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AUTH.NAME AUTHOR AFFILIATION
ZIMMERMAN,S.R. Carolina Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION
DENTON,H.R. Office of Nuclear Reactor Regulation, Director

SUBJECT: Forwards addl info in response to SER Confirmatory Item 4 re design documentation of ASME components. Info responds to NRC concerns identified by 850618 ltr & Mechanical Engineering Branch Questions 210.80,210.81 & 210.82.

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SEP 2 6 1985

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Washington, DC 20555

SHEARON HARRIS NUCLEAR POWER PLANT
UNIT NO. 1 - DOCKET NO. 50-400
ASME DESIGN DOCUMENTATION

Dear Mr. Denton:

Carolina Power & Light Company hereby submits additional information in response to the Shearon Harris Nuclear Power Plant (SHNPP) Safety Evaluation Report (SER) Confirmatory Item No. 4 concerning design documentation of ASME components. The attached information responds specifically to the NRC concerns identified by letter dated June 18, 1985 and to Mechanical Engineering Branch Questions 210.80, 210.81, and 210.82.

If you have any further questions on the subject or require additional information, please contact me.

Yours very truly,

S. R. Zimmerman
Manager
Nuclear Licensing Section

SRZ/mf (1941JDK)

Attachment

cc: Mr. B. C. Buckley (NRC)
Mr. David Terao (NRC-MEB)
Mr. G. F. Maxwell (NRC-SHNPP)
Dr. J. Nelson Grace (NRC-RII)
Mr. Travis Payne (KUDZU)
Mr. Daniel F. Read (CHANGE/ELP)
Wake County Public Library
Mr. Wells Eddleman
Mr. John D. Runkle
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Mr. G. O. Bright (ASLB)
Dr. J. H. Carpenter (ASLB)
Mr. J. L. Kelley (ASLB)

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411 Fayetteville Street • P. O. Box 1551 • Raleigh, N. C. 27602

Shearon Harris Nuclear Power Plant
SER Confirmatory Item No. 4

Provide revised sections of Volumes 1, 3, and 4 of the Westinghouse piping design report describing the use of non-code stress indices and flexibility factors and a commitment to include three additional sections as described in NRC letter of February 12, 1985, in the final design report.

RESPONSE:

In response to NRC's letter dated June 18, 1985, "Summary of Audit of Class I Piping Design Report Meeting," CP&L and Westinghouse have reviewed the NRC Findings and confirm that the requested additions to the Design Report (WCAP-9990) will be incorporated into the final design report.

The additions to the Design Report will be as follows:

A. (a) Selection of Corrosion/Erosion Allowance "A" in NB-3641.1: Section 3.2.2 "Pressure" of Volume 1 and Section 3.1.2 "Pressure" of Volume 4 will be expanded to cover the selection of corrosion/erosion allowance "A" of NB-3641.1.

(b) Branch Connections, NB-3643: Section 2 "Criteria" of Volume 3, will be expanded to confirm that the branch connections, nozzle opening, meet the requirements of NB-3643.

(c) Attachments, NB-3645: Attachments will be addressed in Section 4.5 "Welded Attachments" of Volume 4.

(d) Purchased Fittings, NB-3649: Section 4.6 "Class 1 Fittings" of Volume 4 will be expanded to address compliance with NB-3649 "Pressure Design of Other Piping Products".

For the above changes to the final Design Report, reference will be provided for the detailed evaluations files.

B. An Appendix will be added to Volumes 1, 3, and 4 which provides the files for generic calculations, design and as-built analyses applicable to Shearon Harris. A statement will be added confirming that these files are retained for as long as the Design Report.

C. Section 3, "Loading" of Volumes 1 and 4 will be expanded to cross reference the Design Specification loading requirements (D-Spec. 955239) with the analysis and qualification loading conditions.

Shearon Harris Nuclear Power Plant
NRC Question 210.80

Your response to Q210.59 requires additional information. In our review of your piping design specifications, we were furnished the specification identified as CAR-SH-M-30, "General Power Piping, Nuclear Safety Class 1, 2, 3, and Non-nuclear Safety Class Piping." Your response to Q210.59 provided in your 9/19/83 letter indicated that the CAR-SH-M-30 specification when supplemented with CAR-SH-M-71 forms a complete design specification for piping and supports. However, the M-71 specification is not applicable to ASME Class 1 piping and supports. You have provided the Westinghouse Specification 955239 for Class 1 piping but appear to have no design specification covering Class 1 supports (non-NSSS).

a) Provide the design specification for Class 1 piping supports (not in the Westinghouse scope).

b) Provide the complete design specification CAR-SH-M-71 for our review.

c) Revise page 2 of the M-71 specification (paragraphs 2.04 and 2.06) to accurately state that the design limits and loading combinations for Seismic Category I fluid System Equipment will be in accordance with the FSAR commitment (and not the PSAR commitment as currently stated).

RESPONSE:

The above NRC question is based on Revision 0 of specification CAR-SH-M-71. These concerns are addressed in Revision 1 of the specification as follows:

a) The scope of the specification, on page 1, paragraph 1.01, has been revised to clearly indicate that the information necessary for the design and analysis of Safety Class 1 piping and pipe supports not provided by the NSSS supplier (Westinghouse) is contained in CAR-SH-M-71. Analysis of Safety Class 1 piping is discussed in paragraphs 8.01 (page 9a) and 8.08 (page 10). Design criteria for all pipe supports is given in Appendix I.

b) A complete copy of specification CAR-SH-M-71, Revision 1 is attached.

c) Regulatory Guide 1.48 is now listed in paragraph 3, page 4a with the other applicable NRC documents. The reference to the PSAR has been removed.

(1941JDK/mf)

Project Identification

No. CAR-SH-M-71

EBASCO SERVICES INCORPORATED

EBASCO SPECIFICATION

DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1, 2 & 3 AND ANSI B31.1 NONNUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS | R1

PURCHASER : EBASCO SERVICES INCORPORATED, AGENT

OWNER: CAROLINA POWER & LIGHT COMPANY

OPERATING COMPANY: CAROLINA POWER & LIGHT COMPANY

PROJECT: SHEARON HARRIS NUCLEAR POWER PLANT

UNIT NO.: 1 NOMINAL MW 950,000 kW PER UNITS | R1

LOCATION: WAKE COUNTY, NORTH CAROLINA

SELLER:

"THIS DOCUMENT IS DELIVERED IN ACCORDANCE WITH AND IS SUBJECT TO THE PROVISIONS OF SECTION X OF THE CONTRACT BETWEEN CAROLINA POWER & LIGHT COMPANY AND EBASCO SERVICES INCORPORATED DATED SEPTEMBER 1,1970, AMENDED". | R1

Spec. Status	Date	Prepared By:	Reviewed By:	Pages Affected	CP&L Approval Date
Original	3/14/78	N Battista/ G Nariani	R J Giorgio N/A 3/18/78	All	
Rev. 1	3/7/85	T Hannan	R C Rossi NCPE No. 11504	All	CE-15983 3/5/85

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports | R1

Project Identification
No. CAR-SH-M-71

Ralph J. Giorgio
3/25/82

I, Ralph J. Giorgio, Professional Engineering Registration Number 8330 in the State of North Carolina, certify that this design specification is correct and applicable with respect to the requirements of Article NA-3250 of the ASME Boiler and Pressure Vessel Code Section III.

EBASCO SPECIFICATION

DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1, 2, & 3 and ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I and SEISMICALLY DESIGNED PIPING AND SUPPORTS

CONTENTS

R1

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports | R1

Project Identification
No. CAR-SH-M-71

1. SCOPE

.01 This specification provides, in accordance with Article NA-3250 "Provisions of Design Specifications" and related paragraphs of the American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section III (hereinafter referred to as ASME Code), the information required for the design and analysis of Safety Classes 2 & 3 Seismic Category I piping and supports, and the design and analysis of the piping and pipe supports not provided by the NSSS supplier for Safety Class 1 piping. This specification also provides the information required for the design and analysis of B31.1 Seismic Category I and seismically designed piping and supports. R1

.02 Station piping shall be furnished in accordance with Ebasco Purchase Specifications CAR-SH-M30 and CAR-SH-M30A. Instrument tubing and supports shall be furnished in accordance with Ebasco Drawings CAR-2166-B-429, 431,432 and 434, and Site Specifications 059 & 061. Hangers and supports for said piping shall be furnished in accordance with Ebasco Purchase Specification CAR-SH-M30B. R1

The material, testing, handling, storage, cleanliness and shipping requirements for piping, tubing, and supports are given in the respective specifications and drawings referenced above. R1

.03 Systems covered under this specification are:

Chemical and Volume Control System	Sampling System (Nuclear)
Safety Injection System	Condensate System
Reactor Coolant System	Steam Generator Blowdown System
Boron Recycle System	Chilled Water Supply System
Containment Spray System	Demineralized Water System
Component Cooling Water System	Instrument Air System
Residual Heat Removal System	Leak Test System
Spent Fuel Pool Cooling & Cleanup System	Miscellaneous Drain System
Service Water System	Leak Detection System

R1

1. SCOPE (Cont'd)

.03 (Cont'd)

Primary Sampling System	Reactor Vessel Level Indication System
Hydrogen Sampling System	Fire Protection System
Post Accident Sampling System	Feedwater System
Nitrogen System	Emergency Air System
Auxiliary Feedwater System	Service Air System
Main Steam System	Screen Wash System
Chilled Water Return System	Waste Gas System
Fuel Oil System	Waste Liquid System
Primary Makeup Water System	

R1

.04 Any conflict between this specification and any of the reference documents shall be brought to the attention of the Project Mechanical Engineering Supervisor for resolution. R1

2. DEFINITIONS

The following definitions apply to the terms listed below as used in this specification:

R1

Piping - Includes straight pipes, tubes, piping and tubing bends, fittings, flanges, gaskets, bolting, and welded integral attachments. It does not include structures and equipment such as building frames, valves, pumps, pressure vessels, foundations, penetrations, expansion joints or piping supports.

Supports - Includes supports, spring hangers, constant support, mechanical and hydraulic snubbers, rigid hangers, anchors, guides, thermal restraints, seismic restraints, supplementary steel for pipe supports, attachments for hangers, piping covering protection saddles and fasteners for hangers. It does not include pipe whip restraints which do not restrain the piping in Normal, Upset or Emergency conditions.

2. DEFINITIONS (Cont'd)

Supplementary Steel - Any structural steel framing between the existing building members, that is required primarily to support the piping.

Standard Support Component - A support assembly consisting of one or more units which are catalog items and generally mass produced.

Seismic Category I - Piping and supports which are designed to withstand the event of a Safe Shutdown Earthquake (SSE) without loss of capability to perform their safety functions.

Seismically Designed - Piping and supports whose continued function are not required but whose failure could reduce the functioning of those safety related systems/components designated to mitigate the consequences of an accident to an unacceptable safety level are designed and constructed so that an SSE would not cause such a failure. R1

Essential Systems - Those systems needed to shutdown the reactor and to mitigate the consequences of a design basis accident without off-site power.

High Energy Piping Systems - Those systems, or portions of systems, whose normal operating conditions exceed 200°F or 275 psig.

Moderate Energy Piping System - Those systems or portions of systems, which are maintained above atmospheric pressure, whose maximum normal operating conditions are less than, or equal to, 200°F and 275 psig. In addition, those systems, or portions of systems, which exceed either or both of the above conditions but only for a period less than two percent of the system normal operating time (not including testing), or are in operation less than one percent of the plant normal operating time (not including testing), are classified as moderate energy piping systems.

3. APPLICABLE CODES, STANDARDS, DOCUMENTS & DRAWINGS

ASME - American Society of Mechanical Engineers - Boiler and Pressure Vessel Code.
Section III, Division 1, Nuclear Power Plant Components 1971 Edition*, and Addenda thereto dated as follows: 6/30/71, 12/31/71, 6/30/72, 12/31/72, 6/30/73.

*- For Mechanical snubbers, Section III, Subsection NF, 1977 Edition including Summer 1978 Addenda is applicable. For hydraulic snubbers, Section III, Subsection NF, 1980 Edition including Addenda thru Winter 1981 is applicable.

Section XI - Rules for Inservice Inspection for Nuclear Power Plant Components. 1977 Edition including Addenda thru Summer 1978 (as ammended by 10CFR 50.55, 11/1/79).

ANSI - American National Standards Institute

B31.1 - Code for Power Piping, June 15, 1973 Issue including Addendum dated June 30, 1973.
N45.2.11- Quality Assurance Program Requirements for Nuclear Power Plants, 1974.
N18.2 - Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants, 1973
N18.2a Revision and Addendum to Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants, 1975 R1

AISC - American Institute of Steel Construction
Specification for the Design, Fabrication and Erection of Structural Steel Buildings (Seventh Edition, February 1969, including supplements dated 11/1/70, 12/8/71, 6/12/74).

MSS - Manufacturers Standardization Society of the Valve and Fittings Industry.

SP-58 - Pipe Hangers and Supports. (1967 Edition)

3. APPLICABLE CODES, STANDARDS, DOCUMENTS & DRAWINGS (Cont'd)

USNRC - United States Nuclear Regulatory Commission.

NRC Regulatory Guide 1.48, Revision 0	Design Limits and Loading Combinations for Seismic Category I Fluid System Equipment
NRC Regulatory Guide 1.67, dated 10/73	Installation of Overpressure Protection Devices.
NRC Regulatory Guide 1.29, Revision 3	Seismic Design Classification
NRC Regulatory Guide 1.84	Code Case Acceptability.
NRC Regulatory Guide 1.85	Materials Code Case Acceptance ASME Section III, Division 1
NRC Regulatory Guide 1.92, Revision 1	Combining Modal Responses and Spatial Components In Seismic Response Analysis.
Standard Review Plan 3.6.1,	Plant Design for Protection Against Postulated Piping Failures In Fluid Systems Outside Containment.
Standard Review Plan 3.6.2,	Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping.
Standard Review Plan 3.7.3,	Seismic Subsystem Analysis
Standard Review Plan 3.9.3	ASME Code Class 1, 2 & 3 Components, Component Supports, and Core Support Structures.

R1

3. APPLICABLE CODES, STANDARDS, DOCUMENTS & DRAWINGS (Cont'd)

USNRC - United States Nuclear Regulatory Commission (Cont'd)

Branch Technical Position APCSB 3-1	-	Protection Against Postulated Piping Failures in Fluid Systems Outside Containment, March 1975.
Branch Technical Position MEB 3-1	-	Postulated Break and Leakage Locations in Fluid System Piping Outside Containment, March 1975. R1

Site Specifications:

059	-	Stainless Steel Flareless Compression Fittings and Tube Fittings for Field Welding ASME Section III, Code Class 2.
061	-	Stainless Steel Tubing ASME Section III Class 2 For PPC.

3. APPLICABLE CODES, STANDARDS, DOCUMENTS & DRAWINGS (Cont'd)

WRC - Welding Research Council Bulletin No. 107, August 1965

AWS - American Welding Society

Standard - A2.0-68 - Standard Welding Symbols (1968 Edition)

D1.1 - Structural Welding Code - Steel (1975 Edition including provision from 1982 Edition for tubular steel)

Ebasco Specifications:

CAR-SH-M30	-	General Power Piping
M30A	-	Heavy Wall Seamless Pipe
M30B	-	General Power Piping (Hangers, Supports & Anchors)
M31	-	Heat, Antisweat and Process Heating Insulation, Non-Nuclear Safety Class. R1
M54	-	Nuclear Containment Mechanical Penetrations, Components and Assemblies.

Ebasco Drawings:

CAR-2166-B-429	Ebasco Instrument Installation Details (WP).
CAR-2166-B-431	Ebasco Instrument Installation Details (BOP).
CAR-2166-B-432	Ebasco Instrument List with Data and References (BOP).
CAR-2166-B-434	Ebasco Instrument List with Data and References (WP).
CAR-2165-G-064	Containment Building Liner Penetrations (Sheet 1).
CAR-2165-G-065	Containment Building Liner Penetrations (Sheet 2).
CAR-2165-G-107/S01	- Field Installation Tolerances for Hangers
CAR-2165-G-107/S02	- Field Installation Tolerances for Piping
CAR-2168-G-6091	- Standard Details Steel Structural Tolerances

Applicable Vendor Drawings of Components which are supplied to the analyst via the Ebasco EMDRAC System.

ETR - 1002 - Design Considerations for the Protection from the Effects of Pipe Rupture, November 1975

Ebasco Valve and Specialties List - 1364 B069

3. APPLICABLE CODES, STANDARDS, DOCUMENTS & DRAWINGS (Cont'd)

NSSS Suppliers Equipment Specifications and Vendor Equipment Design and Seismic Reports which are supplied to the analyst via the Ebasco EMDRAC System. R1

Westinghouse Overpressure Reports - WCAP-7769 Rev. 1 and Overpressure Protection Report for SHNPP (March 1980).

4. ENVIRONMENTAL CONDITIONS

.01 The environmental conditions to be considered for all piping and supports covered by this specification are as follows:

Containment Building R1

	Normal	LOCA	Stm Line Break
a - Peak Temperature	80 - 120°F	257°F	379°F
b - Peak Pressure	Atmosphere	36.7 psig	39.1 psig
c - Relative Humidity	40%	100%	100%
d - Radiation	3.5×10^6 Rads	Integrated dose for 40 years of normal operation.	
	1.3×10^7 Rads	Dose one year after the design basis accident	

Steam Tunnel R1

	Normal	LOCA	Stm Line Break
a - Peak Temperature	111°F	NA	340°F
b - Peak Pressure	Atmosphere	NA	22 psia
c - Relative Humidity	20-90%	NA	100%
d - Radiation	1.0×10^3 Rads	Integrated dose for 40 years of normal operation.	
	2.5×10^4 Rads	Dose one year after the design basis accident	

4. ENVIRONMENTAL CONDITIONS (Cont'd)

.01 (Cont'd)

Auxiliary Building

	Normal	LOCA	Stm Line Break
a - Temperature	60 - 104°F	130°F	NA
b - Pressure	ATM	ATM	NA
c - Relative Humidity	20-90%	100%	NA
d - Radiation	1.0×10^5 Rads	Integrated dose for 40 years of normal plant operation	
	2.7×10^6 Rads	Dose one year after the design basis accident	

Fuel Handling Building

	Normal	LOCA	Stm Line Break	
a - Temperature	60 - 104°F	120°F	NA	
b - Pressure	ATM	ATM	NA	
c - Relative Humidity	20-90%	100	NA	R1
d - Radiation	1.0×10^4 Rads	Integiated dose for 40 years of normal plant operation		
	1.0×10^3 Rads	Dose one year after the design basis accident		

5. CLASSIFICATION OF PIPING

.01 The classification of piping covered by this specification as Safety Class 1, 2 or 3, or ANSI B31.1 Non-Nuclear Safety/Seismic Category I or Seismically Designed is identified on the Piping Line List, Appendix D. Similarly, the classification of tubing is identified by the I&C Classification System indicated on Drawings 2166B-432 & 434.

5. CLASSIFICATION OF PIPING (Cont'd)

.02 Ebasco categories 1,2 and 3 correspond to Safety Classes 1,2 and 3 respectively, and Seismic Category I. These classifications are determined in accordance with ANSI N18.2 and N18.2a. Ebasco categories 4,5,6,7 and 8 are non-nuclear safety and only those lines designated Seismic Category I or seismically designed are covered by this specification. R1

.03 I&C Safety Classes N1&N2 correspond to Safety Classes 1&2 respectively and Seismic Category I. These classifications are determined in accordance with ANSI N18.2 and N18.2a.

6. PIPING AND SUPPORT BOUNDARIES

.01 The boundaries of the piping and supports covered by this specification are defined by the descriptions in Appendix D, Appendix B, and as follows:

a- The first circumferential joint in welded connections and the attaching weld of WPAs, the connecting weld shall be considered part of the piping.

b- The face of the first flange in bolted connections, the bolts shall be considered part of the piping.

c- The first threaded joint in screwed connections.

d- Boundaries for penetrations are shown on Drawing G-2165-065.

e- Boundary for instrument tubing ends at the last fitting before the instrument.

f. For supports, the connecting weld to an embedded plate or building structural steel shall be considered within the support boundary. R1

.02 The specific dimensional locations and structural characteristics of all boundaries shall be obtained from the following:

a- Piping -From general arrangement drawings, flow diagrams, P&IDs, and applicable vendor drawings.

b- Supports - Embedded plate and structural steel drawings.

.03 Allowable forces and moments at all piping boundaries shall comply with the requirments of Appendix C. Forces and moments at all support boundaries shall be verified in accordance with Paragraph 10 of Appendix I.

7. GENERAL DESIGN REQUIREMENTS

01. The design stress combinations which act simultaneously during the various plant and system operating conditions to be considered in the pipe design and analysis are specifically indicated in the Load Combinations, Appendix F.

7. GENERAL DESIGN REQUIREMENTS (Cont'd)

02. For the systems covered in the Thermal Mode Diagrams, Appendix B, the temperatures noted for piping shall be used in all pipe design thermal expansion stress analysis in lieu of the temperatures specified in the Piping Line List, Appendix D. For all systems not addressed in Appendix B, the maximum operating temperature listed in Appendix D for that piping shall be used in all pipe design thermal expansion stress analysis.

.03 Unless otherwise designated in the Load Combinations, Appendix F, the design pressure values given in the Piping Line List, Appdneix D, may be used in lieu of the peak pressure (P max) as allowed by ASME Section III, since the peak pressure and earthquake need not be taken to act concurrently.

R1

.04 For tubing subject to dynamic conditions (i.e., sampling lines), the process line maximum operating pressure/temperature specified in the Piping Line List, Appendix D shall be applied throughout. For tubing subject to static conditions (i.e, impluse lines), the process line maximum operating temperature as defined above shall be applied up to the three dimensional clamp only and the process line maximum operating pressure specified in the Piping Line List, Appendix D, shall apply throughout.

7. GENERAL DESIGN REQUIREMENTS (Cont'd)

.05 Stress analysis of piping shall be performed in accordance with ASME Section III using a stress range reduction factor (f) equal to 1.0.

.06 Pipe end loads imposed by the piping on equipment nozzles shall not exceed the values given in Appendix C, unless higher loads are approved in writing by the equipment supplier.

.07 Equipment weights, center of gravity and locations and displacements of end connections required for the design and analysis of the piping covered by this specification shall be derived from the respective equipment manufacturers' drawings and specifications.

.08 Operating Basis Earthquake (OBE) and Design Basis Earthquake (DBE) loads shall be developed from the applicable floor response spectra and anchor movements provided by the Ebasco Civil Department. In the absence of DBE spectra, Safe Shutdown Earthquake (SSE) loads equal to twice the OBE Loads shall be used for the DBE loads.

.09 No reduction in allowable stress limits shall be considered due to environmental conditions. R1

.10 Piping systems, or portions of systems, having a natural frequency greater than or equal to 33 Hz may be considered rigid. In cases where the natural frequency is less than 33 Hz, a flexibility analysis shall be performed. The natural frequency, thermal displacements and analytical model, where applicable, for each are to be obtained from the respective equipment Design or Seismic Report.

.11 Vibration loads are not considered in the initial stress analysis. Excessive vibrations will be determined during the thermal expansion and vibration monitoring program at the site. Items of concern will be addressed by HPES stress analysis as they are identified.

.12 Pipe end loads for containment penetrations are specified in Ebasco Specification CAR-SH-M54, Part 2, Paragraph 4.06, and on Drawing 2165-G-064.

.13 Pipe support design criteria is given in Appendix I.

.14 Piping supported from flexible platforms shall be designed utilizing the applicable floor and wall building response spectra.

8. SPECIFIC DESIGN REQUIREMENTS

.01 All Safety Class 1 piping, except that covered in Paragraph 8.09, shall be analyzed by Ebasco in accordance with ASME Section III, Subsection NC for the purpose of suggesting support types and locations. The NSSS supplier shall use this information as a starting point in performing the Class 1 analysis for this piping. The NSSS supplier is responsible for determining the actual support types and locations and corresponding loads. Upon receipt of the completed Class 1 analysis, the existing Class 1 piping supports shall be evaluated and revised where necessary. R1

R1

8. SPECIFIC DESIGN REQUIREMENTS (Cont'd)

.02 All Safety Class 2 piping shall be analyzed in accordance with ASME Section III, Subsection NC.

.03 All Safety Class 3 piping shall be analyzed in accordance with ASME Section III, Subsection ND.

.04 All ANSI B31.1/Seismic Category I piping shall be analyzed in accordance with ASME Section III, Subsection ND.

.05 All ANSI B31.1/Seismically Designed piping shall be analyzed in accordance with ASME Section III, Subsection ND.

.06 In the case of non-Seismic Category I piping attached to Seismic Category I piping, the dynamic effects were included in the modeling of the Seismic Category I piping up to the first anchor or system of restraints which decouples the piping. R1

.07 (DELETED)

.08 All piping and supports exposed to external wind forces shall be evaluated with regard to the plant safety features to isolate the containment and safely shutdown the plant. Any line whose loss will jeopardize these plant safety features shall be analyzed and designed for tornado/hurricane and wind loads or protected from same by means such as shields or barriers. Lines requiring said analysis are identified in the Loading Combinations, Appendix F, along with the applicable loads.

The Design Basis Tornado/Hurricane and Wind Loads (DBT) are not assumed to act concurrently with a seismic event. Rather the DBT Loads are to be compared to the seismic loads to determine which is greater and therefore, should be used for design purposes. DBT loads are not to be considered for the Faulted Plant Condition unless the piping is required to provide a long term core cooling following a LOCA.

.09 The seal water bypass lines to the reactor coolant pumps are qualified to Safety Class 2 rules and are therefore, to be analyzed by Ebasco in accordance with ASME Section III, Subsection NC.

.10 The wall thickness/schedule specified in the Piping Line List, Appendix D, includes an allowance for corrosion/erosion as necessary.

9. PLANT CONDITIONS

01. Normal Conditions

Any condition in the course of system start-up, operation in the design power range and system shutdown, in the absence of Upset, Emergency or Faulted conditions.

.02 Upset Conditions

Any deviations from Normal Condition anticipated to occur often enough that design should include a capability to withstand the conditions without operational impairment. The Upset Condition includes those transients caused in a system component requiring its isolation from the system, transients due to a loss of load or power and any system upset not resulting in a forced outage. The Upset Conditions include the effect of the specified earthquake for which the system must remain operational or must regain its operational status. | R1

.03 Emergency Conditions

Any deviations from Normal Conditions which require shutdown for correction of the conditions or repair of damage in the system. The conditions have a low probability of occurrence but are included to provide assurance that no gross loss of structural integrity will result as a concomitant effect of any damage developed in the system. The total number of postualted occurrences for such events shall not exceed twenty-five (25) for the life of the plant. | R1

.04 Faulted Conditions

Those combinations of conditions associated with extremely low probability postulated events whose consequences are such that the integrity and operability of the nuclear energy system may be impaired to the extent where considerations of public health and safety are involved. Such considerations require compliance with safety criteria as may be specified by jurisdictional authorities. Among the Faulted Conditions may be a specified earthquake for which safe shutdown is required.

10. SYSTEM CONDITIONS

System design stress requirements for piping for specified plant conditions are indicated in the load combinations presented in Appendix F. The allowable stresses for support members are given in Appendix I. | R1

11. QUALITY ASSURANCE REQUIREMENTS

The quality assurance requirements for the design and analysis of piping and supports covered by this specification, as defined in Paragraph 1.01, shall comply with ANSI N45.2.11, Quality Assurance Program Requirements for the Design of Nuclear Power Plants.

12. INSULATION REQUIREMENTS

.01 The Piping Line List, Appendix D, indicates which piping requires insulation. The insulating material for all piping located outside containment shall limit the heat loss during maximum operating temperature conditions to not more than 65 BTU/HR-SQ FT of outer surface of insulation. The appropriate insulation thickness for each pipe located outside containment is to be determined from the Piping Line List, Appendix D.

For piping 2 inches and smaller located inside containment with a maximum operating temperature of 400°F or less, no insulation is required. Personnel protection from this piping is achieved by the installation of a pipe shield around the hot surfaces where personnel are most likely to be, i.e., near access platforms, walkways, etc. The pipe shield system is fabricated from type 304 expanded stainless steel and designed for total and rapid removal and replacement. The positive locking buckles for these pipe shields are seismically qualified. Details of this personnel protection are given in Appendix J, Personnel Protection for 2" and Smaller Pipes Inside Containment (Up to 400°F). R1

All other piping inside containment which requires insulation shall have reflective type insulation of the thickness specified in Table 12.1, with the corresponding weight identified in Table 12.2.

R1

12. INSULATION (Cont'd)

.02 Insulation for piping systems shall be as follows:

a. REFLECTIVE - For all piping inside of Containment.

b. COMPOSITE - For piping subjected to inservice inspection in accordance with ASME Section XI (as identified in Ebasco Specification M-30, Appendix D) outside of Containment

c. CONVENTIONAL - Piping not subject to inservice inspection outside of Containment.

d. Chilled water system piping shall be provided with a fiber glass pipe insulation with an all purpose vapor barrier jacket consisting of white paper surface bonded to aluminum foil and reinforced with a fiber glass yarn. An adhesive will be needed to seal the jacket. Lap shall be reinforced with FSKL tape or approved equal. The insulation shall have a thermal conductivity of 0.23 BTU/^{o}F-Hr-Ft^{2}/In at 75^{o}F mean temperature. R1

Based on the above the piping insulation shall be:

i) 1 inch for pipes up to 1-inch
ii) 1 1/2 inch for pipes 1-inch up to 4-inch
iii) 2 inch for pipes 6-inch and larger

.03 Details of pipe insulation are covered in Ebasco Specification M-31.

.04 Insulation requirements for tubing are detailed on drawing CAR-2166-B-431.

12. INSULATION (Cont'd)

TABLE 12.1

INSULATION THICKNESS (IN.) INSIDE CONTAINMENT

MAXIMUM OPERATING TEMPERATURE (°F)

	140-200	201-250	251-300	301-350	351-400	401-450	451-500	501-550	551-600	601-650	651-700
3/4	NONE	NONE	NONE	NONE	NONE	0.975	0.975	0.975	0.975	1.475	1.475
1.0	NONE	NONE	NONE	NONE	NONE	1.343	1.343	1.343	1.343	1.343	1.343
2.0	NONE	NONE	NONE	NONE	NONE	1.313	1.313	1.3.3	1.313	1.313	1.313
3.0	1.250	1.250	1.250	1.250	1.250	1.750	1.750	1.750	1.750	2.250	2.250
4.0	1.250	1.250	1.250	1.250	1.250	1.750	1.750	1.750	1.750	2.750	2.750
6.0	1.188	1.188	1.188	1.688	1.688	2.188	2.688	2.688	2.688	3.188	3.188
8.0	1.188	1.188	1.188	1.688	1.688	2.188	2.688	2.688	3.688	3.688	3.688
0.0	1.125	1.125	1.125	1.625	2.125	2.125	2.625	3.125	3.625	4.125	5.125
2.0	1.125	1.125	1.125	1.625	2.125	2.125	2.625	3.125	3.625	4.125	5.125
4.0	1.500	1.500	1.500	1.500	2.000	2.500	2.500	3.500	4.000	4.500	5.000 R1
6.0	1.500	1.500	1.500	1.500	2.000	2.500	2.500	3.500	4.000	4.500	5.500
3.0	1.500	1.500	1.500	1.500	2.000	2.500	2.500	3.500	4.000	4.500	5.500
).0	1.500	1.500	1.500	1.500	2.000	2.500	3.000	3.500	4.000	4.500	5.500
:.0	1.500	1.500	1.500	1.500	2.000	2.500	3.000	3.500	4.000	4.500	5.500
.0	1.500	1.500	1.500	1.500	2.000	2.500	3.000	3.500	4.000	5.000	5.500
.0	1.500	1.500	1.500	1.500	2.000	2.500	3.000	3.500	4.500	5.000	5.500
3.0	1.500	1.500	1.500	1.500	2.000	2.500	3.000	3.500	4.500	5.000	6.000
).0	1.500	1.500	1.500	1.500	2.000	2.500	3.000	3.500	4.500	5.000	6.000
:.0	1.500	1.500	1.500	1.500	2.000	2.500	3.000	3.500	4.500	5.000	6.000
5.0	1.500	1.500	1.500	1.500	2.000	2.500	3.000	3.500	4.500	5.500	6.500
:.0	1.500	1.500	1.500	1.500	2.000	2.500	3.000	3.500	4.500	5.500	6.500

TABLE 12.2
INSULATION WEIGHT (LBS. PER FT.) INSIDE CONTAINMENT
MAXIMUM OPERATING TEMPERATURE (°F)

PIPE SIZE	140-200	201-250	251-300	301-350	351-400	401-450	451-500	501-550	551-600	601-650	651-700
3/4	---	---	---	---	---	1.5	1.5	1.5	1.5	2.2	2.2
1.0	---	---	---	---	---	1.7	1.7	1.7	1.7	2.4	2.4
2.0	---	---	---	---	---	2.5	2.5	2.5	2.5	2.5	2.5
3.0	3.3	3.3	3.3	3.0	3.0	5.0	5.0	5.0	5.0	5.5	5.5
4.0	4.0	4.0	4.0	3.8	3.8	6.0	6.0	6.0	6.0	7.5	7.5
6.0	5.5	5.5	5.5	6.5	6.5	8.2	9.0	9.0	9.0	10.5	10.5
8.0	7.0	7.0	7.0	8.0	9.0	10.0	10.5	11.5	13.0	14.0	14.0
10.0	8.0	8.0	8.0	9.5	11.0	11.5	12.0	14.5	15.0	17.0	19.0
12.0	10.0	10.0	10.0	11.0	12.2	13.0	14.0	16.0	17.0	19.0	21.5
14.0	11.5	11.5	11.5	11.5	14.0	15.0	15.5	18.0	20.0	21.0	23.5
16.0	13.0	13.0	13.0	14.0	15.5	16.5	17.5	20.0	22.0	24.5	27.0
18.0	14.2	14.2	14.2	16.0	17.0	18.0	19.0	21.5	24.0	27.0	29.5
20.0	15.8	15.8	15.8	17.5	19.0	19.8	22.0	23.0	26.0	29.0	33.0
22.0	17.5	17.5	17.5	19.0	20.2	21.5	24.0	25.0	28.0	31.0	35.5
24.0	19.0	19.0	19.0	20.5	22.0	23.0	26.0	27.0	30.0	34.5	37.5
26.0	20.5	20.5	20.5	22.0	23.5	24.8	27.5	30.5	33.5	37.0	40.0
28.0	22.0	22.0	22.0	23.5	25.0	26.5	29.5	33.0	36.0	39.0	44.0
30.0	23.5	23.5	23.5	25.0	27.0	28.0	31.0	34.5	37.5	41.5	46.0
32.0	25.0	25.0	25.0	27.0	28.2	29.5	33.0	36.5	40.0	43.5	48.5
36.0	28.0	28.0	28.0	30.0	31.5	33.0	36.5	40.5	44.5	52.0	60.0
42.0	33.0	33.0	33.0	35.0	37.0	39.5	46.5	51.5	57.5	61.5	68.5

R1

13. ANALYSIS OF BURIED PIPING

.01 Seismic analysis of Seismic Category I buried piping shall be based upon Newmark's method, "Earthquake Response Analysis of Reactor Structures", and Hetényi's theory, "Beams on Elastic Foundations". The analysis shall include calculation of stresses in the buried portion of the piping due to loads acting on the nonburied portion of the piping inside the building (interaction effect), superimposed on the stresses due to various loads acting on the buried portion of the piping. The resultant stresses shall be within the allowable stress criteria of the applicable portion of ASME Section III.

.02 Settlement in the fill along the piping due to differential depth of backfill will not cause any significant stresses in the piping.

.03 At points where piping leaves the ground and is attached to structures, the maximum possible differential movement between the ground and the structure shall be determined. The differential movement must be absorbed either by providing sufficient flexibility in the piping from the ground to the structure, or by the use of flexible joints in the piping. R1

.04 In instances where piping which enters structures is supported or anchored within the structure and not at the wall penetration, the wall penetration must be sized to provide sufficient room for differential pipe movement.

.05 The excavated area under the 30 in. and 8 in. service water pipe lines, between the Tank Building and Turbine Building walls and the rock or natural ground, was backfilled with concrete which will have insignificant differential settlement.

.06 The fill in the yard area supporting Seismic Category I piping is not subject to liquefaction during a seismic event.

.07 For the analysis of Seismic Category I pipes buried in fill in the yard the following properties are to be used:

Soil Density (pcf)	135
Soil Subgrade Modulus (lb /sq. in/in)	50
Pressure Wave Velocity (fps)	1500
Coefficient of Friction	0.2
Maximum Velocity of Free Field Earthquake Motion (ft/sec.)	0.09
Maximum Acceleration of Free Field Earthquake Motion (ft/sec sq)	3.8
Velocity of Compressional Wave Propagation in Soil (fps)	2300
Velocity of Shear Wave Propagation in Soil (fps)	870

R1

13. ANALYSIS OF BURIED PIPING (Cont'd)

.08 Field tests to determine the moisture content and density of the fill were performed on the five types of random fill prior to construction in order to develop the construction procedure and also during actual fill placement. Average values of the test results are given below:

Type 1: Brown clayey silt with yellow silty clay:

Dry Density	=	114 pcf
Moisture Content	=	10 percent
Compaction	=	97 percent maximum standard proctor density

Type 2: Brown clayey (sandy) silt with pieces of siltstone and some sandstone:

Dry Density	=	125 pcf
Moisture Content	=	7 percent
Compaction	=	98 percent maximum standard proctor density

R1

Type 3: Brown clayey silt with yellow silty clay:

Dry Density	=	117 pcf
Moisture Content	=	13 percent
Compaction	=	99 percent maximum standard proctor density

Type 4: Brown clayey silt with pieces of siltstone (rock sized up to 10 in.):

Dry Density	=	127 pcf
Moisture Content	=	7.5 percent
Compaction	=	98 percent maximum standard proctor density

13. ANALYSIS OF BURIED PIPING (Cont'd)

.08 (Cont'd)

Type 5: Brown siltstone (rock sized up to 21 in.):

Dry Density	=	136 pcf from test fill section	R1
Moisture Content	=	4.5 percent	

14. PIPE RUPTURE ANALYSIS

.01 The capability to safely shutdown the plant and maintain a cold shutdown condition must not be impaired by the effects of the postulated pipe breaks. This is accomplished by a combination of design features such as separation, barriers and pipe whip restraints. After a postulated pipe break event, the consequences are considered to be:

a. Pipe whip
b. Jet impingement
c. Compartment pressurization
d. Compartment flooding
e. High temperature/high humidity environment

.02 The criteria used for the protection against dynamic effects associated with postulated pipe rupture are as follows:

a. Branch Technical Position APCSB 3-1
b. Branch Technical Position MEB 3-1

c. ETR-1002

.03 Main steam and feedwater piping between the containment penetration and the pipe rupture restraint system outside containment are not subject to the postulation of pipe breaks. R1

.04 In conducting the pipe rupture analysis, the following assumptions are used:

a. If the postulated pipe failure results in an automatic separation of the turbine generator from the power grid, or results in an automatic reactor trip, then offsite power is assumed to be unavailable.

b. If the postulated pipe failure requires safety system response to the event, the analysis assumes a single active component failure in either the safety systems required to mitigate the consequences of the event or their auxiliary supporting features except as noted in item 14.04d The single active failure is in addition to the postulated pipe failure and any direct consequence of the piping failure.

c. Operator action to mitigate the consequences of the postulated pipe failure is analyzed for each specific event. The feasibility of initiating operator actions on a timely basis, as well as the accessibility provided to allow the operator actions, is demonstrated.

14. PIPE RUPTURE ANALYSIS (Cont'd)

d. Where the postulated piping failure is assumed to occur in one of two or more redundant trains of a dual purpose moderate energy essential system (i.e., one required to operate during normal plant conditions as well as to shutdown the reactor and mitigate the consequences of the piping failure), single failures of components in the other train or trains of that system only are not assumed, provided the system is designed to Seismic Category I standards, is powered from both offsite and onsite sources, and is constructed, operated and inspected to quality assurance, testing, and inservice inspection standards appropriate for nuclear safety systems.

e. An unrestrained whipping pipe is considered capable of:

i) Rupturing impacted pipes of smaller nominal pipe sizes, and
ii) Developing through-wall leakage cracks in equal or larger nominal pipe sizes with thinner wall thicknesses.

The energy level in a whipping pipe is considered insufficient to rupture an impacted pipe of equal or greater nominal pipe size and equal or heavier wall thickness.

f. Jet impingement forces from a given pipe of specified nominal pipe size and wall thickness are considered capable of:

i) Rupturing targeted pipes of smaller nominal pipe size, and R1
ii) Developing through-wall leakage cracks in pipe of larger nominal pipe size and thinner wall thickness.

15. SEISMIC INTERACTION STUDY

In NRC Regulatory Guide 1.29, the requirement to survive the effects of the safe shutdown earthquake include systems and components whose function may not be required for safe shutdown but whose failure may prevent a system important to safety from functioning. To address this requirement, a seismic interaction study was performed for the Shearon Harris plant. The guidelines, methodology, and evaluation criteria used in this study, as it applies to piping and supports covered under this specification are summarized below:

Step 1: The first step is the designation of structures, systems and components as targets or sources. A target is defined as any safety-related structure, system, and component required to safely shutdown the plant and maintain the plant in a safe shutdown condition, and certain accident mitigating systems such as containment isolation, main steam isolation and main feedwater isolation. All nonsafety related systems, piping and components are designated as sources.

R1

15. SEISMIC INTERACTION STUDY (Cont'd)

Step 2: The second step is the identification of interactions involving sources and targets. This is accomplished by review of system piping drawings, HVAC duct routing drawings, conduit and cable tray drawings, general arrangements and civil/structural design drawings. In addition, all pertinent spatial considerations were incorporated in the study.

Step 3: Step 3 is the evaluation and disposition status of identified interactions. Based upon established acceptance criteria, each interaction is evaluated and classified as acceptable or unacceptable and documented along with the identification of the interaction components, source(s) and target(s), description of the interaction, and pertinent spatial data.

Step 4: Step 4 is the corrective action taken to resolve unacceptable interactions. The first course of action is to relocate the nonsafety system or component to an area where an adverse system interaction is not possible. Where it is impracticable to relocate systems or components due to equipment layout or construction progress in the area, the identified detrimental source will be seismically designed to prevent interaction with a target. Unacceptable piping sources are seismically designed and so designated as "SD" in the Piping Line List, Appendix D. In some cases only portions of lines need be seismically designed, these lines will so be noted in the remarks column of the Piping Line List. Piping lines or portions of lines designated seismically designed are stress analyzed to establish design loading and locations for supports and restraints.

R1

16. ALLOWABLE PIPE STRESS

.01 The allowable stresses for piping covered by this specification, except for the pressurizer safety and relief valves discharge piping under sustained and dynamic loadings during normal operation, are as follows:

Plant Condition	Equation	S Allowable
Normal	(8)	$1.0S_h$
	(10)	S_A
	(11)	$S_h + S_A$
Upset	(9)	$1.2S_h$
	(10)	S_A
	(11)	$S_h + S_A$
Emergency	(9)	$1.8S_h$
Faulted	(9)	$2.4S_h$
Test	(9)	$1.35SY$

where S_h, S_A, SY and Equations 8 thru 11 are defined by ASME Section III, Subsections NC & ND. R1

.02 The allowable stresses for the seismically designed pressurizer safety relief valve discharge piping under sustained and dynamic loadings during normal operation are as follows:

Plant/System Operating Condition	Load Combination	Stress Allowables
Normal	N	$1.0S_h$
Upset	N + SOT_U	$1.2S_h$
Upset	N + OBE + SOT_U	$1.8S_h$
Emergency	N + SOT_E	$1.8S_h$
Faulted	N + MS/FWPB or DBPB + SSE + SOT_F	$2.4S_h$
Faulted	N + LOCA + SSE + SOT_F	$2.4S_h$

where,

R1

16. ALLOWABLE PIPE STRESS (Cont'd)

.02 (Cont'd)

N	=	Sustained Loads During Normal Plant Operation
SOT	=	System Operating Transient
SOT_U	=	Relief Valve Discharge Transient (1)
SOT_E	=	Safety Valve Discharge Transient (1)
SOT_F	=	Max (SOT_U; SOT_E); or Transition Flow
OBE	=	Operating Basis Earthquake
SSE	=	Safe Shutdown Earthquake
MS/FWPB	=	Main Steam or Feedwater Pipe Break
DBPB	=	Design Basis Pipe Break
LOCA	=	Loss of Coolant Accident

R1

(1) May also include transition flow, if determined that required operating procedures could lead to this condition.

.03 Essential piping is indicated by the designation "E" in the ISI column in the Piping Line List, Appendix D. For this essential piping, the Emergency stress allowables apply for loading combinations 4 thru 10 given in Appendix F. For all other piping listed in Appendix D and covered by the scope of this specification, the Faulted stress allowables apply for loading combinations 4 thru 10 given in Appendix F.

APPENDIX A
(DELETED)

R1

APPENDIX B
Thermal Mode Diagrams

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes
1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic
Category I and Seismically Designed Piping and Supports | R1

Project Identification
No. CAR-SH-M-71

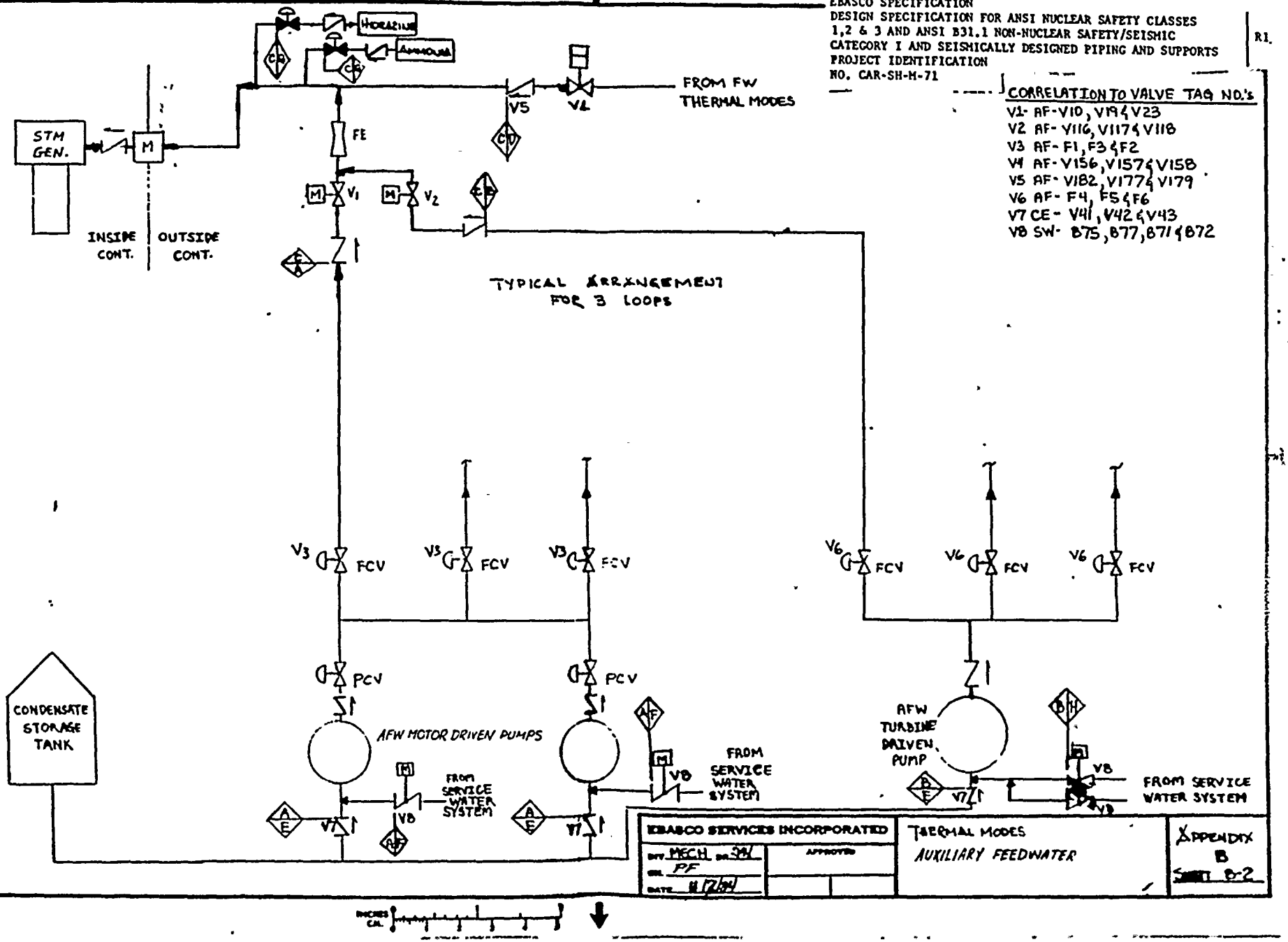
SYSTEMS

Auxiliary Feedwater
Boron Recycle
Chemical & Volume Control
Chilled Water Supply & Return
Component Cooling
Containment Spray
Feedwater
Fuel Oil
Main Steam
Reactor Coolant
Safety Injection/RHR
Spent Fuel Pool Cooling & Cleanup | R1
Steam Generator Blowdown
Service Water

EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION NO. CAR-SH-M-71

R1.

CORRELATION TO VALVE TAG NO.'s
V1- AF-V10, V19 & V23
V2 AF- V116, V117 & V118
V3 AF- F1, F3 & F2
V4 AF- V156, V157 & V158
V5 AF- V182, V177 & V179
V6 AF- F4, F5 & F6
V7 CE- V41, V42 & V43
V8 SW- B75, B77, B71 & B72



EBASCO SERVICES INCORPORATED	THERMAL MODES AUXILIARY FEEDWATER	APPENDIX B SHEET B-2
DIV MECH DR. 341 CHK PF DATE 11/7/84	APPROVED	

				OPERATING TEMPERATURE (°F)																	
NO.	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	A	B	C	D	E	F	G	H										
1	25-100% POWER OPERATION	NORMAL	NOT OPERATING	AMB.	AMB.	328 TO 435	328 TO 435	AMB.	60	126	60										
2	HYDROTEST	NORMAL	NORMAL	AMB.	AMB.	AMB.	AMB.	AMB.	60	AMB.	60										
3	STARTUP TO 25% POWER	NORMAL	NORMAL	AMB.	AMB.	AMB. TO 328	AMB.	AMB.	60	126	60										
4	SHUTDOWN TO HOT STANDBY	NORMAL	NORMAL	AMB.	AMB.	AMB. TO 435	AMB.	AMB.	60	126	60										
5	MS SAFETY VALVE OPERATION	UPSET	UPSET	120	435	435	AMB. TO 435	AMB. TO 435	60	126	60										
6	LOCA; MSLB; FWLB	FAULTED	UPSET	120	120	120	AMB TO 435	AMB. TO 120	60	126	60										
7																					
8																					
9		1																			
10																					

NOTES:

1- POSITION SPECIFIED IS THE FINAL VALVE POSITION

2- VALVES V8 ARE OPENED IF LEVEL IN CONDENSATE STORAGE TANK IS BELOW MINIMUM. IN THIS CASE, VALVES V7 WILL CLOSE.

3- AMB. EQUALS THE TEMPERATURE OF THE CONTENTS OF THE CONDENSATE STORAGE TANK

4 ONE EACH OF VALVES V1, V2 V3 & V6 WILL CLOSE TO ISOLATE THAT STM. GEN. IN WHICH A RUPTURE HAS OCCURED.

(1) VALVE POSITION {O: NORMALLY OPEN, C: NORMALLY CLOSED}

	SYSTEM OPERATING MODE	V1	V2	V3	V4	V5	V6	V7	V8	V	V	V	V	V
1	HOT OPER.	O	O	C	O	C	C	C	C					
2	NORMAL	NA	NA	NA	NA	NA	NA	NA	NA					
3	NORMAL	O	O	O	O	O	O	O	C					
4	NORMAL	O	O	O	C	C	O	O	C					
5	UPSET	O	O	O	C	C	O	O	C					
6	UPSET	O(4)	O(4)	O(4)	C	C	O(4)	O(2)	C(2)					
7														
8														
9														
10														

EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2&3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I & SEISMICALLY DESIGNED PIPING & SUPPORTS

PROJECT IDENTIFICATION NO. CAR-SH-M-71

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS DWG G-044

EBASCO SERVICES INCORPORATED		THERMAL MODES OF OPERATION	APPENDIX B
DESIGN BECH DATE 10-21	APPROVED	AUXILIARY FEEDWATER SYSTEM	SHEET 2 OF 2
CHK JDC			
DATE 11/21/74			

CLIENT CP&L

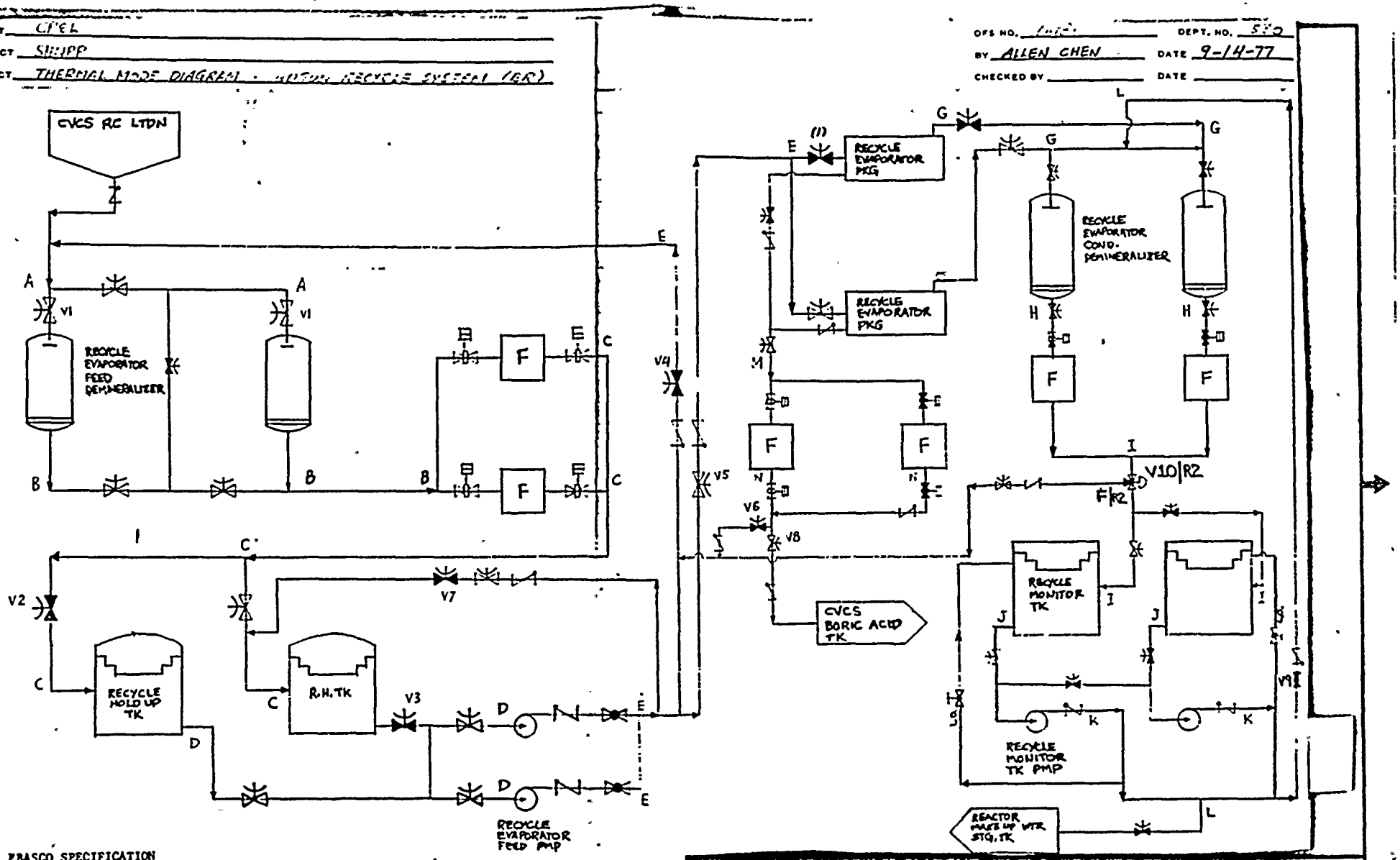
PROJECT SHNPP

SUBJECT THERMAL MODE DIAGRAM - BORON RECYCLE SYSTEM (BR)

OFS NO. [illegible] DEPT. NO. 5352

BY ALLEN CHEN DATE 9-14-77

CHECKED BY _____ DATE _____



EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION NO. CAR-SH-M-71

R1

EBASCO SERVICES INCORPORATED

THERMAL MODE BORON RECYCLE

APPENDIX B

SHEET B-41

OPERATING TEMPERATURE (°F)

NO.	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	A	B	C	D	E	G	H	I	J	K	L	M	N	O				
1	NORMAL	NORMAL	NORMAL	115	115	115	120	115	130	130	130	130	130	130	130	130	120				
2	NORMAL	NORMAL	ABNORMAL (UPSET)	140	140	140	140	140	130	130	130				180	180					
3																					
4																					
5																					
6																					
7																					
8																					
9		1																			
10																					

NOTES:

1) ONLY ONE EVAPORATOR SHOULD BE IN OPERATION AT ANY TIME.

VALVE POSITION {O: NORMALLY OPEN, C: NORMALLY CLOSED}

SYSTEM OPERATING MODE	V1	V2	V3	V4	V5	V6	V7	V8	V9	V	V	V	V
1 NORMAL	O	C	C	C	O	C	O	O	C				
2													
3													
4													
5													
6													
7													
8													
9													
10													

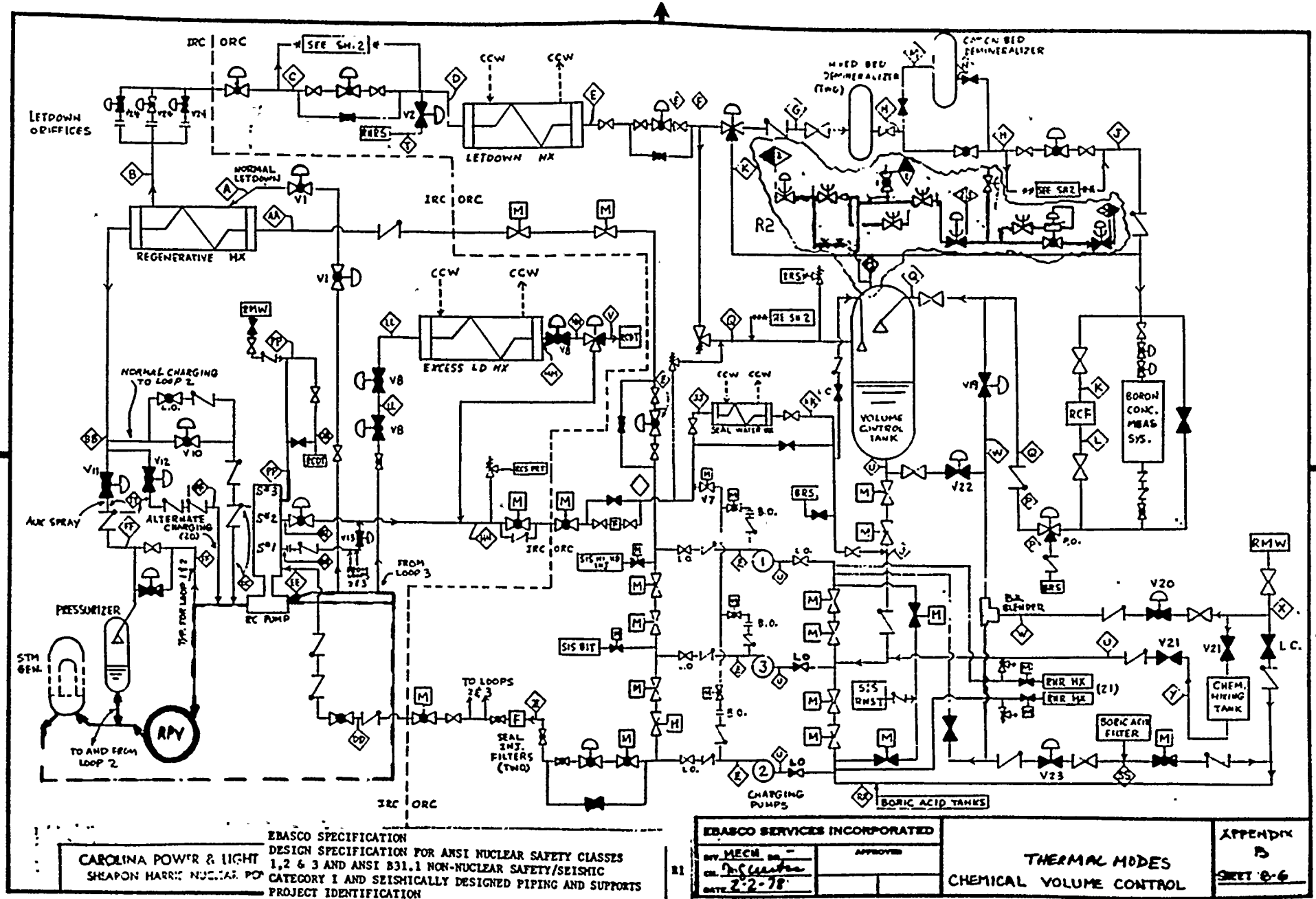
EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ASME NUCLEAR SAFETY CLASSES 1, 2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING & SUPPORTS

PROJECT IDENTIFICATION
No. CAR-SH-M-71

R1 SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS DWG _____

EBASCO SERVICES INCORPORATED		SYSTEM	APPENDIX
MECH 2-28-85	APPROVED	BORON RECYCLE	B SHEET 2 of 2
PSE 2-28-85			

B-5



CAROLINA POWER & LIGHT
SHEARON HARRIS NUCLEAR POWER PLANT

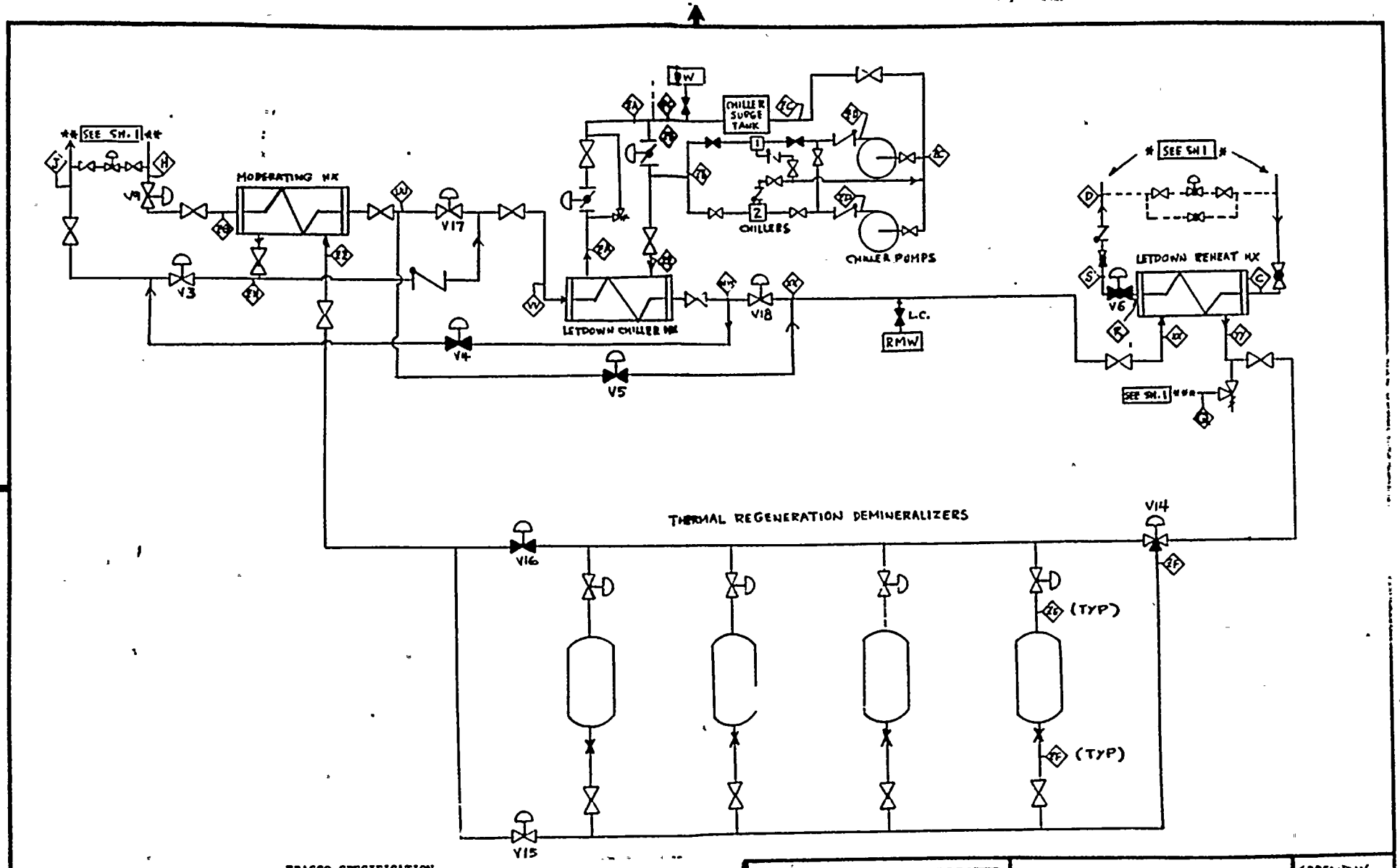
EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION NO. CAR-SH-M-71

R1

EBASCO SERVICES INCORPORATED

DEV. MECH.	APPROVED	THERMAL MODES
CH. [signature]		CHEMICAL VOLUME CONTROL
DATE 2-2-78		

APPENDIX B
SHEET B-6



CAROLINA POWER & LIGHT CO
SHEARON HARRIS NUCLEAR POWER

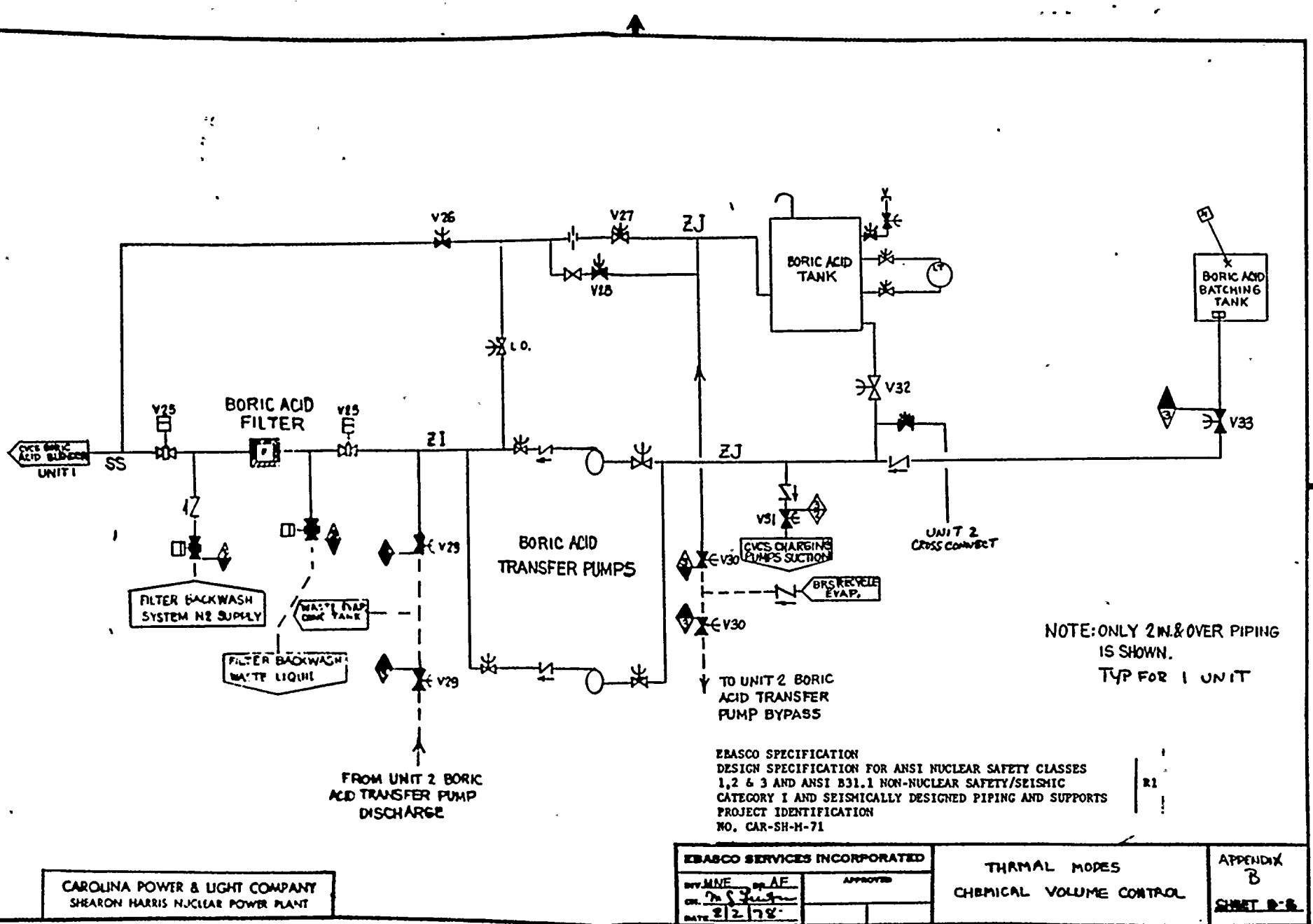
EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION
NO. CAR-SH-M-71

R1

EBASCO SERVICES INCORPORATED
BY MECH
CH
DATE 2-2-78
APPROVED

THERMAL MODES
CHEMICAL VOLUME CONTROL

APPENDIX B
SHEET B-7


V26
V27
ZJ
V18
BORIC ACID TANK
BORIC ACID BATCHING TANK
L.O.
V32
V33
V25
BORIC ACID FILTER
V15
ZI
ZJ
SS
UNIT 1
V31
V29
BORIC ACID TRANSFER PUMPS
V30
CVCS CHARGING PUMPS SUCTION
BRS RECYCLE EVAP.
UNIT 2 CROSS CONNECT
FILTER BACKWASH SYSTEM N2 SUPPLY
WASTE DRAIN TANK
FILTER BACKWASH WASTE LIQUID
TO UNIT 2 BORIC ACID TRANSFER PUMP BYPASS
FROM UNIT 2 BORIC ACID TRANSFER PUMP DISCHARGE
NOTE: ONLY 2 IN. & OVER PIPING IS SHOWN. TYP FOR 1 UNIT
EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION NO. CAR-SH-M-71
R1
CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT
EBASCO SERVICES INCORPORATED
DRV. MNE DR. AF
APPROVED
DATE 8/2/78
THERMAL MODES
CHEMICAL VOLUME CONTROL
APPENDIX B
SHEET B-8

NO	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	OPERATING TEMPERATURE (°F) A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T
1	CONSTANT POWER	NORMAL	NORMAL (NO BIRS) (14)	559	590 (11)	583 (11)	293 (11)	115	115	115	115	115	116	113	115 (3)	116 (3)	113	113	293	293	AMB
2	POWER GENERATION	NORMAL	DILUTION (NORMAL) (12)	554	590	293	293	115	115	115	115	104 (7)	104	104	115 (3)	115 (3)	104	104	100	293	AMB
3	POWER GENERATION	NORMAL	BORATION (NORMAL) (13)	554	590	293	280 (8)	115	115	115	116	106 (9)	106	106	115 (3)	115 (3)	106	106	250	250	AMB
4	REFUELING	NORMAL	RHR PURIFICATION (NORMAL) (5,14,16)	350	350	350	350	115	115	115	115	115	115	113	115	115	113	113	350	350	350
5	POWER GEN & START-UP	NORMAL	EXCESS LETDOWN FLOW (NORMAL) (4,16)	554	554	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB
6	START-UP	NORMAL	EXCESS LETDOWN FLOW TO RCDT (NORMAL)	559	559	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB
7	NORMAL	NORMAL	ABNORMAL (UPSET)	609	609	382	382	382	250	150	150	80	250	250	150	150	160	250	382	382	350
8																					
9																					
10																					

NOTES:

+ WHEN A VALVE POSITION IS NOT SPECIFIED THE POSITION IS NOT RELEVENT TO THE SPECIFIED MODE.

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

VALVE POSITION (O=NORMALLY OPEN, C=NORMALLY CLOSED)

SYSTEM OPERATING MODE	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13
1 NORMAL	O	C	C	C	C	C	O	C	C	O	C	C	C
2 DILUTION	O	C	O	C	C	C	O	C	O	O	C	C	C
3 BORATION	O	C	C	O	O	O	O	C	O	O	O	C	C
4 RHR PUR	C	O	C	C	+	C	O	C	C	O	O	C	+
5 EXCESS L	C	C	+	+	+	+	O	O	O	C	C	C	C
6 EXCESS L	C	C	+	+	+	+	O	O	O	C	C	C	C
7 ABNORM	O	C	+	+	+	+	O	C	+	O	C	C	C
8													
9													
10													

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports
Project Identification
No. CAR-SH-M-71

R1

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS DWG. _____

EBASCO SERVICES INCORPORATED
DRN. MNB CK. JEL APPROVED
DATE 2-28-85

SYSTEM: CHEMICAL VOLUME CONTROL

APPENDIX S
PAGE 4 OF 7

OPERATING TEMPERATURE (°F)

	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM
1	CONSTANT POWER	NORMAL	NORMAL (14) (NO BTRS)	115	AMB	AMB	125	AMB	130 (4)	130	501 (11)	501 (17)	130	130	555	150	150	150	115	AMB	AMB
2	POWER GENERATION	NORMAL	DILUTION (12) (NORMAL)	115	AMB	AMB	125	AMB	130 (4)	130	501	501	130	130	555	150	150	150	115	AMB	AMB
3	POWER GENERATION	NORMAL	BORATION (13) (NORMAL)	115	AMB	AMB	125	115 (11)	130 (4)	130	501	501	130	130	555	150	150	150	115	AMB	AMB
4	REFUELING	NORMAL	RHR PURIFICATION (NORMAL) (11,14,15)	115	AMB	AMB	125	AMB	130 (4)	130	130	130	130	130	350 (18)	150	150	150	115	AMB	AMB
5	POWER GEN & START-UP	NORMAL	EXCESS LETDOWN (NORMAL) (10,16)	115	AMB	AMB	125	AMB	130 (4)	AMB	AMB	AMB	130	130	555	150	160	160	115	559	165
6	START-UP	NORMAL	EXCESS LETDOWN FLOW TO RCP (NORMAL)	115	115	AMB	125	AMB	130 (4)	AMB	AMB	159	80	130	555	150	150	150	115	559	165
7	NORMAL	NORMAL	(SEE NOTES)	(23)(26) 150	(26) 200	(26) 110	125	(24)(26) 120	(21)(26) 170	(26) 250	(26) 350	(26) 90	(27) 300	(27) 855	(26) 589	(18) 591	(26) 200	(26) 200	(26) 200	(26) 589	(26) 589
8																					
9																					
10																					

VALVE POSITION (O=NORMALLY OPEN, C=NORMALLY CLOSED)

	OPERATING MODE	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26
1	NORMAL	(6)†	+	+	+	+	C	C	(6)+	C	C	(10)O	O	C
2	DILUTION	O	O	C	O	O	C	C	+	C	C	O	O	C
3	BORATION	O	C	O	C	C	C	C	O	C	C	O	O	C
4	RHR PUR	+	+	+	+	+	C	C	C	C	C	C	O	C
5	EXCESS L	+	+	+	+	+	C	C	C	C	C	C	O	C
6	EXCESS L	+	+	+	+	+	C	C	C	C	C	C	O	C
7	ABNORMAL	+	+	+	+	+	C	C	C	C	C	C	O	C
8														
9														
10														

NOTES:

† WHEN A VALVE POSITION IS NOT SPECIFIED THE POSITION IS NOT RELEVANT TO THE SPECIFIED MODE.

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM: PROCESS.DWG

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category 1 and Seismically Designed Piping and Supports
Project Identification
No. CAR-SH-M-71

R1

EBASCO SERVICES INCORPORATED		SYSTEM	APPENDIX
BY MNE ON 2/11	APPROVED	CHEMICAL VOLUME CONTROL	B
CK PF			SHEET 6 OF 7
DATE 2-20-85			

B-10

OPERATING TEMPERATURE (°F)

	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	NN	PP	QQ	RR	SS	TT	UU	VV	WW	XX	YY	ZZ	ZA	ZB	ZC	ZD	ZE	ZF
1	Constant Power	Normal	(14) Normal (No BTRS)	150	160	160	165	75	(17) 501	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB
2	Power Generation	Normal	(12) Dilution (Normal)	150	160	160	115	75	501	73	73	80	50	50	50	(5) 65	(5) 39	46	(4) 96	90	90
3	Power Generation	Normal	(13) Boration (Normal)	150	160	160	115	75	501	81	124	96	81	140	140	(5) 55	(5) 39	46	(4) 146	140	140
4	Refueling	Normal	(13,15) RHR Purification (Normal)	150	160	160	115	75	(17) 130	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB
5	Power Gen & Start-up	Normal	(14,16) Excess Letdown (Normal)	165	160	160	115	75	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB
6	Start-up	Normal	Excess Letdown Rou to Rcdt (Normal)	165	160	160	115	75	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB
7	Normal	Normal	(SEE NOTES)	(26) 300	(26) 120	(26) 200	(28) 300	(29) 220	(26) 560	(26) 160	(26) 160	(26) 160	(26) 160	(26) 160	(26) 105	(26) 105	(26) 105	(26) 105	(26) 105	(26) 160	(26) 160
8																					
9																					
10																					

VALVE POSITION { O NORMALLY OPEN, C NORMALLY CLOSED }

SYSTEM OPERATING MODE	V27	V28	V29	V30	V31	V32	V	V	V	V	V	V	V
1 Normal	O	C	C	C	C	O							
2 Dilution	O	C	C	C	C	O							
3 Boration	O	C	C	C	O	O							
4 RHR Pur	O	C	C	C	C	O							
5 Excess L	O	C	C	C	C	O							
6 Excess L	O	C	C	C	C	O							
7 Abnormal	O	C	C	C	C	O							
8													
9													
10													

NOTES:

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes
1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic
Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS DWG _____

EBASCO SERVICES INCORPORATED
DRN MNE DATE 2-7
CH. PE DATE 2-28-85
APPROVED

SYSTEM
CHEMICAL VOLUME CONTROL

APPENDIX B
SHEET 6 OF 7

B-11

NO	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	OPERATING TEMPERATURE (°F) ZG	ZH	ZI	ZJ
1	CONSTANT POWER	NORMAL	NORMAL (11) (NO BTRS)	AMB	AMB	75	95
2	POWER GENERATION	NORMAL	DILUTION (NORMAL) (12)	AMB	92	75	75
3	POWER GENERATION	NORMAL	BORATION (NORMAL) (13)	AMB	114	75	75
4	COLD SHUTDOWN	NORMAL	RHE (13,14,16) PURIFICATION (NORMAL)	AMB	AMB	75	75
5	POWER GEN & START-UP	NORMAL	EXCESS LETDOWN (NORMAL) (14,16)	AMB	AMB	75	75
6	START-UP	NORMAL	EXCESS LETDOWN FLOW TO RCDT (NORMAL)	AMB	AMB	75	75
7	NORMAL	NORMAL	(SEE NOTES)	AMB (26) 160	AMB (26) 160	75 (28) 220	75 (28) 220
8							
9							
10							

NOTES:

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

VALVE POSITION { C=NORMALLY OPEN / C=NORMALLY CLOSED }

SYSTEM OPERATING MODE	V	V	V	V	V	V	V	V	V	V	V	V	V
1 NORMAL													
2 DILUTION													
3 BORATION													
4 PUR PUR													
5 EXC LET													
6 EXC LET													
7 ABNORMAL													
8													
9													
10													

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS.DWG

EBASCO SERVICES INCORPORATED		SYSTEM	APPENDIX
DR. MNE	APPROVED	CHEMICAL VOLUME CONTROL	B
CH. PP			SHEET NO. 7
DATE 2-28-85			

8-12

THERMAL MODES OF OPERATION - CVCS

NOTES:

1) [illegible] shown unless otherwise noted.
2) AMB denotes: Ambient
3) When CBD is not in use, temperature is AMB
4) One pump operation. Other pump(s) are pressurized downstream at discharge check valve(s). 130°F is maximum allowable temp.
5) Downstream of butterfly TCV's, mixing of 39° & 55° yields 46° to Chiller Surge Tank.
6) During dilution, flow is straight through. During boration, flow is through branch.
7) Mixing 92° water from Moderating HX with main CVCS letdown flow of 115° yields 104° (est.)
8) Mixing 250° water from Letdown Reheat HX (T.S.) with 293° main CVCS letdown flow yields 280° (est).
9) Similar to note 7, with 96°, yields 106°(est.).
10) One valve normally open. All three closed for RHRS Purification and Excess Letdown.
11) Chemical Mixing Tank used intermittently for PH control, and for oxygen control during startup from cold position.
This tank is not necessarily used during Borate mode.
12) Dilution Mode of Reactor Makeup Water System may also operate at this time. Relevant points affected are as follows:

	Q	W	X	
Valves V20 & V19 are open	110°	115°	120°	There is an additional Alternate Dilute Mode, where valve V22 is also open, allowing water to flow to charging Pump suction header. No other conditions are affected.

13) Borate Mode of Reactor Makeup Water System may also operate at this time. Relevant points affected are as follows:

	SS	W	U
Valves V23 and V22 are open.	75°	75°	110°

14) Automatic Mode of Reactor Makeup Water System may also operate at this time. Relevant points affected are as follows:

	SS	X	W	U
Valves V20, V22, V23, are open.	75°	120°	95°	110°

15) The highest temperature is listed, and exists at initiation of this mode. When normal letdown line not available. Flow through excess letdown line may be directed to RCDT. During startup, excess letdown line may be used, with flow to RCDT, to supplement main letdown flow. Conditions for flow to RCDT during power operation are similar except where noted.

R1

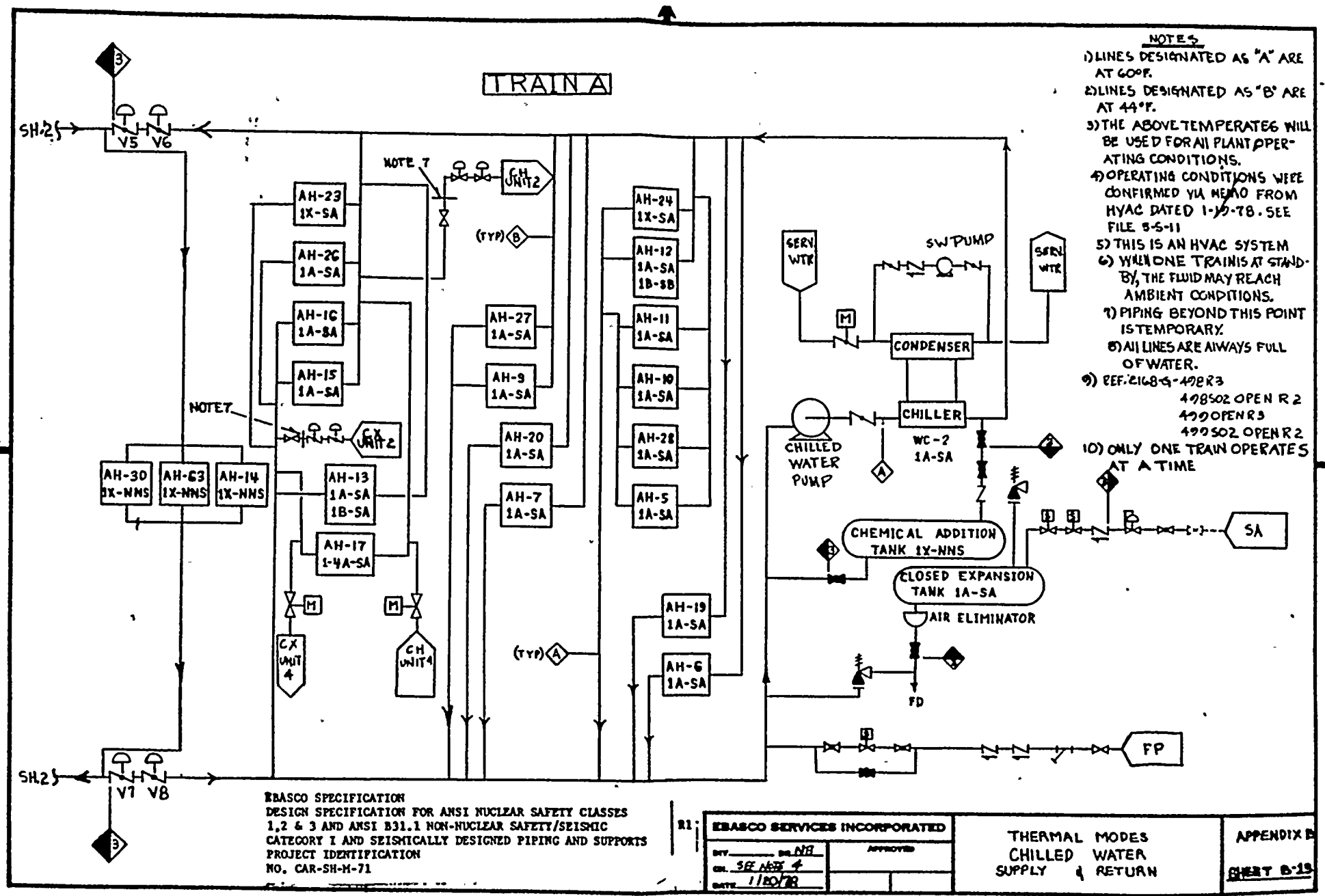
THERMAL MODES OF OPERATION - CVCS

17) Temperatures at these points differ as follows:

	B	C	D	BB	CC
CVCS Purification	300	300	300	429	429
Heatup	380	380	380	466	466

18) Aux Spray line may operate at this time. 130° charging water will mix with main spray bleed bypass line from RCS.
19) For Aux Spray line only (see Note 18). For Atl. Charging line, temperature is AMB.
20) Charging line may be used at any time at operator preference. When in use, V2 opens, V10 closes, and conditions are the same as charging line conditions. Pt CC will then see RCS conditions.
21) Refer to Thermal Modes of Operation for RHRS & SIS for details in this area.
22) Upstream of valve V7 is 300°. Charging pump header 300°.
23) Downstream of suction line check valve to pump suction is 300°.
24) To charging line check valve IRC.
25) To first isolation valves. Plant Condition Emergency, System Condition-Emergency
26) Plant Condition-Normal; System Condition-Upset
27) Plant Condition-Faulted; System Condition-Faulted
28) Plant Condition-Faulted; System Condition-Normal
29) Plant Condition-Normal; System Condition-Emergency

R1



NOTES

1) LINES DESIGNATED AS "A" ARE AT 60°F.
2) LINES DESIGNATED AS "B" ARE AT 44°F.
3) THE ABOVE TEMPERATES WILL BE USED FOR ALL PLANT OPERATING CONDITIONS.
4) OPERATING CONDITIONS WERE CONFIRMED VIA MEMO FROM HVAC DATED 1-19-78. SEE FILE 5-5-11
5) THIS IS AN HVAC SYSTEM
6) WHEN ONE TRAIN IS AT STAND-BY, THE FLUID MAY REACH AMBIENT CONDITIONS.
7) PIPING BEYOND THIS POINT IS TEMPORARY.
8) ALL LINES ARE ALWAYS FULL OF WATER.
9) REF. 2168-G-498 R3
   498 SO2 OPEN R 2
   499 OPEN R 3
   499 SO2 OPEN R 2
10) ONLY ONE TRAIN OPERATES AT A TIME

EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION NO. CAR-SH-M-71

R1

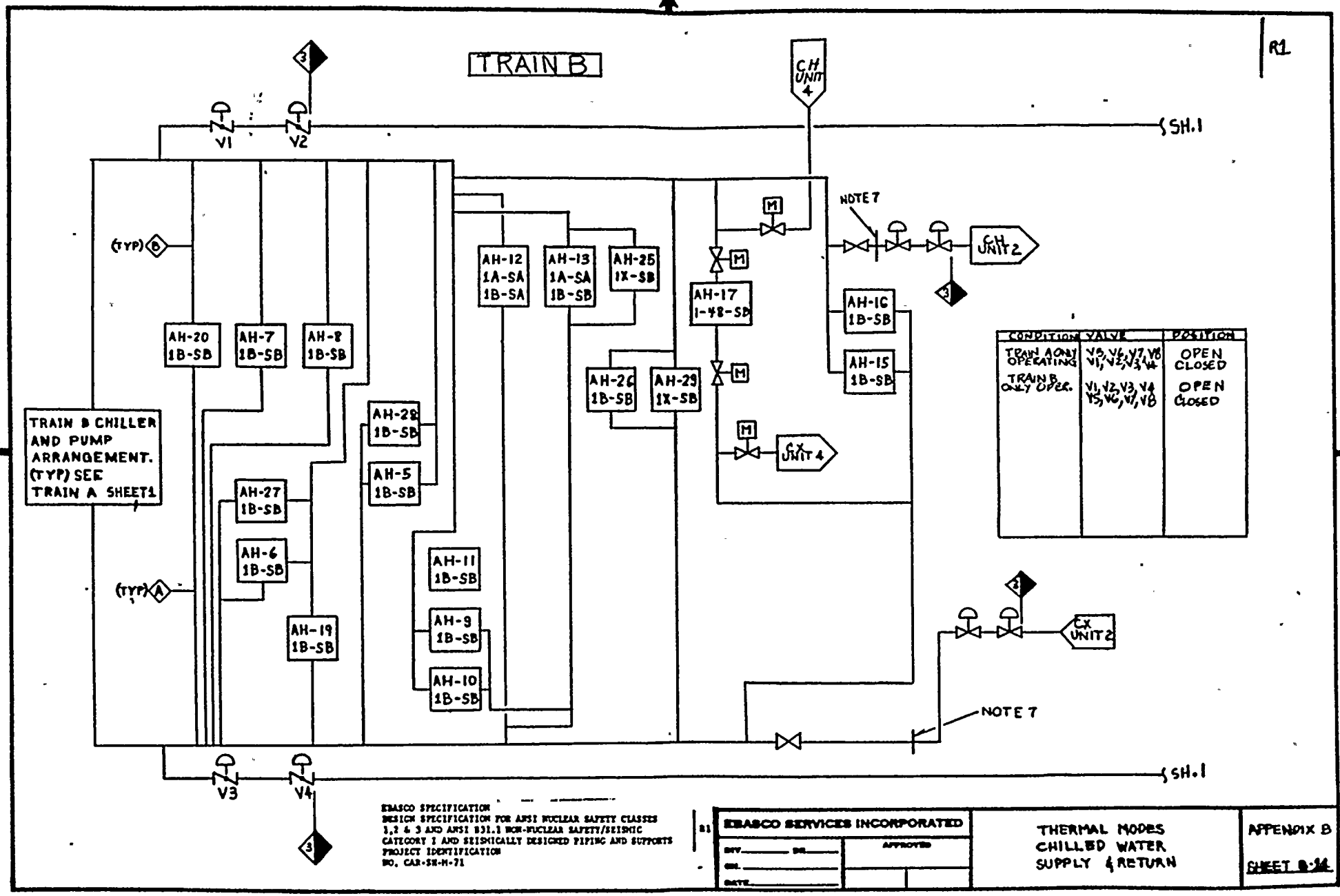
EBASCO SERVICES INCORPORATED

DWN. _____ DES. NB
CHK. SEE NOTE 4
DATE 1/20/78

APPROVED

THERMAL MODES
CHILLED WATER
SUPPLY & RETURN

APPENDIX B
SHEET B-19



EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION
NO. CAR-SH-M-71

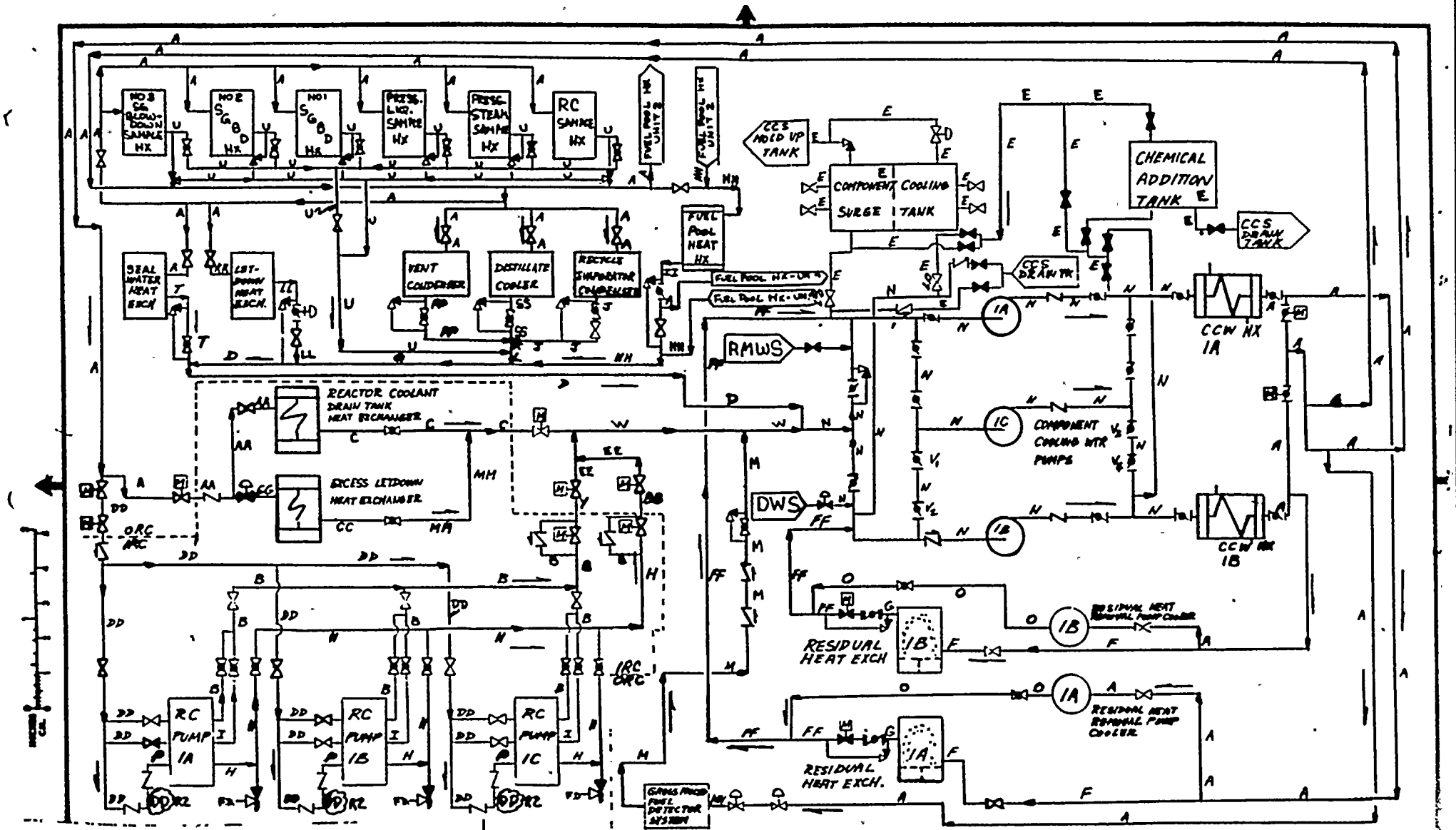
R1

EBASCO SERVICES INCORPORATED

DEV. DES.
CHK. APPROVED
DATE

THERMAL MODES
CHILLED WATER
SUPPLY & RETURN

APPENDIX B
SHEET B-14



EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION NO. CAR-SH-M-71

REV	DATE	REVISION	BY	CHK
R1 2	1-10-85	P REV. TO DD PENDING	TH	
1	1/11/76	GENERAL REVISION	MJL	

EBASCO SERVICES INCORPORATED
DIV. MNE BR. TC
DR. APPROVED
CH.
DATE 5-5-76

THERMAL MODES COMPONENT COOLING

APPENDIX B
SHEET 15

OPERATING TEMPERATURE (°F)

	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	NORMAL OPERATION	NORMAL	NORMAL	105	115	125	114	AMB	AMB	AMB	122	106	131	127	126	164	116	105 ③	105	112		
2	START-UP	NORMAL	NORMAL	105	115	125	114	116	AMB	AMB	122	106	131	127	126	164	116	105 ③	105	112		
3	SHUTDOWN 4 HRS	NORMAL	NORMAL	105	115	125	114	AMB	AMB	AMB	122	106	131	127	126	164	116	105	105	112		
4	SHUTDOWN ① 20 HRS	NORMAL	NORMAL	120	130	140	129	AMB	120	145	137	121	146	142	141	164	131	125	120	127		
5	REFUELING	NORMAL	NORMAL	105	AMB	105	112	AMB	105	120	AMB	AMB	131	127	126	164	116	110	AMB	112		
6	SAFETY INJECTION	FAULTED	NORMAL	105	105	125	48	AMB	120	145	122	106	131	115	115	164	145	110	554	105		
7	POST ACCIDENT	FAULTED	NORMAL	105	115	125	118	AMB	120	145	122	106	131	115	115	164	145	110	122	105		
8	LOSS OF POWER NOT STAND BY PUMP SEAL HEAT	UPSET	NORMAL	105	115	125	118	AMB	120	145	122	106	131	115	115	164	145	110	122	105		
9	RCP THERMAL BARRIER RUPTURE	EMERG.	EMERG.	200	200	200	200	200	200	200	554	200	200	200	200	200	200	200	554	200		
10																						

NOTES:

① DURING THE 20 HOUR SHUTDOWN PERIOD (EVENT 4), AN ADDITIONAL CCW HEAT LOAD IS IMPOSED ON THE SYSTEM BY THE RHR HXS THE CCW HX. OUTLET IS NORMALLY 105°, DURING EVENT 4 IT IS 120°F..

② CCWS EMERGENCY TEMPERATURE IS 200°F.

③ FOR LINES DIRECTLY SERVICING RCP THERMAL BARRIERS UPSET TEMPERATURE IS 650°F.

④ ALL LINES ARE FILLED AT ALL TIMES FOR EACH EVENT

VALVE POSITION (O NORMALLY OPEN C NORMALLY CLOSED)

SYSTEM VALVE NO.														
	O	O	O	O	O	O	O	O	O	O	O	O	O	O
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS.DWG

R1 CAR-2165-G-819
G-820
G-821
G-822

EBASCO SERVICES INCORPORATED

BY MNE DATE 5/1
CH DATE 12-28-85
APPROVED

THERMAL MODES
COMPONENT COOLING

APPENDIX B
SHEET 2 OF 5

B-16

NO	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	OPERATING TEMPERATURE (°F) T	U	W	Y	AA	BB	CC	DD	EE	FF	GG	HH	II
1	NORMAL OPERATION	NORMAL	NORMAL	118	135	119	115	105	122	AMB	105	122	105 (3)	AMB	105	110
2	START-UP	N	N	118	135	119	115	105	122	145	105	122	105 (3)	105	105	110
3	SHUTDOWN 4 HRS	N	N	118	135	119	115	105	122	145	105	122	105	105	105	110
4	SHUTDOWN 20 HRS	N	N	AMB	150	134	135	120	137	AMB	120	137	145	AMB	120	110
5	REFUELING	N	N	118	135	119	AMB	105	AMB	AMB	AMB	AMB	145	AMB	105	110
6	SAFETY INJECTION	F	N	118	135	125	115	105	122	145	105	115	145	105	105	110
7	POST ACCIDENT	F	N	118	135	125	115	105	122	145	105	115	145	105	105	110
8	LOSS of Power HOT STANDBY PUMP DEADHEAD 1	U	N	118	135	125	115	105	122	145	105	115	145	105	105	110
9	RCP THERMAL BARRIER RUPTURE	EMERGENCY	EMERGENCY	200	200	200	200	200	554	200	200	200	200	200	200	200
10																

NOTES:

SEE SHT. 1

R1

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes
1, 2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic
Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-21

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS DWG.

SEE SHT. 1

VALVE POSITION { O=NORMALLY OPEN, C=NORMALLY CLOSED }

SYSTEM OPERATING MODE	V	V	V	V	V	V	V	V	V	V	V	V	V
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

EBASCO SERVICES INCORPORATED

SYSTEM
THERMAL MODES
COMPONENT COOLING

APPENDIX

APPROVED

DATE 2-28-85

8-17

NO	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	OPERATING TEMPERATURE (°F) KK	LL	MM	NN	PP	SS
1	NORMAL OPERATION	N	N	105	173	118	105	120	115
2	STARTUP	N	N	105	173	145	105	120	115
3	SHUTDOWN - 4 HRS.	N	N	105	173	145	105	120	115
4	SHUTDOWN 20 HRS	N	N	105	188	160	120	135	130
5	REFUELING	N	N	105	AMB	AMB	105	120	115
6	SAFETY INJECTION	F	N	105	173	145	105	120	115
7	POST ACCIDENT	F	N	105	173	145	105	120	115
8	LOSS of POWER HOT-STANDBY PUMP HEAD	U	N	105	173	145	105	120	115
9	RCP THERMAL BARRIER RUPTURE	EMERGENCY	EMERGENCY	200	300	200	200	200	200
10									

VALVE POSITION { O NORMALLY OPEN / C NORMALLY CLOSED }

SYSTEM OPERATING MODE	V	V	V	V	V	V	V	V	V	V	V	V	V	V
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														

NOTES:

R1

Edasco Specification
Design Specification for ANSI Nuclear Safety Classes
1, 2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic
Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM: PROCESS.DWG

SEE SHT. 1

EDASCO SERVICES INCORPORATED
DES. KNE DR. [illegible]
CH. [illegible]
DATE 2-28-85
APPROVED

SYSTEM
THERMAL MODES
COMPONENT COOLING

APPENDIX B
SHEET 4 OF 5

NOTES:

1. VALVES V_1, V_2, V_3, V_4 ARE NORMALLY CLOSED.
2. DURING CHEMICAL ADDITION, WATER FLOWS THROUGH CHEMICAL ADDITION TANK.
3. INLET & OUTLET TEMPERATURES ARE THE SAME WHEN RHR PUMP IS NOT OPERATING.
4. AMBIENT = 60° → 120°F
5. TEMPERATURES DURING LOCA EVENT:

FROM:		
0 HRS →	2 HRS =	260°F
2 HRS →	24 HRS =	215°F
24 HRS →	31 DAYS =	180 → 140°F
31 DAYS →	365 DAYS =	140 – 120°F

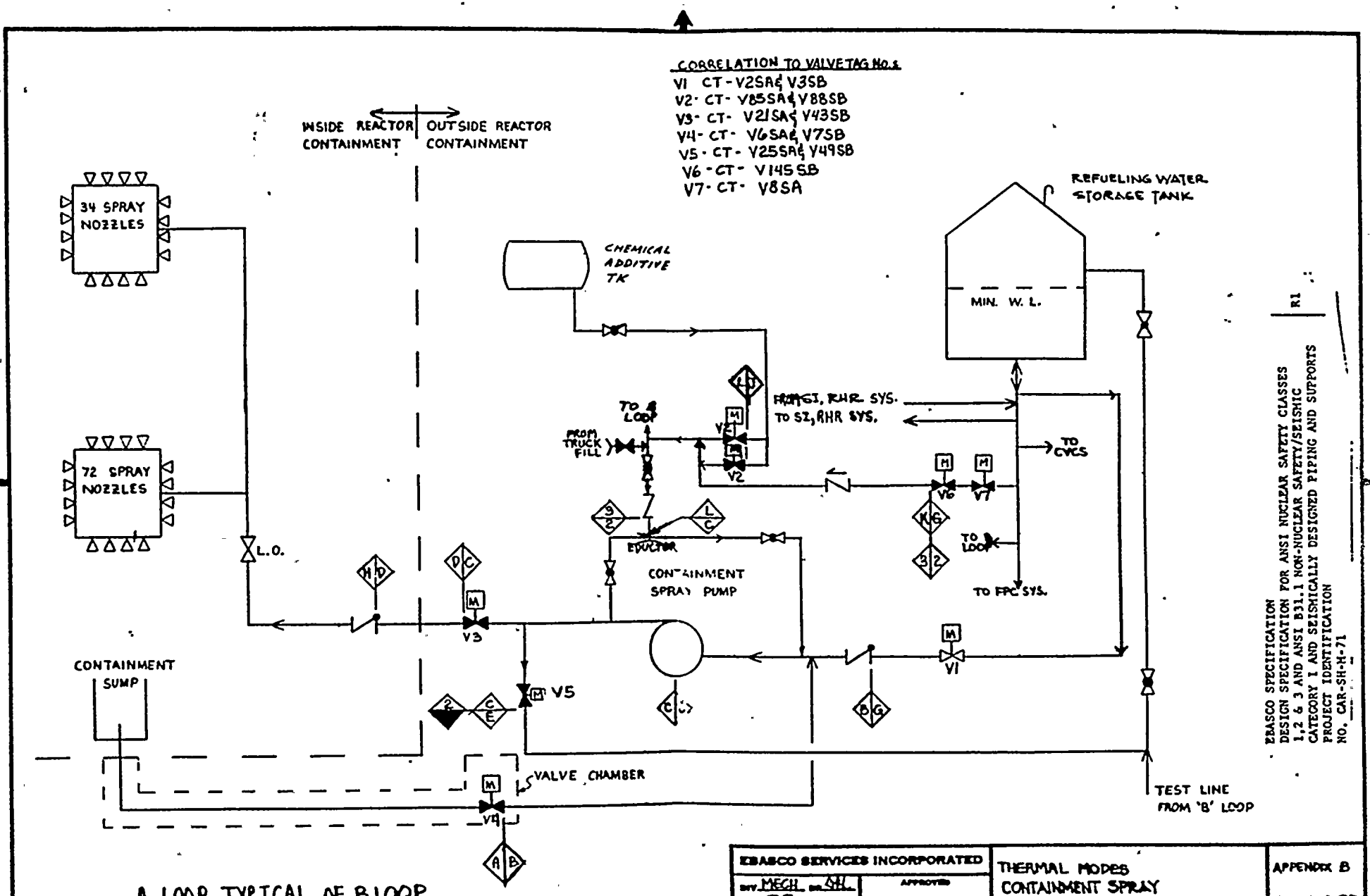
6. ANALYSES TO BE MADE USING THOSE ITEMS IN NOTES 4 & 5 WHICH WILL PRODUCE THE MOST CONSERVATIVE RESULTS (WORST CASE BASIS).
7. ALL INFORMATION, UNLESS NOTED, HAS BEEN OBTAINED FROM WESTINGHOUSE LINE LIST, SUB # 1.
8. REFERENCE DRAWINGS: EBASCO & CORRESPONDING WESTINGHOUSE FLOW DIAGRAMS: CAR-2165-G-819
   " " 820
   " " 821
   " " 822

EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1, 2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I & SEISMICALLY DESIGNED PIPING AND SUPPORTS — R1

PROJECT IDENTIFICATION NO. CAR-SH-PY-71

EBASCO SERVICES INCORPORATED		THERMAL MODES OF OPER. COMPONENT COOLING SYSTEM	APPENDIX B
BY MNE	APPROVED		SHEET 6 OF 5
CK'D PF			
DATE 2-28-85			

819


CORRELATION TO VALVE TAG No.s
V1 CT-V2SA& V3SB
V2 CT-V85SA& V88SB
V3 CT-V21SA& V43SB
V4 CT-V6SA& V7SB
V5 CT-V25SA& V49SB
V6 CT-V145SB
V7 CT-V8SA
INSIDE REACTOR CONTAINMENT
OUTSIDE REACTOR CONTAINMENT
34 SPRAY NOZZLES
72 SPRAY NOZZLES
CHEMICAL ADDITIVE TK
REFUELING WATER STORAGE TANK
MIN. W. L.
FROM I, RHR. SYS.
TO S2, RHR SYS.
TO CVCS
TO LOOP
FROM TRUCK FILL
EDUCTOR
CONTAINMENT SPRAY PUMP
TO FPC SYS.
L.O.
V1
V2
V3
V4
V5
V6
V7
CONTAINMENT SUMP
VALVE CHAMBER
TEST LINE FROM 'B' LOOP
EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES
1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC
CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION
NO. CAR-SH-H-71
R1
A LOOP TYPICAL OF B LOOP
EBASCO SERVICES INCORPORATED
DIV. MECH
CHK. PF
DATE 11-2-84
APPROVED
THERMAL MODES
CONTAINMENT SPRAY
APPENDIX B
SHEET B-20

OPERATING TEMPERATURE (°F)

NO.	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	A	B	C	D	E	G	H	J	K	L
1	CS PUMP TEST	NORMAL	NORMAL	AMB (4)	AMB TO 125	40 TO 125	AMB	40 TO 125	40 TO 125	AMB (4)	AMB TO 105	40 TO 125	AMB TO 105
2	CS ACTUATION SIGNAL (LOCA)	FAULTED	UPSET	260	AMB TO 260	40 TO 260 (3)	40 TO 260 (3)	AMB	40 TO 125	40 TO 260 (3)	AMB TO 105	AMB	AMB TO 105
3	CS ACTUATION SIGNAL (MSLB or FWLB)	FAULTED	UPSET	260	AMB TO 260	40 TO 260 (3)	40 TO 260 (3)	AMB	40 TO 125	40 TO 260 (3)	AMB TO 105	AMB	AMB TO 105
4													
5													
6													
7													
8													
9		1											
10													

NOTES:

1- VALVE OPENS AFTER RWST IS EMPTY

2- VALVE CLOSES AFTER V4 IS OPENED

3- 40°F TO 125°F WHEN SUCTION IS FROM THE RWST

4- LINE IS EMPTY DURING THIS OPERATING MODE

VALVE POSITION {O: NORMALLY OPEN, C: NORMALLY CLOSED}

SYSTEM OPERATING MODE	V1	V2	V3	V4	V5	V6	V7	V	V	V	V	V	V
1	NORMAL	O	C	C	C	O	O	O						
2	UPSET	O(2)	O	O	O(1)	C	C	C						
3	UPSET	O(2)	C	O	O(1)	C	C	C						
4														
5														
6														
7														
8														
9														
10														

EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2&3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I & SEISMICALLY DESIGNED PIPING & SUPPORTS

PROJECT IDENTIFICATION
NO. CAR-SH-PI-N1

R1 SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS DWG. 6-050

EBASCO SERVICES INCORPORATED	THERMAL MODES OF OPERATION CONTAINMENT SPRAY SYSTEM	APPENDIX B

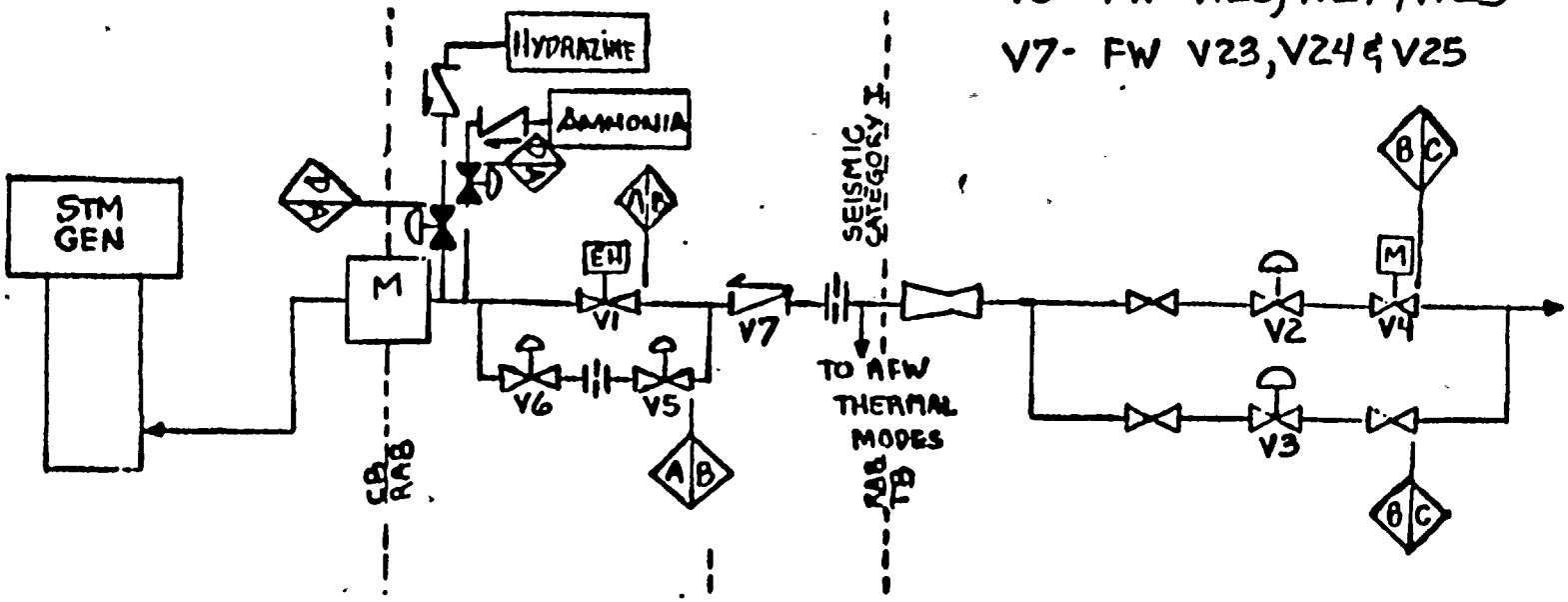
Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71 — ...

CORRELATION TO VALVE TAG No.s

V1- FW V26, V27 & V28
V2- FW F3, F4 & F5
V3- FW F6, F7 & F8
V4- FW V102, V103 & V104
V5- FW F9, F10 & F11
V6- FW V123, V124 & V125
V7- FW V23, V24 & V25



TYPICAL FOR 3 LOOPS

EBASCO SERVICES INCORPORATED
DRAWN MEH DATE 11-2-84
APPROVED
THERMAL MODES OF OPERATION
FEEDWATER SYSTEM
APPENDIX B SHEET 1 OF 2

NO.	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	OPERATING TEMPERATURE (°F) A	B	C	D
1	25-100% POWER OPERATION	NORMAL	NORMAL	328 TO 435	328 TO 435	328 TO 435	126
2	HYDRO TEST	NORMAL	NORMAL	AMB.	AMB.	AMB.	AMB.
3	STARTUP TO 25% POWER	NORMAL	NORMAL	AMB. TO 328	AMB. TO 328	AMB. TO 328	126
4	SHUTDOWN TO HOT STANDBY	NORMAL	NORMAL	AMB. TO 435 (8)	120 TO 435	120 TO 435	126
5	FULL LOAD REJECTION	UPSET	UPSET	435	435	435	126
6	MS SAFETY VALVE OPERATION	UPSET	UPSET	328 TO 435	328 TO 435	328 TO 435	126
7	LOCA, MSLB, OR FWLB	FAULTED	FAULTED (1)	AMB. TO 435	AMB. TO 435	AMB. TO 435	AMB. TO 126
8							
9		1					
10							

NOTES:

1- PORTION OF PIPING FROM V-7 TO THE PENETRATION IS TO BE EMERGENCY SYSTEM OPERATING MODE.

2- VALVES ARE CLOSED BELOW 250°F.

3- POSITION SPECIFIED IS THE FINAL VALVE POSITION.

4- INITIAL VALVE POSITION IS AS GIVEN IN MODE 3.

5- NO FLOW BELOW 250°F.

(3) VALVE POSITION {O: NORMALLY OPEN, C: NORMALLY CLOSED}

SYSTEM OPERATING MODE	V1	V2	V3	V4	V5	V6	V7	V	V	V	V	V	V
1 NORMAL	O	O	C	O	O	O	O						
2 NORMAL	NA	NA	NA	NA	NA	NA	NA						
3 NORMAL	C	C	O	C	O(2)	O(2)	O						
4 NORMAL	C	C	C	C	O(2)	O(2)	O						
5 UPSET	O	O	C	O	O(2)	O(2)	O						
6 UPSET	C	C	C	C	C	C	C						
(2) 7 FAULTED	C	C	C	C	C	C	C						
8													
9													
10													

EBASCO SPECIFICATION DESIGN SPECIFICATION FOR MSL NUCLEAR SAFETY CLASSES 1,2&3 AND MSL B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I & SEISMICALLY DESIGNED PIPING & SUPPORTS

PROJECT IDENTIFICATION NO. CAR-SH-M-71

R1

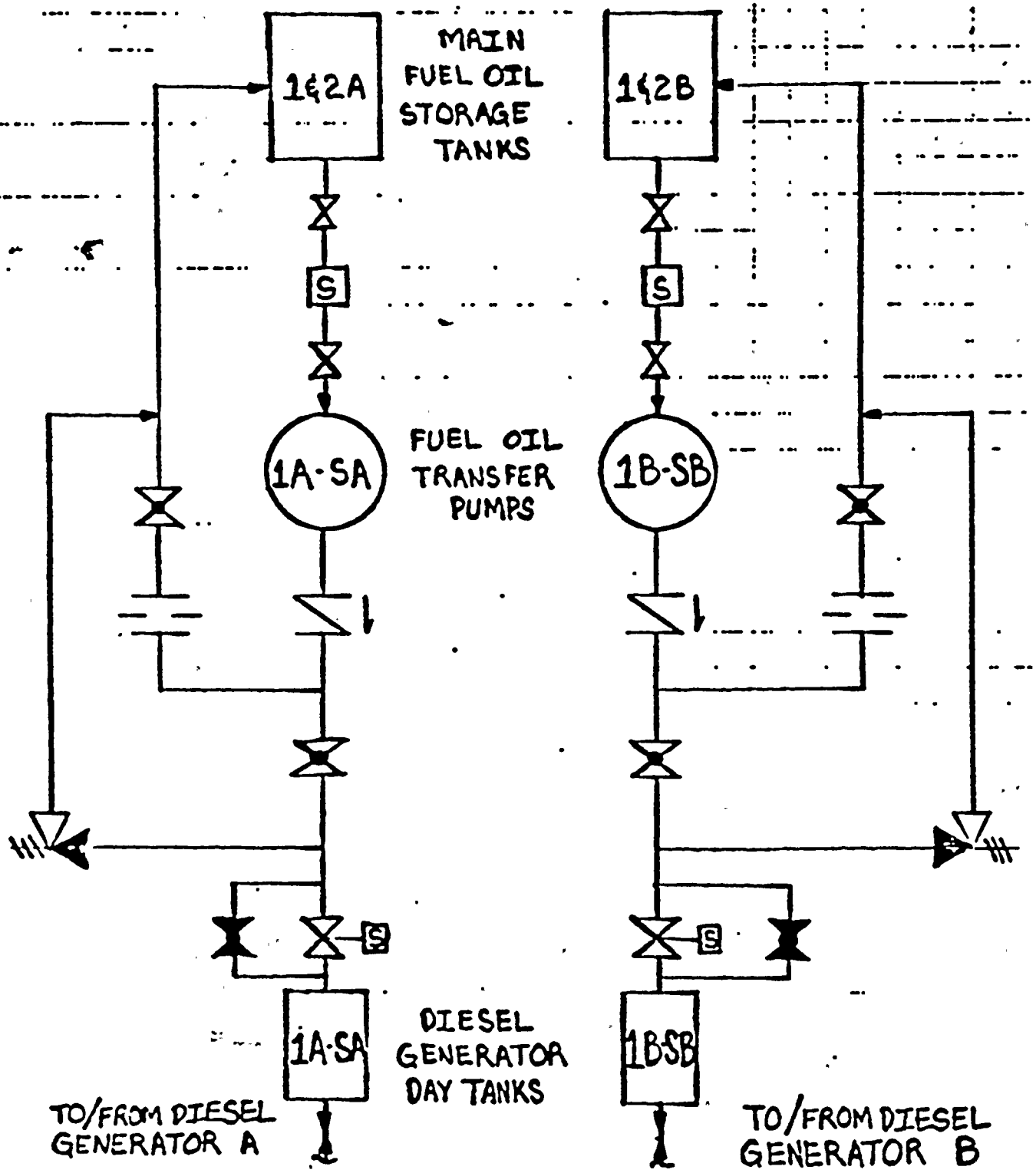
SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS DWG G-044

EBASCO SERVICES INCORPORATED	THERMAL MODES OF OPERATION FEEDWATER SYSTEM	APPENDIX B SHEET 2 OF 2
DES. MECH. APP. APPROVED CHK. FF DATE 8-23-71		

8-23

R1

Project Identification
No. CAR-SH-M-71



EBASCO SERVICES INCORPORATED		THERMAL MODES OF OPERATION	APPENDIX B SHEET 1 OF 2
DIV MECH DR JJ CH	APPROVED	FUEL OIL SYSTEM	
DATE 11/2/84			

NO.	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	OPERATING TEMPERATURE (°F)																			
1	LOSS OF OFF-SITE POWER	ALL	NORMAL	105																			
2	TEST	NORMAL	NORMAL	AMB.																			
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							

NOTES:

VALVE POSITION {O: NORMALLY OPEN; C: NORMALLY CLOSED}

SYSTEM OPERATING MODE	V	V	V	V	V	V	V	V	V	V	V	V	V
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2&3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I & SEISMICALLY DESIGNED PIPING & SUPPORTS A1

PROJECT IDENTIFICATION NO. CAR-SH-M-71

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS DWG: G-0434133

EBASCO SERVICES INCORPORATED

THERMAL MODES OF OPERATION

FUEL OIL SYSTEM

APPENDIX B SHEET 2 of 2

EBASCO SERVICES INCORPORATED

APPROVED

DATE 11/2/84

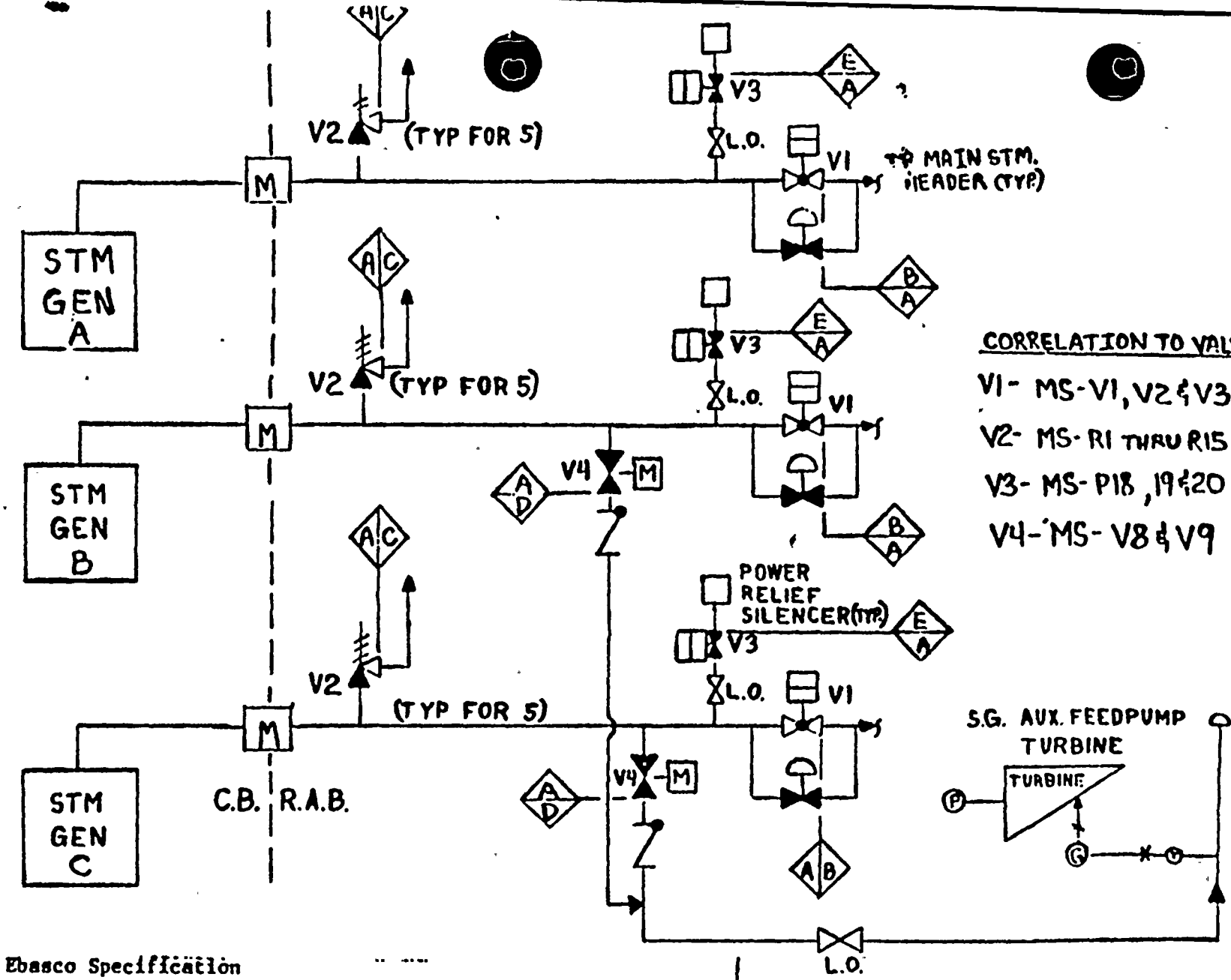
THERMAL MODES OF OPERATION

MAIN STEAM SYSTEM

B-26

APPENDIX B

SHEET 1 OF 2



CORRELATION TO VALVE TE

V1- MS-V1, V2 & V3

V2- MS-R1 THRU R15

V3- MS-P18, 19 & 20

V4- MS-V8 & V9

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

NO.	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	OPERATING TEMPERATURE (°F) A	B	C	D	E
1	10-100% POWER OPERATION	NORMAL	NORMAL	540 TO 555	540 TO 555	AMB.	AMB.	AMB.
2	HYDRO TEST	NORMAL	NORMAL	AMB. (5)	AMB. (5)	AMB. (6)	AMB. (5)	AMB. (6)
3	START-UP-10% POWER	NORMAL	NORMAL	212 TO 555	212 TO 555	AMB. (6)	AMB.	AMB. TO 489
4	SHUTDOWN TO HOT STANDBY	NORMAL	NORMAL	212 TO 555	212 TO 555	AMB. (6)	AMB.	489
5	FULL LOAD REJECTION	UPSET	UPSET	540 TO 550	540 TO 550	489	AMB.	489
6	MS SAFETY VALVE OPERATION	UPSET	UPSET	572	572	309	AMB.	AMB.
7	LOCA MSLB OR FWLB	FAULTED	FAULTED (1)	540 TO 555	AMB. TO 555 (4)	489	540 TO 555 (6)	489
8								
9		1						
10								

NOTES:
1- MS PIPING BETWEEN CONTAINMENT PENETRATIONS & MS ISOLATION VALVES SHALL BE CONSIDERED AS EMERGENCY SYSTEM OPERATING MODE.
2- POSITION SPECIFIED IS THE FINAL VALVE POSITION.
3- INITIAL VALVE POSITION IS AS IN MODE 3.
4- DEPENDENT UPON POWER LEVEL AT TIME OF OCCURRENCE
5- LINE IS FILLED WITH WATER
6- LINE IS EMPTY

(2) VALVE POSITION {O: NORMALLY OPEN, C: NORMALLY CLOSED}

SYSTEM OPERATING MODE	V1	V2	V3	V4	V	V	V	V	V	V	V	V	V
1 NORMAL	O	C	C	C									
2 NORMAL	NA	NA	NA	NA									
3 NORMAL	O	C	C	C									
4 SUBCOOLED	O	C	O	C									
5 UPSET	O	C	O	C									
6 UPSET	C	O	C	C									
7 FAULTED	C	C	O	O									
8													
9													
10													

EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR NSSI NUCLEAR SAFETY CLASSES 1,2&3 AND ANSI-B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I & SPECIFICALLY RESAILED PIPING & SUPPORTS

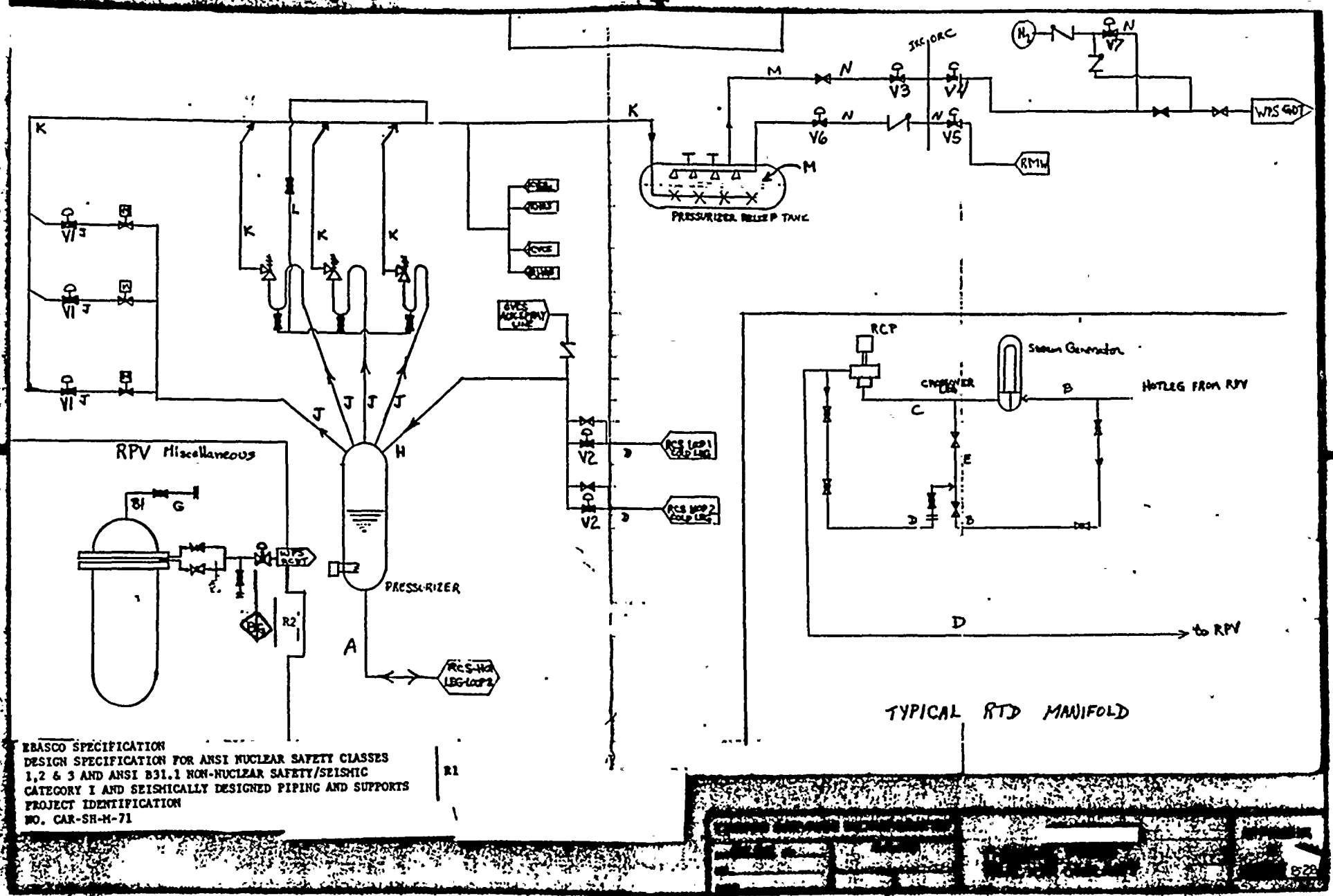
PROJECT IDENTIFICATION
NO. CAR-SLA-71

R1 SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS DWG G-042

EBASCO SERVICES INCORPORATED

THERMAL MODES OF OPERATION
MAIN STEAM SYSTEM

APPENDIX B SHEET 2 of 2



EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION
NO. CAR-SH-M-71

R1

	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	OPERATING TEMPERATURE °F) A	B	C	D	E	G	H	I	J	K	L	M	N	O	P	R	S	T
1	NORMAL OPERATION	NORMAL	NORMAL	653	619	555	555	587	120	619	555	653	120	AMB	120	120					
2	TRIP	UPSET	UPSET	644	644	586	589	616	120	644	589	668	470	AMB	200	120					
3	LOCA	FAULTED	FAULTED	125	125	125	125	Amb	Amb	Amb	Amb	Amb	Amb	Amb	120	120					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

NOTES:

AMB: 60 ~ 120°F

R1

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category 1 and Seismically Designed Piping and Supports

Project Identification No. CAR-SH-M-71

VALVE POSITION { O=NORMALLY OPEN C=NORMALLY CLOSED }

SYSTEM OPERATING MODE	V1	V2	V3	V4	V5	V6	V7	V	V	V	V	V	V
1 NORMAL	C	C	O	O	O	C	O						
2 UPSET	C	O	O	O	O	C	O						
3 FAULTED	C	C	C	C	C	C	O						
4													
5													
6													
7													
8													
9													
10													

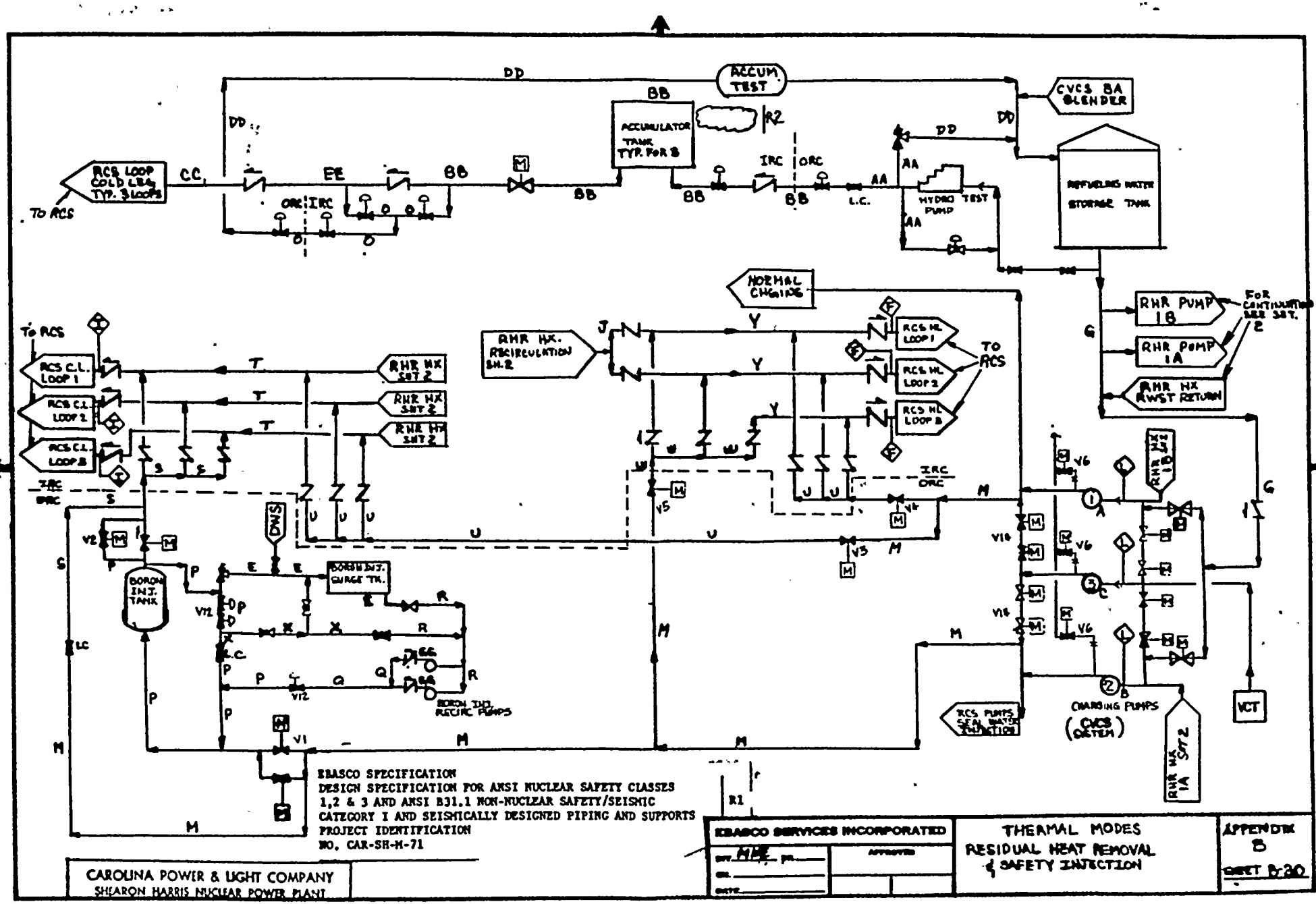
SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM: PROCESS.DWG

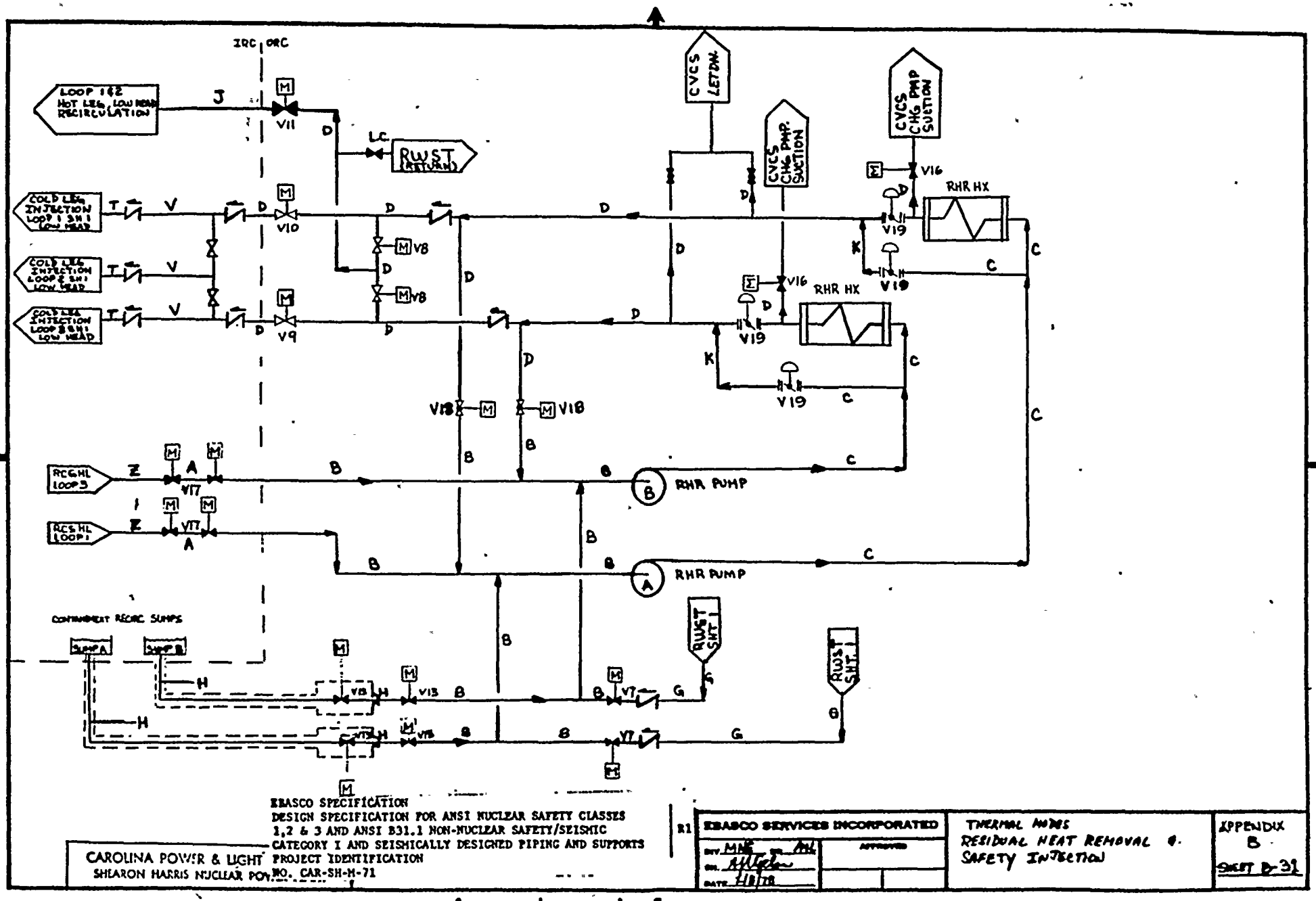
CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

EBASCO SERVICES INCORPORATED
BY MHE 2/20
CH PE
DATE 2-20-85
APPROVED

SYSTEM
REACTOR COOLANT SYSTEM THERMAL MODES.

APPENDIX B
SHEET 2 OF 2


ACCUM. TEST
CVCS BA BLENDER
ACCUMULATOR TANK TYP. FOR 3
RCS LOOP COLD LEG TYP. 3 LOOPS
To RCS
REFUELING WATER STORAGE TANK
HYDRO PUMP TEST
NORMAL CHARGING
RHR HX. RECIRCULATION SH. 2
RHR PUMP 1B
RHR PUMP 1A
RHR HX RWST RETURN
For continuation see Sht. 2
RCS C.L. LOOP 1
RCS C.L. LOOP 2
RCS C.L. LOOP 3
RHR HX SHT 2
RCS HL LOOP 1
RCS HL LOOP 2
RCS HL LOOP 3
BORON INJ. TANK
BORON INJ. SURGE TK.
BORON INJ. RECIRC PUMPS
RCS PUMPS SEAL WATER INJECTION
CHARGING PUMPS (CVCS SYSTEM)
VCT
RHR HX 1A SHT 2
EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION NO. CAR-SH-M-71
CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT
EBASCO SERVICES INCORPORATED
THERMAL MODES
RESIDUAL HEAT REMOVAL & SAFETY INJECTION
APPENDIX B
SHEET B-30


IRC
ORC
LOOP 1&2 HOT LEG (LOW HEAD) RECIRCULATION
V11
LC
RWST (RETURN)
CVCS LETDN.
CVCS CHG PMP. SUCTION
CVCS CHG PMP SUCTION
V16
RHR HX
COLD LEG INJECTION LOOP 1 & 4 (LOW HEAD)
COLD LEG INJECTION LOOP 2 & 3 (LOW HEAD)
COLD LEG INJECTION LOOP 3 & 1 (LOW HEAD)
V10
V8
V9
V19
V18
RCS HL LOOP 3
RCS HL LOOP 1
V17
RHR PUMP
CONTAINMENT RECIRC SUMPS
SUMP A
SUMP B
V13
RWST SHT. 1
EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION NO. CAR-SH-M-71
CAROLINA POWER & LIGHT
SHEARON HARRIS NUCLEAR POWER
R1
EBASCO SERVICES INCORPORATED
THERMAL ANDES
RESIDUAL HEAT REMOVAL & SAFETY INJECTION
APPENDIX B
SHEET B-31

OPERATING TEMPERATURE (°F)

NO	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	A	B	C	D	E	F	G	H	I	J	K	L	M	O	P	Q	R
1	NORMAL OPERATION	NORMAL	NORMAL	(8) AMB	AMB	AMB	AMB	165	618	AMB	(3) AMB	558	(1) AMB	AMB	115	130	(1) AMB	165	165	185
2	STARTUP	NORMAL	NORMAL	350	350	350	350	165	618	AMB	(3) AMB	558	(7) AMB	350	115	130	(7) AMB	165	165	165
3																				
4	SHUTDOWN 4 HRS	NORMAL	NORMAL	350	350	350	250	165	350	AMB	(3) AMB	250	(5) AMB	350	115	130	(1) AMB	165	165	165
5	REFUELING SHUTDOWN 28 HRS	NORMAL	NORMAL	150	150	150	140	165	140	AMB	(3) AMB	140	140	140	115	115	(1) AMB	165	165	165
6	SAFETY INJECTION (SMALL BREAK)	FAULTED	NORMAL	AMB	AMB	AMB	AMB	180	618	AMB	(13) 200	AMB	AMB	AMB	AMB	AMB	(1) AMB	165	180	165
7	SAFETY INJECTION (LARGE BREAK)	FAULTED	NORMAL		AMB	AMB	AMB	180	AMB	AMB	(15) 215	125	AMB	AMB	AMB	AMB	(1) AMB	AMB	180	165
8	POST ACCIDENT RECIRCULATION	FAULTED	NORMAL	AMB	240	240	140	AMB	240	AMB	260	140	140	240	140	140	(1) AMB	140	AMB	AMB
9	LOSS OF POWER REACTOR TRP. UPSET	NORMAL	NORMAL	(8) AMB	AMB	AMB	AMB	180	618	AMB	(3) AMB	558	(1) AMB	AMB	115	130	(1) AMB	165	165	165
10																				

NOTES:

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

VALVE POSITION {O=NORMALLY OPEN C=NORMALLY CLOSED}

SYSTEM OPERATING MODE	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS DWG.

EBASCO SERVICES INCORPORATED

		APPROVED
D.	MNE	
C.	EF	
DATE	2-20-85	

SYSTEM: RHR/SI

APPENDIX B
SHEET 3 OF 5

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						
				THERMAL		WEIGHT			PRESSURE		1/2 SSE		SSE		OTHER SYSTEM CONDITIONS											SPECIAL DESIGN CONSIDERATIONS
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	1/2 SSE (OBE) INERTIA	1/2 SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓							✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓											
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓		✓										
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓										
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓										
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓										
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓										
PIPE RUPTURE	NA	NA	11*	✓	✓	✓	✓		✓		✓	✓			✓ (NOTE 1)	✓ (NOTE 2)										

NOTE 1: RUPTURE OUTSIDE CONTAINMENT
NOTE 2: RUPTURE OUTSIDE CONTAINMENT
* THIS LOAD COMBINATION IS FOR PIPE RUPTURE STRESS SUMMARY ONLY.

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports
PROJECT IDENTIFICATION NO. CAR-SH-M-71

R1

EBASCO SERVICES INCORPORATED
DRY. JNE DR. JEK
CH. JDF
DATE 11-2-81
APPROVED

DESIGN STRESS COMBINATIONS SYSTEM
STM. GENERATOR BLOWDOWN

APPENDIX F
SHEET 1 of 1

R1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																					SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS...											
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (OBE) INERTIA	SSE (OBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓				✓							
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓				✓							
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓			✓							
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓			✓							
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓			✓							
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓			✓							
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓			✓							
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓			✓							
PIPE RUPTURE			11																							
			—																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

EBASCO SERVICES INCORPORATED

DES. MHF DR. SDL
CH. RF
DATE 11-2-84

APPROVED

DESIGN STRESS COMBINATIONS
SYSTEM
WASTE GAS

APPENDIX F
REVISION 11

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS CONDITIONS DUE TO SIMULTANEOUS CONDITIONS: THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS										SPECIAL DESIGN CONSIDERATIONS
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPT	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓				✓							
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓				✓							
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓			✓							
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓			✓							
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓			✓							
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓			✓							
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓			✓							
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓			✓							
PIPE RUPTURE			11																						
			—																						

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

EBASCO SERVICES INCORPORATED

DES. MHF DATE 1-12-84
CH. PF DATE 1-12-84
APPROVED

DESIGN STRESS COMBINATIONS
SYSTEM
WASTE LIQUID

APPENDIX F
SHEET 1051

F-33

APPENDIX G
Containment Building Displacement

CONT. BLDG. CYLI. WALL DISPLACEMENT DUE TO LOCA

DATA: DISPLACEMENTS IN CYLI. WALL AND DOME
DUE TO LOCA PRESSURE 45 PSI AND TEMP.

	RADIAL DIRECTION			LONGITUDINAL DIRECTION*		
Elevation Ft	Pressure 45.0 PSI	Temp.*	Total	Pressure 45.0 PSI	Temp*	Total
216.0	0.000	0.000	0.000	0.000	0.000	0.0
226.0	0.138	0.037	0.175	0.040	0.063	0.103
246.0	0.543	0.219	0.762	0.135	0.105	0.240
276.0	0.626	0.220	0.846	0.330	0.201	0.531
286.0	0.654	0.217	0.871	0.405	0.234	0.639
306.0	0.678	0.217	0.895	0.566	0.298	0.864
326.0	0.656	0.217	0.873	0.724	0.363	1.087
356.0	0.612	0.215	0.827	0.948	0.460	1.408
376.0	0.612	0.214	0.826	1.097	0.525	1.622
	ADDITIONAL DISP. (POINT TO SPHERE CENTER)					
404.0	0.613	0.215	0.828			
419.0	0.613	0.215	0.828			
435.0	0.613	0.215	0.828			

* THE TEMP. DISPLACEMENTS INDICATED ARE DUE TO NORMAL OPERATING TEMPERATURE (90° OUTSIDE AND 120° INSIDE): THE DISPLACEMENTS DUE TO THE LINER INTERACTION ARE NOT INCORPORATED, BUT THESE EFFECTS ARE NOT SIGNIFICANT.

** THE LONGITUDINAL DISPLACEMENTS OF THE INSIDE AND OUTSIDE FACES ARE DIFFERENT: THE DATA LISTED IN THIS TABLE ARE AVERAGE DISPLACEMENTS.

Reference: Calculation by M. Patel checked by J. Shen 10/24/77 (C-H Dept.)

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1, 2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

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CONT. BLDG. CYLI. WALL, DISP. DUE TO TEST PRESSURE

DATA: DISPLACEMENTS IN CYLI. WALL AND DOME DUE TO TEST PRESSURE 51.75 PSI AND ATMOSPHERIC TEMP. (SUMMER)

	RADIAL DIRECTION			**LONGITUDINAL DIRECT:		
Elevation Ft.	Pressure 51.75 PSI.	TEMP.*	Total	Pressure	Temp.*	Total
216.0	0.0	0.0	0.0	0.0	0.0	0.0
226.0	0.159	0.025	0.184	0.046	0.042	0.088
246.0	0.624	0.132	0.756	0.155	0.070	0.225
276.0	0.720	0.147	0.867	0.380	0.134	0.514
286.0	0.752	0.146	0.898	0.466	0.156	0.622
306.0	0.780	0.145	0.925	0.651	0.199	0.85
326.0	0.754	0.145	0.899	0.833	0.242	1.075
356.0	0.704	0.145	0.849	1.090	0.307	1.397
376.0	0.704	0.145	0.849	1.262	0.350	1.612
	ADDITIONAL DISPLACEMENT (POINT TO SPHERE CENTER)					
404.0	0.705	0.143	0.848			
419.0	0.705	0.143	0.848			
435.0	0.705	0.143	0.848			

* THE TEMP. DISPLACEMENTS INDICATED ARE DUE TO ATMOSPHERIC TEMP OF 90°F. (SUMMER) ON BOTH SIDES OF WALL.

** THE LONGITUDINAL DISPLACEMENTS OF THE INSIDE AND OUTSIDE FACES ARE DIFFERENT: THE DATA LISTED IN THIS TABLE ARE AVERAGE DISPLACEMENTS.

Reference: Calculation by M. Patel checked by J. Shen 10/24/77 (C-H Dept.)

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1, 2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

R1

SHEET 2 OF —

CHKD. BY [illegible] DATE 10/20/77. OPS NO. — DEPT. NO. —

CLIENT CAROLINA POWER & LIGHT COMPANY

PROJECT 1977-78-79-80 900,000 KW-UNITS 1, 2, 3 & 4

SUBJECT CONT. BLDG. CYLI. WALL, DISP. DUE TO TEST PRE.

DATA: DISPLACEMENTS IN CYLI. WALL AND DOME DUE TO TEST PRESSURE 51.75 PSI AND ATMOSPHERIC TEMP. (SUMMER)

ELEVATION FT.	RADIAL DIRECTION			** LONGITUDINAL DIRECT		
	PRESSURE 51.75 PSI	TEMP.*	TOTAL	PRESSURE	TEMP.*	TOTAL
216.0	0.0	0.0	0.0	0.0	0.0	0.0
226.0	0.159	0.025	0.184	0.046	0.042	0.088
246.0	0.624	0.132	0.756	0.155	0.070	0.225
276.0	0.720	0.147	0.867	0.380	0.134	0.514
286.0	0.752	0.146	0.898	0.466	0.156	0.623
306.0	0.780	0.145	0.925	0.651	0.199	0.85
326.0	0.754	0.145	0.899	0.833	0.242	1.075
356.0	0.704	0.145	0.849	1.090	0.307	1.397
376.0	0.704	0.145	0.849	1.262	0.350	1.612
	ADDITIONAL DISPLACEMENT (POINT TO SPHERE CENTER)					
404.0	0.705	0.143	0.848			
419.0	0.705	0.143	0.848			
435.0	0.705	0.143	0.848			

* THE TEMP. DISPLACEMENTS INDICATED ARE DUE TO ATMOSPHRIC TEMP OF 90° F. (SUMMER) ON BOTH SIDES OF WALL.

** THE LONGITUDINAL DISPLACEMENTS OF THE INSIDE AND OUTSIDE FACE ARE DIFFERENT; THE DATA LISTED IN THIS TABLE ARE AVERAGE DISPLACEMENTS.

FORM 501 REV 7-71

R1

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes
1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic
Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

APPENDIX H
Piping Supports Load Combinations

SUBJECT RESTRAINT LOADING COMBINATIONS

CHECKED BY E.R.S. DATE 3/??/76

LOAD COMBINATIONS FOR CLASS 2 AND 3 PIPING SUPPORTS

SYSTEM	COMPONENT	PLANT OPERATING CONDITION	COMPONENT OPERATING CONDITION	COMBINATION NO.	Design Pressure P_D	Test Pressure P_T	Normal Op. Pressure P_N	Upset Pressure P_U	Accident Pressure P_A	Design Temp. T_D	Test Temp. T_T	Normal Op. Temp. T_N	Upset Temp. T_U	Accident Cond. Temp. T_A	Thermal Expansion VTE	Thermal Anchor Movement VTA	Pipe Dead Weight WP	Pipe Sustained Weight (Contents Included) WS	Test Weight WT	OBE Inertia	OBE Anchor Movement	DBE Inertia	DBE Anchor Movement	Differential Bldg Settlement (B) VBS	Relief Valve Open Systems (Dynamic) RVS	Relief Valve Closed Systems (Dynamic) RVT	Fluid Hammer or Fast Valve Closure Systems (Dynamic)	Other Upset Conditions / Emergency Conditions as Specified in Design Spec. TOU	Emergency Conditions / Combinations as Specified in Design Spec. TDE	LOCA	Jet Impingement Load		Tornado Wind Load RTW	Tornado Missile Impact Load RTM	Pipe Vibrations RPV	Dead Weight of Restraint & Other Environmental Loads Acting upon Restraint (A)	OTHER LOADS (C)
ALL SAFETY CLASS 2 & 3 SYSTEMS OTHER THAN ESSENTIAL SYSTEMS	RIGID RESTRAINTS LINEAR OR PLATE & SHELL TYPE (PIPE WHIP RESTRAINTS NOT INCLUDED)	UPSET	DESIGN	1	✓					✓							✓	✓		✓	✓														✓	✓	✓
		TEST	TEST	2		✓					✓								✓																✓	✓	✓
		NORMAL	NORMAL	3			✓					✓			✓	✓	✓	✓						✓											✓	✓	✓
		UPSET	UPSET	4			✓					✓			✓	✓	✓	✓		✓	✓			✓											✓	✓	✓
				5				✓					✓		✓	✓	✓	✓		✓	✓			✓	✓										✓	✓	✓
				6				✓					✓		✓	✓	✓	✓		✓	✓			✓		✓									✓	✓	✓
				7				✓					✓		✓	✓	✓	✓		✓	✓			✓			✓								✓	✓	✓
				8				✓					✓		✓	✓	✓	✓		✓	✓			✓				✓							✓	✓	✓
				9			✓					✓			✓	✓	✓	✓						✓									✓	✓	✓	✓	✓
		EMERGENCY	EMERGENCY	10				✓					✓		✓	✓	✓	✓						✓	✓								✓	✓	✓	✓	✓
				11				✓					✓		✓	✓	✓	✓						✓		✓							✓	✓	✓	✓	✓
				12				✓					✓		✓	✓	✓	✓						✓			✓						✓	✓	✓	✓	✓
				13				✓					✓		✓	✓	✓	✓						✓				✓					✓	✓	✓	✓	✓
				14					✓					✓	✓	✓	✓	✓						✓					✓						✓	✓	✓
		FAULTED	FAULTED	15			✓					✓			✓	✓	✓	✓				✓	✓	✓											✓	✓	✓
				16				✓					✓		✓	✓	✓	✓				✓	✓	✓	✓										✓	✓	✓
				17				✓					✓		✓	✓	✓	✓				✓	✓	✓		✓									✓	✓	✓
				18				✓					✓		✓	✓	✓	✓				✓	✓	✓			✓								✓	✓	✓
				19				✓					✓		✓	✓	✓	✓				✓	✓	✓				✓							✓	✓	✓
				20					✓					✓	✓	✓	✓	✓				✓	✓	✓					✓						✓	✓	✓
				21					✓					✓	✓	✓	✓	✓				✓	✓	✓						✓					✓	✓	✓
				22					✓					✓	✓	✓	✓	✓				✓	✓	✓							✓				✓	✓	✓

REMARKS

(A) SUPPORT DESIGNER SHALL CALCULATE RESTRAINT DEADLOADS & OTHER ENVIRONMENTAL LOADS ACTING ON THE RESTRAINT ASSEMBLY ITSELF & ACCOUNT FOR THEM IN HIS DESIGN

(B) WHENEVER DIFFERENTIAL BLDG. SETTLEMENT LOAD IS [illegible] SHALL BE ADDED ONLY IF IT INCREASES NET REACTION FROM OTHER LOADS WHICH ARE GIVEN EITHER WITH PROPER SIGNS OR AS ABSOLUTE VALUES.

(C) SUPPORT DESIGNER SHALL ACCOUNT FOR THE EFFECTS OF FRICTION & THERMAL MOVEMENT ON THE RESTRAINT BETWEEN THE POINT OF PIPE ATTACHMENT & ATTACHMENT TO STRUCTURE.

R1

CAROLINA POWER & LIGHT CO.
SHEARON HARRIS NUCLEAR PROJECT
REACTOR LOADING COMBINATIONS

O.S. NO. CAR 4224-001 DIST. NO. 600
BY SWK-GSC-BKG DATE 3/26
CHECKED BY E.R.S DATE 3/

LOAD COMBINATIONS FOR CLASS 2 AND 3 PIPING SUPPORTS

SYSTEM / COMPONENT	PLANT OPERATING CONDITION	COMPONENT OPERATING CONDITION	COMBINATION NO.	COINCIDENT LINE PRESSURES: DESIGN PRESSURE (PD)	TEST PRESSURE (PT)	NORMAL OP. PRESSURE (PR)	UPSET PRESSURE (PU)	ACCIDENT PRESSURE (PA)	COINCIDENT SYSTEM TEMP: DESIGN TEMP. (TD)	TEST TEMP. (TT)	NORMAL OP. TEMP. (TO)	UPSET TEMP. (TU)	ACCIDENT COND. TEMP. (TA)	RESTRAINT LOADS DUE TO VARIOUS PIPE LOADING CONDITIONS: THERMAL EXPANSION (TE)	THERMAL ANCHOR MOVMT (YTA)	PIPE DEAD WEIGHT (WP)	PIPE SUSTAINED WEIGHT (WS)	TEST WEIGHT (WT)	OBE INERTIA (YO)	OBE ANCH. MOVMT (YOA)	SSE INERTIA (YI)	SSE ANCH. MOVMT (YIA)	DIFFERENTIAL BLDG SETTLEMENT (YBS)	RELIEF VALVE OPEN SYSTEMS (DYNAMIC) (RVS)	RELIEF VALVE CLOSED SYSTEMS (DYNAMIC) (RVC)	FLUID HAMMER OR (RVS+RVC) (FVC)	2 OR MORE SIMULTANEOUS SRSS (TRS)	EMERGENCY CONDITIONS COMBINATIONS AS SPECIFIED IN DESIGN SPEC.	LOCA (TPS)	JET IMPINGEMENT LOAD (YJ)	TORNADO WIND LOAD (RW)	TORNADO MISSILE IMPACT LOAD (RM)	PIPE VIBRATIONS (RV)	DEAD WEIGHT OF RESTRAINT & OTHER ENVIRONMENTAL LOADS ACTING UPON RESTRAINT	OTHER LOADS	REMARKS
SNUBBERS	UPSET	DESIGN	1	✓					✓										✓	✓													✓	✓	✓	(A) SNUBBER LOAD FOR ANY DYNAMIC EVENT AS IDENTIFIED HEREIN SHALL BE COMPUTED ON FAILURE BASES
	TEST	TEST	2		✓					✓																						✓	✓	✓	
	NORMAL	NORMAL	3			✓					✓																						✓	✓	✓	
	UPSET	UPSET	4				✓					✓								✓	✓				✓								✓	✓	✓	(B) FOR HYDRAULIC SNUBBERS INITIAL IMPACT LOAD ONLY SHALL BE CONSIDERED SNUBBER WILL BE ASSUMED TO YIELD UNDER SUSTAINED LOADING ACTION
			5				✓					✓								✓	✓					✓						✓	✓	✓	
			6				✓					✓								✓	✓						✓					✓	✓	✓	
			7				✓					✓								✓	✓							✓				✓	✓	✓	
			8			✓					✓																		✓	✓	✓	✓	✓	✓	
	EMERGENCY	EMERGENCY	9				✓					✓													✓					✓	✓	✓	✓	✓	(C) FOR MECHANICAL SNUBBERS TOTAL LOAD (INITIAL AND SUSTAINED) SHALL BE CONSIDERED.
			10				✓					✓														✓				✓	✓	✓	✓	✓	
			11				✓					✓															✓			✓	✓	✓	✓	✓	
			12				✓					✓																✓		✓	✓	✓	✓	✓	
			13				✓	✓				✓	✓																✓	✓	✓	✓	✓	✓	
	FAULTED	FAULTED	14				✓					✓									✓	✓			✓					✓	✓	✓	✓	✓	(D) SUPPORT DESIGNER SHALL CALCULATE RESTRAINT DEAD LOAD PLUS OTHER ENVIRONMENTAL LOADS ACTING ON THE RESTRAINT ASSEMBLY UPON RACCIDENT CONDITION THEN INITIATION
			15				✓					✓									✓	✓				✓				✓	✓	✓	✓	✓	
			16				✓					✓									✓	✓					✓			✓	✓	✓	✓	✓	
			17				✓					✓									✓	✓						✓		✓	✓	✓	✓	✓	
			18					✓					✓								✓	✓							✓		✓	✓	✓	✓	(E) SUPPORT DESIGNER SHALL ACCOUNT FOR THE EFFECTS OF
			19					✓					✓								✓	✓							✓	✓	✓	✓	✓	✓	
			20					✓					✓								✓	✓								✓	✓	✓	✓	✓	

ALL SAFETY CLASS 2 & 3 SYSTEMS OTHER THAN ESSENTIAL SYSTEMS (R)

IRI

IRI

RI

IRI [illegible] RESTRAINT [illegible] THE POINT OF [illegible] ATTACHMENT [illegible]

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Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category 1 and Seismically Designed Piping and Supports

R1

H-2

Project Identification
No. CAR-SH-M-71

CAROLINA POWER & LIGHT CO.
SHEARON HARRIS NUCLEAR PROJECT
RESTRAINT LOADING COMBINATIONS

BY SNK-GSC-BKG DATE 5-17-76
CHECKED BY EAS DATE 2/22/76

LOAD COMBINATIONS FOR CLASS 2 AND 3 PIPING SUPPORTS

SYSTEM / COMPONENT	PLANT OPERATING CONDITION	COMPONENT OPERATING CONDITION	COMBINATION NO.	COINCIDENT LINE PRESSURES: DESIGN PRESSURE Pd	TEST PRESSURE Pt	NORMAL OP. PRESSURE Po	UPSET PRESSURE Pu	ACCIDENT PRESSURE Pa	COINCIDENT SYSTEM TEMP: DESIGN TEMP. Td	TEST TEMP. Tt	NORMAL OP. TEMP. To	UPSET TEMP. Tu	ACCIDENT COND. TEMP. Ta	RESTRAINT LOADS DUE TO VARIOUS PIPE LOADING CONDITIONS: THERMAL EXPANSION Te	THERMAL ANCHOR MOVMT. TA	PIPE DEADWEIGHT Wp	PIPE SUSTAINED WEIGHT (CONSIDERED SIMULTANEOUS) Ws	TEST WEIGHT Wt	OBE INERTIA Yo	OBE ANCH. MOVMT. Yo	DBE INERTIA Yd	DBE ANCH. MOVMT. DIFFERENTIAL BLDG SETTLEMENT Ya	RELIEF VALVE OPEN SYSTEMS (DYNAMIC) Rvo	RELIEF VALVE CLOSED SYSTEMS (DYNAMIC) Rv	FLUID HAMMER OR STEAM CHUGGING (DYNAMIC) Fvc	OTHER LOAD CONDITIONS AS SPECIFIED IN DESIGN SPEC. Rm	EMERGENCY CONDITIONS AS SPECIFIED IN DESIGN SPEC. Re	LOCA JET IMPINGEMENT LOAD Rj	TORNADO WIND LOAD Rw	TORNADO MISSILE IMPACT LOAD Rt	PIPE VIBRATIONS Rv	DEAD WEIGHT OF RESTRAINT & OTHER ENVIRONMENTAL LOADS ACTING UPON RESTRAINT (D)	OTHER LOADS (E)	REMARKS
ALL SAFETY CLASS 2 & 3 SYSTEMS OTHER THAN ESSENTIAL SYSTEMS (A) — SPRING HANGERS (CONSTANT OR VARIABLE)	UPSET	DESIGN	1	✓					✓							✓	✓															✓	✓	
	TEST	TEST	2		✓					✓								✓														✓	✓	
	NORMAL	NORMAL	3			✓					✓			✓	✓	✓	✓		✓													✓	✓	
	UPSET	UPSET	4				✓					✓		✓	✓	✓	✓															✓	✓	
	EMERGENCY	↓	5					✓					✓	✓	✓	✓	✓															✓	✓	
	FAULTED		6					✓					✓	✓	✓	✓	✓															✓	✓	

REMARKS

(A) FOR CONSTANT SPRING HANGER MEAN VARIABILITY ≤ 0.06 FOR VARIABLE SPRING HANGER MEAN VARIABILITY ≤ 0.25

(B) THERMAL LOADS ONLY FOR VARIABLE SPRING HANGER

(C) UNDER ALL UPSET, EMERGENCY AND FAULTED PLANT CONDITIONS EXCEPT THE POSTULATED PIPE RUPTURE CONDITIONS OF THE SYSTEM SUPPORTED BY THE SUBJECT SPRING HANGER, THE DESIGN SHOULD BE SUCH AS TO ACCOMMODATE PIPE MOTIONS AND THE SPRING HANGER SHALL EFFICIENTLY SUPPORT THE INDICATED LOADS WITHOUT BOTTOMING UP. MEAN VARIABILITY LIMITS SPECIFIED ABOVE SHALL BE MAINTAINED UNDER THESE CONDITIONS.

(D) SUPPORT DESIGNER SHALL CALCULATE RESTRAINT DEADLOAD & OTHER ENVIRONMENTAL LOADS ACTING ON THE RESTRAINT & APPLY ITS EFFECTS TO ACCOUNT FOR THEM IN THE DESIGN

(E) SUPPORT DESIGNER SHALL ACCOUNT FOR THE EFFECTS OF FRICTIONAL RESTRAINT TO THERMAL MOVEMENT ON THE RESTRAINT BETWEEN THE POINT OF PIPE ATTACHMENT & ATTACHMENT TO STRUCTURE.

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Project Identification
No. CAR-SH-M-71

CLIENT CAROLINA POWER & LIGHT CO.
PROJECT SHEARON HARRIS NUCLEAR PROJECT
SUBJECT RESTRAINT LOADING COMBINATIONS

BY SNK BKG DATE 3-19-76
CHECKED BY E.R.I DATE 3/24/76

LOAD COMBINATIONS FOR CLASS 2 AND 3 PIPING SUPPORTS FOR ESSENTIAL SYSTEMS

SYSTEM [A]	COMPONENT	PLANT OPERATING CONDITION [R]	COMPONENT OPERATING CONDITION [R]	COMBINATION NO.	COINCIDENT LINE PRESSURES: DESIGN PRESSURE Pb	TEST PRESSURE Pr	NORMAL OR. PRESSURE Pn	UPSET PRESSURE Pu	ACCIDENT PRESSURE Pa	COINCIDENT SYSTEM TEMP.: DESIGN TEMP. Tb	TEST TEMP. Tr	NORMAL OP. TEMP. Tn	UPSET TEMP. Tu	ACCIDENT COND TEMP. Ta	RESTRAINT LOADS DUE TO VARIOUS PIPE LOADING CONDITIONS: THERMAL EXPANSION TE	THERMAL ANCHOR MOVMT TEA	PIPE DEAD WEIGHT WP	PIPE SUSTAINED WEIGHT (EMPTY OR FLUID CONT.) WS	TEST WEIGHT WT	OBE INERTIA WI	OBE ANCH. MOVMT XI	DBE INERTIA YIB	DBE ANCH. MOVMT YIA	DIFFERENTIAL BLDG SETTLEMENT (B) VBS	RELIEF VALVE OPEN SYSTEMS (DYNAMIC) [R] RVS	RELIEF VALVE CLOSED SYSTEMS (DYNAMIC) [R] RVI	FLUID HAMMER SYSTEMS (DYNAMIC) [R] FVS	EMERGENCY CONDITION COMBINATIONS AS SPECIFIED IN DESIGN SPEC. [A] TWL	EMERGENCY CONDITION COMBINATIONS AS SPECIFIED IN DESIGN SPEC. [R] IDS	LOCA [A] YIB	JET IMPINGEMENT LOAD [N] YJL	TORNADO WIND [R] RTW	TORNADO MISSILE IMPACT LOAD [A] RTM	PIPE VIBRATIONS [R] RPV	DEAD WEIGHT OF RESTRAINT & OTHER ENVIRONMENTAL LOADS ACTING ON RESTRAINT ASSEMBLY ITSELF (B) [R]	OTHER LOADS (C) [N]	REMARKS
ALL SAFETY CLASS 2 & 3 ESSENTIAL SYSTEMS [N]	RIGID RESTRAINTS (LINEAR OR PLATE & SHELL TYPE) PIPE WHIP RESTRAINTS NOT INCLUDED	FAULTED	DESIGN	1	✓					✓							✓	✓	✓	✓										✓				✓	✓	✓	(B) SUPPORT DESIGNER SHALL CALCULATE RESTRAINT DEADLOADS, OTHER ENVIRONMENTAL LOADS ACTING ON THE RESTRINT ASSEMBLY ITSELF & ACCOUNT FOR THEM IN HIS DESIGN. (B) WHEREVER DIFFERENTIAL BLDG. SETTLEMENT LOAD IS INCLUDED, IT SHALL BE ADDED ONLY IF IT INCREASES NET REACTION FROM OTHER LOADS WHICH ARE GIVEN EITHER WITH PROPER SIGNS OR AS ABSOLUTE VALUES. (C) SUPPORT DESIGNER SHALL ACCOUNT FOR THE EFFECTS OF FRICTION & THERMAL MOVEMENT ON THE RESTRAINT BETWEEN THE POINT OF PIPE ATTACHMENT & ATTACHMENT TO STRUCTURE.
		TEST	TEST	2		✓					✓																										
		NORMAL	NORMAL	3			✓					✓													✓												
		UPSET	UPSET	4			✓					✓													✓												
				5				✓					✓												✓	✓											
				6				✓					✓												✓		✓										
				7					✓					✓											✓			✓									
				8					✓					✓											✓				✓								
				9			✓					✓													✓												
		EMERGENCY		10				✓	✓				✓	✓											✓	✓											
				11				✓	✓				✓	✓											✓		✓										
				12				✓	✓				✓	✓											✓			✓									
				13				✓	✓				✓	✓											✓				✓								
				14					✓					✓											✓												
		FAULTED		15			✓					✓													✓												
				16				✓	✓				✓	✓											✓	✓											
			EMERGENCY	17				✓	✓				✓	✓											✓		✓										
				18				✓	✓				✓	✓											✓			✓									
				19				✓					✓												✓												
				20					✓					✓											✓												
				21					✓					✓											✓												
				22					✓					✓											✓												

R1 R1 R1

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Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports | R1

Project Identification
No. CAR-SH-M-71

CLIENT CAROLINA POWER & LIGHT CO.

PROJECT SHEARON HARRIS NUCLEAR PROJECT

SUBJECT RESTRAINT LOADING COMBINATIONS

BY JWK-GSC DATE

CHECKED BY E.R.F. DATE 1/19/76

LOAD COMBINATIONS FOR CLASS 2 AND 3 PIPING SUPPORTS FOR ESSENTIAL SYSTEMS

SYSTEM [F]	COMPONENT	PLANT OPERATING CONDITION [F]	COMPONENT OPERATING CONDITION [F]	COMBINATION NO.	COINCIDENT LINE PRESSURES: DESIGN PRESSURE P_D [F]	TEST PRESSURE P_T [F]	MAXIMUM NORMAL OP. PRESSURE P_O [F]	UPSET PRESSURE P_S [R]	ACCIDENT PRESSURE P_A [N]	COINCIDENT SYSTEM TEMP: DESIGN TEMP. T_D [F]	TEST TEMP. T_T [F]	NORMAL OP. TEMP. T_O [N]	UPSET TEMP. T_S [N]	ACCIDENT COND TEMP. T_A [N]	RESTRAINT LOADS DUE TO VARIOUS PIPE LOADING CONDITIONS: THERMAL EXPANSION V_E	THERMAL ANCHOR MOVMT V_TA	PIPE DEAD WEIGHT V_D	PIPE SUSTAINED WEIGHT (CONTAINS FLUID WT.) V_S	TEST WEIGHT V_T	OBE INERTIA V_I1 [R]	OBE ANCH. MOVMT V_I2 [R]	DBE INERTIA V_I1 [R]	DBE ANCH MOVMT V_I2 [R]	DIFFERENTIAL BLDG SETTLEMENT V_BS [R]	RELIEF VALVE OPEN SYSTEMS (DYNAMIC) V_RS [R]	RELIEF VALVE CLOSED SYSTEMS (DYNAMIC) V_RI [N]	FLUID HAMMER OR SAFETY VALVE DISCHARGE (DYNAMIC) V_FS [N]	OTHER UNLIST CONDITIONS/ COMBINATIONS ASSIGNED IN DESIGN SPEC. V_OL [F]	EMERGENCY CONDITIONS/ COMBINATIONS ASSIGNED IN DESIGN SPEC. V_EM [R]	LOCA V_LO [R]	JET IMPINGEMENT LOAD V_JL [R]	TORNADO WIND LOAD V_TW [N]	TORNADO MISSILE IMPACT LOAD V_TM [N]	PIPE VIBRATIONS V_V [R]	DEAD WEIGHT OF RESTRAINT & OTHER ENVIRONMENTAL LOADS ACTING UPON RESTRAINT [B] [R]	OTHER LOADS [C] [R]	REMARKS
ALL SAFETY CLASS 2 & 3 ESSENTIAL SYSTEMS [F]	SNUBBERS	FAULTED	DESIGN	1	✓					✓								✓	✓																			
		TEST	TEST	2		✓					✓																											
		NORMAL	NORMAL	3			✓					✓																										
		UPSET	UPSET	4				✓					✓						✓	✓					✓													
				5				✓					✓						✓	✓						✓												
				6				✓					✓						✓	✓							✓										
				7				✓					✓						✓	✓								✓									
				8		✓					✓																										
		EMERGENCY		9				✓					✓													✓											
				10				✓					✓														✓										
				11				✓					✓															✓									
				12				✓					✓																✓								
				13					✓					✓																✓							
		FAULTED		14		✓					✓													✓	✓												
			EMERGENCY	15				✓					✓												✓	✓			✓								
				16				✓					✓												✓	✓				✓							
				17				✓					✓												✓	✓					✓						
				18				✓					✓												✓	✓						✓					
				19					✓					✓												✓	✓							✓			
				20					✓					✓												✓	✓							✓			
				21					✓					✓												✓	✓							✓			

REMARKS

(A) SNUBBER LOAD FOR ANY DYNAMIC EVENT AS IDENTIFIED HEREIN SHALL BE COMPUTED ON FOLLOWING BASES

(B) FOR HYDRAULIC SNUBBERS INITIAL IMPACT LOAD ONLY SHALL BE CONSIDERED. SNUBBER WILL BE ASSUMED TO YIELD UNDER SUSTAINED LOADING ACTION. [R1]

(ii) FOR MECHANICAL SNUBBERS TOTAL LOAD (INITIAL AND SUSTAINED) SHALL BE CONSIDERED. [R1]

(B) SUPPORT DESIGNER SHALL CALCULATE RESTRAINT DEAD LOAD & OTHER ENVIRONMENTAL LOADS ACTING ON THE RESTRAINT NORMALLY ITSELF & ACCOUNT FOR THEM IN HIS DESIGN [R1]

(C) SUPPORT DESIGNER SHALL ACCOUNT FOR THE EFFECTS OF FRICTION & THERMAL MOVEMENT ON THE RESTRAINT BETWEEN THE POINT OF PIPE ATTACHMENT & ATTACHMENT TO STRUCTURE

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

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Project Identification
No. CAR-SH-M-71

CLIENT CAROLINA POWER & LIGHT CO.
PROJECT SHEARON HARRIS NUCLEAR PROJECT
SUBJECT RESTRAINT LOADING COMBINATIONS

DWG NO. CAR 4994-001 REV. NO. 600
BY SWK BKG DATE 3-21-76
CHECKED BY E.R.S. DATE 3/24/76

LOAD COMBINATIONS FOR CLASS 2 AND 3 PIPING SUPPORTS FOR ESSENTIAL SYSTEMS

SYSTEM [R1]	COMPONENT	PLANT OPERATING CONDITION [R1]	COMPONENT OPERATING CONDITION [R1]	COMBINATION NO.	COINCIDENT LINE PRESSURE: DESIGN PRESSURE Pd	TEST PRESSURE Pt	NORMAL OP. PRESSURE Pn [R1]	UPSET PRESSURE Pu [R1]	ACCIDENT PRESSURE Pa [R1]	COINCIDENT SYSTEM TEMP: DESIGN TEMP Td	TEST TEMP. Tt	NORMAL OP. TEMP. Tn [R1]	UPSET TEMP. Tu [R1]	ACCIDENT COND TEMP. Ta [R1]	RESTRAINT LOADS DUE TO VARIOUS PIPE LOADING CONDITIONS: THERMAL EXPANSION Ye	THERMAL ANCHOR MVMT Yta	PIPE DEAD WEIGHT Wp	PIPE SUSTAINED WEIGHT (CONTENTS INCLUDED) Ws	TEST WEIGHT Wt	OBE Yo	OBE INERTIA Yoi	OBE ANCH. MOVMT Yoa	DBE Yd	DBE INERTIA Ydi	DBE ANCHOVMT Yda	DIFFERENTIAL BLDG SETTLEMENT Yds	RELIEF VALVE OPEN SYSTEMS (DYNAMIC) Yrvs [R1]	RELIEFVALVE CLOSED SYSTEMS (DYNAMIC) Yrvc [R1]	FLUID HAMMER OR FAST VALVE CLOSURE Yfh [R1]	EMERGENCY CONDITIONS COMBINATIONS AS SPECIFIED IN DESIGN SPEC. [R1]	EMERGENCY CONDITIONS COMBINATIONS AS SPECIFIED IN DESIGN SPEC. [R1]	LOCA JET IMPINGEMENT LOAD [R1]		TORNADO WIND LOAD [R1]	TORNADO MISSILE IMPACT LOAD [R1]	PIPE VIBRATIONS [R1]	DEAD WEIGHT OF RESTRAINT & OTHER ENVIRONMENTAL LOADS ACTING UPON RESTRAINT [C] [R1]	OTHER LOADS [D] [R1]	REMARKS
ALL SAFETY CLASS 2 & 3 ESSENTIAL SYSTEMS [R1]	SPRING HANGERS (CONSTANT OR VARIABLE)	LOCA	DESIGN	1	✓					✓							✓	✓																✓	✓	Ⓐ THERMAL LOADS FOR VARIABLE SPRING HANGERS ONLY
		NORMAL	NORMAL	2			✓					✓			✓	✓	✓	✓																✓	✓	
		UPSET	UPSET	3				✓					✓		✓	✓	✓	✓																✓	✓	Ⓑ UNDER ALL UPSET, EMERGENCY AND FAULTED PLANT OPERATING CONDITIONS EXCEPT THE POSTULATED PIPE RUPTURE CONDITION OF THE SYSTEM SUPPORTED BY THE SUBJECT SPRING HANGER, THE DESIGN SHALL BE SUCH AS TO ACCOMMODATE THE PIPE MOTIONS AND EFFECTIVELY SUPPORT THE INDICATED LOADS WITHOUT BOTTOMING UP. MEAN VARIABILITY FOR CONSTANT SPRING HANGERS ≤ 0.06 AND MEAN VARIABILITY FOR VARIABLE SPRING HANGERS ≤ 0.25
		EMERGENCY	↓	4				✓						✓	✓	✓	✓	✓															✓	✓	
		FAULTED		5				✓						✓	✓	✓	✓	✓															✓	✓	
		TEST	TEST	6	✓					✓								✓															✓	✓	Ⓒ SUPPORT DESIGNER SHALL CALCULATE RESTRAINT DEADLOAD & OTHER ENVIRONMENTAL LOADS ACTING ON THE RESTRAINT ASSEMBLY ITSELF & ACCOUNT FOR THEM IN HIS DESIGN

Ⓓ SUPPORT DESIGNER SHALL ACCOUNT FOR THE EFFECTS OF FRICTION & THERMAL MISALIGNMENT ON THE RESTRAINT BETWEEN THE POINT OF PIPE ATTACHMENT & ATTACHMENT TO STRUCTURE.

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

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Project Identification
No. CAR-SH-M-71

APPENDIX I

R1

PIPE SUPPORT DESIGN CRITERIA

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1, 2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

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Project Identification
No. CAR-SH-M-71

1. DESIGN EQUATIONS

Support/Restraint (S/R) design shall be based on the following eight (8) equations (the components for each equation will be provided with the stress analysis transmittals):

Equation 1 - Normal Operating

Equation 2 - Operating Basis Earthquake (OBE)

Equation 3 - Hurricane

Equation 4 - Pipe or Equipment Accident

Equation 5 - Tornado

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Equation 6 - Design Basis Earthquake (DBE or SSE)

Equation 7 - Pipe or Equipment Accident Plus Operating Basis Earthquake

Equation 8 - Pipe or Equipment Accident Plus Design Basis Earthquake.

1. DESIGN EQUATIONS (Cont'd)

The allowable stresses for major structural components and the supplementary steel are tabulated below based on section strength S. For structural steel, S is the required section strength based on the elastic design methods and allowable stresses defined in Part I of the AISC Specification for the Design, Fabrication & Erection of Structural Steel for Buildings (1969). When external loads such as restraint dead weight or thermal expansion are added to the piping loads, the support/restraint must meet these allowables.

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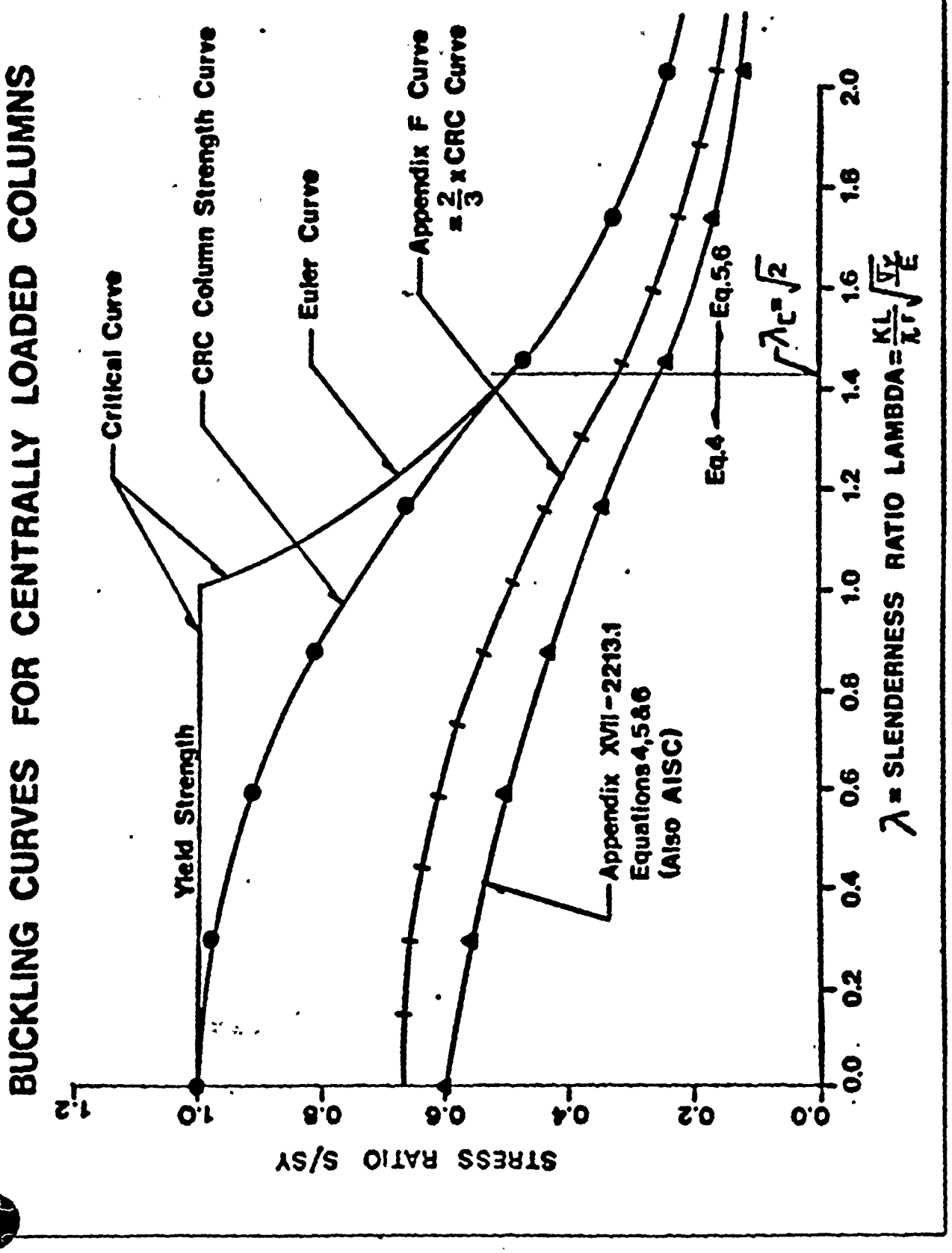
TABLE 1.1

Equation No.	Essential System		Non-Essential System	
	Flexure	Shear	Flexure	Shear
1	S	S	S	S
2	S	S	S	S
3	S	S	S	S
4	S	S	1.5S	1.3S
5	S	S	1.5S	1.3S
6	1.33S	1.3S	1.5S	1.3S
7	1.5S	1.3S	1.5S	1.3S
8	1.5S	1.3S	1.5S	1.3S

The increase in allowable stresses in Table 1.1 is subject to the following limitations:

.01 Compressive stress in compression members is limited to 2/3 critical buckling stress maximum in all cases as determined from the following curve.

Project Identification .
No. CAR-SH-M-71
1. Design Equations (Cont'd)
.01 (Cont'd)



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1. DESIGN EQUATIONS (Cont'd)

.02 Material yield stress shall not be exceeded.

.03 Loads on bolts are limited to the normal allowable loads in the AISC Specification.

.04 Loads on concrete expansion anchors shall be limited to a 4:1 factor of safety based on ultimate load. Self drilling concrete type anchors are not used on this project.

2. S/R DESIGN LOADS

.01 For stress-analyzed lines the following load cases shall be used in the design of supports.

CASE NO.	TITLE	DESIGN EQUATION
41	Sustained Load (Dead Weight)	1
42	Test Weight (Hydrostatic)	1
51/52	Fluid Hammer	2
101	OBE XYZ Inertial Response	2
103	DBE XYZ Inertial Response	6
501	Highest Positive Thermal (Normal Plant Condition)	1
502	Highest Negative Thermal (Normal Plant Condition)	1
503	Highest Positive Thermal (Normal or Upset Condition)	2
504	Highest Negative Thermal (Normal or Upset Condition)	2
505	Highest Positive Thermal (Test, Normal, Upset, Emergency or Faulted Condition)	6, 7, 8
506	Highest Negative Thermal (Test, Normal, Upset, Emergency or Faulted Condition)	6, 7, 8

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2. S/R DESIGN LOADS (Cont'd)

.02 The load cases above are to be combined for support/restraint design as follows:

Case No.	System Condition	Load Condition	Design Equation
510	Normal	Largest of a. (501 + 41) or b. (502 + 41)	1
520	Upset	(Largest of a. (501 + 41) or b. (502 + 41) or c. (503 + 41) or d. (504 + 41) or e. (41) + OBE (I + D) + (largest of a. Fluid Hammer or b. Relief Valve Discharge or any other system transients)*	2
530	Emergency	Same as Upset (520) plus the larger of combinations f. (505 + 41) or g. (506 + 41). Also use DBE in place of OBE.	6
540	Faulted	Same as Emergency (530) plus LOCA plus Jet Impingement	7, 8

R1

* Fluid Hammer/Relief Valve Discharge Loads may be combined with OBE loads by square root of the sum of the squares (SRSS) method if required.

The design loads for supports are Case No. 510 - Normal, 520 - Upset, 530 - Emergency, and 540-Faulted. When the computer-analyzed case 510, 520, 530, or 540 is not available, the equivalent load combination shall be manually generated. When the case numbers from the stress analysis output are not the same as listed here, the equivalent load cases and load combination shall be used.

R1

2. S/R DESIGN LOADS (Cont'd)

.03 For supports on piping systems without a stress analysis, the following design loads shall be used. Except for plumbing and drainage lines, which are not stress analyzed, these loads are subject to later verification against stress analysis loads.

a. 2" and Under Piping

Lateral and vertical restraints shall be designed for the loads tabulated below where W_T is the dead weight of pipe filled with water.

TABLE 2.1

LINE SIZE (IN)	1/2 & under	3/4	1	1 1/4	1 1/2	2
DESIGN LOAD FOR LATERAL RESTRAINT (LBS)	169	269	420	585	842	1361
DESIGN LOAD FOR VERTICAL RESTRAINT (LBS)	$169+W_T$	$269+W_T$	$420+W_T$	$585+W_T$	$842+W_T$	$1361+W_T$

R1

The allowable support design stresses to be used with these loads shall be those for Normal Operating Condition (Equation 1) as specified in Table 1.1. The maximum span length for each pipe size shall be as given in Table 2.4 and 2.5.

For anchors on piping systems without a stress analysis, where piping on both sides of the anchor is seismic, the loads in Table 2.2 shall be used.

TABLE 2.2

PIPE SIZE (in.)	Fx, Fy & Fz (lbs)	Mx, My & Mz (lbs-in.)
3/4	200	1,600
1	400	3,200
1 1/4	600	4,800
1 1/2	1,000	8,000
2	1,500	16,000

2. S/R DESIGN LOADS (Cont'd)

.03 (Cont'd)
a: (Cont'd)

The above loads shall be considered as DBE loads, and the corresponding allowable stresses shall be those for Equation 6 Table 1.1.

For anchors, the six components of forces and moments shall be applied simultaneously.

b. 2 1/2" and Larger Piping

R1

Loads to be used for the design of supports for 2 1/2" and larger piping shall be as shown in Table 2.3. These loads are considered to be DBE or Emergency conditions.

For vertical restraints, the weight of the piping and its contents shall be calculated based on the weight span method, and shall be added to the magnitude of the lateral restraint forces from Table 2,3.

The allowable support design stresses to be used with the above loads are those of Equation 6 in Table 1.1.

The maximum span length for each pipe size shall be as given in Table 2.4 and 2.5.

R1

2. S/R DESIGN LOADS (Cont'd)

.03 (Cont'd)

b. (Cont'd)

TABLE 2.3

PIPE SCH.	PIPE SIZE	COMBINED THERMAL & SEISMIC DBE FORCES (LBS) LATERAL	AXIAL	ANCHOR*	ANCHOR* MOMENTS FT-LBS(DBE)
40	2 1/2"	560	1,500	1,500	3,100
80	2 1/2"	700	1,500	1,500	3,900
40	3"	840	2,200	2,200	5,000
80	3"	1,100	2,200	2,200	6,500
40	4"	1,340	3,000	3,000	9,400
80	4"	1,800	3,000	3,000	12,500
40	6"	3,000	8,000	8,000	24,800
80	6"	4,200	8,000	8,000	35,600
40	8"	5,200	12,000	12,000	49,000
80	8"	7,500	12,000	12,000	71,500
40	10"	8,000	18,000	18,000	87,200
80	10"	10,500	18,000	18,000	115,000
40	12"	12,000	23,000	23,000	137,400
80	12"	14,500	23,000	23,000	165,400
40	14"	15,000	33,000	33,000	179,000
80	14"	23,000	33,000	33,000	286,500
40	16"	20,000	47,000	47,000	267,000
80	16"	32,000	47,000	47,000	423,000
40	20"	33,000	75,000	75,000	496,000
80	20"	54,000	75,000	75,000	808,000
40	24"	52,000	128,000	128,000	831,000
80	24"	87,000	128,000	128,000	1,380,000
.750"	30"	90,000	150,000	150,000	1,433,000
.875"	30"	105,000	158,000	158,000	1,650,000
1.00"	30"	116,000	175,000	175,000	1,865,000

*FORCES AND MOMENTS ARE COMPONENTS F_x, F_y, F_z, M_x, M_y, & M_z

2. S/R DESIGN LOADS (Cont'd)

.03 (Cont'd)

c. Plumbing and Drainage Lines

Pipe-supports for plumbing and drainage lines shall be designed for the loads for lateral and vertical restraints in Tables 2.4 and 2.5 below. Friction forces will not be applied.

Loads tabulated herein are based on Pipe Sch. 40.

TABLE 2.4

LOADS FOR VERTICAL SUPPORTS

PIPE SIZE (IN.)	MAX. SPAN (FT)	WGT OF PIPE WITH WATER (LBS)	SEISMIC CONDITION	SEISMIC FORCE (LBS)	DIFFERENTIAL SEISMIC FORCE OBE=.3G DBE=.6G (LBS)	TOTAL DESIGN LOAD (LBS)
3/4	7	12	OBE	34	4	50
			DBE	68	7	87
1	7	14	OBE	57	4	75
			DBE	114	8	136
1 1/4	9	26	OBE	90	8	124
			DBE	180	16	222
1 1/2	9	32	OBE	120	10	162
			DBE	240	20	292
2	10	51	OBE	142	15	208
			DBE	284	30	365
2 1/2	11	87	OBE	320	26	433
			DBE	640	52	779
3	12	130	OBE	490	39	659
			DBE	980	78	1,188
4	14	228	OBE	830	68	1,126
			DBE	1,660	136	2,024
6	17	535	OBE	2,000	161	2,696
			DBE	4,000	322	4,857
8	19	950	OBE	3,600	285	4,235
			DBE	7,200	570	8,720
10	22	1650	OBE	5,500	495	7,645
			DBE	11,000	990	13,640
12	23	2346	OBE	7,500	704	10,550
			DBE	15,000	1,408	18,754
14	25	3053	OBE	9,000	916	12,969
			DBE	18,000	1,832	22,885
16	27	4301	OBE	11,700	1,290	17,291
			DBE	23,400	2,581	30,282

R1

R1

3. FRICTION FORCES

Friction forces shall be considered when the pipe can slide against the support in the unrestrained direction. Friction loads in the unrestrained direction of the pipe shall be added to the design loads or load combinations in the preceding paragraph 2 when the total movement of the pipe in the unrestrained direction exceeds 1/16 inches. The friction load in each unrestrained direction shall be calculated as follows:

$$F = f_1 W_1 \text{ or } f_2 W_2 \text{ whichever is greater}$$

Where: F = Friction reaction force

f = Coefficient of friction for the surfaces in sliding contact. For steel on steel "f_1" shall be 0.6 for loads due to dead weight and thermal force, "f_2" shall be 0.30 for loads due to dead weight, thermal and a dynamic event such as seismic.

R1

W_1 = Dead Weight and thermal load

W_2 = Dead Weight, thermal load, OBE and occasional loads

At points of support where excessive friction cannot be tolerated, reduced friction slides may be used. Acceptable slide components are self lubricating bronze slide plates, as manufactured by, or equivalent to, Merriman Bros Inc Lubrite slide plates. A design coefficient of 0.15 shall be used for this application.

R1

2. S/R DESIGN LOADS (Cont'd)

.03 (Cont'd)

c. (Cont'd)

TABLE 2.5

LOADS FOR HORIZONTAL RESTRAINTS

PIPE SIZE (IN.)	MAX. SPAN (FT)	WGT OF PIPE WITH WATER (LBS)	SEISMIC CONDITION	SEISMIC FORCE (LBS)	DIFFERENTIAL SEISMIC FORCE OBE=.3G DBE=.6G (LBS)	TOTAL DESIGN LOAD (LBS)
3/4	7	12	OBE	22	4	26
			DBE	44	7	51
1	7	14	OBE	37	4	41
			DBE	74	8	82
1 1/4	9	26	OBE	60	8	68
			DBE	120	16	136
1 1/2	9	32	OBE	78	10	88
			DBE	156	20	176
2	10	51	OBE	125	15	140
			DBE	250	30	280
2 1/2	11	87	OBE	210	26	236
			DBE	420	52	472
3	12	130	OBE	315	39	354
			DBE	630	78	708
4	14	228	OBE	540	68	608
			DBE	1,080	136	1,216
6	17	535	OBE	1,300	161	1,461
			DBE	2,600	322	2,922
8	19	950	OBE	2,400	285	2,685
			DBE	4,800	570	5,370
10	22	1650	OBE	3,600	495	4,095
			DBE	7,200	990	8,190
12	23	2346	OBE	4,900	704	5,604
			DBE	9,800	1,408	11,208
14	25	3053	OBE	5,900	916	6,816
			DBE	11,800	1,832	13,632
16	27	4301	OBE	7,600	1,290	8,890
			DBE	15,200	2,581	17,781

2. S/R DESIGN LOADS (Cont'd)

.03 (Cont'd)

c. (Cont'd)

In addition to the loads given in Tables 2.4 and 2.5, the effect of concentrated loads such as valves obtained by using the following factors multiplied by the weights of the concentrated loads shall be added.

	Vertical Supports		Horizontal Restraints	
	OBE	DBE	OBE	DBE
Effect of Concentrated loads	3.3G	6.6G	2.4G	4.8G

d. PLUMBING LINES IN CONTAINMENT BUILDING

For plumbing lines in the Containment Building Unit 1 which are supported against the columns, design loads for restraints shall be determined as described herein. These loads shall be used for 10S walls only. R1

Design loads equals = F span + F displ + F conc + Valve/Pipe wt
Valve/pipe is for vertical restraints only. The components of the above design loads are given in Tables 2.6 and 2.7 below.

TABLE 2.6

SEISMIC SPAN FORCES (F SPAN) LBS				
PIPE SIZE (IN)	LATERAL		VERTICAL	
	OBE	DBE	OBE	DBE
3	100	200	150	240
4	150	300	250	400
6	300	600	400	640

TABLE 2.7

SEISMIC FORCES PER PIPE SIZE (LBS)					
		OBE		DBE	
PIPE SIZE (IN.)	VALVE/PIPE WT (MAX)	WGT F CONC	BLDG REL F DISP	WGT F CONC	BLDG REL F DISP
3	30	45	30	90	60
4	42	63	42	126	84
6	80	120	80	240	160

4. SEISMIC/NON-SEISMIC INTERFACE ANCHORS

Design loads for seismic/non-seismic interface anchors shall be obtained as follows:

a. For Equation 1,

$DW_s + DW_{ns}$

Or $DW_s + DW_{ns} + TH_s + TH_{ns}$

Where the subscript s denotes the seismic portion and ns the non-seismic portion of the pipe.

DW = Dead Weight

TH = Thermal Forces

b. For Equation 2, R1

$DW_s + DW_{ns} + TH_s + TH_{ns} + 3OBE_s + 2OL_s + 2SSD_s$

Where OL = Occasional Loads

SSD = Loads due to Seismic Displacements

c. For Equation 6,

$DW_s + DW_{ns} + TH_s + TH_{ns} + 3DBE_s + 2OL_s + 2SSD_s$

d. In addition to the design load criteria given in a. thru c. above, one of the following criteria must be met for seismic/non-seismic interface anchors:

i - The interface anchor will be designed to a bending moment moment that causes initial yielding in the pipe,

or,

ii - Two (2) two-way restraints shall be designed on the non-seismic side of the interface anchor.

R1

5. STANDARD SUPPORT COMPONENTS

Standard support components to be used must have their load capacity data established by the manufacturers. No additional calculation to qualify the component standard parts is required unless the parts are used outside the scope covered by the load capacity data.

6. SUPPLEMENTARY STEEL

Supplementary steel and any structural parts that have to be qualified shall be designed in accordance with the AISC Specification for the Design, Fabrication and Erection of Structural Steel for Building. The increase in the normal allowable stresses for the various design equations shall be in accordance with paragraph 1 except that the deflection at the support points due to all load combinations of Equation 1 (Normal Operation) or Equation 2 (OBE) for frames supporting snubbers shall not exceed 1/32" in each restrained direction, and this deflection shall shall not exceed 1/16" for all other frames, including anchors.

R1

7. WELDED PIPE ATTACHMENT

.01 Welded pipe attachments shall be analyzed considering the attachments as structural members for load transfer, and for additional local stress concentration they impose on the piping. The load combinations and the allowable stresses for the design analysis of the welded pipe attachments as structural members shall be as defined in paragraphs 1 and 2. The local stress analysis of ASME Class 1 piping is not in the scope of this document. However, for the purpose of support design only, the welded pipe attachments on ASME Class 1 piping shall be treated in the same manner as those for ASME Class 2 and 3 piping subject to later design verification of the piping by a Class 1 analysis. For ASME Class 2 and 3 welded pipe attachments, the load combinations to be used in determining additional local stress concentration shall be as follows:

Code Equation 8: P + DW

Code Equation 9 (Upset): P + DW + OBE + OL

Code Equation 9 (Emergency or Faulted): P + DW + DBE + OL

Code Equation 10 (Normal, Upset, Emergency or Faulted):
TH or TH + SSD*

Code Equation 11 (Normal, Upset, Emergency or Faulted):
P + DW + (TH or TH + SSD*)

*SSD is included in Code Eq. 10 or 11 only if it has been excluded from Code Eq 9.

7. WELDED PIPE ATTACHMENT (Cont'd)

.01 (Cont'd)

Where Code Equations above are from ASME Boiler and Pressure Vessel Code Section III paragraphs NC-3650 and ND-3650, and

P = Pressure

and DW, TH, OBE, DBE, OL, and SSD have been previously defined.

.02 The allowable stresses for the total combined stresses from the existing pipe stresses and the additional local pipe stresses shall not exceed the following:

Code Equation 8: 1.0 S_h

Code Equation 9 (Upset): 1.2 S_h

Code Equation 9 (Emergency or Faulted): 1.8 S_h R1

Code Equation 10 (Normal, Upset, Emergency or Faulted): S_A

Code Equation 11 (Normal, Upset, Emergency or Faulted): $S_h + S_A$

.03 The local stresses in the piping due to welded pipe attachments shall be determined where applicable by the method given in Welding Research Council Bulletin No. 107 (WRC 107). Where WRC-107 is not applicable, other acceptable methods such as finite-element analysis or other conservative methods within the state of the art may be employed. For Code Equation 8 or 9, only the primary stresses shall be considered. For Code Equation 10 or 11, both the primary and secondary stresses shall be included.
Allowable stresses for welded pipe attachment welds to the piping are the same as those for the pipe itself at the point of attachment. Piping equations given in Paragraph 7.02 must be satisfied for the welded pipe attachment welds.

.04 The acceptance criteria for the local stresses due to welded pipe attachments are the same for ASME Section III paragraphs NC-3650 and ND-3650, ie Code Equations 8, 9 and one of Code Equations 10 and 11 have to be satisfied.

8. SPRING CONSTANT

Spring constants shall be calculated for all ASME Class 1 pipe supports and shown on the detail drawings. Spring constants shall account for the combined stiffnesses of the component parts and structural framing in each restrained direction for each support.

9. WELD DESIGN CRITERIA

The allowable weld stresses shall be in accordance with AWS D1.1, Section 9 - Design of New Bridges, for open structural shapes and plates, and Section 10 - Tubular Structures, for tubular structural sections. The increases in allowable weld stresses for various design equations are as given in Table 1.1 except that in all cases the shear stress at the base metal shall not exceed $0.55F_y$. For fillet welds using E70XX electrodes, the allowable weld stresses for Normal conditions are 18.32 KSI for ASTM A36 base metal and 21 KSI for ASTM A500 Gr B base metal.

Weld symbols to be shown on the pipe support details shall be in accordance with American Welding Society Standard - A 2.0-68, Standard Welding Symbols, with the exceptions listed below. The word "typical" shall not be used where it creates ambiguity or confusion. The all-around symbol shall be used only when the all-around weld without any break in contour can be made. The following exceptions to AWS Standard A 2.0-68 will be allowed:

.01 For skew T-joint welds with a dihedral angle between 30° and 60° a fillet weld symbol shown shall represent a partial penetration groove weld. Weld sizes shall be determined by subtracting 1/4" or 1/8" from the as-welded groove joint, as described below. The effective throat of this partial penetration groove weld shall be assumed to be 1/4" less than the specified groove depth for dihedral angles between 30° and 45°, and 1/8" less for dihedral angles between 45° and 60°. R1

.02 For a 90°-joint between two unequal width square or rectangular tubular sections, a fillet weld symbol may be used on the curved portion of the larger tubular section provided the width ratio of the smaller section to the larger is not greater than 0.8.

10. EMBEDDED PLATE AND STRUCTURAL STEEL VERIFICATION

Embedded plates Type 1 (6" x 3/4" strip plate) and Type 2 (8" x 1" strip plate) shall be design verified as part of the support design calculation. The allowable loads for each component for the above two (2) types of plates shall be as given in Table 10.1. The term "concentric attachment" means that the weld pattern joining the structural attachment to the embedded plate is symmetrical about the longitudinal centerline of the embedded plate. Deviation from this symmetrical arrangement shall be within the tolerances given on Ebasco Drawing CAR-2168-G6091.
In Table 10.1 , x is the longitudinal direction, z is the transverse direction and y is the normal direction of the embedded plate. The subscripts xa, ya and za denote the allowable load for each of the corresponding component acting alone. The total load interaction shall satisfy the following relation:

$$Fx/Fxa + Fy/Fya + Fz/Fza + Mx/Mxa + My/Mya + Mz/Mza \leq 1$$ R1

When the interaction above cannot be satisfied, the design should be changed where possible. Where the design cannot be changed and the interaction check fails, the footprint loads at the point of attachment shall be forwarded to Ebasco Civil Design Engineering for review and disposition. In all cases, footprint loads shall be shown on the support detail drawings for final review of embedded plates by Ebasco Civil Design Engineering. Verification of support loads on structural steel and on embedded plates other than Types 1 and 2 shall be done by Ebasco Civil Design Engineering.

10. EMBEDDED PLATE VERIFICATION (Cont'd)

TABLE 10.1

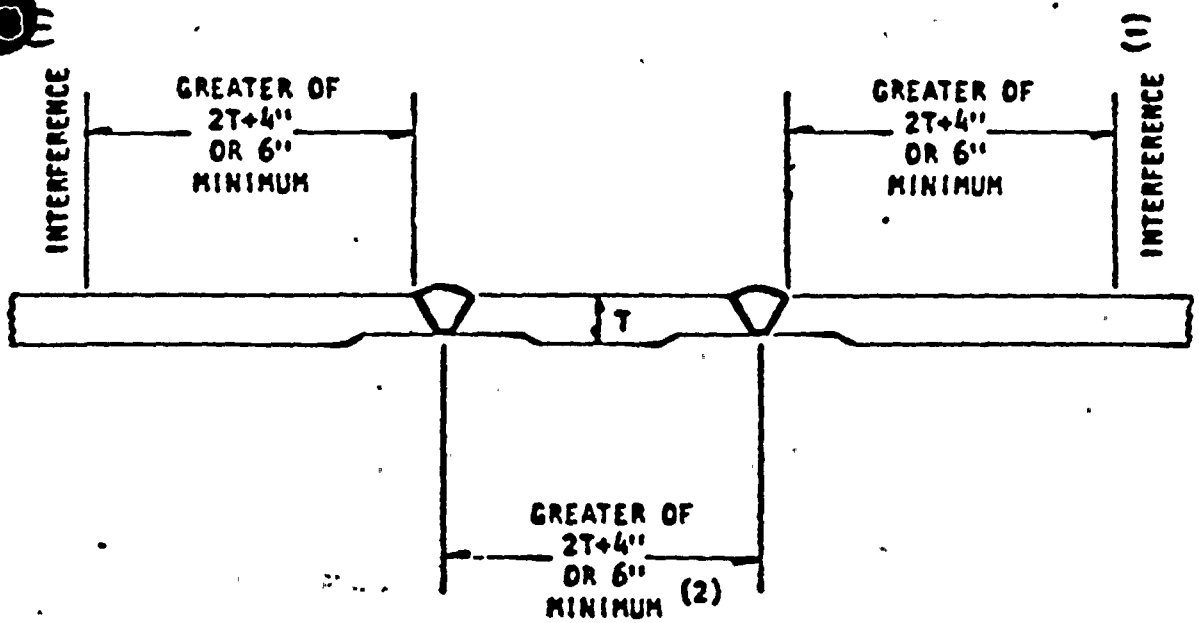
PLATE TYPE	ALLOWABLE LOAD (KIP, IN.)					
	F_{xa}	F_{ya}	F_{za}	M_{xa}	M_{ya}	M_{za}
1 (With Tolerance)	5	5	5	4.4	13.2	13.2
2 (CONCENTRIC ATTACHMENT)	46.6	20.0	24.7	62.3	302.8	57.7
2 (With Tolerance)	40.4	12.1	24.7	58.0	302.8	49.5

R1

IN-SERVICE INSPECTION

In service inspection requirementsfor ASME Section III Class 1 & 2 piping shall be in accordance with Specifications M-30 and M30A. Support design shall provide access for the required in-service as indicated in Figure 11.1.

FIGURE 11.1
CIRCUMFERENTIAL WELD CLEARANCE CRITERIA R1



NOTES:

1) Interference such as pipe hanger, pipe whip restraint, wall penetration, etc.

2) Short spools of straight pipe must be provided between fittings less than 12" in diameter. Also, no two welds in straight pipe should be closer together than the distance shown.

APPENDIX J

R1

Personnel Protection For 2" & Smaller Pipes Inside Containment (Up to 400°F)

The following criteria is to be applied to determine piping inside containment to be fitted with personnel protection:

1. Only piping which is 2" or smaller and without insulation need be considered.

2. Maximum operating temperature of 140°F to 400°F. Per APPENDIX D, Piping Line List, pipes up to 140°F do not require insulation, and therefore do not require personnel protection devices.

3. Only piping within 7'-6" vertically and 3'-2" horizontally of areas where personnel are most likely to be (access platforms, walkways, etc) need be considered.

Based on the above criteria, the piping listed in this Appendix requires personnel protection to the extent indicated herein. The corresponding weight of the personnel protection for each case can be determined from the following table: R1

PIPE SIZE (in)	WEIGHT OF PERSONNEL PROTECTION WEIGHT PER FOOT (lbs)
1/2	1.5
3/4	1.55
1	1.6
1 1/2	1.7
2	1.8

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1, 2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

PORTIONS OF PIPES REQUIRING PERSONNEL PROTECTION LINE NO.	EXTENT OF PERSONNEL PROTECTION SHOWN ON SHEET
7CS1-52-1	J-3, 4
7CS1-46-1	J-3
7CS¾-49-1	J-4
7CS¾-685-1	J-3
7CS1-53-1	J-3, 5
7CS1-47-1	J-3
7CS¾-50-1	J-5
7CS¾-686-1	J-3
7CS1-54-1	J-3, 6
7CS1-48-1	J-3
7CS¾-51-1	J-6
7CS¾-687-1	J-3
5RC¾-160-1	J-6
5RC¾-161-1	J-4
5RC¾-162-1	J-5
2CS2-138SN-1	J-7
2CS2-89SA-1	J-6
2CS2-91SA-1	J-7
2CS2-92SA-1	J-7
2CS¾-141SN-1	J-9
2CS1-655SN-1	J-9
2CS2-197SN-1	J-9
8MO1-218-1	J-8

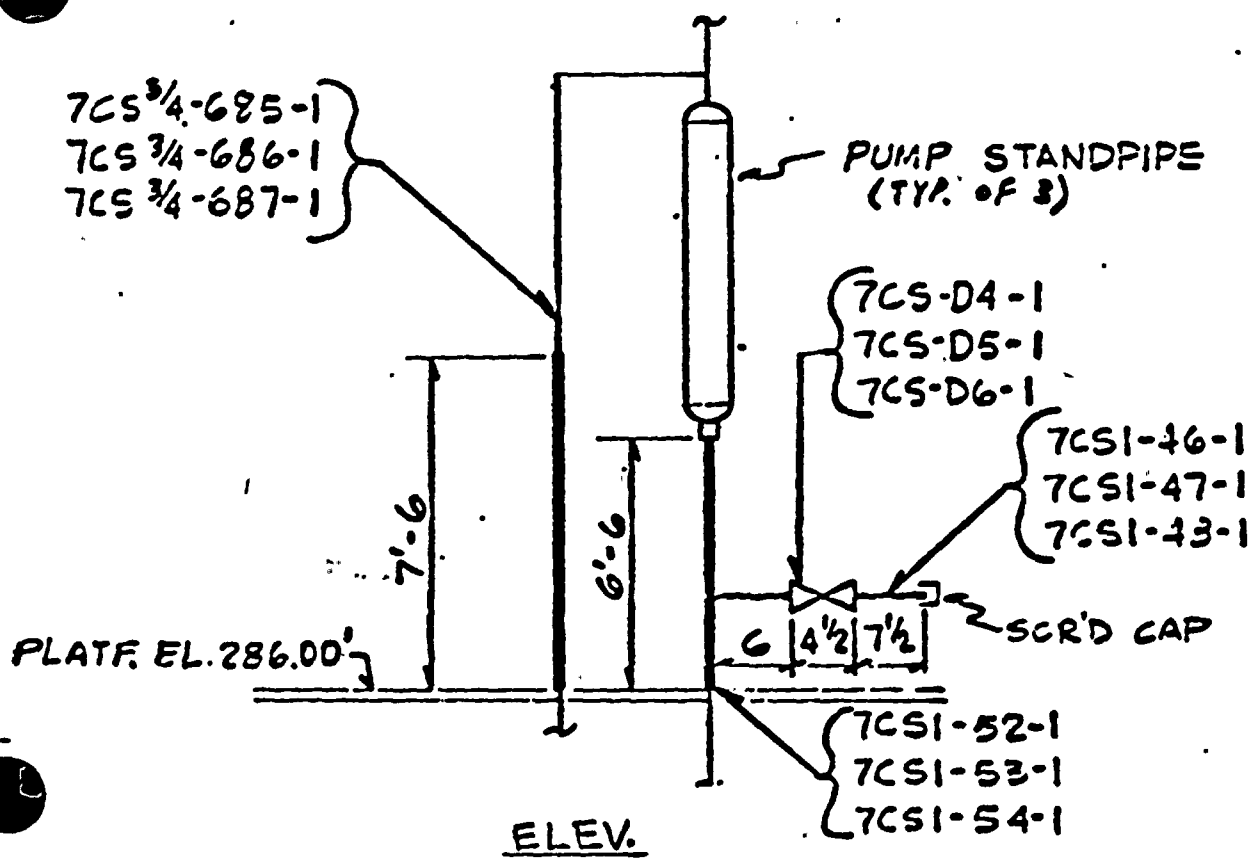
PORTIONS OF PIPES REQUIRING PERSONNEL PROTECTION LINE NO.	EXTENT OF PERSONNEL PROTECTION SHOWN ON SHEET
6WL¾-330-1	J-12
6WL¾-361-1	J-12
6WL2-370-1	J-11
6WL¾-1000-1	J-10
6WL¾-1001-1	J-10
6WL¾-1002-1	J-10
6WL2-372-1	J-14
6WL2-373-1	J-14
6WL¾-329-1	J-14
6WL¾-360-1	J-14
6WL2-326-1	J-10
6WL2-325-1	J-13
6WL2-1758-1	J-13
6WL2-1759-1	J-13
6WL2-1760-1	J-13

R1

NO SCALE

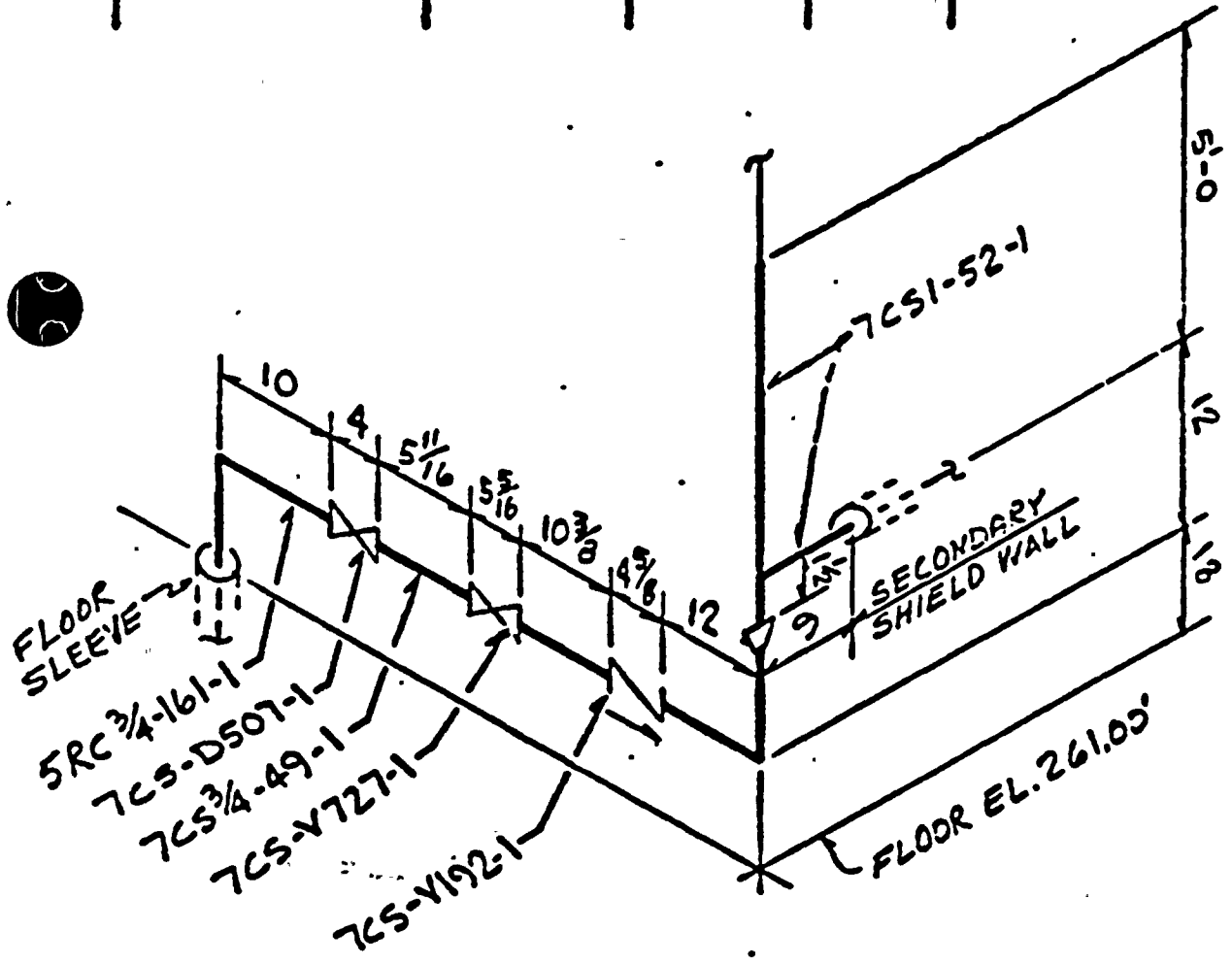
PIPE SIZE	LINE NO.	REF. DWG. NO.	COORD.	TEMP.
3/4"	7CS 3/4-685-1	G-139	K-2	160°
	7CS 3/4-686-1			
	7CS 3/4-687-1			
1"	7CS 1-46-1			
	7CS 1-47-1			
	7CS 1-48-1			
	7CS 1-52-1			
	7CS 1-53-1			
	7CS 1-54-1			

R1



NO SCALE

PIPE SIZE	LINE NO.	REF. DWG. NO.	COORD.	TEMP.
3/4"	7CS 3/4-49-1	G-138	D-1	160°
1"	7CS1-52-1	"	D-2	"
3/4"	SRC 3/4-161-1	"	C-1	"



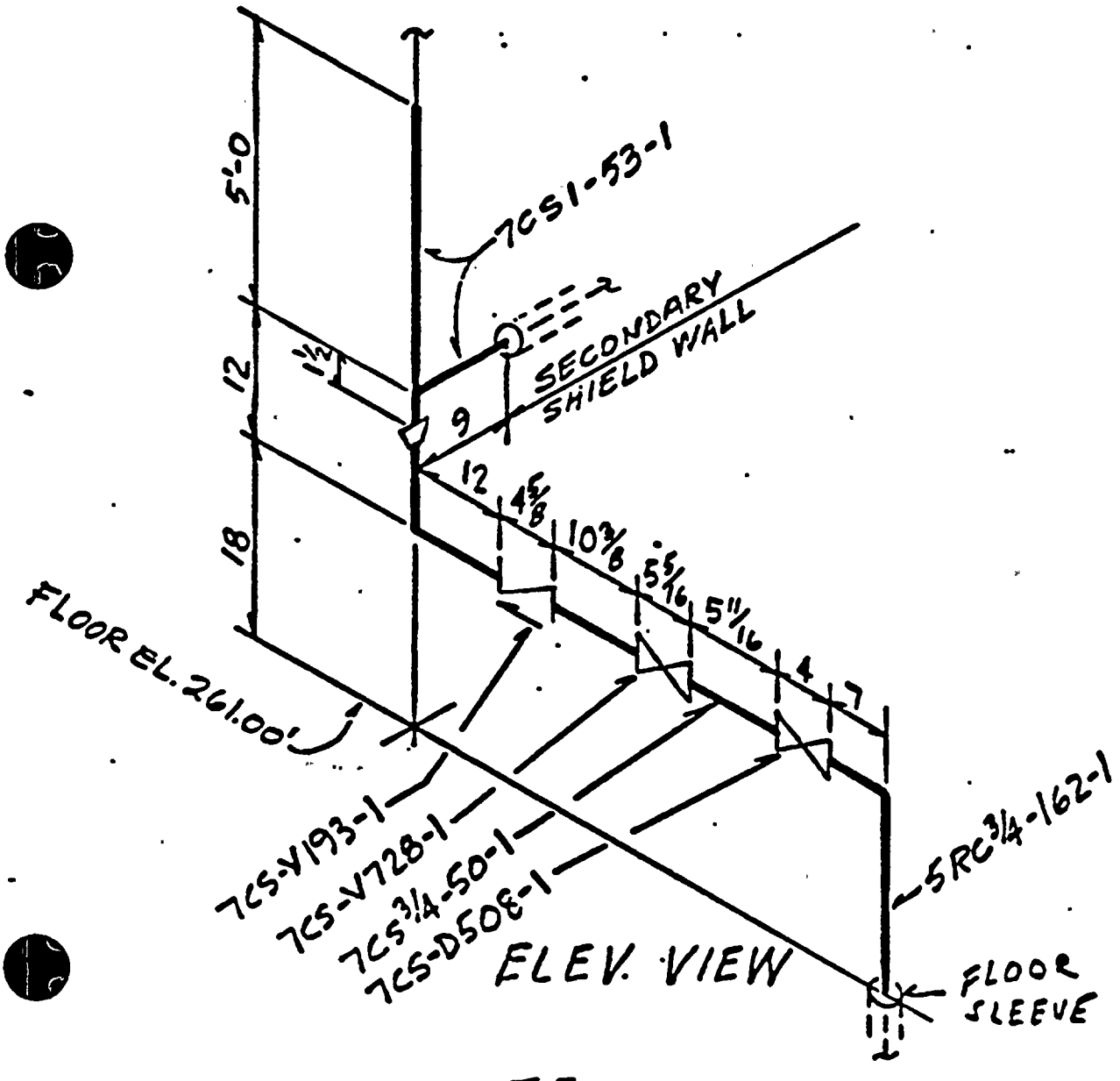
ELEV. VIEW

R1

Project Identification
No. CAR-SH-M-71

NO SCALE

PIPE SIZE	LINE NO.	REF. DWG. NO.	CO-ORD.	TEMP.
3/4"	7CS 3/4-50-1	G-138	F-10	160°
1"	7CS1-53-1	"	"	"
3/4"	5RC 3/4-162-1	"	"	"

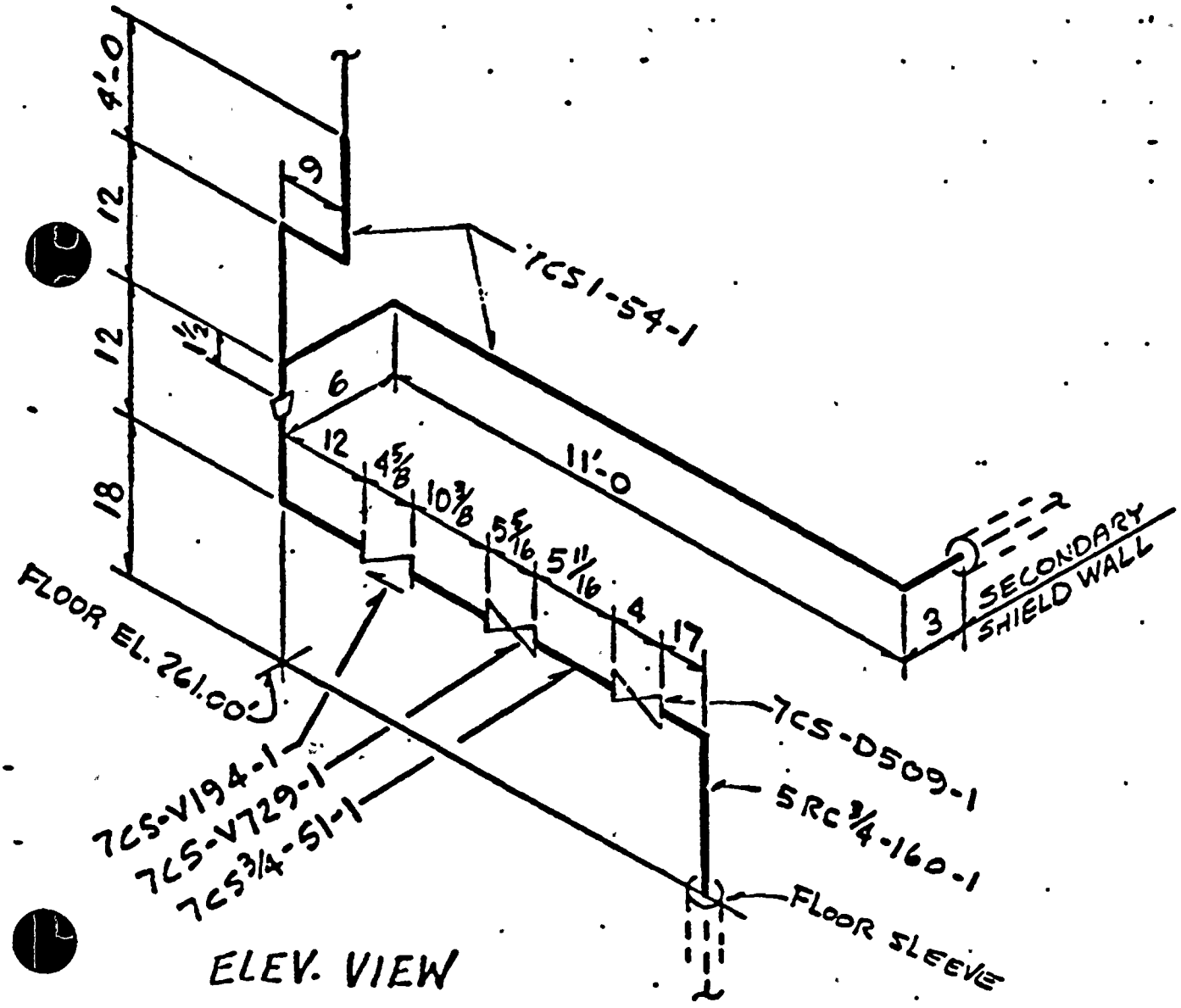


R1

Project Identification No. CAR-SH-M-71

NO SCALE

PIPE SIZE	LINE NO.	REF. DWG. NO.	COORD.	TEMP.
3/4"	7CS 3/4-51-1	G-138	D-18	160°
1"	7CS 1-54-1	"	E-18	"
3/4"	SRC 3/4-160-1	"	D-18	"



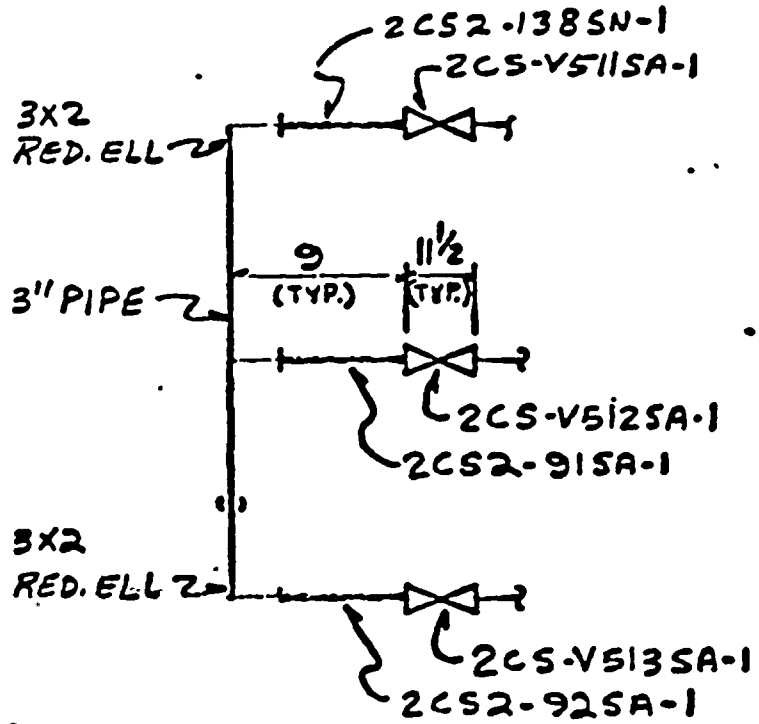
ELEV. VIEW

R1

NO SCALE

PIPE SIZE	LINE NO.	REF. DWG. NO.	CO-ORD.	TEMP.
2"	2CS2-91SA-1	G-138	K-3	290°
2"	2CS2-92SA-1	"	"	"
2"	2CS2-138SN-1	"	J-4	240°

R1

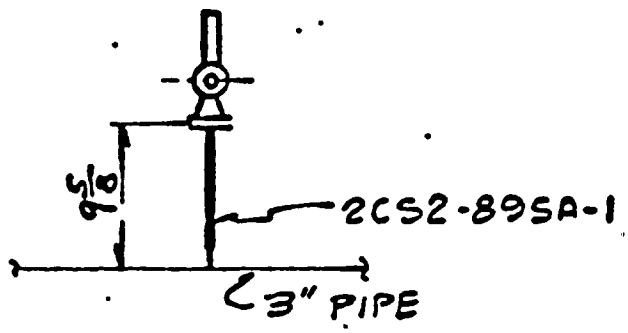


PLAN

Project Identification
No. CAR-SH-M-71

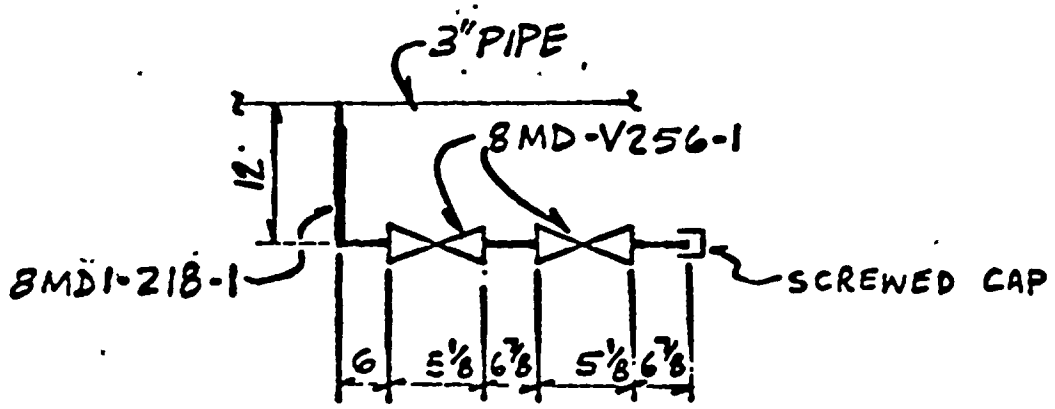
NO SCALE

PIPE SIZE	LINE NO.	REF. DWG. NO.	CO-ORD	TEMP.
2"	2CS2-89SA-1	G-139	E-1	290°
1"	8MD1-21B-1	G-180501	N-3	140°



R1

ELEV.



ELEV.

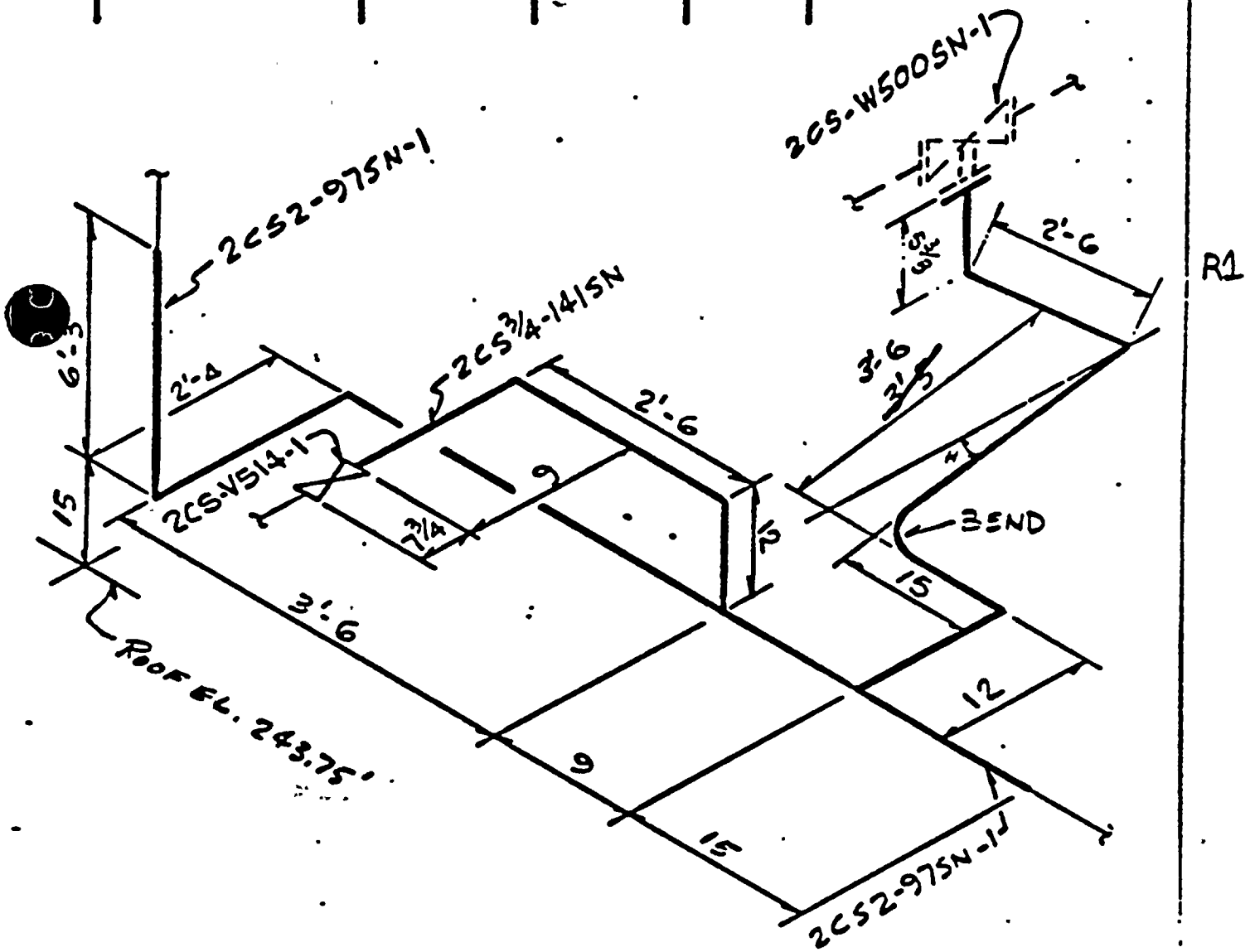
Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1, 2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

NO SCALE

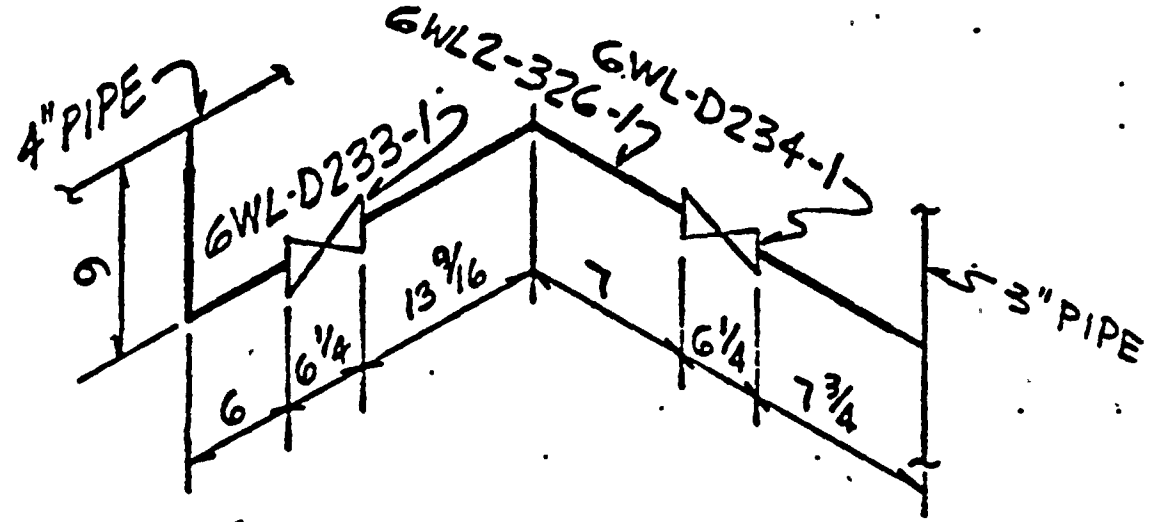
PIPE SIZE	LINE NO.	REF. DWG. NO.	CO-ORD.	TEMP.
3/4"	2CS3/4-141SN-1	G-139	B-18	150°
2"	2CS2-975N-1	G-139	B-18	↓
1"	2CS1-655SN-1	G-138	L-11	



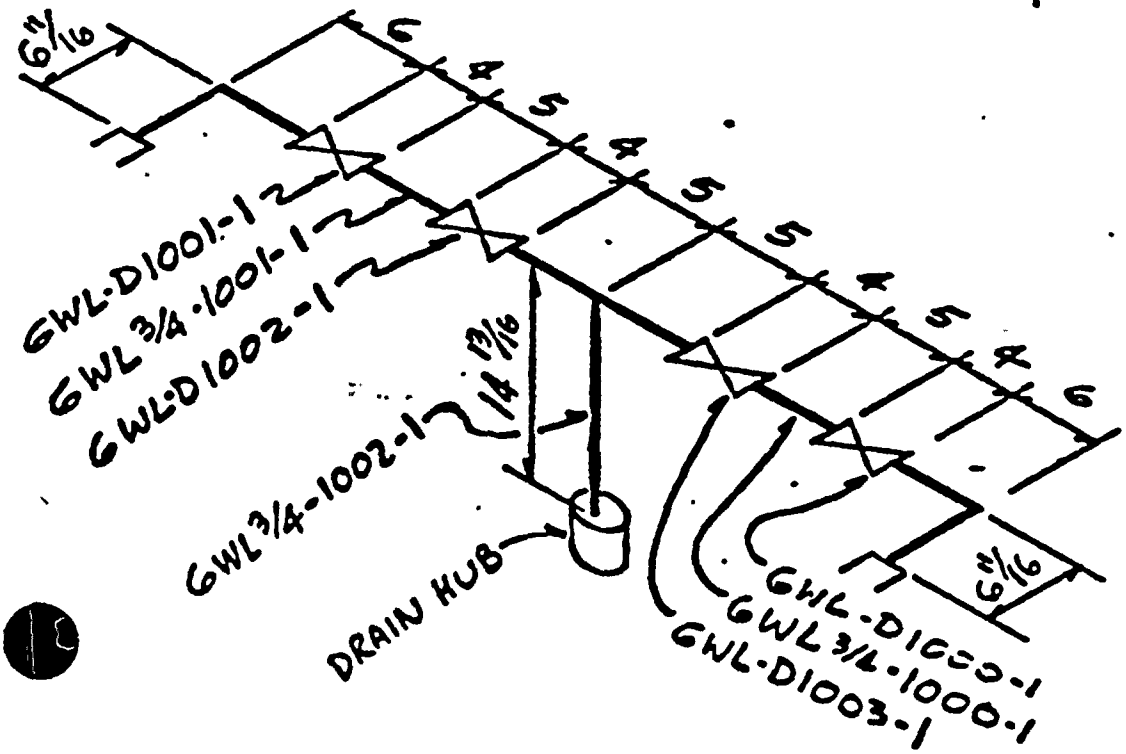
Project Identification
No. CAR-SH-M-71

NO SCALE

PIPE SIZE	LINE NO.	REF. DWG. NO.	CO-ORD.	TEMP.
2"	GWL2-326-1	G-129	J-3	170°
3/4"	GWL3/4-1000-1	↓	G-7	200°
3/4"	GWL3/4-1001-1	↓	↓	↓
3/4"	GWL3/4-1002-1	↓	↓	↓



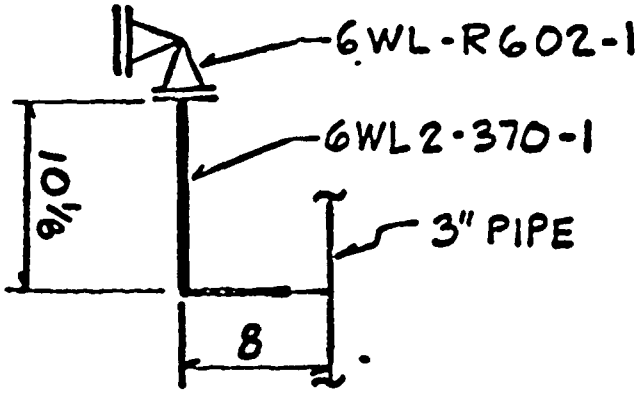
R1



NO SCALE

PIPE SIZE	LINE NO.	REF. DWG. NO.	CO-ORD.	TEMP.
2"	6WL2-370-1	G-129	J-9	170°

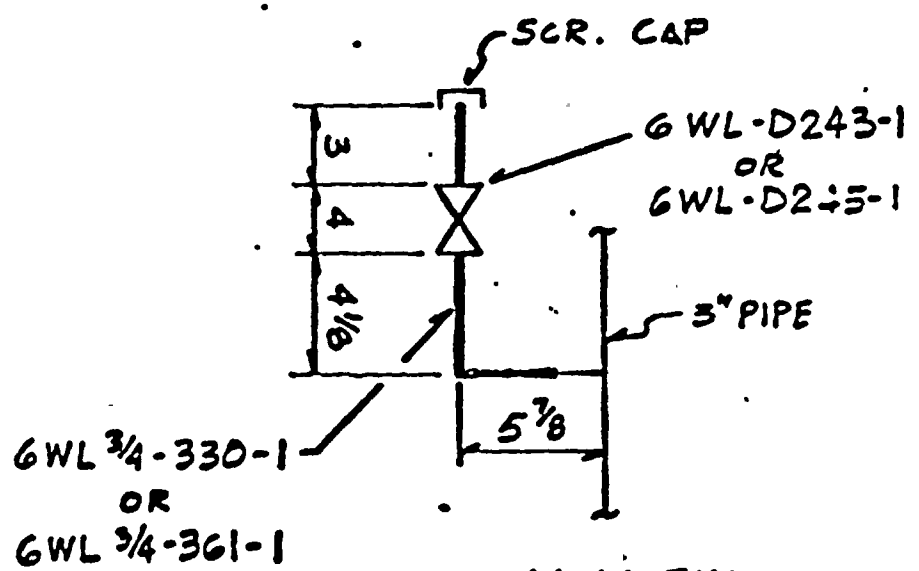
R1



ELEV. VIEW

NO SCALE

PIPE SIZE	LINE NO.	REF. DWG. NO.	CO-ORD.	TEMP.
3/4"	GWL 3/4-330-1	G-129	K-13	200°
"	GWL 3/4-361-1	"	"	"



ELEV. VIEW

R1

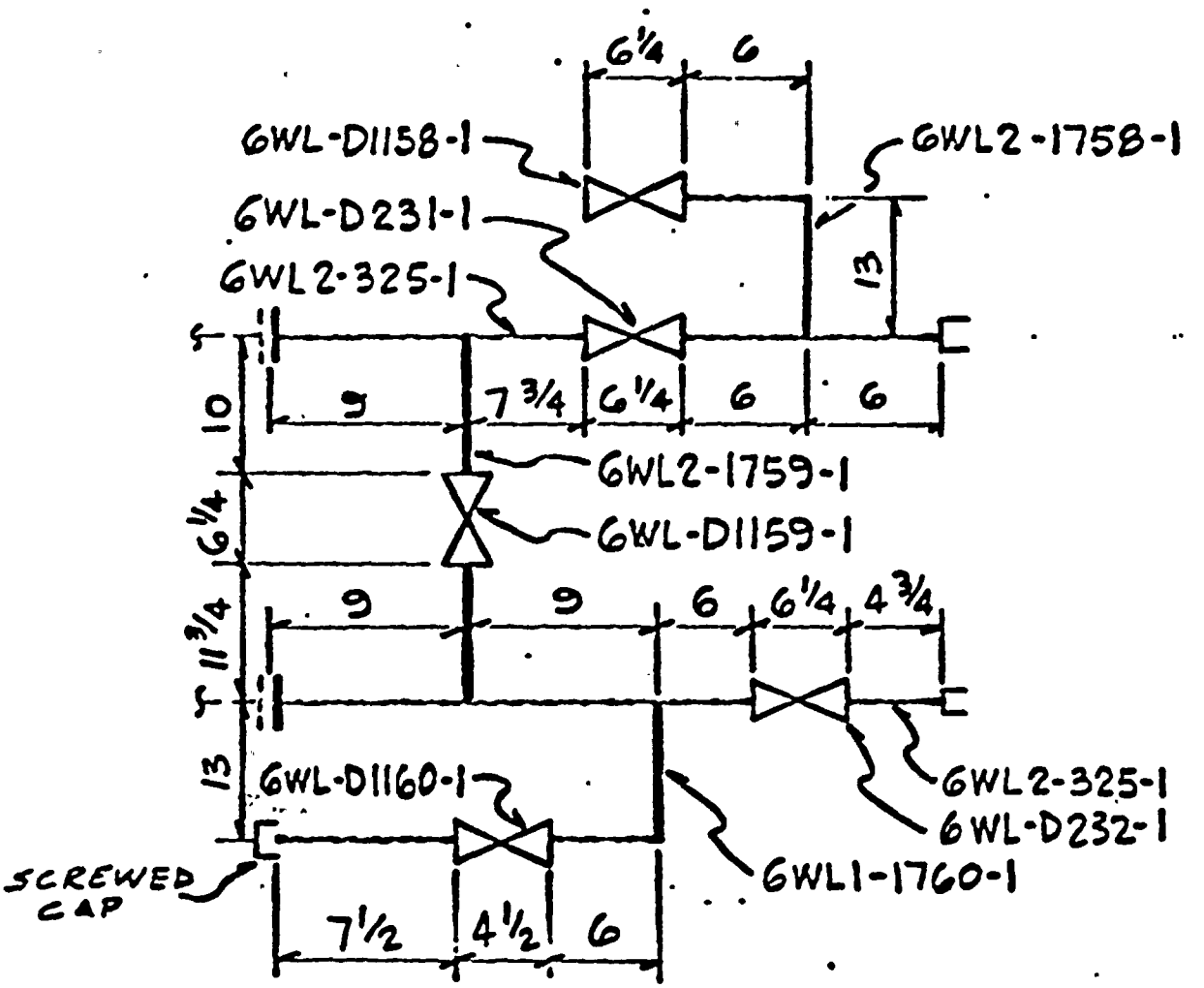
Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1, [illegible]B and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification No. CAR-SH-M-71

NO SCALE

PIPE SIZE	LINE NO.	REF. DWG. NO.	CO-ORD.	TEMP.
2	6WL2-1758-1	G-129	F-12	170
2	6WL2-1759-1	↓	↓	↓
2	6WL2-1760-1			
2	6WL2-325-1			



ELEV. VIEW

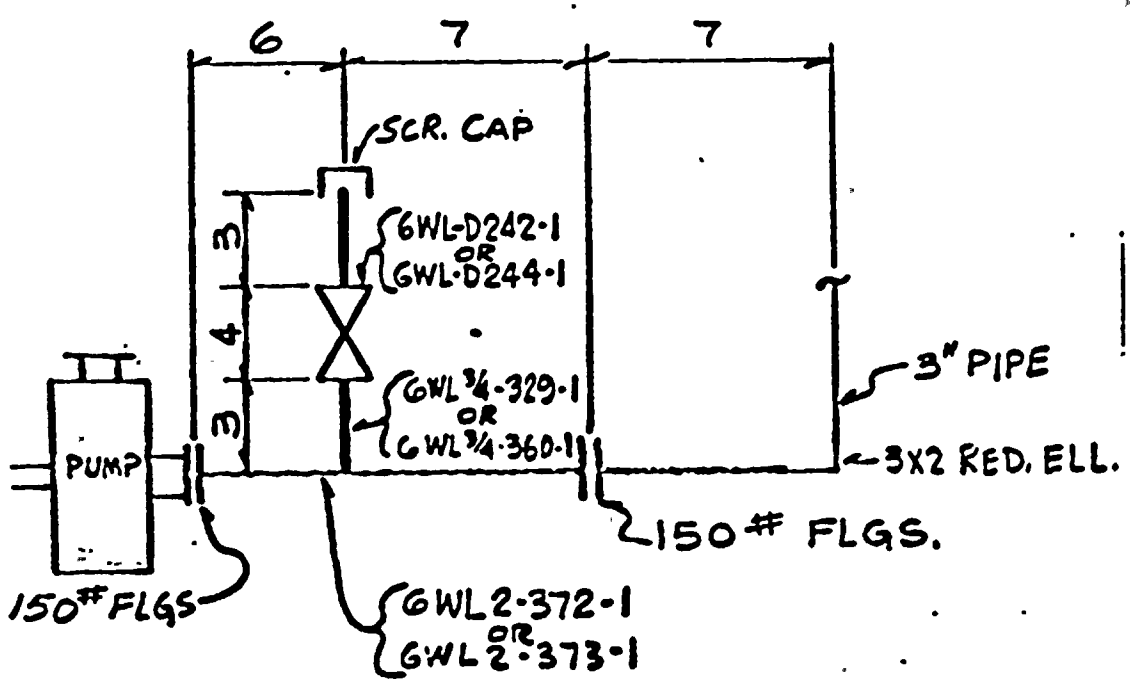
R1

NO SCALE

PIPE SIZE	LINE NO.	REF. DWG. NO.	COORD.	TEMP.
2"	6WL2-372-1	9-129	K-3	200°
2"	6WL2-373-1			
3/4"	6WL3/4-329-1			
3/4"	6WL3/4-360-1			

D

R1



ELEV. VIEW

C

	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	OPERATING TEMPERATURE (°F) S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE		GG			
1	NORMAL OPERATION	NORMAL	NORMAL	① AMB	① AMB	① AMB	① AMB	① AMB	165	① AMB	618	AMB	AMB	558	AMB	① ATM		165			
2	STARTUP	NORMAL	NORMAL	① AMB	① AMB	① AMB	① AMB	① AMB	165	① AMB	350	AMB	AMB	558	AMB	① ATM		165			
3																					
4	SHUTDOWN 4 HRS	NORMAL	NORMAL	② AMB	250	② AMB	250	② AMB	165	② AMB	350	AMB	AMB	250	AMB	ATM		165			
5	REFUELING & SHUTDOWN 200°F	NORMAL	NORMAL	AMB	140	140	140	AMB	165	140	140	120	AMB	140	AMB	AMB		165			
6	SAFETY INJECTION (SMALL BRK)	FAULTED	NORMAL	③ AMB	AMB	AMB	AMB	AMB	165	AMB	AMB	AMB	AMB	AMB	AMB	④ ATM		180			
7	SAFETY INJECTION (LARGE BRK)	FAULTED	NORMAL	AMB	AMB	AMB	AMB	AMB	165	AMB	AMB	AMB	AMB	AMB	AMB	AMB		180			
8	POST ACCIDENT RECIRCULATION	FAULTED	NORMAL	140	140	140	140	140	165	140	140	AMB	AMB	240	AMB	AMB		180			
9	LOSS OF POWER RENTR TRIP.	UPSET	NORMAL	① AMB	① AMB	① AMB	① AMB	① AMB	180	① AMB	618	AMB	AMB	558	AMB	① ATM		165			
10																					

NOTES:

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes
1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic
Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

VALVE POSITION (O=NORMALLY OPEN, C=NORMALLY CLOSED)

SYSTEM OPERATING MODE	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19
1 NORMAL	C	C	C	C	C	O	O	O	O	O	C	O	C	O	C	C	C	O	O
2 NORMAL	C	C	C	C	C	O	O	O	O	O	C	O	C	O	C	C	C	O	O
3	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
4 SHUTDN	C	C	C	C	C	O	C	O	O	O	C	O	C	O	C	C	O	O	O
5 SHUTDOWN	C	C	C	C	C	O	C	O	O	O	C	O	C	O	C	C	O	C	O
6 SI	O	O	C	C	C	C	O	O	O	O	C	C	C	O	O	C	C	O	O
7 SI	O	O	C	C	C	C	O	O	O	O	C	C	C	O	O	C	C	O	O
8 RECIRC 1	O	O	O	C	C	C	C	C	O	O	C	C	O	C	C	O	C	O	O
9 RECIRC 2	C	C	C	O	O	C	C	O	O	C	O	C	O	C	C	O	C	O	O

LEGEND:

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS. DWG

EBASCO SERVICES INCORPORATED

DIV. NNE DR. SH

CH. PF

DATE 2-28-85

APPROVED

SYSTEM: RHR/SI

APPENDIX B

SHEET 4 OF 5

B-33

NOTES:

1. IF LEAKAGE PAST THE FIRST AND SECOND CHECK VALVE ON ANY RCS BRANCH CONN. IS ASSUMED, THE LINE TEMPERATURE FOR THESE AUXILIARY BRANCH LINES UP TO THE FIRST MOTOR OPERATED VALVE (NORMALLY CLOSED) WILL BE AMB.
2. ABNORMAL LINE TEMPERATURE IS 250°F.
3. LINE NORMALLY NOT FILLED.
4. ALL LINES NORMALLY FILLED UNLESS NOTED OTHERWISE.
5. ABNORMAL LINE TEMPERATURE IS 350°F.
6. DURING EVENTS 1 AND 9 THE RHR SYSTEM IS NOT IN SERVICE.
7. ABNORMAL LINE TEMPERATURE IS 350°F
8. ABNORMAL LINE TEMPERATURE IS AMB.
9. AMB = 60°F — 120°F (OUTSIDE CONTAINMENT)
   AMB = 100°F-120°F (INSIDE CONTAINMENT)

11. (DELETED)
12. ALL ANALYSES TO BE PERFORMED USING THOSE CONDITIONS EITHER STATED OR NOTED, WHICH CAUSE THE MOST SEVERE CASE.
13. ALL INFORMATION HAS BEEN DERIVED FROM:
    WESTINGHOUSE LINE LIST FOR RHR & SI SUB 1
    EBASCO & WEST. F/D's
    LETTERS: EBW-1224
    CQL-4506
    EBW-1159
14. (DELETED)
15. LINE IS FILLED ONLY UPTO VALVE INSIDE VALVE CHAMBER FROM CONTAINMENT SIDE.

EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2&3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I & SEISMICALLY DESIGNED PIPING & SUPPORTS
PROJECT IDENTIFICATION NO. CAR-SH-M-71

R1

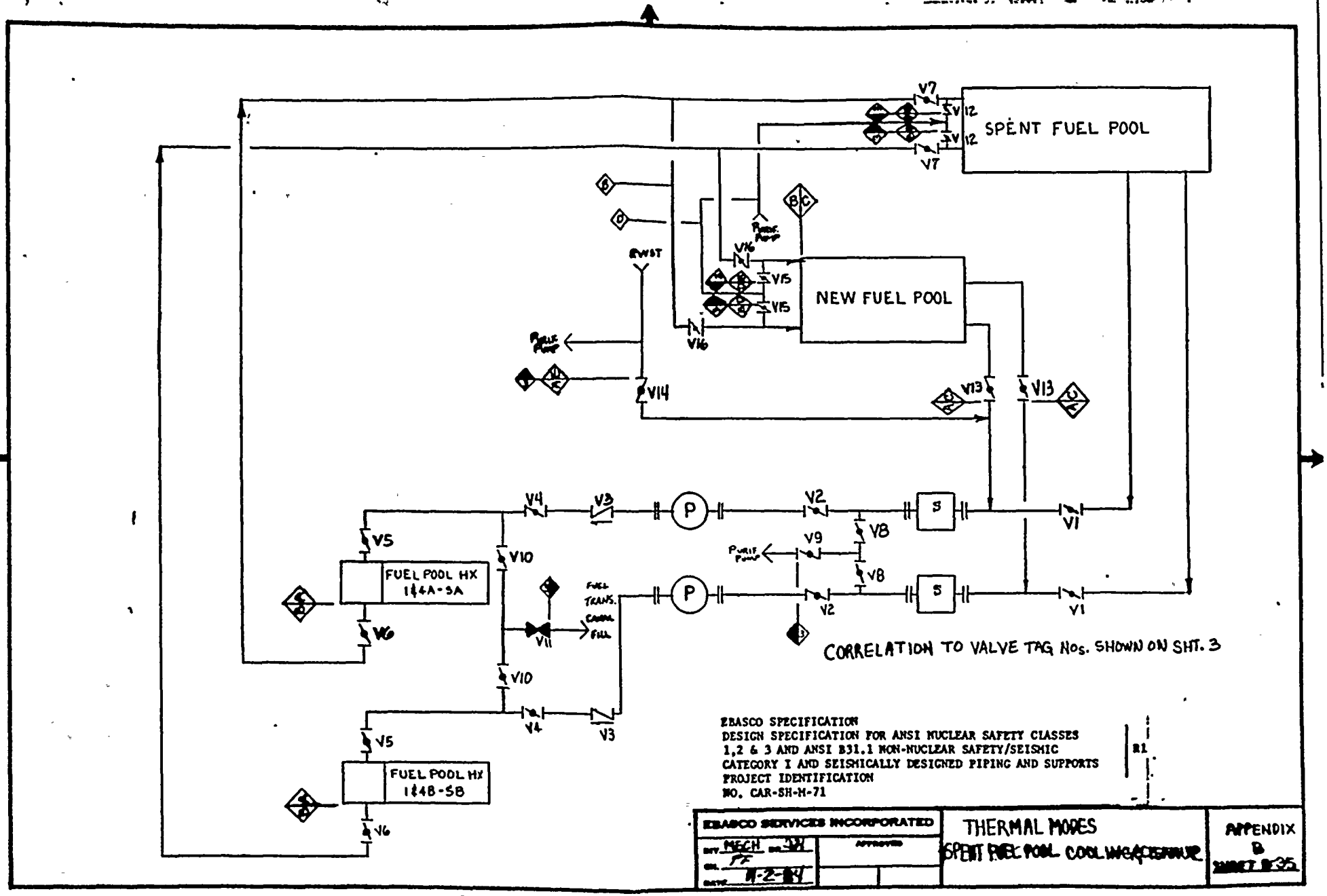
CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

B-34

EBASCO SERVICES INCORPORATED
DRN. MHE CHK. SSL APPROVED
CHK. PF
DATE 8-28-86

THERMAL MODES OF OPERATION
RESIDUAL HEAT REMOVAL & SAFETY INJECTION SYSTEMS

APPENDIX B
SHT 5 OF 5


SPENT FUEL POOL
NEW FUEL POOL
FUEL POOL HX 1&4A-SA
FUEL POOL HX 1&4B-SB
V1
V2
V3
V4
V5
V6
V7
V8
V9
V10
V11
V12
V13
V14
V15
V16
P
S
FUEL TRANS. CANAL FILL
CORRELATION TO VALVE TAG Nos. SHOWN ON SHT. 3
EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION
NO. CAR-SH-M-71
R1
EBASCO SERVICES INCORPORATED
THERMAL MODES
SPENT FUEL POOL COOLING/CLEANUP
APPENDIX B
SHEET B-35

OPERA TEMPERATURE (°F)

(1) MODE NO.	(1) EVENT	PLANT OPERATING CONDITION	(1) SYSTEM OPERATING MODE	A	B	(A) C	D	E
1	ALL	NORMAL-FAULTED	NORMAL	125	114	125	AMB.	AMB.
2	ALL	NORMAL-FAULTED	NORMAL	145	124	145	AMB.	AMB.
3	ALL	NORMAL-FAULTED	EMERGENCY	212	160	212	AMB.	AMB.
4	ALL	NORMAL-FAULTED	EMERGENCY	150	124	150	AMB.	AMB.
5								
6								
7								
8								
9								
10								

NOTES: (SEE SHEET 3)

(2) VALVE POSITION {O: NORMALLY OPEN, C: NORMALLY CLOSED}

SYSTEM OPERATING MODE	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16
1	O	O	O	O	O	O	O	O	O	C	C	C	C	O	O	O/C
2	O	O	O	O	O	O	O	C/O	C/O	C	C	C/O	C	C	C	O/C
3	O	O	O	O	O	O	O	C/O	C/O	C	C	C/O	C	C	C	O/C
4																
5																
6																
7																
8																
9																
10																

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS DWG 6-205

BECHTEL SPECIFICATION
DESIGN SPECIFICATION FOR ASME NUCLEAR POWER CLASS 1, 2 & 3 AND ANSI B 31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I, (SUPPORTS) PIPING/SYSTEMS

PROJECT IDENTIFICATION
NO. CAR-SH-NC-21

BECHTEL SERVICES INCORPORATED

TITLE FINAL MODES OF OPERATION

FINAL CARLINA 1 SYSTEM

APPENDIX B

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1, 2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

Correlation to Valve Tag Number

V 1-SF-B 20SA & B18 SB	V 9-SF-B 31SN
V 2-SF-B 1SA & B2SB	V 10-SF-B11SN & B16SN
V 3-SF-B 1SA & V2SB	V 11-SF-V4SN
V 4-SF-B 3SA & B4SB	V 12-SF-B32SA & B33SB
V 5-SF-B 9SA & B10SB	V 13-SF-B22SA & B21SB
V 6-SF-B 19SA & B15SB	V 14-SF-B17SA
V 7-SF-B 28SA & B24SB	V 15-SF-B34SA & B35SB
V 8-SF-B 29SA & B30SB	V 16-SF-B26SA & B25SB

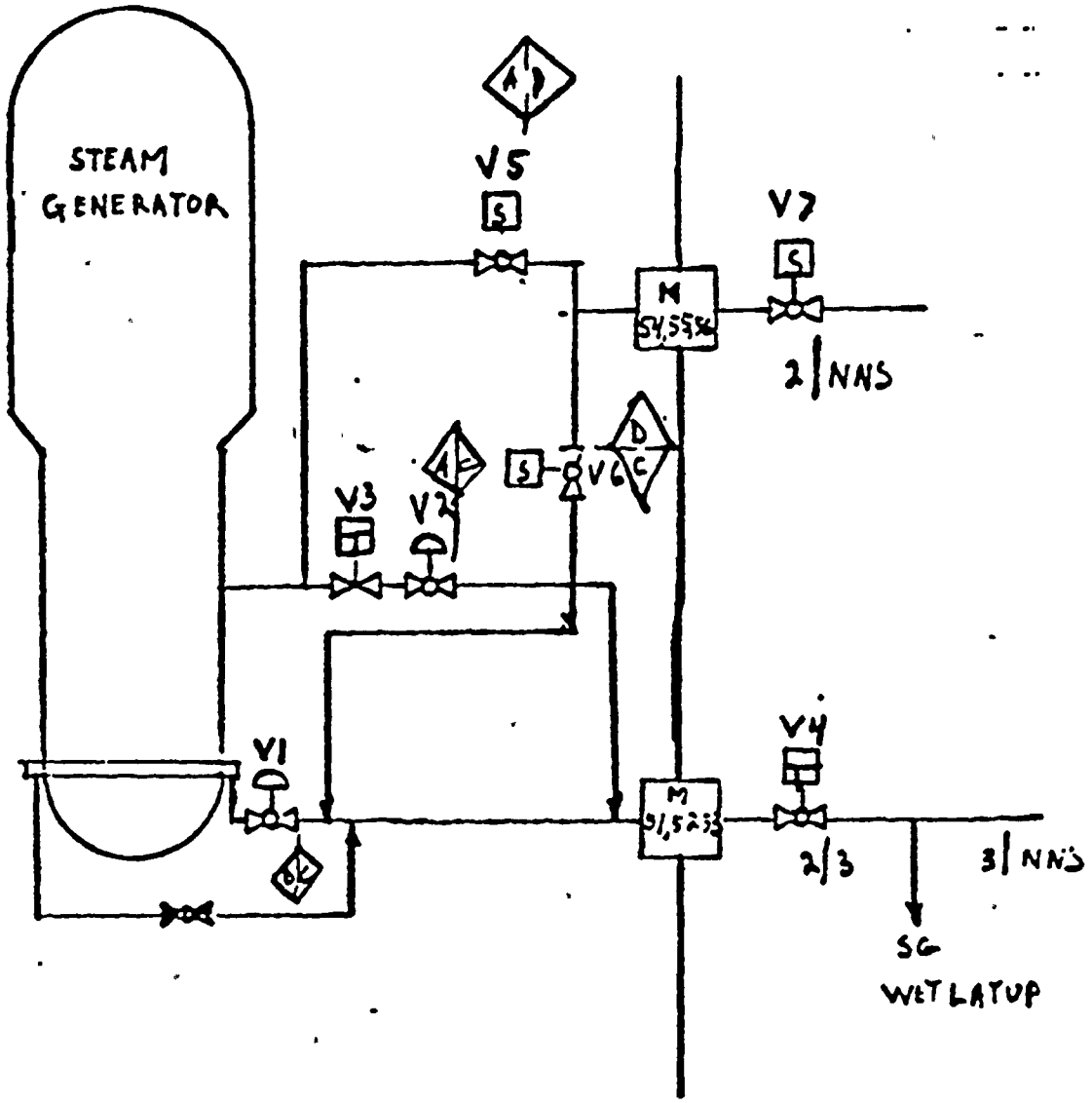
NOTES:

1. Modes correspond to the following:
   Mode 1-Both trains operating
   Mode 2-One train operating. Temperature given applies only to that train operating. Second train is assumed to be ambient.
   Mode 3-Both trains are assumed out of service allowing the pool to boil. Subsequently, one train is started. Temperature given applies onl to the train which is operating. This condition is not postulated to occur coincident with the SSE.
   MODE 4- One train is assumed to be out of service. The remaining train is operating. Temperature given applies only to the train which is operating. This condition is postulated to occur coincident with the SSE.
2. The system is arranged such that the trains may be cross tied. This means that, one train operating "can be taken as pump" A" feeding heat exchanger "B" or vice versa.
3. Temperature indicated is for both New and Spent Fuel Pools alligned to the pumps. If only the Spent Fuel Pool is alligned, this temperature is ambient.
4. The Purification System will be isolated in this mode due to temperature limitations of the Demineralizer.
5. Valve is open or closed depending on which pools are in use.
6. Valve(s) is (are) open for filling operations only. The temperature in this case would be taken to be "ambient" and System Operating Mode "Normal.

EBASCO SERVICES INCORPORATED		THERMAL MODES OF OPERATION: SPENT FUEL POOL COOLING & CLEANUP SYSTEM	APPENDIX B SHEET - OF
DIV MECH DR CK PF DATE 11-2-84	APPROVED		

RELATION TO VALVE TAG NO.

V1 - BDP7
V2 - BDF4
V3 - BD-V5
V4 - BD-V15
V5 - SP-V8
V6 - SP-V865
V7 - SP-V121



TYPICAL FOR THREE S/G

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

EBASCO SERVICES INCORPORATED		THERMAL MODES OF OPERATION STEAM GENERATOR BLOWDOWN SYSTEM	APPENDIX B SHEET 1 OF 2
DIV MECH DR SJ CH ZT DATE 11-2-81	APPROVED		

OPERATING TEMPERATURE (°F)

NO.	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	A	B	C	D
1	MAX LOAD	NORMAL	NORMAL	544	544	544	536
2	75% LOAD	NORMAL	NORMAL	549	549	549	544
3	50% LOAD	NORMAL	NORMAL	554	564	634	881
4	25% LOAD	NORMAL	NORMAL	557	557	557	565
5	NO LOAD	NORMAL	NORMAL	558	558	558	568
6	TEST	NORMAL	NORMAL	AMB. (5)	AMB. (5)	AMB. (5)	AMB. (5)
7	AUX FEEDWATER PUMP START (1)	UPSET	UPSET	558	558	366	366
8	2D BREAK NEAR SAG (4)	FAULTED	FAULTED	366 (6)	366 (6)	366 (6)	366
9	2D BREAK UPSTREAM OF VALVE V4 (4)	FAULTED	FAULTED	543	543	366 (6)	366
10	T SIGNAL (4)	UPSET	UPSET	543	543	543	543

NOTES:

1- REF. (3) LTRS. CQL-1305, DATED 1/20/77 & CQL-3052, DATED 4/1/75.

2- ALL ISOLATION VALVES FAIL CLOSED.

3- POSITION INDICATED IS FINAL VALVE POSITION

4- TEMPERATURES WILL DECREASE TO SHUTDOWN TEMPERATURES.

5- LINE IS FILLED WITH WATER.

6- LINE IS EMPTY

(2) VALVE POSITION {O: NORMALLY OPEN, C: NORMALLY CLOSED}

SYSTEM OPERATING MODE		V1	V2	V3	V4	V5	V6	V7	V	V	V	V	V	V
1	NORMAL	O	O	O	O	O	O	O						
2	NORMAL	O	O	O	O	O	O	O						
3	NORMAL	O	O	O	O	O	O	O						
4	NORMAL	O	O	O	O	O	O	O						
5	NORMAL	O	C	C	O	C	O	O						
6	TEST	NA	NA	NA	NA	NA	NA	NA						
7	UPSET	C	C	C	O	C	C	O						
8	FAULTED	C	C	O	O	O	O	O						
9	FAULTED	C	C	C	C	C	C	C						
10	UPSET	C	C	C	C	C	C	C						

EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ASME NUCLEAR SAFETY CLASSES 1, 2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY / SEISMIC CATEGORY I & SEISMICALLY DESIGNED PIPING & SUPPORTS

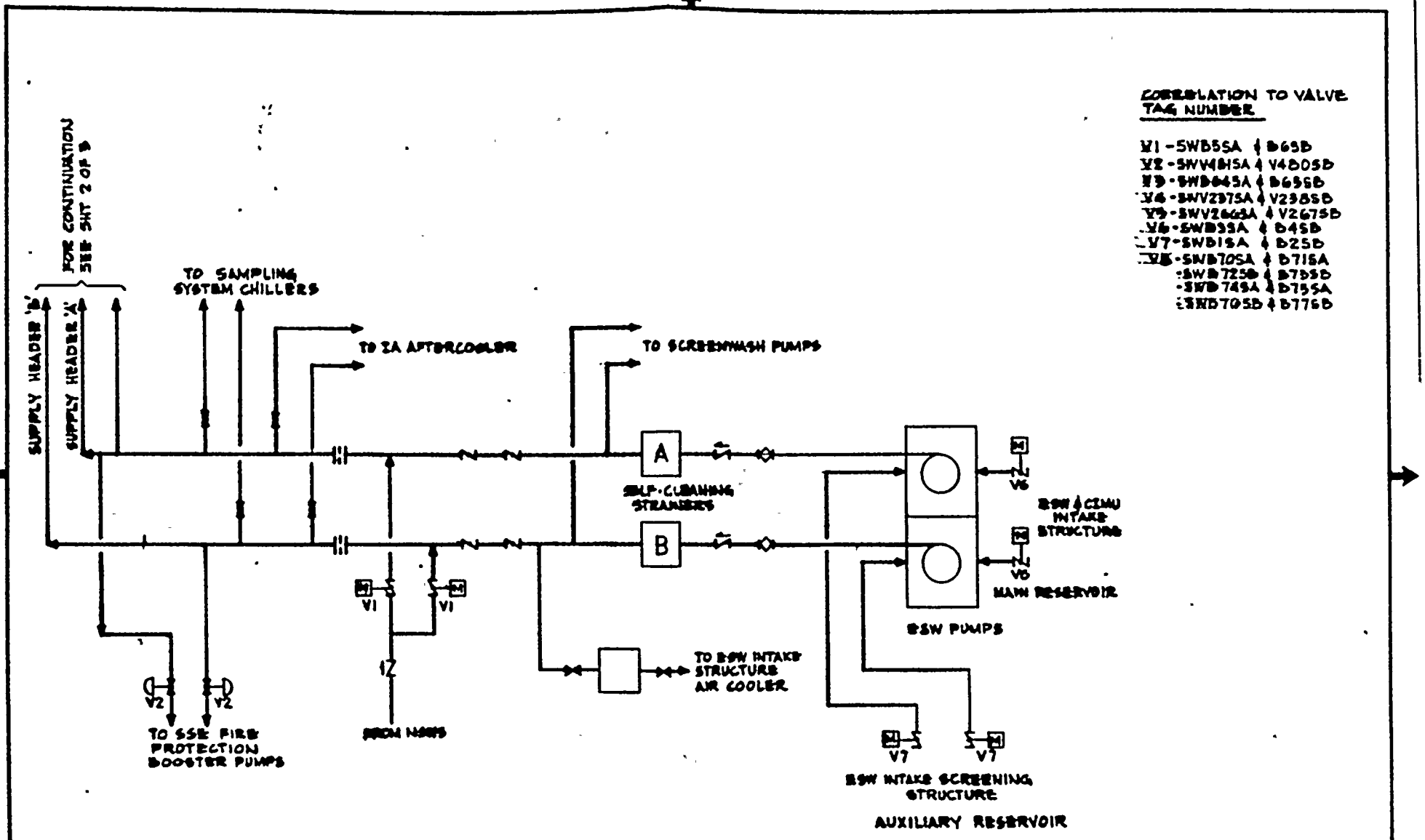
PROJECT IDENTIFICATION
NO. CSSR-GH-PY-21

R1

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS DWG G-051

EBASCO SERVICES INCORPORATED		THERMAL MODES OF OPERATION STEAM GENERATOR BLOWDOWN SYSTEM	APPENDIX B SHEET 2 of 2
DESIGN M.S. DATE 1/21/77	APPROVED		
CHECKED P.E. DATE 1/21/77			

8-59



EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION NO. CAR-SH-M-71

R1

EBASCO SERVICES INCORPORATED

THERMAL HYDRS SERVICE WATER

APPENDIX B

SHEET B-40

OPERATING TEMPERATURE (°F)

NO.	PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING MODE	A	B (4)	C (7)	D	E	F	G	H	J
1	STATION BLACKOUT	UPSET	UPSET (6)	40 TO 95	105	112	60 TO 95	103	125 (8)	104	106	128
2	SAFETY INJECTION SIGNAL	EMERGENCY / FAULTED	EMERGENCY (6)	40 TO 95	105	112	60 TO 185	103	125 (8)	104	117 TO 122	128
3 (1)	ALL EXCEPT No. 1 & 2 ABOVE	NORMAL	NORMAL (6)	40 TO 95	105	112	60 TO 95	LESS THAN 103	125 (8)	104	LESS THAN 106	40 TO 95
4												
5												
6												
7												
8												
9												
10												

NOTES:

1- FLOW PROVIDED FROM THE NORMAL SW PUMPS. ALL ESW PUMPS ARE OFF.

2- OPERATOR WILL OPEN AT LEAST 1 PAIR OF VALVES (V6) AFTER RWST IS EMPTIED.

3- BOOSTER PUMPS ARE RUNNING DURING THIS MODE.

4- PREFERRED POSITIONS ARE INDICATED. HOWEVER, IF VALVES (V6) ARE OPEN, THEN VALVES (V7) ARE CLOSED.

5- TEMPERATURES ARE LOWER IF TEMPERATURES FOR "A" ARE LOWER

6- BOTH LOOPS ARE OPERATING HOWEVER, ONLY ONE LOOP IS REQUIRED

7- EITHER LOOP A OR B ONLY IS ALLIGNED, NOT BOTH.

8- TEMPERATURE FROM PIPING LINE LIST, "IN REMOTE D".

VALVE POSITION {O: NORMALLY OPEN, C: NORMALLY CLOSED}

(2) SYSTEM OPERATING MODE	V1	V2	V3	V4	V5	V6 (4)	V7 (4)	V8	V	V	V	V	V
1 UPSET	C	C	O	O	O	C	O	C					
2 EMERGENCY/FAULTED	C	C	C	C	C	C	O	*C/O					
3 NORMAL	O	C	O	O	O	C	O	C					
4													
5													
6													
7													
8													
9													
10													

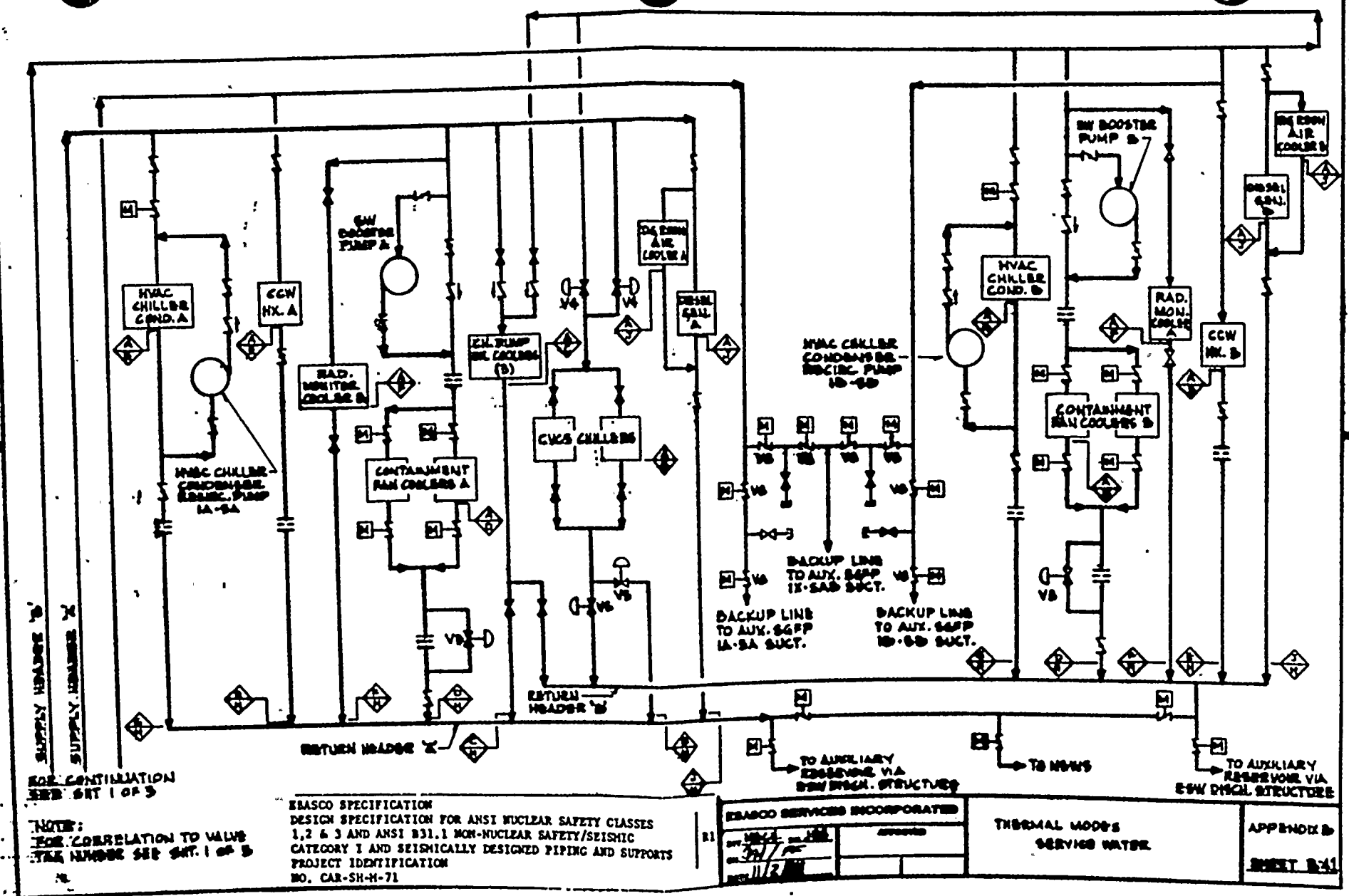
EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ASME NUCLEAR SAFETY CLASSES 1,2&3 AND ANSI B31.1 NON-NUCLEAR SAFETY /SEISMIC CATEGORY I SEISMICALLY DESIGNED PIPING & SUPPORTS

PROJECT IDENTIFICATION
NO. CAR-SH-FP-71

SEE SYSTEM FLOW DIAGRAM FOR DETAILS OF SYSTEM PROCESS DWG G-047

EBASCO SERVICES INCORPORATED	THERMAL MODES OF OPERATION SERVICE WATER SYSTEM	APPENDIX B SHEET 3 of 3
DRN. MEB DATE 8/1/84 CHK. PF DATE 8/1/84 APPROVED		

B-42


SUPPLY HEADER 'B'
SUPPLY HEADER 'A'
HVAC CHILLER COND. A
CCW HX. A
SW BOOSTER PUMP A
RAD. MONITOR. COOLER B
EMERG. DIESEL GEN. (B)
DIESEL GEN. A
CONTAINMENT FAN COOLERS A
CVCS CHILLERS
HVAC CHILLER CONDENSER RECIRC. PUMP 1A-SA
RETURN HEADER 'B'
RETURN HEADER 'A'
HVAC CHILLER CONDENSER RECIRC. PUMP 1B-SB
BACKUP LINE TO AUX. SGFP 1A-SA SUCT.
BACKUP LINE TO AUX. SGFP 1B-SB SUCT.
SW BOOSTER PUMP B
HVAC CHILLER COND. B
RAD. MON. COOLER A
CCW HX. B
CONTAINMENT FAN COOLERS B
DIESEL GEN. B
TO AUXILIARY RESERVOIR VIA ESW PHSCL. STRUCTURE
TO NSWS
TO AUXILIARY RESERVOIR VIA ESW PHSCL. STRUCTURE
FOR CONTINUATION SEE SHT 1 OF 3
NOTE:
FOR CORRELATION TO VALVE TAG NUMBER SEE SHT. 1 OF 3
EBASCO SPECIFICATION
DESIGN SPECIFICATION FOR ANSI NUCLEAR SAFETY CLASSES 1,2 & 3 AND ANSI B31.1 NON-NUCLEAR SAFETY/SEISMIC CATEGORY I AND SEISMICALLY DESIGNED PIPING AND SUPPORTS
PROJECT IDENTIFICATION
NO. CAR-SH-M-71
R1
EBASCO SERVICES INCORPORATED
THERMAL MODES
SERVICE WATER
APPENDIX B
SHEET B-41

APPENDIX C
Nozzle Loading for System Components

Allowable loads for nozzles interfacing with piping covered by this specification shall be obtained from the applicable vendor specification or drawing provided through the Ebasco EMDRAC System, or the applicable Ebasco specification or drawing. In the absence of Vendor Information, the allowable nozzle loads shall be determined as shown below:

R1

Operating Condition	Maximum Operation Temperature °F: 140° and above		Below 140° F	
	F	M	F	M
Normal	500 A	625 Z	300 A	375 A
Upset	700 A	875 Z	400 A	500 Z
Emergency	800 A	1000 Z	460 Z	565 Z
Faulted	900 A	1125 Z	500 A	625 Z
Self limiting thermal loads included in all above cases	400 Z	500 Z	200 A	250 Z

where:

A = Metal area of connecting pipe ($in.^2$)

Z = Section modulus of connecting pipe ($in.^3$)

F = Total resultant force acting in any direction (lbs)

M = Total resultant moment acting in any driection (ft-lbs)

Note: F and M are assumed to act concurrently

APPENDIX D
Piping Line List

APPENDIX D
Piping Line List
1364 - B070

APPENDIX E
Reactor Coolant System Designs Transients

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1, 2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports | R1

Project Identification
No. CAR-SH-M-71

Reactor Coolant System Transients are not included because no Class I piping analyses are being done by Ebasco.

APPENDIX F
Loading Combinations

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS...												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE(OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT.	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPT	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓			✓				✓				
SSE	FAULTED	(NOTE 1)	4	✓	✓	✓	✓		✓				✓	✓	✓			✓				✓				
LOCA	FAULTED	(NOTE 1)	5	✓	✓	✓	✓		✓							✓		✓				✓				
MSLB	FAULTED	(NOTE 1)	6	✓	✓	✓	✓		✓							✓		✓				✓				
½ SSE + LOCA	FAULTED	(NOTE 1)	7	✓	✓	✓	✓		✓		✓	✓				✓		✓				✓				
SSE + LOCA	FAULTED	(NOTE 1)	8	✓	✓	✓	✓		✓				✓	✓		✓		✓				✓				
½ SSE + MSLB	FAULTED	(NOTE 1)	9	✓	✓	✓	✓		✓		✓	✓				✓		✓				✓				
SSE + MSLB	FAULTED	(NOTE 1)	10	✓	✓	✓	✓		✓				✓	✓		✓		✓				✓				
PIPE RUPTURE	NA	NA	11*	✓	✓	✓	✓		✓		✓	✓			✓			✓				✓				
			—																							

* THIS LOAD COMBINATION IS FOR PIPE RUPTURE STRESS SUMMARY ONLY.

NOTE 1: EMERGENCY FOR ESSENTIAL PIPING; FAULTED FOR NONESSENTIAL PIPING.

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

EBASCO SERVICES INCORPORATED			DESIGN STRESS COMBINATIONS SYSTEM AUXILIARY FEEDWATER	APPENDIX F SHEET 1 of 1
DRN MNE CHK SW	APPROVED			
DES PF				
DATE 8-4-85				

F-1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (OBE) INERTIA	SSE (OBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓																	
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓																
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓							✓							
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓					✓							
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓										✓							
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓										✓							
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓							✓							
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓					✓							
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓							✓							
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓					✓							
PIPE RUPTURE			11																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

F-2

EBASCO SERVICES INCORPORATED			DESIGN STRESS COMBINATIONS SYSTEM BORON RECYCLE	APPENDIX F SHEET 1 of 1
DSV MHE DATE 4/2-84	APPROVED			
DSE PF DATE 4-2-84				

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																							SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS													
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	DA	DI	DA	CBNG	CBAC	CBPTR	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓												
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓										
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓				✓								
SSE	FAULTED	(NOTE 1)	4	✓	✓	✓	✓		✓				✓	✓	✓				✓								
LOCA	FAULTED	(NOTE 1)	5	✓	✓	✓	✓		✓							✓											
MSLB	FAULTED	(NOTE 1)	6	✓	✓	✓	✓		✓							✓											
½ SSE + LOCA	FAULTED	(NOTE 1)	7	✓	✓	✓	✓		✓		✓	✓				✓											
SSE + LOCA	FAULTED	(NOTE 1)	8	✓	✓	✓	✓		✓				✓	✓		✓											
½ SSE + MSLB	FAULTED	(NOTE 1)	9	✓	✓	✓	✓		✓		✓	✓				✓			✓								
SSE + MSLB	FAULTED	(NOTE 1)	10	✓	✓	✓	✓		✓				✓	✓		✓			✓								
PIPE RUPTURE	NA	NA	11*	✓	✓	✓	✓		✓		✓	✓			✓				✓								

* THIS LOAD COMBINATION IS FOR PIPE RUPTURE LOAD SUMMARY ONLY.

NOTE 1: EMERGENCY FOR ESSENTIAL PIPING; FAULTED FOR NON ESSENTIAL PIPING.

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

R1

F3

EBASCO SERVICES INCORPORATED

DEV. MHE DATE 3-4-85 APPROVED

DESIGN STRESS COMBINATIONS SYSTEM
CHEMICAL & VOLUME CONTROL

APPENDIX F
SHEET 1051

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (OBE) INERTIA	SSE (OBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓																	
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓																
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓							✓							
SSE	FAULTED	EMERG.	4	✓	✓	✓	✓		✓				✓	✓					✓							
LOCA	FAULTED	EMERG.	5	✓	✓	✓	✓		✓																	
MSLB	FAULTED	EMERG.	6	✓	✓	✓	✓		✓																	
½ SSE + LOCA	FAULTED	EMERG.	7	✓	✓	✓	✓		✓		✓	✓							✓							
SSE + LOCA	FAULTED	EMERG.	8	✓	✓	✓	✓		✓				✓	✓					✓							
½ SSE + MSLB	FAULTED	EMERG.	9	✓	✓	✓	✓		✓		✓	✓							✓							
SSE + MSLB	FAULTED	EMERG.	10	✓	✓	✓	✓		✓				✓	✓					✓							
PIPE RUPTURE			11																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

F-4

EBASCO SERVICES INCORPORATED

DES. MME DR. JJK
CH. PC
DATE 11-2-84
APPROVED

DESIGN STRESS COMBINATIONS
SYSTEMS
CHILLED WATER SUPPLY & RETURN

APPENDIX F
SHEET 1 of 1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																							SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS													
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPT	WH	RV	LD	PST	FVC	JI				
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓												
TESTING	NORMAL	TEST	2	✓	✓	✓	✓	✓		✓					✓		✓										
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓				✓								
SSE	FAULTED	(NOTE 1)	4	✓	✓	✓	✓		✓				✓	✓	✓				✓								
LOCA	FAULTED	(NOTE 1)	5	✓	✓	✓	✓		✓							✓			✓								
MSLB	FAULTED	(NOTE 1)	6	✓	✓	✓	✓		✓							✓			✓								
½ SSE + LOCA	FAULTED	(NOTE 1)	7	✓	✓	✓	✓		✓		✓	✓				✓			✓								
SSE + LOCA	FAULTED	(NOTE 1)	8	✓	✓	✓	✓		✓				✓	✓		✓			✓								
½ SSE + MSLB	FAULTED	(NOTE 1)	9	✓	✓	✓	✓		✓		✓	✓				✓			✓								
SSE + MSLB	FAULTED	(NOTE 1)	10	✓	✓	✓	✓		✓				✓	✓		✓			✓								
PIPE RUPTURE			11																								
			—																								

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

R1

NOTE 1: EMERGENCY FOR ESSENTIAL PIPING; FAULTED FOR NON ESSENTIAL PIPING.

EBASCO SERVICES INCORPORATED			DESIGN STRESS COMBINATIONS SYSTEM COMPONENT COOLING WATER	APPENDIX F SHEET 1 of 1
DRN. MHF DATE 2/8	APPROVED			
CHK. PF				
DATE 3-4-85				

F-5

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																							SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM...CONDITIONS..													
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTR	WH	RV	LD	PST	FVC	JI				
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓										✓								
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓																	
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓							✓								
SSE	FAULTED	(NOTE 1)	4	✓	✓	✓	✓		✓				✓	✓					✓								
LOCA	FAULTED	(NOTE 1)	5	✓	✓	✓	✓		✓										✓								
MSLB	FAULTED	(NOTE 1)	6	✓	✓	✓	✓		✓										✓								
½ SSE + LOCA	FAULTED	(NOTE 1)	7	✓	✓	✓	✓		✓		✓	✓							✓								
SSE + LOCA	FAULTED	(NOTE 1)	8	✓	✓	✓	✓		✓				✓	✓					✓								
½ SSE + MSLB	FAULTED	(NOTE 1)	9	✓	✓	✓	✓		✓		✓	✓							✓								
SSE + MSLB	FAULTED	(NOTE 1)	10	✓	✓	✓	✓		✓				✓	✓					✓								
PIPE RUPTURE			11																								
			—																								

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

Project Identification No. CAR-SH-M-71

R1 NOTE 1:- EMERGENCY FOR ESSENTIAL PIPING; FAULTED FOR NONESSENTIAL PIPING

NOTE 2: THERMAL MODES FOR CONDENSATE SYSTEM ARE INCLUDED WITH AUXILIARY FEEDWATER THERMAL MODES.

EBASCO SERVICES INCORPORATED			DESIGN STRESS COMBINATIONS SYSTEM CONDENSATE	APPENDIX F SHEET 1 of 1
DRN. MHE CHK.	APPROVED			
DES. FP				
DATE 3-9-05				

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS											SPECIAL DESIGN CONSIDERATIONS
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (OBE) INERTIA	SSE (OBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			NT*
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓											
SSE	FAULTED	(NOTE 1)	4	✓	✓	✓	✓		✓				✓	✓	✓											
LOCA	FAULTED	(NOTE 1)	5	✓	✓	✓	✓		✓							✓										✓
MSLB	FAULTED	(NOTE 1)	6	✓	✓	✓	✓		✓							✓										✓
½ SSE + LOCA	FAULTED	(NOTE 1)	7	✓	✓	✓	✓		✓		✓	✓				✓										✓
SSE + LOCA	FAULTED	(NOTE 1)	8	✓	✓	✓	✓		✓				✓	✓		✓										✓
½ SSE + MSLB	FAULTED	(NOTE 1)	9	✓	✓	✓	✓		✓		✓	✓				✓										✓
SSE + MSLB	FAULTED	(NOTE 1)	10	✓	✓	✓	✓		✓				✓	✓		✓										✓
PIPE RUPTURE			11																							

*NT - SPRAY NOZZLE THRUST

NOTE 1: EMERGENCY FOR ESSENTIAL PIPING; FAULTED FOR NONESSENTIAL PIPING.

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

R1

EBASCO SERVICES INCORPORATED

DESIGN STRESS COMBINATIONS
SYSTEM
CONTAINMENT SPRAY

APPENDIX F
SHEET 1 of 1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓				✓							
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓				✓							
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓			✓							
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓			✓							
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓			✓							
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓			✓							
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓			✓							
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓			✓							
PIPE RUPTURE			11																							
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Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

F-8

EBASCO SERVICES INCORPORATED

DRN MHF DES OH
CHK PF
APPROVED
DATE 11-2-81

DESIGN STRESS COMBINATIONS
SYSTEM
DEMINERALIZED WATER

APPENDIX F
SHEET 1 of 1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																							SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS													
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI				
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓												
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓										
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓												
SSE	FAULTED	(NOTE 1)	4	✓	✓	✓	✓		✓				✓	✓	✓												
LOCA	FAULTED	(NOTE 1)	5	✓	✓	✓	✓		✓							✓											
MSLB	FAULTED	(NOTE 1)	6	✓	✓	✓	✓		✓							✓											
½ SSE + LOCA	FAULTED	(NOTE 1)	7	✓	✓	✓	✓		✓		✓	✓				✓											
SSE + LOCA	FAULTED	(NOTE 1)	8	✓	✓	✓	✓		✓				✓	✓		✓											
½ SSE + MSLB	FAULTED	(NOTE 1)	9	✓	✓	✓	✓		✓		✓	✓				✓											
SSE + MSLB	FAULTED	(NOTE 1)	10	✓	✓	✓	✓		✓				✓	✓		✓											
PIPE RUPTURE			11																								
			—																								

NOTE 1: EMERGENCY FOR ESSENTIAL PIPING; FAULTED FOR NON ESSENTIAL PIPING

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

F-9

EBASCO SERVICES INCORPORATED			DESIGN STRESS COMBINATIONS SYSTEM EMERGENCY AIR	APPENDIX F SHEET 1 of 1
DES. MHF DR. CHK. PF DATE 3-4-85	APPROVED			

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE(OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT (NOTE 1) GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	HT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPT	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓			✓								
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓			✓								
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓		✓								
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓		✓								
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓		✓								
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓		✓								
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓		✓								
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓		✓								
PIPE RUPTURE	NA	NA	11*	✓	✓	✓	✓		✓		✓	✓						✓								
			—																							

NOTE 1: CBAG SHALL BE BASED UPON 45 PSIG.

* THIS LOAD COMBINATION IS FOR PIPE RUPTURE STRESS SUMMARY ONLY.

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

R1

F-10

EBASCO SERVICES INCORPORATED

DESIGN STRESS COMBINATIONS
SYSTEM
FEEDWATER

APPENDIX F
SHEET 1 of 1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																							SPECIAL DESIGN CONSIDERATIONS
				THERMAL		...WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (OBE) INERTIA	SSE (OBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENTAL GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓				✓							
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓				✓							
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓			✓							
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓			✓							
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓			✓							
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓			✓							
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓			✓							
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓			✓							
PIPE RUPTURE			11																			✓				
			—																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

F-11

EBASCO SERVICES INCORPORATED

DES. MNE DATE 11-2-87 CHK. JPF APPROVED

DESIGN STRESS COMBINATIONS
SYSTEM
FIRE PROTECTION

APPENDIX F
SHEET 1 of 1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓																	
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓																
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓														
SSE	FAULTED	EMERG. (1) (2) / FAULTED	4	✓	✓	✓	✓		✓				✓	✓												
LOCA	FAULTED	EMERG. (1) (2) / FAULTED	5	✓	✓	✓	✓		✓																	
MSLB	FAULTED	EMERG. (1) (2) / FAULTED	6	✓	✓	✓	✓		✓																	
½ SSE + LOCA	FAULTED	EMERG. (1) (2) / FAULTED	7	✓	✓	✓	✓		✓		✓	✓														
SSE + LOCA	FAULTED	EMERG. (1) (2) / FAULTED	8	✓	✓	✓	✓		✓				✓	✓												
½ SSE + MSLB	FAULTED	EMERG. (1) (2) / FAULTED	9	✓	✓	✓	✓		✓		✓	✓														
SSE + MSLB	FAULTED	EMERG. (1) (2) / FAULTED	10	✓	✓	✓	✓		✓				✓	✓												
PIPE RUPTURE			11																							
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Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

R1 (1)- APPLIES TO FO PIPING FROM THE DAY TK. TO THE DIESEL
(2)- APPLIES TO FO PIPING FROM THE STORAGE TK. TO THE DAY TK.

EBASCO SERVICES INCORPORATED			DESIGN STRESS COMBINATIONS SYSTEM FUEL OIL	APPENDIX F SHEET 105
BY MHE DATE 3/87	APPROVED			
CH PF				
DATE 11-2-84				

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PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS											SPECIAL DESIGN CONSIDERATIONS
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT						
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD						
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓											
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓											
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓										
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓										
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓										
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓										
PIPE RUPTURE			11																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

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Project Identification
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EBASCO SERVICES INCORPORATED

DWN MHP DES. JFV
CHK JFV
APPVD
DATE 12-84

DESIGN STRESS COMBINATIONS
SYSTEM
HYDROGEN SAMPLING

APPENDIX F
SHEET 1of1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓											
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓											
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓										
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓										
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓										
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓										
PIPE RUPTURE			11																							
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Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

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EBASCO SERVICES INCORPORATED			DESIGN STRESS COMBINATIONS SYSTEM INSTRUMENT AIR	APPENDIX F SHEET 1 of 1
DRN. MHF	DATE 11-2-84	APPROVED		
CHK. PF				

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT							
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPT	WH	RV	LD							
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓											
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓											
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓				✓						
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓										
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓										
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓										
PIPE RUPTURE			11																							
			—																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

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Project Identification
No. CAR-SH-M-71

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EBASCO SERVICES INCORPORATED

DESIGN STRESS COMBINATIONS

SYSTEM
LEAK DETECTION

APPENDIX F
SHEET 16 of

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION:	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																							SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS													
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPT	WH	RV	LD	PST	FVC	JI				
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓												
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓										
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓												
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓												
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓											
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓											
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓											
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓											
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓											
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓											
PIPE RUPTURE			11																								

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

F-16

EBASCO SERVICES INCORPORATED

DESIGN STRESS COMBINATIONS
SYSTEM
LEAK TEST

APPENDIX F
SHEET 1051

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																							
				THERMAL		WEIGHT			PRESSURE		1/2 SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	1/2 SSE (OBE) INERTIA	1/2 SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT (2) GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	TORNADO / HURRICANE & WIND (2)	JET IMPINGEMENT	STEAM HAMMER	SPECIAL DESIGN CONSIDERATIONS
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTR	WH	RV	LD	PST	FVC	DBT	JI	SH	
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓				✓			✓			✓	
SSE	FAULTED	EMERG.	4	✓	✓	✓	✓		✓				✓	✓	✓				✓			✓	✓		✓	
LOCA	FAULTED	FAULTED (4)	5	✓	✓	✓	✓		✓							✓			✓			✓			✓	
MSLB	FAULTED	FAULTED (4)	6	✓	✓	✓	✓		✓							✓			✓			✓			✓	
½ SSE + LOCA	FAULTED	FAULTED (4)	7	✓	✓	✓	✓		✓		✓	✓				✓			✓			✓			✓	
SSE + LOCA	FAULTED	FAULTED (4)	8	✓	✓	✓	✓		✓				✓	✓		✓			✓			✓			✓	
½ SSE + MSLB	FAULTED	FAULTED (4)	9	✓	✓	✓	✓		✓		✓	✓				✓			✓			✓			✓	
SSE + MSLB	FAULTED	FAULTED (4)	10	✓	✓	✓	✓		✓				✓	✓		✓			✓			✓			✓	
PIPE RUPTURE	NA	NA	11 (1)	✓	✓	✓	✓		✓		✓	✓							✓			✓			✓	

(1) - THIS LOAD COMBINATION IS FOR PIPE RUPTURE STRESS SUMMARY ONLY.

(2) - REFER TO PARAGRAPH 8.08 OF THIS SPECIFICATION FOR THE APPLICATION OF DBT LOADS. AFFECTED LINES ARE 6"MS44-8-1 & 6"MS44-9-1. THE TOTAL WIND FORCE ON EACH LINE IS 191,269 lbs.

(3) - BASED ON 45 psig.

(4) FOR PIPING FROM THE CONTAINMENT PENETRATIONS TO THE MSIVs, THE SYSTEM OPERATING CONDITION IS EMERGENCY.

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports
PROJECT IDENTIFICATION NO. CAR-SH-M-71

R1

EBASCO SERVICES INCORPORATED			DESIGN STRESS COMBINATIONS SYSTEM MAIN STEAM	APPENDIX F SHEET 1061
R1	DRN. MNE DATE 2/1	APPROVED		
	CH. PVF DATE 11-2-84			

DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	THERMAL		WEIGHT			PRESSURE		1/2 SSE		SSE		OTHER SYSTEM CONDITIONS											SPECIAL DESIGN CONSIDERATIONS
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	1/2 SSE (OBE) INERTIA	1/2 SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
1/2 SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓											
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓											
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓										
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓										
1/2 SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓										
1/2 SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓										
PIPE RUPTURE			11																							
			—																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

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F-18

EBASCO SERVICES INCORPORATED
DRN. MHE CHK. GH
APP.
DATE 11-2-84
APPROVED

DESIGN STRESS COMBINATIONS
SYSTEM
MISCELLANEOUS DRAINS

APPENDIX F
SHEET 1031

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE(OBE) ANCHOR MOVEMENT	SSE (OBE) INERTIA	SSE (OBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓																	
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓																	
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓							✓							
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓					✓							
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓										✓							
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓										✓							
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓							✓							
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓					✓							
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓							✓							
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓					✓							
PIPE RUPTURE			11																							
			—																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

F-19

EBASCO SERVICES INCORPORATED

DEV MHP DES AH
DES JPF
DATE 11-2-84
APPROVED

DESIGN STRESS COMBINATIONS
SYSTEM
NITROGEN

APPENDIX F
SHEET 1 of 1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (OBE) INERTIA	SSE (OBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT							
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD							
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓											
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓											
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓										
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓										
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓										
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓										
PIPE RUPTURE			11																							
			—																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-N-71

EBASCO SERVICES INCORPORATED

DEV. MNF CH. JPK
CH. JPK
DATE 11-2-81
APPROVED

DESIGN STRESS COMBINATIONS
SYSTEM
POST ACCIDENT SAMPLING

APPENDIX F
SHEET 165

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																							SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS...													
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPT	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓																	
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓																	
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓							✓							
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓					✓							
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓										✓							
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓										✓							
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓							✓							
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓					✓							
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓							✓							
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓					✓							
PIPE RUPTURE			11																							
			—																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

F-21

EBASCO SERVICES INCORPORATED

DWG. M-1E SH. 011
BY [illegible]
CK'D
DATE 11-2-81
APPROVED

DESIGN STRESS COMBINATIONS
SYSTEM
PRIMARY MAKEUP WATER

APPENDIX F
SHEET 1 of 1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS...											SPECIAL DESIGN CONSIDERATIONS
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT						
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPT	WH	RV	LD						
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓											
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓					✓						
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓										
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓										
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓										
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓										
PIPE RUPTURE			11																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

F-22

EBASCO SERVICES INCORPORATED

BY MNP DATE 11-2-84

APPROVED

DESIGN STRESS COMBINATIONS
SYSTEM
PRIMARY SAMPLING

APPENDIX F
SHEET 1 of 1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTR	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓	✓	✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓				✓							
SSE	FAULTED	EMERG.	4	✓	✓	✓	✓		✓				✓	✓	✓				✓							
LOCA	FAULTED	EMERG.	5	✓	✓	✓	✓		✓							✓				✓						
MSLB	FAULTED	EMERG.	6	✓	✓	✓	✓		✓							✓		✓	✓							
½ SSE + LOCA	FAULTED	EMERG.	7	✓	✓	✓	✓		✓		✓	✓				✓		✓	✓	✓						
SSE + LOCA	FAULTED	EMERG.	8	✓	✓	✓	✓		✓				✓	✓		✓		✓	✓	✓						
½ SSE + MSLB	FAULTED	EMERG.	9	✓	✓	✓	✓		✓		✓	✓				✓		✓	✓							
SSE + MSLB	FAULTED	EMERG.	10	✓	✓	✓	✓		✓				✓	✓		✓		✓	✓							
PIPE RUPTURE			11*	✓	✓	✓	✓		✓		✓	✓			✓ (NOTE 2)	(NOTE 3) ✓										
			—																							

NOTE 1: THE COMBINATIONS DESCRIBED HEREIN SHALL BE BASED UPON ASME SECT. III CODE CLASS 2 ALLOWABLES FOR RESTRAINT SELECTION ONLY. ACTUAL PIPING STRESSES SHALL BE DEVELOPED BY THE NSSS SUPPLIER (WESTINGHOUSE) BASED UPON THEIR CLASS 1 ANALYSIS.

NOTE 2: RUPTURE OUTSIDE CONTAINMENT

NOTE 3: RUPTURE INSIDE CONTAINMENT

* THIS LOAD COMBINATION IS FOR PIPE RUPTURE STRESS SUMMARY ONLY.

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1, 2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports
PROJECT IDENTIFICATION NO. CAR-SH-M-71

R1

EBASCO SERVICES INCORPORATED

DES. MNF DR. MF CH. JPF APPROVED DATE 11-2-84

DESIGN STRESS COMBINATIONS (NOTE 1)
SYSTEM
CLASS 1 BRANCH PIPING (REACTOR COOLANT)

APPENDIX F SHEET 1 of 1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT							
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD							
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓											
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓											
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓										
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓										
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓										
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓										
PIPE RUPTURE			11																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

F-24

EBASCO SERVICES INCORPORATED			DESIGN STRESS COMBINATIONS SYSTEM REACTOR VESSEL LEVEL INDICATION	APPENDIX F SHEET 1 of 1
DRN. MNE DATE 11/2	APPROVED			
CHK. [illegible] DATE 11-2-84				

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									(NOTE 2)
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓											
SSE	FAULTED	(NOTE 4)	4	✓	✓	✓	✓		✓				✓	✓	✓											
LOCA	FAULTED	(NOTE 4)	5	✓	✓	✓	✓		✓							✓				✓						
MSLB	FAULTED	(NOTE 4)	6	✓	✓	✓	✓		✓							✓										
½ SSE + LOCA	FAULTED	(NOTE 4)	7	✓	✓	✓	✓		✓		✓	✓				✓				✓						
SSE + LOCA	FAULTED	(NOTE 4)	8	✓	✓	✓	✓		✓				✓	✓		✓				✓						
½ SSE + MSLB	FAULTED	(NOTE 4)	9	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + MSLB	FAULTED	(NOTE 4)	10	✓	✓	✓	✓		✓				✓	✓		✓										
PIPE RUPTURE			11*	✓	✓	✓	✓		✓		✓	✓			✓ (NOTE 2)	(NOTE 3) ✓										

NOTE 1: INCLUDE, IF APPLICABLE, TEST TEMP. CORRECTION FACTOR PER CODE
NOTE 2: RUPTURE OUTSIDE CONTAINMENT
NOTE 3: RUPTURE INSIDE CONTAINMENT
* THIS LOAD COMBINATION IS FOR PIPE RUPTURE STRESS SUMMARY ONLY.

NOTE 4: EMERGENCY FOR ESSENTIAL PIPING; FAULTED FOR NON-ESSENTIAL PIPING

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports
PROJECT IDENTIFICATION
NO. CAR-SH-M-71

R1

F-25

EBASCO SERVICES INCORPORATED

BY	DATE	APPROVED
MHE	9/7	
CH PF		
DATE 9-9-85		

DESIGN STRESS COMBINATIONS SYSTEMS
SAFETY INJECTION/RESIDUAL HEAT REMOVAL

APPENDIX F
SHEET 16 of 51

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (OBE) INERTIA	SSE (OBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓			✓								
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓			✓								
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓		✓								
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓		✓								
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓		✓								
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓		✓								
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓		✓								
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓		✓								
PIPE RUPTURE			11																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

F-26

EBASCO SERVICES INCORPORATED
DRY MHF DATE 9/4
CH PF DATE 11-2-81
APPROVED

DESIGN STRESS COMBINATIONS
SYSTEM
SAMPLING (NUCLEAR)

APPENDIX F
SHEET 1051

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JH			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓																	
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓																
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓														
SSE	FAULTED	(NOTE 1)	4	✓	✓	✓	✓		✓				✓	✓												
LOCA	FAULTED	(NOTE 1)	5	✓	✓	✓	✓		✓																	
MSLB	FAULTED	(NOTE 1)	6	✓	✓	✓	✓		✓																	
½ SSE + LOCA	FAULTED	(NOTE 1)	7	✓	✓	✓	✓		✓		✓	✓														
SSE + LOCA	FAULTED	(NOTE 1)	8	✓	✓	✓	✓		✓				✓	✓												
½ SSE + MSLB	FAULTED	(NOTE 1)	9	✓	✓	✓	✓		✓		✓	✓														
SSE + MSLB	FAULTED	(NOTE 1)	10	✓	✓	✓	✓		✓				✓	✓												
PIPE RUPTURE			11																							

NOTE 1: EMERGENCY FOR ESSENTIAL PIPING; FAULTED FOR NON-ESSENTIAL PIPING

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

EBASCO SERVICES INCORPORATED

DES. MNP DR. KM
CH. PF
DATE 2-4-85
APPROVED

DESIGN STRESS COMBINATIONS
SYSTEM
SCREEN WASH

APPENDIX F
SHEET 1 of 1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (DBE) INERTIA	SSE (DBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPTG	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓											
SSE	FAULTED	FAULTED	4	✓	✓	✓	✓		✓				✓	✓	✓											
LOCA	FAULTED	FAULTED	5	✓	✓	✓	✓		✓							✓										
MSLB	FAULTED	FAULTED	6	✓	✓	✓	✓		✓							✓										
½ SSE + LOCA	FAULTED	FAULTED	7	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + LOCA	FAULTED	FAULTED	8	✓	✓	✓	✓		✓				✓	✓		✓										
½ SSE + MSLB	FAULTED	FAULTED	9	✓	✓	✓	✓		✓		✓	✓				✓										
SSE + MSLB	FAULTED	FAULTED	10	✓	✓	✓	✓		✓				✓	✓		✓										
PIPE RUPTURE			11																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

EBASCO SERVICES INCORPORATED
DES. MNF DR. SK
CH. FK APPROVED
DATE 11-2-81

DESIGN STRESS COMBINATIONS
SYSTEM
SERVICE AIR

APPENDIX F SHEET 1 of 1

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (OBE) INERTIA	SSE (OBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAC	CBPT	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓						✓											
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓					✓		✓									
½SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓			✓				✓							
SSE	FAULTED	(NOTE 1)	4	✓	✓	✓	✓		✓				✓	✓	✓				✓							
LOCA	FAULTED	(NOTE 1)	5	✓	✓	✓	✓		✓							✓										
MSLB	FAULTED	(NOTE 1)	6	✓	✓	✓	✓		✓							✓										
½SSE+LOCA	FAULTED	(NOTE 1)	7	✓	✓	✓	✓		✓		✓	✓				✓			✓							
SSE+LOCA	FAULTED	(NOTE 1)	8	✓	✓	✓	✓		✓				✓	✓		✓			✓							
½SSE+MSLB	FAULTED	(NOTE 1)	9	✓	✓	✓	✓		✓		✓	✓				✓			✓							
SSE+MSLB	FAULTED	(NOTE 1)	10	✓	✓	✓	✓		✓				✓	✓		✓			✓							
PIPE RUPTURE			11																							
			—																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

R1

Project Identification
No. CAR-SH-M-71

NOTE 1: EMERGENCY FOR ESSENTIAL PIPING; FAULTED FOR NON ESSENTIAL PIPING.

EBASCO SERVICES INCORPORATED		DESIGN STRESS COMBINATIONS SYSTEM SERVICE WATER	APPENDIX F SHEET 1 of 1
DRT MNF DATE 3-8-85	APPROVED		

PLANT EVENT	PLANT OPERATING CONDITION	SYSTEM OPERATING CONDITION	STRESS COMBINATION NO.	DESIGN STRESS COMBINATIONS DUE TO SIMULTANEOUS CONDITIONS																						SPECIAL DESIGN CONSIDERATIONS
				THERMAL		WEIGHT			PRESSURE		½ SSE		SSE		OTHER SYSTEM CONDITIONS												
				THERMAL EXPANSION	THERMAL ANCHOR MOVEMENTS	PIPE DEAD WEIGHT	PIPE SUSTAINED WEIGHT	PIPE TEST WEIGHT	DESIGN PRESSURE	TEST PRESSURE	½ SSE (OBE) INERTIA	½ SSE (OBE) ANCHOR MOVEMENT	SSE (OBE) INERTIA	SSE (OBE) ANCHOR MOVEMENT	CONTAINMENT BUILD NORMAL GROWTH	CONTAINMENT BUILD ACCIDENT GROWTH	CONTAINMENT BUILD PRESSURE TEST GROWTH	WATER HAMMER	RELIEF VALVE ACTUATION	LOCA DISPLACEMENT	PUMP START-UP & TRIP	FAST VALVE CLOSURE	JET IMPINGEMENT			
				TE	TA	WP	WS	WT	PD	PT	OI	OA	DI	DA	CBNG	CBAG	CBPT	WH	RV	LD	PST	FVC	JI			
POWER OPERATION	NORMAL	NORMAL	1	✓	✓	✓	✓		✓																	
TESTING	NORMAL	TEST	2	✓	✓	✓		✓		✓																
½ SSE	UPSET	UPSET	3	✓	✓	✓	✓		✓		✓	✓														
SSE	FAULTED	(NOTE 1)	4	✓	✓	✓	✓		✓				✓	✓												
LOCA	FAULTED	(NOTE 1)	5	✓	✓	✓	✓		✓																	
MSLB	FAULTED	(NOTE 1)	6	✓	✓	✓	✓		✓																	
½ SSE + LOCA	FAULTED	(NOTE 2)	7	✓	✓	✓	✓		✓		✓	✓														
SSE + LOCA	FAULTED	(NOTE 2)	8	✓	✓	✓	✓		✓				✓	✓												
½ SSE + MSLB	FAULTED	(NOTE 2)	9	✓	✓	✓	✓		✓		✓	✓														
SSE + MSLB	FAULTED	(NOTE 2)	10	✓	✓	✓	✓		✓				✓	✓												
PIPE RUPTURE			11																							

Ebasco Specification
Design Specification for ANSI Nuclear Safety Classes 1,2 & 3 and ANSI B31.1 Non-Nuclear Safety/Seismic Category I and Seismically Designed Piping and Supports

Project Identification
No. CAR-SH-M-71

R1

NOTE 2: EMERGENCY FOR ESSENTIAL PIPING; FAULTED FOR NONESSENTIAL PIPING

EBASCO SERVICES INCORPORATED
DRN MHF DATE 3/4/85 CHK DF APPROVED

DESIGN STRESS COMBINATIONS
SYSTEM
SPENT FUEL POOL COOLING & CLEANUP

APPENDIX F
SHEET 1 of 1

Shearon Harris Nuclear Power Plant
NRC Question 210.81

The staff review of your response to Q210.64 finds that we need additional information regarding how assurance is obtained that Code requirements in NB/NC/ND-3640 are met. Your response states, "In the case of pipe wall thickness determination, Ebasco Design Criteria MNE-65 for pipe line sizing applies, and a standardized worksheet (MNE-WS-16) is employed to document this calculation."

Provide several examples of the above worksheets for various ASME Class 1, 2, and 3 piping applicable to Shearon Harris for our review.

RESPONSE:

Attached are three examples of pipe wall sizing using the standardized worksheet, MNE-WS-16, for each classification of ASME Section III piping. In addition to the worksheets, other pertinent portions of the piping wall thickness calculations have been included in order to assist you in reviewing them. Items included in the calculations which do not pertain to determining the wall thickness of the example pipe lines have been so noted. The example calculations provided are part of the following calculations:

Pipe Calc 114	- ASME Section III Class 1	- Reactor Coolant System
Pipe Calc 80	- ASME Section III Class 2	- Fire Protection System
Pipe Calc 65	- ASME Section III Class 3	- Component Cooling Water System

(1941JDK/mf)

R1 BY TLAVIN 7/26/85
CHECKED BY P.FIALA 7/30/85 EBASCO SERVICES INCORPORATED

BY RTW DATE 4-12-84 PIPE-114 SHEET 1 OF 437

CHKD. BY [illegible] DATE [illegible] OFS NO. 2666.332 DEPT. NO. 530

CLIENT CAROLINA POWER & LIGHT COMPANY

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

SUBJECT MIN WALL THICKNESS CALCULATION FOR SYSTEM

PURPOSE:

THE PURPOSE OF THIS CALCULATION IS TO VERIFY THE MINIMUM WALL THICKNESS REQUIREMENT/CORROSION ALLOWANCE FOR SUBJECT LINE.

REFERENCE:

NOT APPLICABLE TO EXAMPLE WORKSHEET.

1) EBASCO SPECIFICATION CAR-SH-M-3C REV. 16
2) LINE LIST CAR 1364-B070 REV. 18
3) MNE-WS-16 PIPE WALL THICKNESS & SCHEDULE DETERMINATION
4) POWER PIPING CODE ANSI B31.1 ~~1971~~ 1973 THRU S1973
5) NAVCO PIPING CATALOG ED. NO. 10 (REV. JUNE 1, 1974)
6) ASME SECTION III 1971 ED THRU S 1973

CONCLUSION:

MIN. WALL THICKNESS/CORROSION ACTUALS ARE ACCEPTABLE FOR ALL PIPE LINE NOS OF REACTOR COOLANT SYSTEM

NOT APPLICABLE TO EXAMPLE WORKSHEET.

SUMMARY

CALC CASE No.	PIPE ϕ	SCHEDULE No.	CALC PG(S)	CALC CASE No.	PIPE ϕ	SCHEDULE No.	CALC PG(S)
114-AX	6	160	3, 23	~~13~~ 114-K	3/8	40S	13, 25
114-B ~~2~~	3/4	160	4, 23	~~14~~ 114-L	6	40S	14, 25
114-C ~~3~~	12	140	5, 23	~~15~~ 114-M	3/4	40S	15, 26
114-D ~~4~~	1	160	6, 23	~~16~~ 114-N	12	40S	16, 26
114-E ~~5~~	2	160	7, 24	~~17~~ 114-O	4	40S	17, 26
114-F ~~6~~	3	160	8, 24	~~18~~ 114-P	3	40S	18, 26
114-G ~~7~~	4	160	9, 24	~~19~~ 114-Q	2	40S	19, 27
114-H ~~8~~	14	160	10, 24	~~20~~ 114-R	1	40S	20, 27
114-I ~~11~~	1/2	160	11, 25	~~21~~ 114-S	1/4	40S	21, 27
114-J ~~12~~	1 1/2	160	12, 25	~~22~~ 114-T	3/8	40S	22, 27

(CONTINUED ON PG 44)

EBASCO SERVICES INCORPORATED

BY RTW DATE 4-12-84 CALC. PIPE-114 SHEET 2 OF 4371

CHKD. BY [illegible] DATE 4-12-84 OFS NO. 2616.332 DEPT. NO. 530

CLIENT CAROLINA POWER & LIGHT COMPANY

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

SUBJECT MINIMUM WALL THICKNESS CALCULATION

FROM REFERENCES (4) & (6) TO DETERMINE MIN. WALL THICKNESS t_m:

I) $$t_m = \frac{P D_o}{2(SE + Py)} + C$$ — NOT APPLICABLE TO EXAMPLE WORKSHEET.

WHERE: P = INTERNAL DESIGN PRESSURE, (PSIG) (from Line List)

D_o = OUTSIDE DIA. OF PIPE, (IN.) (from Line List & Ref. 5)

S = MAX. ALLOWABLE STRESS IN MATERIAL, (PSI) (from Ref (4) & 6).

E = JOINT EFF. (E = 1 for seamless pipe)

y = COEFFICIENT (y = 0.4 for temp. 900 °F & below)

C = ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY (0.065)

II) DETERMINE A, CORROSION ALLOWANCE:

a) $A = t_{(LINE\ LIST)} * 0.875 - t_m$ (from Ref's 2 & 5) — MILL TOLERANCE [SEAMLESS PIPE]

b) $A = t_{(LINE\ LIST)} - 0.010 - t_m$ (from Ref's 2 & 5) [PLATE PIPE]

NOT APPLICABLE TO EXAMPLE WORKSHEET.

CHECKED BY [illegible] 7/30/85 BASCO SERVICES INCORPORATED

BY BTW DATE 4-12-84 CALC. PIPE-114 SHEET 3 OF 571

CHKD. BY [illegible] DATE [illegible] OFS NO. 2666.332 DEPT. NO. 530

CLIENT CAROLINA POWER & LIGHT COMPANY

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

SUBJECT MINIMUM WALL THICKNESS CALCULATION

~~NOTE~~. ALSO, SEE 'STANDARDIZED WORK SHEET' CALC 114A

FROM REFERENCE (6) - MINIMUM WALL THICKNESS

1) $t_m = \frac{P\ D_o}{2(SE+PY)}$

$t_m = \frac{2485 \times 6.625}{2(\underset{16,100}{\cancel{15,900}} + 2485 \times 0.4)} = \cancel{0.487\text{ in}}\ 0.481''$

$t_m =$ ~~0.487 in~~ $0.481''$

2) DETERMINE A, CORROSION ALLOWANCE:

a) FROM REF (2)

$t_{(LINE\ LIST)} = 0.718$ in

b) $A = t_{(LINE\ LIST)} * 0.875 - t_m$

$A = 0.718 * 0.875 - \underset{0.481}{\cancel{0.487}} = \cancel{0.141\text{ in}}\ 0.147''$

$A =$ ~~0.141 in~~ $0.147''$

ALSO, VALID FOR LINE Nos MARKED WITH ~~(1)~~ 114A ON THE LEFT HAND SIDE OF THE ATTACHED 'LINE LIST'.

581/8-81

Q 210.81 p 4 of 27

R1 BY TLN 7/26/85 SSH
CHECKED BY PFIALA 7/30/85

EBASCO SERVICES INCORPORATED

BY BTW DATE 4-12-85 CALC. PIPE - 114 SHEET 4 OF 4371

CHKD. BY DATE OFS NO. 2666.332 DEPT. NO. 530

CLIENT CAROLINA POWER & LIGHT COMPANY

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

SUBJECT MINIMUM WALL THICKNESS CALCULATION

NOTE 2. ALSO, SEE "STANDARDIZED WORK SHEET" CALC 114B FROM REFERENCE (6) - MINIMUM WALL THICKNESS R

1) $t_m = \frac{P\ D_o}{2(SE+PY)} + C$

$t_m = \frac{2485 \times 1.050}{2(15{,}900 + 2485 \times 0.4)} = 0.077 in + 0.065 in$

$t_m = 0.142\ in$

2) DETERMINE A, CORROSION ALLOWANCE:

a) FROM REF (2)

$t_{(LINE\ LIST)} = 0.218 in$

b) $A = t_{(LINE\ LIST)} * 0.875 - t_m$

$A = 0.218 * 0.875 - 0.142$

$A = 0.05\ in$

ALSO, VALID FOR LINE Nos MARKED WITH (2) 114B ON THE LEFT HAND SIDE OF THE ATTACHED "LINE LIST". R1

Q 210.81 p 5 of 27

CHECKED BY [illegible] 11/30/84 ... SERVICES INCORPORATED

BY BTW DATE 4-12-84 CALC. PIPE-114. SHEET 5 OF ~~55~~ 71

CHKD. BY [illegible] DATE [illegible] OFS NO. 2666.332 DEPT. NO. 530

CLIENT CAROLINA POWER & LIGHT COMPANY

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

SUBJECT MINIMUM WALL THICKNESS CALCULATION

~~NOTE 3~~. ALSO, SEE "STANDARDIZED WORK SHEET" CALC 114C
FROM REFERENCE (6) - MINIMUM WALL THICKNESS

1) $t_m = \frac{P\ D_o}{2(SE+PY)}$

$t_m = \frac{2485 \times 12.750}{2(\cancel{16700}\ 166000 + 2485 \times 0.4)} = \cancel{0.895 \text{ in}}\ 0.900''$

$t_m = \cancel{0.895 \text{ in}}\ 0.900''$

2) DETERMINE A, CORROSION ALLOWANCE:

a) FROM REF (2)

$t_{(LINE\ LIST)} = 1.125 \text{ in}$

b) $A = t_{(LINE\ LIST)} * 0.875 - t_m$

$A = 1.125 * 0.875 - \cancel{0.895}\ 0.900 = \cancel{0.089 \text{ in}}\ 0.084''$

$A = \cancel{0.089 \text{ in}}\ 0.084''$

ALSO, VALID FOR LINE NOS MARKED WITH ~~(3)~~ 114C ON THE LEFT HAND SIDE OF THE ATTACHED "LINE LIST".

581/8-81

Q 210.81 p 6 of 27

P* - DESIGN PRESSURE, PSIG	2485	2485	2485	2485
T - DESIGN TEMPERATURE, F	650	650	650	650
PIPE SPECIFICATION & GRADE	SS-1 A376 GR TP316	SS-1 A376 GR TP316	SS-2 A-376 GR TP316	SS-1 A376 GR TP316
SE - ALLOWABLE STRESS, PSI ** R1	~~16100~~ ~~15900~~	15900	~~16900~~ ~~16700~~	~~16100~~ ~~15900~~
D - OUTSIDE DIAMETER OF PIPE, IN.	6.625	1.050	12.750	1.315
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *	0.000	0.065	0.000	0.065
y - COEFFICIENT ***	0.4	0.4	0.4	0.4
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2) R1	~~0.481~~ ~~0.479~~	0.142	0.900	0.161
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)				
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n	0.718	0.218	1.125	0.250
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED	SCH 160	SCH 160	SCH 140	SCH 160
ID - INSIDE DIAMETER OF PIPE, IN. (See NOTE 1)	SEE NOTE 1 CALC 114-A	SEE NOTE 2 CALC 114-B	SEE NOTE 3 CALC 114-C	SEE NOTE 4 CALC 114-D
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *				
y - COEFFICIENT ***				
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2) R1				
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)				
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n				
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED				

Use either of the following equations to determine t_m:

BASED ON OUTSIDE DIAMETER

$$t_m = \frac{P \times D}{2(SE + Py)} + C$$

BASED ON INSIDE DIAMETER (See NOTE 1)

$$t_m = \frac{P \times ID + 2SEC + 2yPC}{2(SE + Py - P)} + B$$

NOT APPLICABLE TO EXAMPLE WORKSHEET

* - C = Allowance for minimum structural stability
= 0.065" for 1/2 to 3-1/2 inch nominal pipe size
= 0.000 for 4 inch nominal pipe size and larger

** - SE = Maximum allowable stress in material due to internal pressure and joint efficiency, at the design temperature, psi.

B = .038" for pipe ordered to specified machined I.D. with tapered backing ring and extruded pipe specified by I.D. with tapered backing ring.
= .000" for the above pipe with flat backing ring or other types of pipe with any Design Guide M-4 backing ring.

*** - y = A coefficient having values as follows: (See NOTE 4)

TEMP. F	900 AND BELOW	950	1000	1050	1100	1150 AND ABOVE
Ferritic Steels	0.4	0.5	0.7	0.7	0.7	0.7
Austenitic Steels	0.4	0.4	0.4	0.4	0.5	0.7

NOTE 1 - Use maximum possible inside diameter with all its tolerances on wall thickness and outside diameters, except for pipe ordered to specified machined I.D. and extruded pipe specified by I.D. where note 8, paragraph 4, of Design Guide MNE-65 governs.

NOTE 2 - The pipe wall thickness required for a given pressure-temperature condition increases as pipe size increases.

NOTE 3 - For seamless pipe use $\frac{t_m}{0.875}$; for any size of plate pipe, add 0.010 inches to the calculated t_m to obtain t_n.

NOTE 4 - The value of "y" may be interpolated between 50 F values shown above. For nonferrous materials and cast iron use y = 0.4.

GENERAL NOTES: See Design Guide MNE-65 Pipe Line Sizing - for specific information.

CLIENT CAROLINA POWER & LIGHT CO. SHT 23 OF 43 71

STATION

PROJECT SHEARON HARRIS NUCLEAR POWER PLT.

BY BTG (JOB ENGINEER) DATE 4-12-84

CHECKED S. FIALA DATE 4-27-84

APPROVED (SUPERVISOR) DATE

R1 BY THAVIN 7/26/85 JJF
CHECKED BY P.FIALA 7/30/85

STANDARDIZED WORK SHEET
PIPE WALL THICKNESS AND SCHEDULE DETERMINATION

EBASCO SERVICES INCORPORATED
MECHANICAL-NUCLEAR ENGINEERING

WORK SHEET MNE-WS-16

638-16 7-72

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SYSTEM : LINE LIST REVISION 18 (02/29/1984) 653

REACTOR COOLANT
UNIT #1

CAROLINA POWER & LIGHT CO
SHEARON HARRIS NUCLEAR POWER PLANT UNIT #1

REPORT 1
SYSTEM RC

IDENTIFICATION C A T	S Y S	NOMINAL SIZE (IN)	CHANL & LINE NO	PIPE WALL THICKNESS OR SCHED. SPEC O.D	IDENTITY CLASS	PIPE CODE MATERIAL	MAXIMUM OPERATING PRES PSIG	MAXIMUM OPERATING TEMP (F)	DESIGN PRES PSIG	DESIGN TEMP (F)	PRES STD. OR ANSI RATG	SYS HYDR TEST PRES PSIG	INSULATION I S GRP.	STRESS ANALYSIS SEIS -MIC.	STRESS ANALYSIS THER -MAL	REMARKS	REV.
1	RC	29	1SN		ASME III 1		2485	644	2485	650		3106	B	I-H	YES	LOOP 1 REACTOR COOLANT HOT LEG FURNISHED BY WESTINGHOUSE 29 "ID WITH 2.33"MIN WALL	00
1	RC	31	2SN		ASME III 1		2485	588	2485	650		3106	C	I-H	YES	LOOP 1 REACTOR COOLANT CROSS OVER LEG FURNISHED BY WESTINGHOUSE 31 "ID WITH 2.48"MIN WALL	00
1	RC	27 1/2	3SN		ASME III 1		2485	589	2485	650		3106	C	I-H	YES	LOOP 1 REACTOR COOLANT COLD LEG FURNISHED BY WESTINGHOUSE 27 .5"ID WITH 2.21"MIN WALL	00
1	RC	29	4SN		ASME III 1		2485	644	2485	650		3106	B	I-H	YES	LOOP 2 REACTOR COOLANT HOT LEG FURNISHED BY WESTINGHOUSE 29 "ID WITH 2.33"MIN WALL	00
1	RC	31	5SN		ASME III 1		2485	588	2485	650		3106	C	I-H	YES	LOOP 2 REACTOR COOLANT CROSS OVER LEG FURNISHED BY WESTINGHOUSE 31 "ID WITH 2.48"MIN WALL	00
1	RC	27 1/2	6SB		ASME III 1		2485	589	2485	650		3106	C	I-H	YES	LOOP 2 REACTOR COOLANT COLD LEG FURNISHED BY WESTINGHOUSE 27 7.5"ID WITH 2.21"MIN WALL	00
1	RC	29	7SN		ASME III 1		2485	644	2485	650		3106	B	I-H	YES	LOOP 3 REACTOR COOLANT HOT LEG FURNISHED BY WESTINGHOUSE 29 "ID WITH 2.33"MIN WALL	00
1	RC	31	8SN		ASME III 1		2485	588	2485	650		3106	C	I-H	YES	LOOP 3 REACTOR COOLANT CROSS OVER LEG FURNISHED BY WESTINGHOUSE 31 "ID WITH 2.48"MIN WALL	00
1	RC	27 1/2	9SN		ASME III 1		2485	589	2485	650		3106	C	I-H	YES	LOOP 3 REACTOR COOLANT COLD LEG FURNISHED BY WESTINGHOUSE 27 7.5"ID WITH 2.21"MIN WALL	00
1	RC	6	10SA	SCH 160	ASME III 1	SS-1 A-376-304	2485	644	2485	650	1500	3106	B	I-H	YES	LOOP 1 HOT LEG INLETTO SIS H I & LO HD RECIRC	00

114-A(1)

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R1 BY TLAVIN 7/26/85

CHECKED BY P. FIALA 7/30/85

NOT APPLICABLE TO EXAMPLE WORKSHEET.

SH 28 of 171

REACTOR COOLANT
UNIT #1

CAROLINA POWER & LIGHT CO
SHEARON HARRIS NUCLEAR POWER PLANT UNIT #1

IDENTIFICATION				PIPE WALL THICKNESS OR SCHED.	IDENTITY	PIPE CODE	MAXIMUM OPERATING		DESIGN		PRES STD. OR	SYS HYDR TEST	INSULATION	STRESS ANALYSIS			REV
CAT	SYS	NOMINAL SIZE (IN)	CHANL & LINE NO	SPEC O.D	CLASS	MATERIAL	PRES PSIG	TEMP (F)	PRES PSIG	TEMP (F)	ANSI RATG	PRES PSIG	GRP.	SEIS	THER -MAL	REMARKS	
2	RC	3/4	11SA	SCH 160	ASME III 2	SS-1 A-376-304	2485	644	2485	650	1500	3106	B	I-H	YES	LOOP 1 HOT LEG TO PI 405 AND PT 403	00
																1 VALVE 2 RC V 1SA	13
1	RC	12	12SA	SCH 140	ASME 1	SS-2 A-376 316	2485	644	2485	650	1500	3106	B	I-H	YES	LOOP 1 HOT LEG OUTLET TO RHR SYSTEM	00
1	RC	1	13SN	SCH 160	ASME III 1	SS-1 A-376-304	2485	644	2485	650	1500	3106	B	I-H	YES	LOOP 1 HOT LEG OUTLET TO RCS RTD	00
1	RC	1	14SN	SCH 160	ASME III 1	SS-1 A-376-304	2485	644	2485	650	1500	3106	B	I-H	YES	LOOP 1 HOT LEG OUTLET TO RCS RTD	00
1	RC	1	15SN	SCH 160	ASME III 1	SS-1 A-376-304	2485	644	2485	650	1500	3106	B	I-H	YES	LOOP 1 HOT LEG OUTLET TO RCS RTD	00
1	RC	2	16SN	SCH 160	ASME III 1	SS-1 A-376-304	2485	644	2485	650	1500	3106	B	I-H	YES	LOOP 1 HOT LEG OUTLET TO RCS RTD BUTT WELD ENDS	00
																1 VALVE 1 RC V 2SN	13
																1 VALVE 1 RC V 109SN	13
2	RC	3/4	17SN	SCH 160	ASME III 2	SS-1 A-376-304	2485	588	2485	650	1500	3106	C	I-H	YES	LOOP 1 CROSSOVER LEG TO FLOW TRANSMITTER 416	00
																1 VALVE 2 RC V 3SN	13
2	RC	3/4	18SN	SCH 160	ASME III 2	SS-1 A-376-304	2485	588	2485	650	1500	3106	C	I-H	YES	LOOP 1 CROSSOVER LEG TO FLOW TRANSMITTER 415	00
																1 VALVE 2 RC V 4SN	13
2	RC	3/4	19SN	SCH 160	ASME III 2	SS-1 A-376-304	2485	588	2485	650	1500	3106	C	I-H	YES	LOOP 1 CROSSOVER LEG TO FLOW TRANSMITTER 414	00
																1 VALVE 2 RC V 5SN	13
2	RC	3/4	20SN	SCH 160	ASME III 2	SS-1 A-376-304	2485	588	2485	650	1500	3106	C	I-H	YES	LOOP 1 CROSSOVER LEG FROM FLOW TRANSMITTER RETURN	00
																1 VALVE 2 RC V 6SN	13
1	RC	3	21SN	SCH 160	ASME III 1	SS-1 A-376-304	2485	616	2485	650	1500	3106	B	I-H	YES	LOOP 1 CROSSOVER LEG INLET TO RCS RTD	00
																1 VALVE 1 RC V 501SN	13
																1 VALVE 1 RC V 540SN	13
1	RC	2	22SN	SCH 160	ASME III 1	SS-1 A-376-304	2485	588	2485	650	1500	3106	C	I-H	YES	LOOP 1 CROSSOVER LEG OUTLET TO WPS RCDT PUMP	00
																1 VALVE 1 RC V 7SN	13
																1 VALVE 1 RC V 8SN	13
1	RC	3	23SN	SCH 160	ASME III 1	SS-1 A-376-304	2485	588	2485	650	1500	3106	C	I-H	YES	LOOP 1 CROSSOVER LEG TO CVCS NORM LTDN	00
																1 VALVE 1 RC V 500SN	13

R1 BY TLAVIN 7/26/85 dlf
CHECKED BY P.FIALA 7/30/85

NOT APPLICABLE TO EXAMPLE WORKSHEET.

EBASCO SERVICES INCORPORATED

CALC 80-0

BY CS DATE 1-23-84 SHEET 1 OF 3

CHKD. BY GR DATE 2-6-84 OFS NO. 6418.332 DEPT. NO. 530

CLIENT CAROLINA POWER & LIGHT COMPANY

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

SUBJECT MIN WALL THICKNESS CALCULATION FOR LINE SEE ATTACHED LINE LIST

PURPOSE:

THE PURPOSE OF THIS CALCULATION IS TO VERIFY THE MINIMUM WALL THICKNESS REQUIREMENT/CORROSION ALLOWANCE FOR SUBJECT LINE.

REFERENCE:

1) EBASCO SPECIFICATION CAR-SH-M-30 REV. 16
2) LINE LIST CAR 1364-B070 REV. 17
3) MNE-WS-16 PIPE WALL THICKNESS & SCHEDULE DETERMINATION
4) POWER PIPING CODE ANSI B31.1 1971 THRU S1973
5) NAVCO PIPING CATALOG ED. NO. 10 (REV. JUNE 1, 1974)
6) ASME SECTION III 1971 ED THRU S 1973

CONCLUSION:

1. t_{NOM} IS ADEQUATE.
2. ALLOWANCE FOR CORROSION IS 0.2065",

NOT APPLICABLE TO EXAMPLE WORKSHEET.

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EBASCO SERVICES INCORPORATED

CALC 800

BY CJ DATE 1-24-84

CHKD. BY SJL DATE 2-6-84

SHEET 2 OF 3

OFS NO. 6418.332. DEPT. NO. 530

CLIENT CAROLINA POWER & LIGHT COMPANY

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

SUBJECT MIN WALL THICKNESS CALCULATION FOR LINE SEE ATTACHED LINE LIST

FROM REFERENCE (6)

(1) $t_m = \frac{P D_o}{2(SE + Py)}$

$t_m = \frac{175 \times 6.625}{2(15{,}000(1) + (175)(.4)}$

$t_m = 0.0385"$

(2) DETERMINE A, CORROSION ALLOWANCE:

$A = t_{\text{LINE LIST}} \times .875 - t_m$ FROM REFERENCE (2) & (5)

$t_{\text{(LINE LIST)}} = 0.280$

$A = 0.280 \times .875 - 0.0385$

$A = 0.2450 - 0.0385$

$A = 0.2065"$

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581/8-81

SYSTEM _____ LINE DESIGNATION NO. SEE ATTACHED LINE LIST

P - DESIGN PRESSURE, PSIG	175			
T - DESIGN TEMPERATURE, F	125			
PIPE SPECIFICATION & GRADE	CS-1 A-106-B			
SE - ALLOWABLE STRESS, PSI **	15,600			
D - OUTSIDE DIAMETER OF PIPE, IN.	6.625			
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *	—			
y - COEFFICIENT ***	0.4			
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2)	0.039			
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)	0.280			
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n				
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED	S/40			
ID - INSIDE DIAMETER OF PIPE, IN. (See NOTE 1)				
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *				
y - COEFFICIENT ***				
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2)				
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)				
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n				
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED				

Use either of the following equations to determine t_m:

BASED ON OUTSIDE DIAMETER

$$t_m = \frac{P \times D}{2 (SE + Py)} + C$$

BASED ON INSIDE DIAMETER (See NOTE 1)

$$t_m = \frac{P \times ID + 2 SEC + 2yPC}{2 (SE + Py - P)} + B$$

* – C = Allowance for minimum structural stability
= 0.065" for 1/2 to 3-1/2 inch nominal pipe size
= 0.000 for 4 inch nominal pipe size and larger

** – SE = Maximum allowable stress in material due to internal pressure and joint efficiency, at the design temperature, psi.

B = .038" for pipe ordered to specified machined I.D. with tapered backing ring and extruded pipe specified by I.D. with tapered backing ring.
= .000" for the above pipe with flat backing ring or other types of pipe with any Design Guide M-4 backing ring.

*** – y = A coefficient having values as follows: (See NOTE 4)

TEMP. F	900 AND BELOW	950	1000	1050	1100	1150 AND ABOVE
Ferritic Steels	0.4	0.5	0.7	0.7	0.7	0.7
Austenitic Steels	0.4	0.4	0.4	0.4	0.5	0.7

NOTE 1 - Use maximum possible inside diameter with all its tolerances on wall thickness and outside diameters, except for pipe ordered to specified machined I.D. and extruded pipe specified by I.D. where note 8, paragraph 4, of Design Guide MNE-65 governs.

NOTE 2 - The pipe wall thickness required for a given pressure-temperature condition increases as pipe size increases.

NOTE 3 - For seamless pipe use $\frac{t_m}{0.875}$; for any size of plate pipe, add 0.010 inches to the calculated t_m to obtain t_n.

NOTE 4 - The value of "y" may be interpolated between 50 F values shown above. For nonferrous materials and cast iron use y = 0.4.

GENERAL NOTES. See Design Guide MNE-65 Pipe Line Sizing - for specific information.

CLIENT CAROLINA POWER & LIGHT COMPANY

SHEET 3 OF 3

STANDARDIZED WORK SHEET
PIPE WALL THICKNESS AND SCHEDULE DETERMINATION

EBASCO SERVICES INCORPORATED
MECHANICAL-NUCLEAR ENGINEERING

WORK SHEET | MNE-WS-16

SUBDIVISION _____

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

CS (LEAD ENGINEER) DATE 1-24-84

CHECKED [signature] DATE 2-6-84

APPROVED _____ (SUPERVISOR) DATE _____

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EBASCO SERVICES INCORPORATED

BY CS DATE 1-23-84 SHEET 1 OF 3
CHKD. BY GK DATE 2-6-84 OFS NO. 6418.332 DEPT. NO. 530
CLIENT CAROLINA POWER & LIGHT COMPANY
PROJECT SHEARON HARRIS NUCLEAR POWER PLANT
SUBJECT MIN WALL THICKNESS CALCULATION FOR LINE SEE ATTACHED LINE LIST

PURPOSE:

THE PURPOSE OF THIS CALCULATION IS TO VERIFY THE MINIMUM WALL THICKNESS REQUIREMENT/CORROSION ALLOWANCE FOR SUBJECT LINE.

REFERENCE:

1) EBASCO SPECIFICATION CAR-SH-M-3C REV. 16
2) LINE LIST CAR 1364-B070 REV. 17
3) MNE-WS-16 PIPE WALL THICKNESS & SCHEDULE DETERMINATION
4) POWER PIPING CODE ANSI B31.1 1971 THRU S1973
5) NAVCO PIPING CATALOG ED. NO. 10 (REV. JUNE 1, 1974)
6) ASME SECTION III 1971 ED THRU S 1973

CONCLUSION:

1. t_{NOM} IS ADEQUATE.
2. ALLOWANCE FOR CORROSION IS 0.1812"

NOT APPLICABLE TO EXAMPLE WORKSHEET.

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EBASCO SERVICES INCORPORATED

BY CJ DATE 1-24-84 SHEET 2 OF 3
CHKD. BY GL DATE 2-6-84 OFS NO. 6.418.332. DEPT. NO. 530
CLIENT CAROLINA POWER & LIGHT COMPANY
PROJECT SHEARON HARRIS NUCLEAR POWER PLANT
SUBJECT MIN WALL THICKNESS CALCULATION FOR LINE SEE ATTACHED LINE LIST

FROM REFERENCE (6)

(1) $t_m = \frac{P D_o}{2(SE + Py)}$

$t_m = \frac{175 \times 4.50}{2(15,000(1) + (175)(.4)}$

$t_m = 0.0261''$

(2) DETERMINE A, CORROSION ALLOWANCE:

$A = t_{\text{LINE LIST}} \times .875 - t_m$ FROM REFERENCE (2) & (5)

$t_{\text{(LINE LIST)}} = 0.237$

$A = 0.237 \times .875 - 0.0261''$

$A = 0.2074 - 0.0261$

$A = 0.1812''$

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LINE DESIGNATION NO. SEE ATTACHED LINE LIST

P - DESIGN PRESSURE, PSIG	175			
T - DESIGN TEMPERATURE, F	125			
PIPE SPECIFICATION & GRADE	CS-1 A106-B			
SE - ALLOWABLE STRESS, PSI **	15,550			
D - OUTSIDE DIAMETER OF PIPE, IN.	4.50			
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *	—			
y - COEFFICIENT ***	0.4			
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2)	0.026			
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)	0.237			
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n				
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED	5/40			
ID - INSIDE DIAMETER OF PIPE, IN. (See NOTE 1)				
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *				
y - COEFFICIENT ***				
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2)				
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)				
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n				
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED				

Use either of the following equations to determine t_m:

BASED ON OUTSIDE DIAMETER

$$t_m = \frac{P \times D}{2 (SE + Py)} + C$$

BASED ON INSIDE DIAMETER (See NOTE 1)

$$t_m = \frac{P \times ID + 2 SEC + 2yPC}{2 (SE + Py - P)} + B$$

* – C = Allowance for minimum structural stability
= 0.065" for 1/2 to 3-1/2 inch nominal pipe size
= 0.000 for 4 inch nominal pipe size and larger

** – SE = Maximum allowable stress in material due to internal pressure and joint efficiency, at the design temperature, psi.

B = .038" for pipe ordered to specified machined I.D. with tapered backing ring and extruded pipe specified by I.D. with tapered backing ring.
= .000" for the above pipe with flat backing ring or other types of pipe with any Design Guide M-4 backing ring.

*** – y = A coefficient having values as follows: (See NOTE 4)

TEMP. F	900 AND BELOW	950	1000	1050	1100	1150 AND ABOVE
Ferritic Steels	.0.4	0.5	0.7	0.7	0.7	0.7
Austenitic Steels	0.4	0.4	0.4	0.4	0.5	0.7

NOTE 1 - Use maximum possible inside diameter with all its tolerances on wall thickness and outside diameters, except for pipe ordered to specified machined I.D. and extruded pipe specified by I.D. where note 8, paragraph 4, of Design Guide MNE-65 governs.

NOTE 2 - The pipe wall thickness required for a given pressure-temperature condition increases as pipe size increases.

NOTE 3 - For seamless pipe use $\frac{t_m}{0.875}$; for any size of plate pipe, add 0.010 inches to the calculated t_m to obtain t_n.

NOTE 4 - The value of "y" may be interpolated between 50 F values shown above. For nonferrous materials and cast iron use y = 0.4.

GENERAL NOTES. See Design Guide MNE-65 Pipe Line Sizing - for specific information.

SHEET 3 OF 3

CLIENT CAROLINA POWER & LIGHT COMPANY

STATION

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

BY CS (JOB ENGINEER) DATE 1-24-84

CHECKED GR DATE 2-6-84

APPROVED (SUPERVISOR) DATE

STANDARDIZED WORK SHEET
PIPE WALL THICKNESS AND SCHEDULE DETERMINATION

EBASCO SERVICES INCORPORATED
MECHANICAL-NUCLEAR ENGINEERING

WORK SHEET MNE-WS-16

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CALC 60.Q

BY CS DATE 1-23-84 SHEET 1 OF 3

CHKD. BY GK DATE 2-6-84 OFS NO. 6418.332 DEPT. NO. 530

CLIENT CAROLINA POWER & LIGHT COMPANY

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

SUBJECT MIN WALL THICKNESS CALCULATION FOR LINE SEE ATTACHED LINE LIST

PURPOSE:

THE PURPOSE OF THIS CALCULATION IS TO VERIFY THE MINIMUM WALL THICKNESS REQUIREMENT/CORROSION ALLOWANCE FOR SUBJECT LINE.

REFERENCE:

1) EBASCO SPECIFICATION CAR-SH-M-30 REV. 16
2) LINE LIST CAR 1364-B070 REV. 17
3) MNE-WS-16 PIPE WALL THICKNESS & SCHEDULE DETERMINATION
4) POWER PIPING CODE ANSI B31.1 1971 THRU S1973
5) NAVCO PIPING CATALOG ED. NO. 10 (REV. JUNE 1, 1974)
6) ASME SECTION III 1971 ED THRU S 1973

CONCLUSION:

1. t_{NOM} IS ADEQUATE.
2. ALLOWANCE FOR CORROSION IS 0.084".

NOT APPLICABLE TO EXAMPLE WORKSHEET.

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581/8-81

FROM REFERENCE (6)

(1) $t_m = \frac{P D_o}{2(SE + PY)} + C$

$t_m = \frac{175 \times 1.315}{2(15{,}000(1) + (175)(.4))} + 0.065$

$t_m = 0.0076" + 0.065" = 0.0726"$

(2) DETERMINE A, CORROSION ALLOWANCE:

$A = t_{\text{LINE LIST}} \times .875 - t_m$ FROM REFERENCE (2) & (5)

$t_{(\text{LINE LIST})} = 0.179$

$A = 0.179 \times .875 - 0.073$

$A = 0.1566 - 0.073$

$A = 0.084"$

SYSTEM 1-F LINE DESIGNATION NO. SEE ATTACHED LINE LIST

P - DESIGN PRESSURE, PSIG	175 *			
T - DESIGN TEMPERATURE, F	125			
PIPE SPECIFICATION & GRADE	CS-1 A106.B			
SE - ALLOWABLE STRESS, PSI **	15,000			
D - OUTSIDE DIAMETER OF PIPE, IN.	1.315			
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *	0.065			
y - COEFFICIENT ***	0.4			
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2)	0.073			
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)	0.179			
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n				
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED	S/80			
ID - INSIDE DIAMETER OF PIPE, IN. (See NOTE 1)				
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *				
y - COEFFICIENT ***				
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2)				
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)				
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n				
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED				

Use either of the following equations to determine t_m:

BASED ON OUTSIDE DIAMETER

$$t_m = \frac{P \times D}{2 (SE + Py)} + C$$

BASED ON INSIDE DIAMETER (See NOTE 1)

$$t_m = \frac{P \times ID + 2 SEC + 2yPC}{2 (SE + Py - P)} + B$$

* – C = Allowance for minimum structural stability
= 0.065" for 1/2 to 3-1/2 inch nominal pipe size
= 0.000 for 4 inch nominal pipe size and larger

** – SE = Maximum allowable stress in material due to internal pressure and joint efficiency, at the design temperature, psi.

B = .038" for pipe ordered to specified machined I.D. with tapered backing ring and extruded pipe specified by I.D. with tapered backing ring.
= .000" for the above pipe with flat backing ring or other types of pipe with any Design Guide M-4 backing ring.

*** – y = A coefficient having values as follows: (See NOTE 4)

TEMP. F	900 AND BELOW	950	1000	1050	1100	1150 AND ABOVE
Ferritic Steels	0.4	0.5	0.7	0.7	0.7	0.7
Austenitic Steels	0.4	0.4	0.4	0.4	0.5	0.7

NOTE 1 - Use maximum possible inside diameter with all its tolerances on wall thickness and outside diameters, except for pipe ordered to specified machined I.D. and extruded pipe specified by I.D. where note 8, paragraph 4, of Design Guide MNE-65 governs.

NOTE 2 - The pipe wall thickness required for a given pressure-temperature condition increases as pipe size increases.

NOTE 3 - For seamless pipe use $\frac{t_m}{0.875}$; for any size of plate pipe, add 0.010 inches to the calculated t_m to obtain t_n.

NOTE 4 - The value of "y" may be interpolated between 50 F values shown above. For nonferrous materials and cast iron use y = 0.4.

GENERAL NOTES. See Design Guide MNE-65 Pipe Line Sizing - for specific information.

CLIENT CAROLINA POWER & LIGHT COMPANY

PLANT IN

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

CS (JOB ENGINEER) DATE 1-24-84

CHECKED [signature] DATE 2-6-84

APPROVED (SUPERVISOR) DATE

SHEET 3 OF 3

STANDARDIZED WORK SHEET
PIPE WALL THICKNESS AND SCHEDULE DETERMINATION

EBASCO SERVICES INCORPORATED
MECHANICAL-NUCLEAR ENGINEERING

WORK SHEET | MNE-WS-16

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FIRE PROTECTION
UNIT #1

CAROLINA POWER & LIGHT CO
SHEARON HARRIS NUCLEAR POWER PLANT

REPORT J
SYSTEM FP

FP-80

CALC	IDENTIFICATION CAT	SYS	NOMINAL SIZE (IN)	CHANL & LINE NO	PIPE WALL THICKNESS OR SCHED. SPEC O.D	IDENTITY CLASS	PIPE CODE MATERIAL	MAXIMUM OPERATING PRES PSIG	MAXIMUM OPERATING TEMP (F)	DESIGN PRES PSIG	DESIGN TEMP (F)	PRES STD. OR ANSI RATG	SYS HYDR TEST PRES PSIG	INSULATION GRP.	STRESS ANALYSIS SEIS -MIC	STRESS ANALYSIS THER -MAL	REMARKS	REV
80-O	2	FP	6	118SN	SCH 40	ASME III 2	CS-1 A-106-GRB	160	105	175	125	150	219		I	YES	FP TO CONTMT BLDG SPRINKLER SYS	00
																	1 VALVE 2 FP V 45SA	13
																	1 VALVE 2 FP V 46SN	15
80-P	2	FP	4	119SN	SCH 40	ASME III 2	CS-1 A-106-GRB	160	105	175	125	150	219		I	YES	FP TO CONTMT BLDG	00
																	1 VALVE 2 FP V 44SA	13
																	1 VALVE 2 FP V 48SN	13
80 Q	2	FP	1	120SN	SCH 80	ASME III 2	CS-1 A-106-GRB	160	105	175	125	150	219		I	YES	FP TEST CONN	00
																	1 VALVE 2 FP V 47SN	13
	2	FP	1	121SN	SCH 80	ASME III 2	CS-1 A-106-GRB	160	105	175	125	150	219		I	YES	FP TEST CONN	00
																	1 VALVE 2 FP V 49SN	13
80-F	8	FP	3	122	SCH 40	B31.1	CS-2 A-53 GRB	160	105	175	125	150	210		SD	NO	HDR TO SPRINKLER SYS IN CONTMT BLDG	11
	8	FP	3	123	SCH 40	B31.1	CS-2 A-53 GRB	160	105	175	125	150	210		SD	NO	HDR TO SPRINKLER SYS IN CONTMT BLDG	11
80-D	8	FP	6	124	SCH 40	B31.1	CS-2 A-53 GRB	160	105	175	125	150	210		SD	NO	HDR TO SPRINKLER SYS IN CONTMT BLDG	11
																	1 VALVE 8 FP V 249	13
80-F	8	FP	3	125	SCH 40	B31.1	CS-2 A-53 GRB	160	105	175	125	150	210		SD	NO	HDR TO SPRINKLER SYS IN CONTMT BLDG	11
	8	FP	4	126	SCH 40	B31.1	CS-2 A-53 GRB	160	105	175	125	150	265		SD	NO	FP RISER IN CONTMT BLDG COL 19, POST SSE STANDPIPE	11
																	1 VALVE 8 FP V 50	13
80-E	8	FP	4	127	SCH 40	B31.1	CS-2 A-53 GRB	160	105	175	125	150	265		SD	NO	FP RISER IN CONTMT BLDG COL 12, POST SSE STANDPIPE	11
																	1 VALVE 8 FP V 51	13
	8	FP	4	128	SCH 40	B31.1	CS-2 A-53 GRB	160	105	175	125	150	265		SD	NO	FP RISER IN CONTMT BLDG COL 4, POST SSE STANDPIPE	11
																	1 VALVE 8 FP V 52	13
																	1 VALVE 8 FP V 250	13

NOT APPLICABLE TO EXAMPLE WORKSHEETS.

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SYSTEM Component Cooling Water 18" LINE DESIGNATION NO: Calculation 65A

P - DESIGN PRESSURE, PSIG	150 Psig			
DESIGN TEMPERATURE, F	200 °F			
PIPE SPECIFICATION & GRADE	CS-1 A-106 GRB	ASME III	Class 3	
ALLOWABLE STRESS, PSI **	15000			
D - OUTSIDE DIAMETER OF PIPE, IN.	18.00"			
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *	—			
y - COEFFICIENT ***	0.4			
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2)	0.0896			
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)	0.375			
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n				
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED	STD			
ID - INSIDE DIAMETER OF PIPE, IN. (See NOTE 1)				
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *				
y - COEFFICIENT ***				
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2)				
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)				
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n				
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED				

Use either of the following equations to determine t_m:

BASED ON OUTSIDE DIAMETER

$$t_m = \frac{P \times D}{2 (SE + Py)} + C$$

BASED ON INSIDE DIAMETER (See NOTE 1)

$$t_m = \frac{P \times ID + 2 SEC + 2yPC}{2 (SE + Py - P)} + B$$

* – C = Allowance for minimum structural stability
= 0.065" for 1/2 to 3-1/2 inch nominal pipe size
= 0.000 for 4 inch nominal pipe size and larger

** – SE = Maximum allowable stress in material due to internal pressure and joint efficiency, at the design temperature, psi.

B = .038" for pipe ordered to specified machined I.D. with tapered backing ring and extruded pipe specified by I.D. with tapered backing ring.
= .000" for the above pipe with flat backing ring or other types of pipe with any Design Guide M-4 backing ring.

*** – y = A coefficient having values as follows: (See NOTE 4)

TEMP. F	900 AND BELOW	950	1000	1050	1100	1150 AND ABOVE
Ferritic Steels	0.4	0.5	0.7	0.7	0.7	0.7
Austenitic Steels	0.4	0.4	0.4	0.4	0.5	0.7

NOTE 1 - Use maximum possible inside diameter with all its tolerances on wall thickness and outside diameters, except for pipe ordered to specified machined I.D. and extruded pipe specified by I.D. where note 8, paragraph 4, of Design Guide MNE-65 governs.
NOTE 2 - The pipe wall thickness required for a given pressure-temperature condition increases as pipe size increases.
NOTE 3 - For seamless pipe use $\frac{t_m}{0.875}$; for any size of plate pipe, add 0.010 inches to the calculated t_m to obtain t_n.
NOTE 4 - The value of "y" may be interpolated between 50 F values shown above. For nonferrous materials and cast iron use y = 0.4.
GENERAL NOTES: See Design Guide MNE-65 Pipe Line Sizing - for specific information.

CUSTOMER CAROLINA POWER & LIGHT COMPANY

STATION

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

CALC. S. Talaga (GOB ENGINEER) DATE 1-6-84

CHECKED DATE 1-3-..

APPROVED ---- Q210.81 p 20 of 27

~~SHEET 3 OF 3~~

STANDARDIZED WORK SHEET
PIPE WALL THICKNESS AND SCHEDULE DETERMINATION

EBASCO SERVICES INCORPORATED
MECHANICAL-NUCLEAR ENGINEERING

WORK SHEET MNE-WS-16

EBASCO SERVICES INCORPORATED

BY S. Talley DATE 1-20-84 SHEET 2 OF 37

CHKD. BY [illegible] DATE 1-20-84 OFS NO. 6418.332 DEPT. NO. 530

CLIENT CAROLINA POWER & LIGHT COMPANY

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT Calculation P-65

SUBJECT MIN WALL THICKNESS CALCULATION FOR Component Cooling Water.

PURPOSE:

THE PURPOSE OF THIS CALCULATION IS TO VERIFY THE MINIMUM WALL THICKNESS REQUIREMENT/CORROSION ALLOWANCE FOR SUBJECT LINE.

REFERENCE:

1) EBASCO SPECIFICATION CAR-SH-M-3C REV. 16
2) LINE LIST CAR 1364-B070 REV. 15
3) MNE-WS-16 PIPE WALL THICKNESS & SCHEDULE DETERMINATION
4) POWER PIPING CODE ANSI B31.1 1971 THRU S1973
5) NAVCO PIPING CATALOG ED. NO. 10 (REV. JUNE 1, 1974)
6) ASME SECTION III 1971 ED THRU S 1973

CONCLUSION:

For each Line in this system the actual corrosion allowance is greater than the specified allowance. Therefore, the wall thickness is adequate for each line

NOT APPLICABLE TO EXAMPLE WORKSHEETS.

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FROM REFERENCE (6)

(1) $t_m = \frac{P D_o}{2(SE + Py)}$

$t_m = \frac{150 * 18}{2(15{,}000 + 150 * .4)}$

$t_m = 0.0896"$

(2) DETERMINE A, CORROSION ALLOWANCE:

$A = (t_{\text{LINE LIST}} * 0.875) - t_m$ FROM REFERENCE (2) & (5)

$t_{\text{(LINE LIST)}} = 0.375$

$A = (0.375 * 0.875) - 0.0896$

$A = 0.238"$

SYSTEM C.C. 8" LINE DESIGNATION NO. Calculation 65B

P - DESIGN PRESSURE, PSIG	150 PSIG			
DESIGN TEMPERATURE, F	200 °F			
PIPE SPECIFICATION & GRADE	SS-1 A-106 GRB	ASME III	class 3	
SE - ALLOWABLE STRESS, PSI **	15,000			
D - OUTSIDE DIAMETER OF PIPE, IN.	8.625			
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *	-			
y - COEFFICIENT ***	0.4			
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2)	0.043			
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)	0.322			
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n				
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED	Sch 40			
ID - INSIDE DIAMETER OF PIPE, IN. (See NOTE 1)				
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *				
y - COEFFICIENT ***				
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2)				
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)				
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n				
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED	Sch 40			

Use either of the following equations to determine t_m:

BASED ON OUTSIDE DIAMETER

$$t_m = \frac{P \times D}{2(SE + Py)} + C$$

BASED ON INSIDE DIAMETER (See NOTE 1)

$$t_m = \frac{P \times ID + 2SEC + 2yPC}{2(SE + Py - P)} + B$$

* – C = Allowance for minimum structural stability
= 0.065" for 1/2 to 3-1/2 inch nominal pipe size
= 0.000 for 4 inch nominal pipe size and larger

** – SE = Maximum allowable stress in material due to internal pressure and joint efficiency, at the design temperature, psi.

B = .038" for pipe ordered to specified machined I.D. with tapered backing ring and extruded pipe specified by I.D. with tapered backing ring.
= .000" for the above pipe with flat backing ring or other types of pipe with any Design Guide M-4 backing ring.

*** – y = A coefficient having values as follows: (See NOTE 4)

TEMP. F	900 AND BELOW	950	1000	1050	1100	1150 AND ABOVE
Ferritic Steels	0.4	0.5	0.7	0.7	0.7	0.7
Austenitic Steels	0.4	0.4	0.4	0.4	0.5	0.7

NOTE 1 - Use maximum possible inside diameter with all its tolerances on wall thickness and outside diameters, except for pipe ordered to specified machined I.D. and extruded pipe specified by I.D. where note 8, paragraph 4, of Design Guide MNE-65 governs.

NOTE 2 - The pipe wall thickness required for a given pressure-temperature condition increases as pipe size increases.

NOTE 3 - For seamless pipe use $\frac{t_m}{0.875}$; for any size of plate pipe, add 0.010 inches to the calculated t_m to obtain t_n.

NOTE 4 - The value of "y" may be interpolated between 50 F values shown above. For nonferrous materials and cast iron use y = 0.4.

GENERAL NOTES: See Design Guide MNE-65 Pipe Line Sizing - for specific information.

~~SHEET 3 OF 3~~

CLIENT CAROLINA POWER & LIGHT COMPANY

STATION

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

BY S. Tala (JOB ENGINEER) DATE 1-6-84

CHECKED DATE 1-

APPROVED

STANDARDIZED WORK SHEET
PIPE WALL THICKNESS AND SCHEDULE DETERMINATION

EBASCO SERVICES INCORPORATED
MECHANICAL-NUCLEAR ENGINEERING

WORK SHEET MNE-WS-16

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FROM REFERENCE (6).

(1) $t_m = \frac{P D_o}{2(SE + Py)}$

$t_m = \frac{150(8.625)}{2(15{,}000 + 150 \times 0.4)}$

$t_m = 0.043''$

(2) DETERMINE A, CORROSION ALLOWANCE:

$A = t_{\text{LINE LIST}} - t_m$ FROM REFERENCE (2) & (5)

$t_{\text{(LINE LIST)}} = 0.322$

$A = 0.322(0.875) - 0.043$

$A = 0.238''$

SYSTEM CC 20" LINE DESIGNATION NO. Calculation 65C

P - DESIGN PRESSURE, PSIG	150			
DESIGN TEMPERATURE, F	200			
PIPE SPECIFICATION & GRADE	CS-1 A-106GRB	ASME III	Class 3	
SE - ALLOWABLE STRESS, PSI **	15000			

D - OUTSIDE DIAMETER OF PIPE, IN.	20"			
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *	-			
y - COEFFICIENT ***	0.4			
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2)	0.099			
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)	0.375			
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n				
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED	STD			

ID - INSIDE DIAMETER OF PIPE, IN. (See NOTE 1)				
C - ALLOWANCE FOR MINIMUM STRUCTURAL STABILITY *				
y - COEFFICIENT ***				
t_m - MINIMUM PIPE WALL THICKNESS, IN. (See NOTE 2)				
t_n - NOMINAL WALL THICKNESS, IN. (See NOTE 3)				
t_s - FIRST STANDARD SCHEDULE THICKNESS EQUAL TO OR GREATER THAN t_n				
SCHEDULE (CORRESPONDING TO t_s)				
SCHEDULE SELECTED				

Use either of the following equations to determine t_m:

BASED ON OUTSIDE DIAMETER

$$t_m = \frac{P \times D}{2 (SE + Py)} + C$$

BASED ON INSIDE DIAMETER (See NOTE 1)

$$t_m = \frac{P \times ID + 2 SEC + 2yPC}{2 (SE + Py - P)} + B$$

* – C = Allowance for minimum structural stability
= 0.065" for 1/2 to 3-1/2 inch nominal pipe size
= 0.000 for 4 inch nominal pipe size and larger

** – SE = Maximum allowable stress in material due to internal pressure and joint efficiency, at the design temperature, psi.

B = .038" for pipe ordered to specified machined I.D. with tapered backing ring and extruded pipe specified by I.D. with tapered backing ring.
= .000" for the above pipe with flat backing ring or other types of pipe with any Design Guide M-4 backing ring.

*** – y = A coefficient having values as follows: (See NOTE 4)

TEMP. F	900 AND BELOW	950	1000	1050	1100	1150 AND ABOVE
Ferritic Steels	0.4	0.5	0.7	0.7	0.7	0.7
Austenitic Steels	0.4	0.4	0.4	0.4	0.5	0.7

NOTE 1 - Use maximum possible inside diameter with all its tolerances on wall thickness and outside diameters, except for pipe ordered to specified machined I.D. and extruded pipe specified by I.D. where note 8, paragraph 4, of Design Guide MNE-65 governs.

NOTE 2 - The pipe wall thickness required for a given pressure-temperature condition increases as pipe size increases.

NOTE 3 - For seamless pipe use $\frac{t_m}{0.875}$; for any size of plate pipe, add 0.010 inches to the calculated t_m to obtain t_n.

NOTE 4 - The value of "y" may be interpolated between 50 F values shown above. For nonferrous materials and cast iron use y = 0.4.

GENERAL NOTES: See Design Guide MNE-65 Pipe Line Sizing - for specific information.

SHEET 3 OF

CUSTOMER CAROLINA POWER & LIGHT COMPANY

STATION

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT

BY S. Talaz (SR. ENGINEER) DATE 1-9-84

CHECKED DATE

APPROVED ----Q21081 p25of27

STANDARDIZED WORK SHEET
PIPE WALL THICKNESS AND SCHEDULE DETERMINATION

EBASCO SERVICES INCORPORATED
MECHANICAL-NUCLEAR ENGINEERING

WORK SHEET | MNE-WS-16

EBASCO SERVICES INCORPORATED

BY S Talay DATE 1-9-88 SHEET 29 OF 37

CHKD. BY [illegible] DATE 1-7-88 OFS NO. _____ DEPT. NO _____

CLIENT CAROLINA POWER & LIGHT COMPANY

PROJECT SHEARON HARRIS NUCLEAR POWER PLANT Calculation C

SUBJECT MIN WALL THICKNESS CALCULATION FOR LINE

FROM REFERENCE (6)

(1) $t_m = \frac{P D_o}{2(SE + Py)}$

$t_m = \frac{150 * 20}{2(15,000 + 150(.4))}$

$t_m = 0.099"$

(2) DETERMINE A, CORROSION ALLOWANCE:

$A = t_{\text{LINE LIST}} - t_m$ FROM REFERENCE (2) & (5)

$t_{\text{(LINE LIST)}} = 0.375$

$A = (0.375 + 0.875) - 0.099$

$A = 0.229"$ Acceptable

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SYSTEM CC Pipe-65 LINE LIST REVISION 16 (9/15/1983) PAGE 115

COMPONENT COOLING WATER — CAROL POWER & LIGHT CO — REF SYSTEM CC
UNIT #1 — SHEARON HARRIS NUCLEAR POWER PLANT — UNIT #1

IDENTIFICATION CAT	SYS	NOMINAL SIZE (IN)	CHANL & LINE NO	PIPE WALL THICKNESS OR SCHED. SPEC O.D	IDENTITY CLASS	PIPE CODE MATERIAL	MAXIMUM OPERATING PRES PSIG	MAXIMUM OPERATING TEMP (F)	DESIGN PRES PSIG	DESIGN TEMP (F)	PRES STD. OR ANSI RATG	SYS HYDR TEST PRES PSIG	Calculation	REMARKS	REV
3	CC	18	2SA	STD	ASME III 3	CS-1 A-106 GRB	108	116	150	200	150	188	65-A	RTN HDR TO CC PMP 1A-SA SUCTION	07
														1 VALVE 3 CC B 1SA	13
														1 VALVE 3 CC B 5SA	13
														1 VALVE 3 CC S 1SA	13
3	CC	18	3SA	STD	ASME III 3	CS-1 A-106 GRB	108	116	150	200	150	188	65-A	CC PMP 1A-SA DISCH TO CC HX 1A-SA	00
														1 VALVE 3 CC B 2SA	13
														1 VALVE 3 CC B 3SA	13
														1 VALVE 3 CC V 162SA	13
3	CC	18	4SA	STD	ASME III 3	CS-1 A-106 GRB	108	105	150	200	150	188	65-A	CC HX 1A-SA OUTLET	00
														1 VALVE 3 CC B 4SA	13
														1 VALVE 3 CC B 19SA	13
3	CC	18	5SB	STD	ASME III 3	CS-1 A-106 GRB	108	116	150	200	150	188	65-A	RTN HDR TO CC PMP 1B-SB SUCTION	07
														1 VALVE 3 CC B 6SB	13
														1 VALVE 3 CC B 11SB	13
														1 VALVE 3 CC S 3SB	13
3	CC	18	6SB	STD	ASME III 3	CS-1 A-106 GRB	108	116	150	200	150	188	65-A	CC PMP 1B-SB DISCH TO CC HX 1B-SB	00
														1 VALVE 3 CC B 12SB	13
														1 VALVE 3 CC B 17SB	13
														1 VALVE 3 CC V 164SB	13
3	CC	18	7SB	STD	ASME III 3	CS-1 A-106 GRB	108	105	150	200	150	188	65-A	CC HX 1B-SB OUTLET	00
														1 VALVE 3 CC B 18SB	13
														1 VALVE 3 CC B 20SB	13
3	CC	8	10SN	SCH 40	ASME III 3	CS-1 A-106 GRB	108	105	150	200	150	188	65-B	CCW HDR TO RCP	00
3	CC	20	11SN	STD	ASME III 3	CS-1 A-106 GRB	108	114	150	200	150	188	65-C	HDR TO HX'S	00
3	CC	12	12SA	STD	ASME III 3	CS-1 A-106 GRB	108	120	150	200	150	188	65-D	RH HX 1A-SA INLET	00
														1 VALVE 3 CC V 166SA	13
3	CC	12	13SA	STD	ASME III 3	CS-1 A-106 GRB	108	145	150	200	150	188	D 65-D	RH HX 1A-SA OUTLET	00
														1 VALVE 3 CC B 21SA	13
														1 VALVE 3 CC V 165SA	13

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NOT APPLICABLE TO EXAMPLE WORKSHEETS.

Shearon Harris Nuclear Power Plant
NRC Question 210.82

The staff has reviewed your response to Q210.77 and finds it acceptable. However, your response does not necessarily follow from the Westinghouse design specifications. The problem is that Piping Specification G-678866 is a pipe material specification and does not control fabrication. The staff believes that the appropriate place to control the fabrication of a girth butt weld is in the fabrication specification (i.e., specification G-678843). Thus, the staff recommends that the specification G-678843 paragraph 5.3 on Butt Welds, be revised by adding a subparagraph 5.3.5 which would reference the minimum wall requirements in Specification G-678866.

For Example:

> "5.3.5 The minimum wall thickness at girth butt welds shall not be less than the minimum wall thickness specified in 3.1.3 of Specification G-678866."

Provide a commitment to revise your specification as suggested above or provide the basis for assuring that the above requirements have been properly incorporated into the Shearon Harris facility.

RESPONSE:

According to Item MEBQ210.82, the NRC recommended that the shop fabrication specification G-678843 be revised in paragraph 5.3 by adding a reference to paragraph 3.1.3 of Piping Specification G-678866. This action is being requested in order to insure that the minimum wall thickness at girth welds made by the piping assembly fabricator is controlled. The NRC recommends this change made or that Westinghouse provide the basis for assuring that these requirements have been properly incorporated into the Shearon Harris facility.

Westinghouse notes that revising the shop fabrication specification (G-678843) to incorporate the above request is impractical for SHNPP since the purchase order with the vendor (Southwest Fabricating & Welding Co.) is closed and the hot and cold leg piping was delivered to the site in 1976 and the crossover leg piping was delivered to the site in 1981.

However, in accordance with the proposed alternate section, Westinghouse can provide assurance that the subject piping meets the requirements for minimum wall thickness in the area of the girth welds as well as the entire piping assembly. The basis is as follows:

1) Paragraph 2.0 in Specification G-678843 for Shop Fabrication states "The following specifications, standards, or codes plus addenda form a part of this specification."

2) Paragraph 2.1.2 in Specification G-678843 specifically lists Piping Equipment Specification G-678866 as an applicable document.

3) The vendor's (Southwest Fabricating & Welding Company) fabrication drawing show the following in Note 22 for the different piping assemblies as follows:

   Hot Leg Piping Drawings - 29" min. design thickness = 2.27"
   Cold Leg Piping Drawings - 27 1/2" min. design thickness = 2.15"
   Crossover Leg Piping Drawings - 31" min. design thickness - 2.42"

4) The vendor drawings are consistent with the minimum wall thickness requirements as stated in Paragraph 3.1.3 of G-678866. These drawings were submitted to Westinghouse for review and approval.

5) The "as-built" revisions of these drawings have the "as-measured" wall thicknesses listed in a table at the top of each drawing. These revisions are sent to Westinghouse for review and approval prior to shipment of the piping assemblies.

6) Each piping assembly has a nameplate attached that provides information as to girth weld location and the measured wall thicknesses at these locations.

7) Westinghouse QA insures that the vendor's inspection data is valid.

Based on the above, CP&L concludes that the specifications invoked and fabrication/ inspection methods employed were adequate to insure that the piping assemblies delivered to the Shearon Harris Unit 1 Site meet the minimum wall thickness requirements.

(1941JDK/mf)