 A 3	(3) #12+ #12GW - 3/4"C	MBA-34
MBA-35							2.2 kVA	3.2 kVA				MBA-36
MBA-37					3.2 kVA	6.1 kVA						MBA-38
MBA-39	CUH-8	(3) #12+ #12GW - 3/4"C	3	15 A		3.2 kVA	6.1 kVA			35 A 3	(3) #8 + #10GW - 3/4"C	MBA-40
MBA-41							3.2 kVA	6.1 kVA				MBA-42
MBA-43					3.2 kVA	5.3 kVA						MBA-44
MBA-45	CUH-14	(3) #12+ #12GW - 3/4"C	3	15 A		3.2 kVA	5.3 kVA			30 A 3	(3) #10 + #10GW - 3/4"C	MBA-46
MBA-47							3.2 kVA	5.3 kVA				MBA-48
MBA-49					6.1 kVA	5.3 kVA						MBA-50
MBA-51	COND-3a- No. 1	(3) #8 + #10GW - 3/4"C	3	35 A		6.1 kVA	5.3 kVA			30 A 3	(3) #10 + #10GW - 3/4"C	MBA-52
MBA-53							6.1 kVA	5.3 kVA				MBA-54
MBA-55					6.1 kVA	3.9 kVA						MBA-56
MBA-57	COND-3a - No. 2	(3) #8 + #10GW - 3/4"C	3	35 A		6.1 kVA	3.9 kVA			20 A 3	(3) #12+ #12GW - 3/4"C	MBA-58
MBA-59							6.1 kVA	3.9 kVA				MBA-60
MBA-61					5.3 kVA	3.9 kVA						MBA-62
MBA-63	COND-4a - No. 1	(3) #10 + #10GW - 3/4"C	3	30 A		5.3 kVA	3.9 kVA			20 A 3	(3) #12+ #12GW - 3/4"C	MBA-64
MBA-65							5.3 kVA	3.9 kVA				MBA-66
MBA-67					1.3 kVA	2.5 kVA						MBA-68
MBA-69	ACCU-1 & ACCU-2	(3) #12 + #12GW - 3/4"C	3	15 A		1.3 kVA	2.5 kVA			15 A 3	(3) #12 + #12GW - 3/4"C	MBA-70
MBA-71							1.3 kVA	2.5 kVA				MBA-72
MBA-73					1.3 kVA	13.7 kVA						MBA-74
MBA-75	ACCU-4	(3) #12 + #12GW - 3/4"C	3	15 A		1.3 kVA	13.7 kVA			70 A 3	(3) #4 + #8GW - 1"C	MBA-76
MBA-77							1.3 kVA	13.7...				MBA-78
MBA-79												MBA-80
MBA-81												MBA-82
MBA-83												MBA-84
Total Connected Load:					474.7...	155.4 kVA	159.1 kVA	160.2 kVA				

Legend:

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANELBOARD TOTALS
MOTOR -	0.0 kVA	0.00%	0.0 kVA	Total Conn. Load: 474.7 kVA
REC -	8.2 kVA	100.00%	8.2 kVA	Total Est. Demand: 474.7 kVA
MECHANICAL -	396.2 kVA	100.00%	396.2 kVA	Total Conn.: 571 A
LTG -	0.1 kVA	100.00%	0.1 kVA	Total Est. Demand: 571 A
KITCHEN -	0.0 kVA	0.00%	0.0 kVA	

Branch Panel: MGB

LOCATION: ELECTRICAL ROOM 033
SUPPLY FROM: MSB
MOUNTING: Surface

VOLTAGE: 480/277 Wye
PHASE: 3
WIRES: 4

A.I.C. RATING: 35 kAIC
MAINS RATING: 800 A
MCB RATING: 700 A
NEUTRAL RATING: 100%

Notes:

CKT	CIRCUIT	WIRE SIZE	P	CB	A	B	C	CB	P	WIRE SIZE	CIRCUIT	CKT
MGB-1					18.1...	17.9 kVA						MGB-2
MGB-3	PANELBOARD RGB (VIA XFMR TRGB)	REFER TO XFMR SCHED.	3	150 A		18.7 kVA	17.9 kVA			80 A 3	(3) #3+ #8GW - 1"C	MGB-4
MGB-5							22.7 kVA	17.9...				MGB-6
MGB-7					9.2 kVA	18.6 kVA						MGB-8
MGB-9	AHU-5	(3) #6 + #10GW - 1"C	3	50 A		9.2 kVA	18.6 kVA</					

Branch Panel: R1A												
LOCATION: ELEC CLOSET 111				VOLTAGE: 120/208 Wye				A.I.C. RATING: 10 kAIC				
SUPPLY FROM: RBA				PHASE: 3				MAINS RATING: 100 A				
MOUNTING: Surface				WIRES: 4				MCB RATING: 100 A				
NEUTRAL RATING: 100%												
Notes: *ALL CIRCUITS THAT SERVICE ELECTRIC WATER COOLER (EWC) SHALL BE GFI BREAKER TYPE												
CKT	CIRCUIT	WIRE SIZE	P	CB	A	B	C	P	WIRE SIZE	CIRCUIT	CKT	
R1A-1	VRF-1.01 THRU VRF-1.05	(2) #12 + #12GW - 3/4"	2	15 A	0.3 kVA	1.3 kVA			15 A	2	(2) #12 + #12GW - 3/4"	R1A-2
R1A-3												R1A-4
R1A-5	VRF-3.01 THRU VRF-3.16	(2) #12 + #12GW - 3/4"	2	15 A	0.9 kVA	0.5 kVA			15 A	2	(2) #12 + #12GW - 3/4"	R1A-6
R1A-7												R1A-8
R1A-9	VRF-4.01 THRU VRF-4.19	(2) #12 + #12GW - 3/4"	2	15 A					15 A	2	(2) #12 + #12GW - 3/4"	R1A-10
R1A-11												R1A-12
R1A-13	*EWC - CORRIDOR 1CA	(2) #12 + #12GW - 3/4"	1	20 A	0.2 kVA	1.9 kVA			20 A	1	(2) #12 + #12GW - 3/4"	R1A-14
R1A-15	*EWC - CORRIDOR-1 2CA-1	(2) #12 + #12GW - 3/4"	1	20 A					20 A	2	(2) #12 + #12GW - 3/4"	R1A-16
R1A-17	CH-6	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"	R1A-18
R1A-19	REC - CORRIDOR	(2) #12 + #12GW - 3/4"	1	20 A	0.8 kVA	0.8 kVA			20 A	1	(2) #12 + #12GW - 3/4"	R1A-20
R1A-21	REC - ROOM 212, 212A, 211	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"	R1A-22
R1A-23	REC - ROOM 101D, 101F, 101C	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"	R1A-24
R1A-25												R1A-26
R1A-27												R1A-28
R1A-29												R1A-30
R1A-31	SPARE	--	1	20 A	0.0 kVA	0.0 kVA			20 A	1	--	R1A-32
R1A-33	SPARE	--	1	20 A					20 A	1	--	R1A-34
R1A-35	SPARE	--	1	20 A					20 A	1	--	R1A-36
R1A-37	SPARE	--	1	20 A	0.0 kVA	0.0 kVA			20 A	1	--	R1A-38
R1A-39	SPARE	--	1	20 A					20 A	1	--	R1A-40
R1A-41	SPARE	--	1	20 A					20 A	1	--	R1A-42
Legend:												
LOAD CLASSIFICATION					CONNECTED LOAD		DEMAND FACTOR		ESTIMATED DEMAND		PANELBOARD TOTALS	
MOTOR -					0.0 kVA		0.00%		0.0 kVA		Total Conn. Load: 22.8 kVA	
REC -					4.2 kVA		100.00%		4.2 kVA		Total Est. Demand: 22.8 kVA	
MECHANICAL -					18.2 kVA		100.00%		18.2 kVA		Total Conn.: 63 A	
LTG -					0.0 kVA		0.00%		0.0 kVA		Total Est. Demand: 63 A	
KITCHEN -					0.0 kVA		0.00%		0.0 kVA			

Branch Panel: RBA											
LOCATION: EQUIPMENT ROOM 0015A				VOLTAGE: 120/208 Wye				A.I.C. RATING: 10 kAIC			
SUPPLY FROM: TRBA				PHASE: 3				MAINS RATING: 225 A			
MOUNTING: Surface				WIRES: 4				MCB RATING: 150 A			
NEUTRAL RATING: 100%											
Notes: *VIA BLC-A											
CKT	CIRCUIT	WIRE SIZE	P	CB	A	B	C	P	WIRE SIZE	CIRCUIT	CKT
RBA-1	PANELBOARD R1A	(4) #1 + #6GW - 1-1/2"	3	100 A	6.7 kVA	0.3 kVA			100 A		
RBA-3											
RBA-5											
RBA-7	DISPLAY CASES *	(2) #12 + #12GW - 3/4"	1	20 A	0.3 kVA	0.5 kVA			20 A	1	(2) #12 + #12GW - 3/4"
RBA-9	TRAP PRIMING STATION	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"
RBA-11	RCP-1 & RCP-2	(2) #12 + #12GW - 3/4"	1	15 A					15 A	1	(2) #12 + #12GW - 3/4"
RBA-13	CH-8	(2) #12 + #12GW - 3/4"	1	20 A	0.9 kVA	1.7 kVA			20 A	1	(2) #12 + #12GW - 3/4"
RBA-15	F-7	(2) #12 + #12GW - 3/4"	1	15 A					15 A	1	(2) #12 + #12GW - 3/4"
RBA-17	REC - MECHANICAL ROOM 0015	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"
RBA-19											
RBA-21	DRYER - LAUNDRY ROOM 0011	(4) #10 + #10GW - 3/4"	2	30 A	0.1 kVA	0.2 kVA			30 A	1	(2) #10 + #10GW - 3/4"
RBA-23	DWH-2	(2) #10 + #10GW - 3/4"	1	25 A					25 A	1	(2) #10 + #10GW - 3/4"
RBA-25											
RBA-27											
RBA-29											
RBA-31	SPARE	--	1	20 A	0.0 kVA	0.0 kVA			20 A	1	--
RBA-33	SPARE	--	1	20 A					20 A	1	--
RBA-35	SPARE	--	1	20 A					20 A	1	--
RBA-37	SPARE	--	1	20 A	0.0 kVA	0.0 kVA			20 A	1	--
RBA-39	SPARE	--	1	20 A					20 A	1	--
RBA-41	SPARE	--	1	20 A					20 A	1	--
Legend:											
LOAD CLASSIFICATION					CONNECTED LOAD		DEMAND FACTOR		ESTIMATED DEMAND		PANELBOARD TOTALS
MOTOR -					0.0 kVA		0.00%		0.0 kVA		Total Conn. Load: 40.3 kVA
REC -					8.2 kVA		100.00%		8.2 kVA		Total Est. Demand: 40.3 kVA
MECHANICAL -					30.3 kVA		100.00%		30.3 kVA		Total Conn.: 112 A
LTG -					0.1 kVA		100.00%		0.1 kVA		Total Est. Demand: 112 A
KITCHEN -					0.0 kVA		0.00%		0.0 kVA		

Branch Panel: RGB											
LOCATION: ELECTRICAL ROOM 033				VOLTAGE: 120/208 Wye				A.I.C. RATING: 10 kAIC			
SUPPLY FROM: TRGB				PHASE: 3				MAINS RATING: 225 A			
MOUNTING: Surface				WIRES: 4				MCB RATING: 225 A			
NEUTRAL RATING: 100%											
Notes: *ALL CIRCUITS THAT SERVICE ELECTRIC WATER COOLER (EWC) SHALL BE GFI BREAKER TYPE											
CKT	CIRCUIT	WIRE SIZE	P	CB	A	B	C	P	WIRE SIZE	CIRCUIT	CKT
RGB-1	F-2, F-5	(2) #12 + #12GW - 3/4"	1	15 A	1.4 kVA	0.6 kVA			15 A	1	(2) #12 + #12GW - 3/4"
RGB-3	MOTORIZED SHADES- GYM...	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"
RGB-5	CH-3	(2) #10 + #10GW - 3/4"	1	25 A					25 A	1	(2) #10 + #10GW - 3/4"
RGB-7	F-10	(2) #12 + #12GW - 3/4"	1	15 A	0.7 kVA	0.7 kVA			15 A	1	(2) #12 + #12GW - 3/4"
RGB-9	F-12	(2) #12 + #12GW - 3/4"	1	15 A					15 A	1	(2) #12 + #12GW - 3/4"
RGB-11	MOTORIZED SHADES- GYM...	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"
RGB-13	REC - FACULTY LOUNGE 038	(2) #12 + #12GW - 3/4"	1	20 A	0.2 kVA	4.1 kVA			20 A	1	(2) #12 + #12GW - 3/4"
RGB-15	VRF-5.01 THRU VRF-5.13	(2) #12 + #12GW - 3/4"	2	15 A					15 A	2	(2) #12 + #12GW - 3/4"
RGB-17											
RGB-19	BACKSTOP 1	(2) #12 + #12GW - 3/4"	1	20 A	1.1 kVA	1.1 kVA			20 A	1	(2) #12 + #12GW - 3/4"
RGB-21	HEIGHT ADJUSTER 1	(2) #12 + #12GW - 3/4"	1	15 A					15 A	1	(2) #12 + #12GW - 3/4"
RGB-23	BACKSTOP 3	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"
RGB-25	HEIGHT ADJUSTER 3	(2) #12 + #12GW - 3/4"	1	15 A	0.2 kVA	0.2 kVA			15 A	1	(2) #12 + #12GW - 3/4"
RGB-27	BACKSTOP 5	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"
RGB-29	HEIGHT ADJUSTER 5	(2) #12 + #12GW - 3/4"	1	15 A					15 A	1	(2) #12 + #12GW - 3/4"
RGB-31	CURTAIN DIVIDER	(2) #12 + #12GW - 3/4"	1	20 A	1.7 kVA	1.4 kVA			20 A	1	(2) #12 + #12GW - 3/4"
RGB-33	JBOX - MASTERNODE 1 CONTROL	(2) #12 + #12GW - 3/4"	1	15 A					15 A	1	(2) #12 + #12GW - 3/4"
RGB-35	JBOX - NODE 2 CONTROL	(2) #12 + #12GW - 3/4"	1	15 A					15 A	1	(2) #12 + #12GW - 3/4"
RGB-37	REC - STAGE 120	(2) #12 + #12GW - 3/4"	1	20 A	0.2 kVA	0.2 kVA			20 A	1	(2) #12 + #12GW - 3/4"
RGB-39	JUNCTION BOX - STAGE 120	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"
RGB-41	REC - GYMNASIUM 119	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"
RGB-43	REC - GYMNASIUM 119	(2) #12 + #12GW - 3/4"	1	20 A	1.6 kVA	0.2 kVA			20 A	1	(2) #12 + #12GW - 3/4"
RGB-45	*EWC - CORRIDOR 1CB	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"
RGB-47	TRAP PRIMING STATION	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"
RGB-49	REC - FACULTY LOUNGE 038	(2) #12 + #12GW - 3/4"	1	20 A	0.2 kVA	1.2 kVA			20 A	1	(2) #12 + #12GW - 3/4"
RGB-51	*EWC - CAFETERIA 023	(2) #12 + #12GW - 3/4"	1	20 A					20 A	1	(2) #12 + #12GW - 3/4"
RGB-53	REC - KILN	(2) #6 + #10GW - 3/4"	2	50 A	0.1 kVA	1.0 kVA			50 A	2	(2) #6 + #10GW - 3/4"
RGB-55											
RGB-57											
RGB-59											
RGB-61											
RGB-63											
RGB-65											
RGB-67											
RGB-69											
RGB-71											
RGB-73	SPARE	--	1	20 A	0.0 kVA	0.0 kVA			20 A	1	--
RGB-75	SPARE	--	1	20 A					20 A	1	--
RGB-77	SPARE	--	1	20 A					20 A	1	--
RGB-79	SPARE	--	1	20 A	0.0 kVA	0.0 kVA			20 A	1	--
RGB-81	SPARE	--	1	20 A					20 A	1	--
RGB-83	SPARE	--	1	20 A					20 A	1	--
Legend:											
LOAD CLASSIFICATION					CONNECTED LOAD		DEMAND FACTOR		ESTIMATED DEMAND		PANELBOARD TOTALS
MOTOR -					0.0 kVA		0.00%		0.0 kVA		Total Conn. Load: 59.5 kVA
REC -					8.2 kVA		100.00%		8.2 kVA		Total Est. Demand: 59.5 kVA
MECHANICAL -					33.8 kVA		100.00%		33.8 kVA		Total Conn.: 165 A
LTG -					0.0 kVA		0.00%		0.0 kVA		Total Est. Demand: 165 A
KITCHEN -					0.0 kVA		0.00%		0.0 kVA		

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
100 WEST ROAD, SUITE 402
TOWSON, MD 21204



PROPOSED NEW
MONTEBELLO ELEMENTARY/
MIDDLE SCHOOL
BALTIMORE CITY PUBLIC SCHOOLS
2020 EAST 32ND STREET, BALTIMORE,
MARYLAND 21

MECHANICAL EQUIPMENT CONNECTION SCHEDULE (VRFs)						
EQUIPMENT DESIG.	ELECTRICAL CHARACTERISTICS				CIRCUIT DESIG.	MECS NOTES
	VOLTAGE	φ	AMPS	KVA		
VRF-1.01	208 V	1	0.29 A	0.06 kVA	R1A-1,3	9
VRF-1.02	208 V	1	0.24 A	0.05 kVA	R1A-1,3	9
VRF-1.03	208 V	1	0.24 A	0.05 kVA	R1A-1,3	9
VRF-1.04	208 V	1	1.20 A	0.25 kVA	R1A-1,3	9
VRF-1.05	208 V	1	1.20 A	0.25 kVA	R1A-1,3	9
VRF-1.06	208 V	1	1.05 A	0.22 kVA	R1A-2,4	9
VRF-1.07	208 V	1	1.20 A	0.25 kVA	R1A-2,4	9
VRF-1.08	208 V	1	0.29 A	0.06 kVA	R1A-2,4	9
VRF-1.09	208 V	1	0.24 A	0.05 kVA	R1A-2,4	9
VRF-1.10	208 V	1	1.45 A	0.30 kVA	R1A-2,4	9
VRF-1.11	208 V	1	1.56 A	0.32 kVA	R1A-2,4	9
VRF-1.12	208 V	1	1.20 A	0.25 kVA	R1A-2,4	9
VRF-1.13	208 V	1	0.29 A	0.06 kVA	R1A-2,4	9
VRF-1.14	208 V	1	0.24 A	0.05 kVA	R1A-2,4	9
VRF-1.15	208 V	1	1.05 A	0.22 kVA	R1A-2,4	9
VRF-1.16	208 V	1	1.45 A	0.30 kVA	R1A-2,4	9
VRF-1.17	208 V	1	1.05 A	0.22 kVA	R1A-2,4	9
VRF-1.18	208 V	1	0.24 A	0.05 kVA	R1A-2,4	9
VRF-1.19	208 V	1	1.05 A	0.22 kVA	R1A-2,4	9
VRF-2.01	208 V	1	0.92 A	0.19 kVA	RBA-4,6	9
VRF-2.02	208 V	1	1.45 A	0.30 kVA	RBA-4,6	9
VRF-2.03	208 V	1	0.28 A	0.06 kVA	RBA-4,6	9
VRF-2.04	208 V	1	1.20 A	0.25 kVA	RBA-4,6	9
VRF-2.05	208 V	1	0.35 A	0.07 kVA	RBA-4,6	9
VRF-2.06	208 V	1	0.28 A	0.06 kVA	RBA-4,6	9
VRF-2.07	208 V	1	0.28 A	0.06 kVA	RBA-4,6	9
VRF-2.08	208 V	1	0.24 A	0.05 kVA	RBA-4,6	9
VRF-2.09	208 V	1	0.57 A	0.12 kVA	RBA-4,6	9
VRF-2.10	208 V	1	1.20 A	0.25 kVA	RBA-4,6	9
VRF-2.11	208 V	1	0.54 A	0.11 kVA	RBA-4,6	9
VRF-2.12	208 V	1	0.57 A	0.12 kVA	RBA-4,6	9
VRF-2.13	208 V	1	0.28 A	0.06 kVA	RBA-4,6	9
VRF-2.14	208 V	1	0.28 A	0.06 kVA	RBA-4,6	9
VRF-3.01	208 V	1	0.39 A	0.08 kVA	R1A-5,7	9
VRF-3.02	208 V	1	0.39 A	0.08 kVA	R1A-5,7	9
VRF-3.03	208 V	1	0.39 A	0.08 kVA	R1A-5,7	9
VRF-3.04	208 V	1	0.39 A	0.08 kVA	R1A-5,7	9
VRF-3.05	208 V	1	0.57 A	0.12 kVA	R1A-5,7	9
VRF-3.06	208 V	1	0.57 A	0.12 kVA	R1A-5,7	9
VRF-3.07	208 V	1	0.54 A	0.11 kVA	R1A-5,7	9
VRF-3.08	208 V	1	1.45 A	0.30 kVA	R1A-5,7	9
VRF-3.09	208 V	1	1.05 A	0.22 kVA	R1A-5,7	9
VRF-3.10	208 V	1	0.57 A	0.12 kVA	R1A-5,7	9
VRF-3.11	208 V	1	0.57 A	0.12 kVA	R1A-5,7	9
VRF-3.12	208 V	1	0.57 A	0.12 kVA	R1A-5,7	9
VRF-3.13	208 V	1	0.57 A	0.12 kVA	R1A-5,7	9
VRF-3.14	208 V	1	0.24 A	0.05 kVA	R1A-5,7	9
VRF-3.15	208 V	1	0.24 A	0.05 kVA	R1A-5,7	9
VRF-3.16	208 V	1	0.24 A	0.05 kVA	R1A-5,7	9
VRF-3.17	208 V	1	0.57 A	0.12 kVA	R1A-6,8	9
VRF-3.18	208 V	1	0.57 A	0.12 kVA	R1A-6,8	9
VRF-3.19	208 V	1	0.57 A	0.12 kVA	R1A-6,8	9
VRF-3.20	208 V	1	0.57 A	0.12 kVA	R1A-6,8	9
VRF-3.21	208 V	1	0.54 A	0.11 kVA	R1A-6,8	9
VRF-3.22	208 V	1	0.57 A	0.12 kVA	R1A-6,8	9
VRF-3.23	208 V	1	1.56 A	0.19 kVA	R1A-6,8	9
VRF-3.24	208 V	1	1.05 A	0.13 kVA	R1A-6,8	9
VRF-3.25	208 V	1	0.57 A	0.12 kVA	R1A-6,8	9
VRF-3.26	208 V	1	0.57 A	0.12 kVA	R1A-6,8	9
VRF-3.27	208 V	1	0.24 A	0.05 kVA	R1A-6,8	9
VRF-3.28	208 V	1	0.24 A	0.05 kVA	R1A-6,8	9
VRF-4.01	208 V	1	0.57 A	0.12 kVA	R1A-9,11	9
VRF-4.02	208 V	1	0.57 A	0.12 kVA	R1A-9,11	9
VRF-4.03	208 V	1	0.57 A	0.12 kVA	R1A-9,11	9
VRF-4.04	208 V	1	0.57 A	0.12 kVA	R1A-9,11	9
VRF-4.05	208 V	1	0.54 A	0.11 kVA	R1A-9,11	9
VRF-4.06	208 V	1	0.57 A	0.12 kVA	R1A-9,11	9
VRF-4.07	208 V	1	0.57 A	0.12 kVA	R1A-9,11	9
VRF-4.08	208 V	1	0.28 A	0.06 kVA	R1A-9,11	9
VRF-4.09	208 V	1	0.28 A	0.06 kVA	R1A-9,11	9
VRF-4.10	208 V	1	0.57 A	0.12 kVA	R1A-9,11	9
VRF-4.11	208 V	1	0.57 A	0.12 kVA	R1A-9,11	9
VRF-4.12	208 V	1	0.57 A	0.12 kVA	R1A-9,11	9
VRF-4.13	208 V	1	0.57 A	0.12 kVA	R1A-9,11	9
VRF-4.14	208 V	1	0.57 A	0.12 kVA	R1A-9,11	9
VRF-4.15	208 V	1	0.43 A	0.05 kVA	R1A-9,11	9
VRF-4.16	208 V	1	0.43 A	0.09 kVA	R1A-9,11	9
VRF-4.17	208 V	1	1.05 A	0.22 kVA	R1A-9,11	9
VRF-4.18	208 V	1	0.28 A	0.06 kVA	R1A-9,11	9
VRF-4.19	208 V	1	0.24 A	0.03 kVA	R1A-9,11	9
VRF-4.20	208 V	1	0.24 A	0.05 kVA	R1A-9,11	9
VRF-4.21	208 V	1	0.24 A	0.05 kVA	R1A-9,11	9
VRF-5.01	208 V	1	0.57 A	0.12 kVA	RGB-15,17	9
VRF-5.02	208 V	1	0.54 A	0.06 kVA	RGB-15,17	9
VRF-5.03	208 V	1	1.05 A	0.13 kVA	RGB-15,17	9
VRF-5.04	208 V	1	0.39 A	0.05 kVA	RGB-15,17	9
VRF-5.05	208 V	1	1.56 A	0.19 kVA	RGB-15,17	9
VRF-5.06	208 V	1	0.24 A	0.03 kVA	RGB-15,17	9
VRF-5.07	208 V	1	0.24 A	0.03 kVA	RGB-15,17	9
VRF-5.08	208 V	1	1.56 A	0.19 kVA	RGB-15,17	9
VRF-5.09	208 V	1	0.28 A	0.03 kVA	RGB-15,17	9
VRF-5.10	208 V	1	0.28 A	0.03 kVA	RGB-15,17	9
VRF-5.11	208 V	1	0.24 A	0.03 kVA	RGB-15,17	9
VRF-5.12	208 V	1	1.20 A	0.14 kVA	RGB-15,17	9
VRF-5.13	208 V	1	1.56 A	0.19 kVA	RGB-15,17	9

MECHANICAL EQUIPMENT CONNECTION SCHEDULE (RTUs)						
EQUIPMENT DESIG.	ELECTRICAL CHARACTERISTICS				CIRCUIT DESIG.	MECS NOTES
	VOLTAGE	φ	AMPS	KVA		
RTU-1	480 V	3	64.70 A	53.79 kVA	MGB-2,4,6	2

MECHANICAL EQUIPMENT CONNECTION SCHEDULE (AHUs)						
EQUIPMENT DESIG.	ELECTRICAL CHARACTERISTICS				CIRCUIT DESIG.	MECS NOTES
	VOLTAGE	φ	AMPS	KVA		
AHU-1	480 V	3	25.8 A	21.4 kVA	MBA-2,4,6	2
AHU-2	480 V	3	33.3 A	27.7 kVA	MBA-7,9,11	2
AHU-3	480 V	3	87.9 A	73.1 kVA	MBA-8,10,12	2
AHU-4	480 V	3	67.1 A	55.8 kVA	MBA-13,15,17	2
AHU-5	480 V	3	33.3 A	27.7 kVA	MGB-7,9,11	2
AHU-6	480 V	3	67.1 A	55.8 kVA	MGB-8,10,12	2

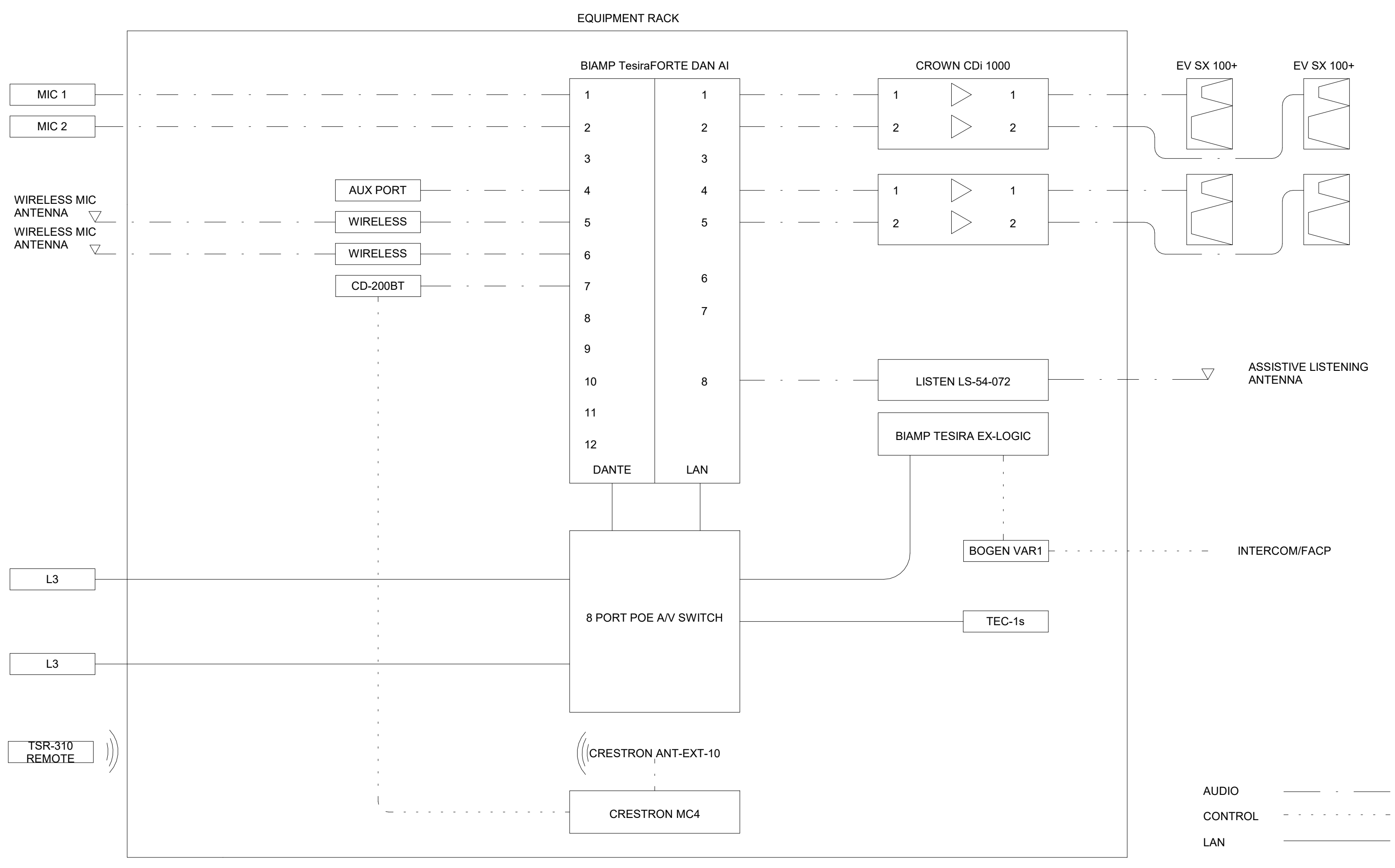
MECHANICAL EQUIPMENT CONNECTION SCHEDULE (FANS)						
EQUIPMENT DESIG.	ELECTRICAL CHARACTERISTICS				CIRCUIT DESIG.	MECS NOTES
	VOLTAGE	φ	AMPS	KVA		
F-1	480 V	3	4.8 A	4.0 kVA	MGB-13,15,17	2
F-2	120 V	1	5.8 A	0.7 kVA	RGB-1	1
F-3	120 V	1	2.5 A	0.3 kVA	RGB-2	1
F-4	120 V	1	2.5 A	0.3 kVA	RGB-2	1
F-5	120 V	1	5.8 A	0.7 kVA	RGB-1	1
F-6	120 V	1	13.8 A	1.7 kVA	RBA-14	1
F-7	120 V	1	13.8 A	1.7 kVA	RBA-15	1
F-8	120 V	1	5.8 A	0.7 kVA	RGB-32	1
F-9	120 V	1	5.8 A	0.7 kVA	RGB-32	1
F-10	120 V	1	5.8 A	0.7 kVA	RGB-7	1
F-11	120 V	1	13.8 A	1.7 kVA	RGB-34	1
F-12	120 V	1	4.4 A	0.5 kVA	RGB-9	1
F-13	120 V	1	5.8 A	0.7 kVA	RGB-8	1
F-14	120 V	1	0.4 A	0.0 kVA	CGB-9	1
F-15	120 V	1	0.4 A	0.0 kVA	RGB-43	1

MECHANICAL EQUIPMENT CONNECTION SCHEDULE (EUHs)						
EQUIPMENT DESIG.	ELECTRICAL CHARACTERISTICS				CIRCUIT DESIG.	MECS NOTES
	VOLTAGE	φ	AMPS	KVA		
EUH-1	480 V	3	12.7 A	10.6 kVA	E2LBA-7,9,11	1
EUH-2	480 V	3	6.1 A	5.1 kVA	MGB-62,64,66	1
EUH-3	480 V	3	6.1 A	5.1 kVA	MGB-67,69,71	1
EUH-4	480 V	3	9.7 A	8.1 kVA	MGB-20,22,24	1
EUH-5	480 V	3	9.7 A	8.1 kVA	MGB-25,27,29	1
EUH-6	480 V	3	9.7 A	8.1 kVA	MGB-79,81,83	1

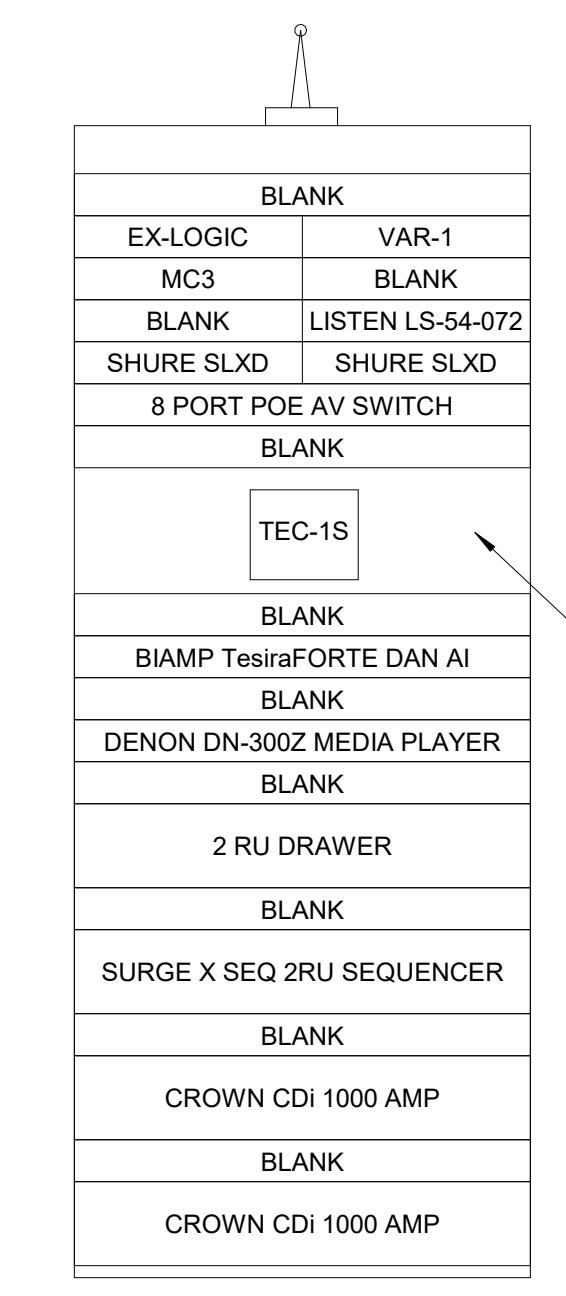
MECHANICAL EQUIPMENT CONNECTION SCHEDULE (CUHs)						
EQUIPMENT DESIG.	ELECTRICAL CHARACTERISTICS				CIRCUIT DESIG.	MECS NOTES
	VOLTAGE	φ	AMPS	KVA		
CUH-1	480 V	3	11.7 A	9.7 kVA	MBA-14,16,18	1
CUH-2	480 V	3	11.7 A	9.7 kVA	MBA-19,21,23	1
CUH-3	480 V	3	7.8 A	6.5 kVA	MBA-20,22,24	1
CUH-4	480 V	3	7.8 A	6.5 kVA	MBA-25,27,29	1
CUH-5	480 V	3	7.8 A	6.5 kVA	MBA-26,28,30	1
CUH-6	480 V	3	7.8 A	6.5 kVA	MBA-31,33,35	1
CUH-7	480 V	3	11.7 A	9.7 kVA	MBA-32,34,36	1
CUH-8	480 V	3	11.7 A	9.7 kVA	MBA-37,39,41	1
CUH-9	480 V	3	11.7 A	9.7 kVA	MGB-55,57,59	1
CUH-10	480 V	3	11.7 A	9.7 kVA	MGB-61,63,65	1
CUH-11	480 V	3	7.8 A	6.5 kVA	MGB-31,33,35	1
CUH-12	480 V	3	7.8 A	6.5 kVA	MGB-32,34,36	1
CUH-13	480 V	3	11.7 A	9.7 kVA	MGB-37,39,41	1
CUH-14	480 V	3	11.7 A	9.7 kVA	MBA-43,45,47	1
CUH-15	480 V	3	7.8 A	6.5 kVA	M1A-1,3,5	1
CUH-16	480 V	3	7.8 A	6.5 kVA	M1A-2,4,6	1
CUH-17	480 V	3	11.7 A	9.7 kVA	M1A-14,16,18	1
CUH-18	480 V	3	7.8 A	6.5 kVA	MGB-38,40,42	1
CUH-19	480 V	3	7.8 A	6.5 kVA	MGB-43,45,47	1
CUH-20	480 V	3	11.7 A	9.7 kVA	MGB-44,46,48	1
CUH-21	480 V	3	7.8 A	6.5 kVA	M1A-13,15,17	1
CUH-22	480 V	3	7.8 A	6.5 kVA	M1A-8,10,12	1
CUH-23	480 V	3	11.7 A	9.7 kVA	M1A-7,9,11	1
CUH-24	480 V	3	11.7 A	9.7 kVA	MGB-50,52,54	1
CUH-25	480 V	3	11.7 A	9.7 kVA	MGB-56,58,60	1
CUH-26	480 V	3	11.7 A	9.7 kVA	MGB-74,76,78	1

MECHANICAL EQUIPMENT CONNECTION SCHEDULE (CHs)						
EQUIPMENT DESIG.	ELECTRICAL CHARACTERISTICS				CIRCUIT DESIG.	MECS NOTES
	VOLTAGE	φ	AMPS	KVA		
CH-1	120 V	1	12.5 A	2.6 kVA	RBA-13	1
CH-2	120 V	1	19.2 A	2.3 kVA	RGB-4	1
CH-3	120 V	1	19.2 A	2.3 kVA	RGB-5	1
CH-4	120 V	1	12.5 A	1.5 kVA	RGB-6	1
CH-5	120 V	1	12.5 A	1.5 kVA	R1A-22	1
CH-6	120 V	1	12.5 A	1.5 kVA	R1A-17	1
CH-7	120 V	1	12.5 A	1.5 kVA	R1A-18	1

MECHANICAL EQUIPMENT CONNECTION SCHEDULE (CONDs)						
EQUIPMENT DESIG.	ELECTRICAL CHARACTERISTICS				CIRCUIT DESIG.	MECS NOTES
	VOLTAGE	φ	AMPS	KVA		
COND-1	480 V	3	26.0 A	21.6 kVA	MGB-26,28,30	6
COND-2 No. 1	480 V	3	19.0 A	15.8 kVA	MBA-50,52,54	5
COND-2 No. 2	480 V	3	14.0 A	11.6 kVA	MBA-56,58,60	

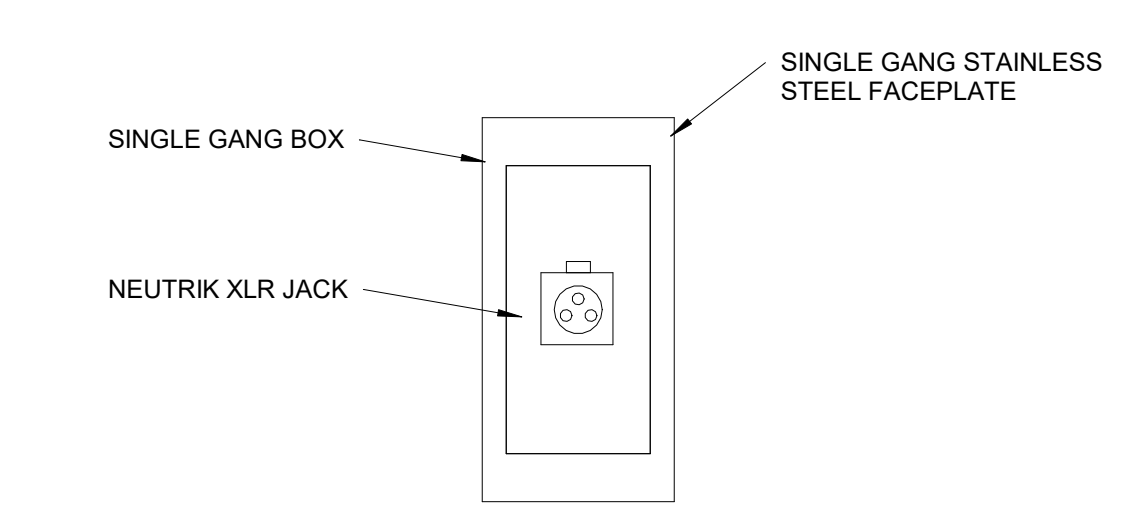


1 CAFE SOUND SYSTEM LINE DIAGRAM
N.T.S.

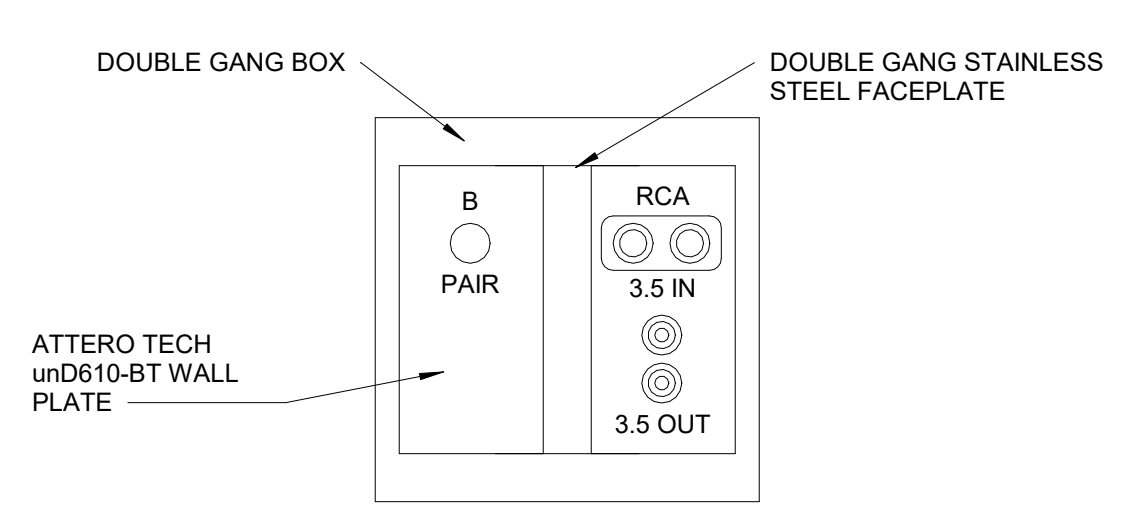


- NOTES:
1. PROVIDE AND INSTALL ALL REQUIRED PATHWAYS, CABLING, RACK EQUIPMENT, MICS, ELECTRONICS AND SPEAKERS FOR THE AUXILIARY SOUND SYSTEM AS DESCRIBED IN THE TECHNOLOGY DRAWINGS.
 2. ELECTRONICS FOR THE AUXILIARY SOUND SYSTEMS SHALL BE PROVIDED, INSTALLED AND TESTED AND BE SHOWN TO BE FREE FROM DEFECT.
 3. 48" WALL MOUNTED SWING EQUIPMENT CABINET SHALL BE PROVIDED, INSTALLED AND PROPERLY SECURED TO THE WALL AND HOLD THE ANTICIPATED AMOUNT OF EQUIPMENT AND WEIGHT.
 4. 48" WALL MOUNTED CABINET SHALL BE INSTALLED 18" AFF.
 5. THE AUXILIARY SOUND SYSTEMS SHALL BE TIED TO THE FAC AND INTERCOM SYSTEM AND SHUNT DURING AN EMERGENCY CALL OR ALERT. COORDINATE WORK WITH INTERCOM, FAC AND ELECTRICAL INSTALLERS.
 6. ALL CABLES SHALL BE RUN IN RIGID METALLIC CONDUIT RUN BEHIND SURFACES WHERE POSSIBLE.
 7. ALL CABLES SHALL BE LABELED AT BOTH ENDS WITH IDENTIFICATION, SIGNAL STRENGTH AND CABLE LENGTH.
 8. SOUND SHALL BE ADJUSTED, VERIFIED AND DEMONSTRATED AS PART OF SYSTEM INSTALLATION. PROVIDE AN EASE PLOT FOR THE SPEAKERS SELECTED WHICH SHOWN SOUND PRESSURE LEVELS FOR THE SPACE BEING SERVED.
 9. SEE RELATED SPECIFICATION SECTION FOR EQUIPMENT AND INSTALLATION DETAILS.

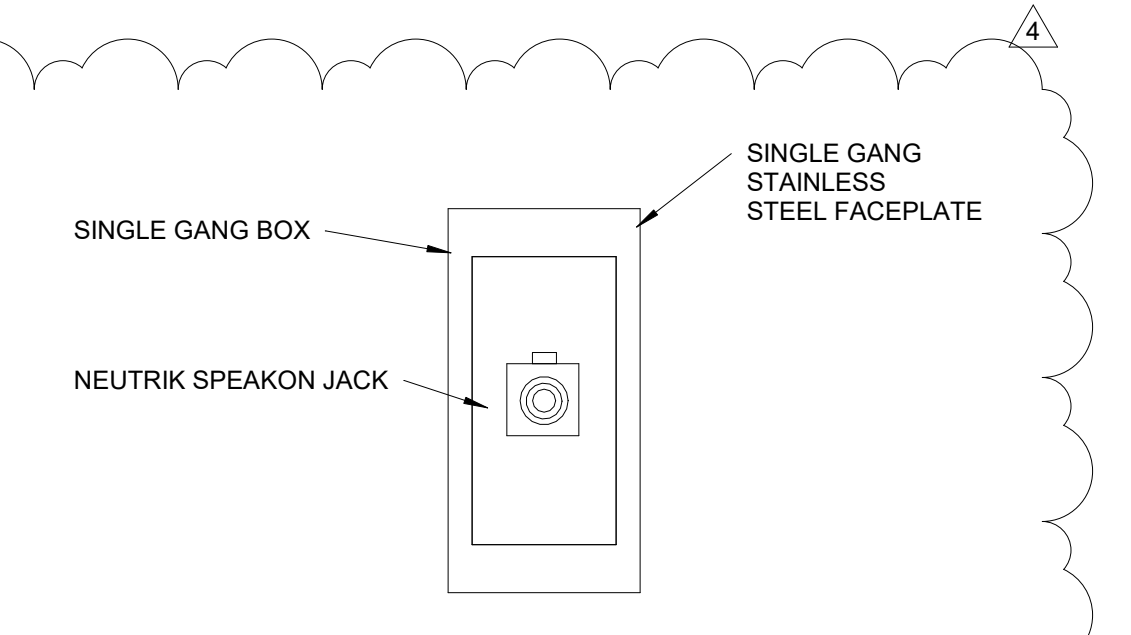
2 CAFE EQUIPMENT RACK
N.T.S.



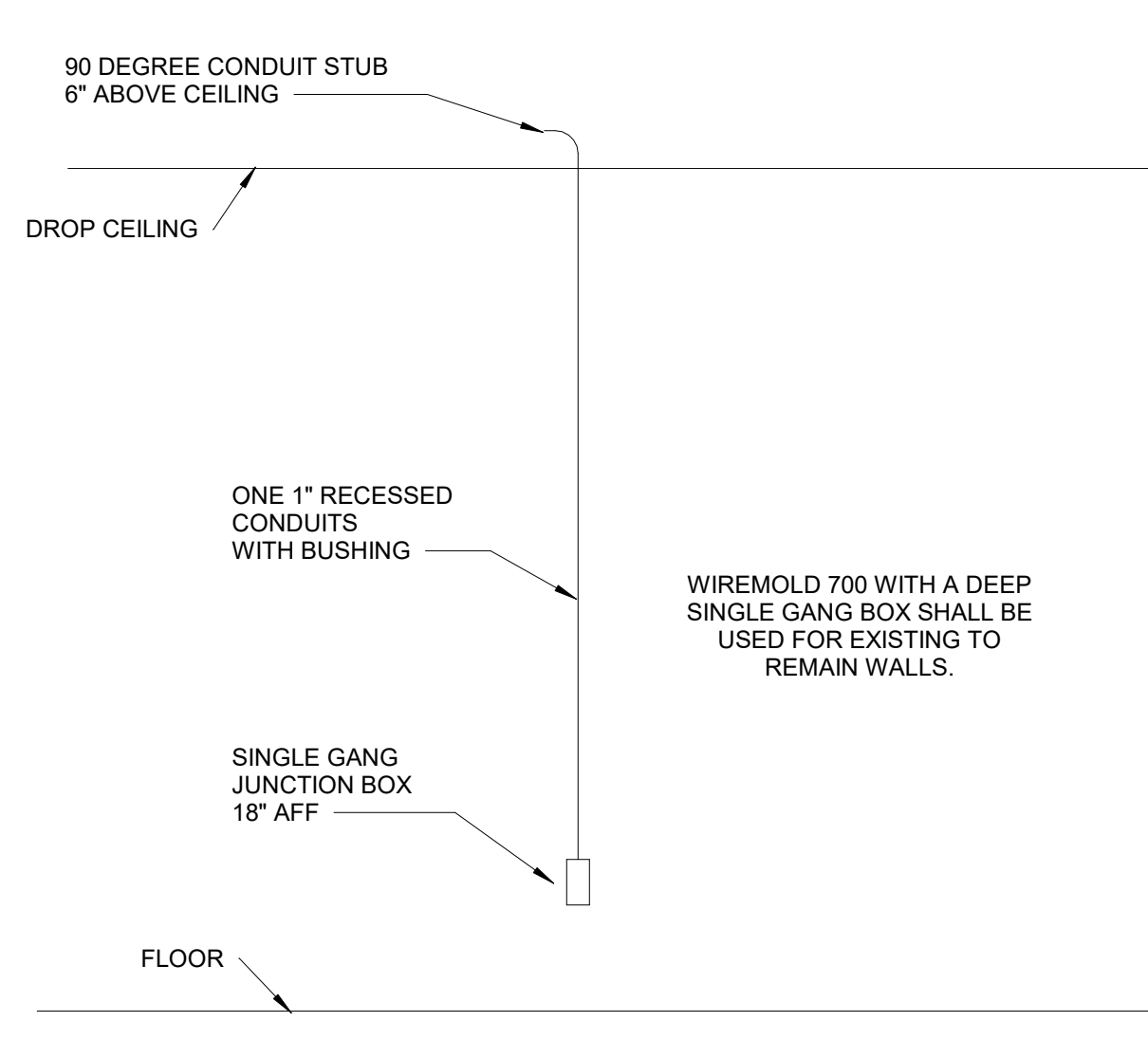
M FACEPLATE



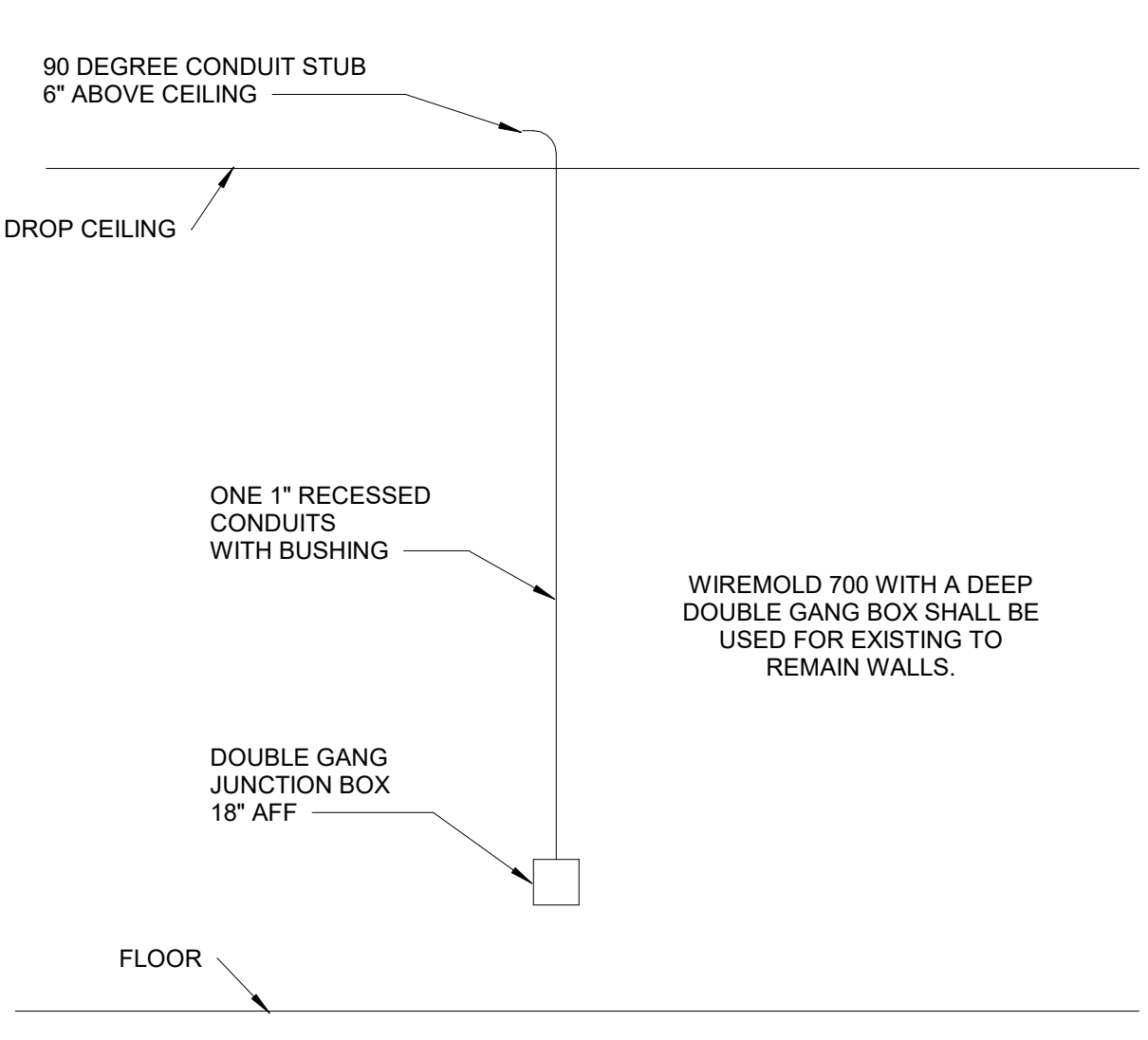
L3 FACEPLATE



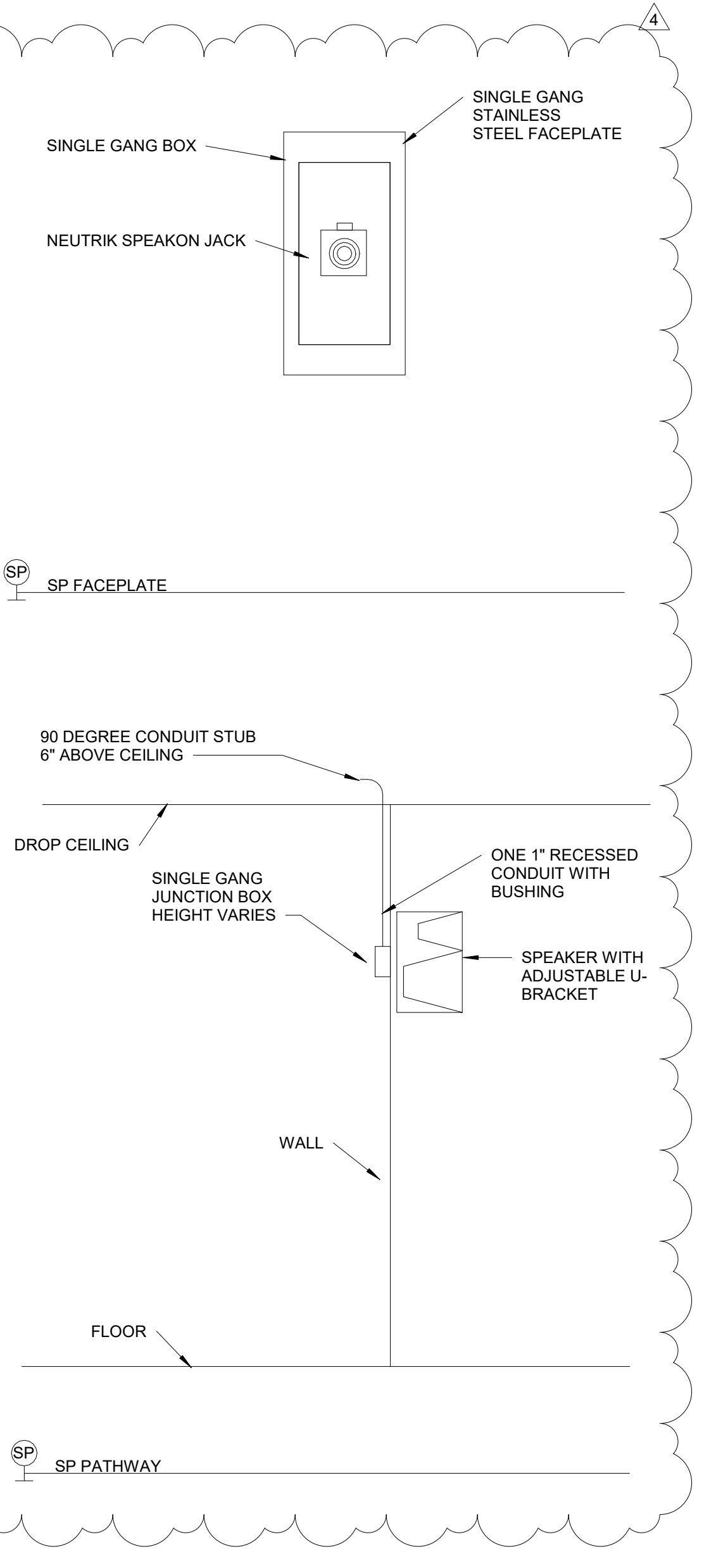
SP FACEPLATE



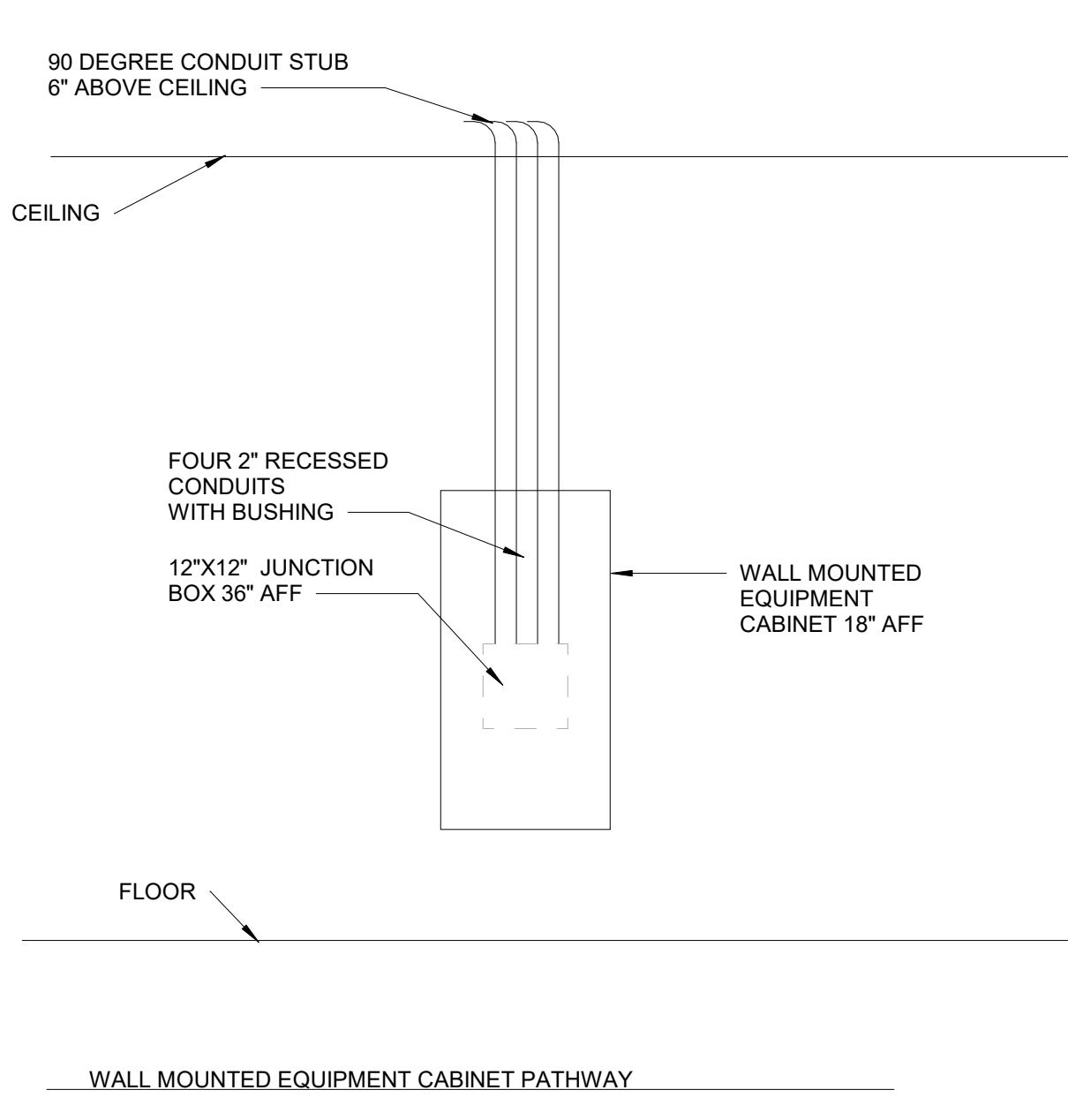
M PATHWAY



L3 PATHWAY



SP PATHWAY



WALL MOUNTED EQUIPMENT CABINET PATHWAY

3 CAFE OUTLETS
N.T.S.

CRABTREE ROHRBAUGH & ASSOCIATES - ARCHITECTS
100 WEST ROAD, SUITE 402
TOWSON, MD 21204

RENOVATIONS & ADDITIONS
MONTEBELLO ELEMENTARY/
MIDDLE SCHOOL
BALTIMORE CITY PUBLIC SCHOOLS
2040 EAST 32ND STREET, BALTIMORE,
MARYLAND 21218

USING AGENCY APPROVAL

Name: _____ Date: _____
Title: _____
Project Manager: _____ Date: _____
Chief of PM&D: _____ Date: _____

MARK	DATE	DESCRIPTION
4	01/08/21	Addendum #4

AS-BUILT REVISIONS

SUBMITTED BY: _____
CAD DWG FILE: BTJ
DRAWN BY: BTJ
CHECKED BY: RSB II
PROJECT NO. BCS-02-004
DATE: NOVEMBER 16, 2020

CAFE SOUND SYSTEM

SCALE: As indicated
DRAWING NO.

T5.4