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TEXAS UTILITIES SERVICES INC.
AGENT FOR
TEXAS UTILITIES GENERATING COMPANY
ACTING FOR
DALLAS POWER & LIGHT COMPANY
TEXAS ELECTRIC SERVICE COMPANY
TEXAS POWER & LIGHT COMPANY

COMANCHE PEAK STEAM ELECTRIC STATION
UNITS NOS. 1 & 2

THIS SPECIFICATION COVERS
[illegible]

DESIGN SPECIFICATION
FOR ALL
ASME SECTION III, CODE CLASS 2 & 3 PIPING

2323-MS-200
~~DECEMBER 11, 1975~~
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REVISION 2 - APRIL 25, 1980

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THIS DOCUMENT COMPLIES WITH PARAGRAPH NA-3250 OF THE
ASME BOILER AND PRESSURE VESSEL CODE SECTION III

STATE OF TEXAS
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PROFESSIONAL

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DATE

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NEW YORK, NEW YORK

PIPING DESIGN SPECIFICATION

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PIPING DESIGN SPECIFICATION

1.0 GENERAL

a. This Design Specification states the functional and design requirements which forms the complete basis for the design, procurement, fabrication, erection, examination, testing, inspection and certificaton of all ASME B&PV Code Section III Class 2 and 3 piping components for the Comanche Peak Steam Electric Station, Units 1 & 2. Rev. 2 Rev. 2

b. The term piping as used throughout this specification, shall be understood to include straight pipe, bends, fittings, flanges, studs and nuts as may be shown on the composite piping drawings of Appendices 1 and 2 of this specification. Rev. 2

c. All components covered under this specification shall be designed and analyzed in accordance with the requirements of the ASME B&PV Code, Section III, Subsections NC or ND, as applicable, and the additional requirements of this specification. Rev. 2

d. The Engineer shall be responsible for compliance with all of the detailed requirements presented in this specification and Section III of the ASME B&PV Code.

1.1 SCOPE

This specification is prepared as a general document intended for the piping designer's use in designing ASME B&PV Code Section III Classes 2 & 3 piping. Documents referenced in the Appendices to this specification supplement the information contained in this specification and will be issued as amendments to this specification in accordance with the project schedule. Rev. 2

1.1.1 MATERIALS AND SERVICES COVERED BY THIS SPECIFICATION

a. Design & stress analysis of all ASME B&PV Code Section III, Classes 2 & 3 piping as defined on the composite piping drawings of Appendix 2, unless exempted in paragraph 1.1.2. Rev. 2

b. Material supply in accordance with the scope and requirements of Specification 2323-MS-43A of Appendix 3.

c. Fabrication, erection, examination, inspection, testing and certification in accordance with the scope and requirements of Specifications 2323-MS-43A, 2323-MS-43B and 2323-MS-100 of Appendix 3.

1.1.2 MATERIALS AND SERVICES NOT COVERED BY THIS SPECIFICATION

a. Design of pumps, valves, tanks, pressure vessels, heat exchangers, orifices, nozzles etc. which is not defined as piping in paragraph 1.0.

b. Design of ASME B&PV Code Section III Class 1 piping (Reactor Coolant Loop only).

c. Design of containment penetration assemblies forming part of both the piping pressure and containment pressure boundaries.

d. Design of piping supplied with skid mounted or package systems.

e. Analysis of Class 1 piping connected to the Reactor Coolant System to the first anchor point beyond the second isolation valve.

f. Design of tank penetrations for ASME Section III concrete tanks. Rev.2

g. Detailed design of pipe supports.

h. The NSSS supplier will perform the analysis for the ASME B&PV Code Section III Class 1 piping. The physical interfaces between this piping and the piping within the scope of this specification is shown on the Flow Diagrams of Appendix 1.

The analysis performed by the NSSS supplier shall include the ASME B&PV Code Section III Code Class 2 piping up to the first effective anchor beyond the classification change.

i. Nozzle movements due to transient conditions for class 1 components shall be supplied by NSSS vendor.

1.2 CLASSIFICATION BOUNDARIES

The piping shown on the composite piping drawings is classified as ANS Nuclear Safety Class 1, 2, 3 or as Non-Nuclear Safety Class. Piping which is non-nuclear safety class but must be seismically supported is designated Class 5. The boundaries between these classes are shown on the Flow Diagrams of Appendix 1. Rev. 2

1.3 DOCUMENTATION REQUIREMENTS AND DOCUMENT CONTROL

a. All calculations and results for components covered by this specification shall be prepared, reviewed and filed in accordance with the requirements for Nuclear Safety Related Components in the Project Procedures Manual.

b. The results of the analysis shall be documented together with applicable piping isometric drawings and support drawings and shall be cross referenced to the computer outputs. Rev. 2

c. A stress report, meeting the requirements of paragraph NA-3350 of the ASME B&PV Code Section III, shall be provided for the following piping, forming part of the containment building pressure boundary:

HOLD

1. The portions of the Main Steam system piping located between Containment Penetrations MI-1 through MI-4 and including sections of lines to the main steam safety valves and through the drain pots to the isolation valves. Rev. 2

2. The portions of the Feedwater and Auxiliary Feedwater piping systems located between Containment Penetrations MI-5 through MI-8 to the Feedwater isolation valves and Containment Penetrations MV-17 through MV-20 to the Auxiliary Feedwater isolation valves.

d. The documentation as specified in subparagraphs a through c above shall be completed and transmitted to the Owner prior to Fuel Load. Rev. 2

2.0 SYSTEM FUNCTIONAL REQUIREMENTS AND SYSTEM DESCRIPTIONS

System functional requirements and system descriptions for all plant systems utilizing ASME B&PV Code Section III Class 2 and 3 piping are detailed in the applicable sections of the CPSES/FSAR as shown in Table 2.0. Applicable Figures for the systems included are also shown in Table 2.0 of this specification. Rev. 2

2.1 REACTOR COOLANT SYSTEM

The Reactor Coolant system (RC) is shown on Flow Diagrams 2323-M-0250 and 0251 of Appendix 1. Rev. 2

During operation, the Reactor Coolant Pumps (RCP) circulate pressurized coolant fluid through the Reactor Pressure Vessel (RPV) and the reactor coolant loops. The fluid, which serves as a coolant, moderator, and solvent for boric acid, is heated as it passes through the RPV core. The coolant fluid in each loop flows from the RPV, through the 29" ID hot leg, and into the Steam Generators (SG) where heat is transferred to the steam supply system for electrical power generation. The fluid flows from the SG to the RCP in the 31" ID crossover leg and then is pumped back to the RPV in the 27-1/2 ID cold leg. The hot legs, crossover legs, and cold legs of the loops comprise the RCL piping which is designed and analyzed by the NSSS supplier. Rev. 2

The RCS pressure is controlled with the aid of a pressurizer in which liquid and vapor are maintained in equilibrium by electrical heaters and fluid sprayers. The piping connecting the pressurizer to the reactor coolant loops consists of a pressurizer surge line which joins the hot leg with the pressurizer and two pressurizer spray lines which run from the cold legs to the pressurizer. The two spray lines are joined before reaching the pressurizer.

To reduce the pressure in the RCS, fluid passes through the spray lines and condenses the steam in the pressurizer. This decreases the pressure and allows additional fluid flow to the pressurizer by way of the surge line. The RCS pressure is increased by using the electrical heaters to heat the fluid in the pressurizer. The additional vapor and corresponding pressure produced by the heating forces fluid from the pressurizer through the surge line to the RCL.

The Presistance Temperature Detector (RTD) manifold bypass loop is used to monitor the temperature of the fluid in each of the hot and cold legs of the RCL. For each hot leg manifold the fluid enters via three scoops in the hot leg, flows through the manifold where the temperature is determined, and returns to the loop at the crossover leg. The fluid flows from the manifold to the same return used for the hot leg manifold flow.

2.2 CHEMICAL AND VOLUME CONTROL SYSTEM

The Chemical and Volume Control system (CS) is shown on Flow Diagrams 2323-M-0253, 0254, 0255, 0256 and 0257 of Appendix 1.

This system maintains a programmed fluid level in the pressurizer, supplies sealwater to the reactor coolant pumps, processes effluent reactor coolant fluid to permit recovery and re-use of soluble chemical neutron absorber and makeup fluid, and is used in filling, draining and pressure testing of the RC system. In addition, the CS system controls the fluid chemistry conditions, the activity level, and the soluble chemical neutron absorber concentration and makeup. Rev. 2

2.3 BORON RECYCLE SYSTEM

The Boron Recycle system (BR) is shown on Flow Diagrams 2323-M-0258 and 0259 of Appendix 1. The BR system operates as part of the CS system in 2.2 above, and provides the means of recovery of the soluble chemical neutron absorber (boric acid) and the reactor coolant makeup water. Rev. 2 Rev. 2

2.4 RESIDUAL HEAT REMOVAL SYSTEM

The Residual Heat Removal system (RH) is shown on Flow Diagram 2323-M-0260 of Appendix 1.

The primary function of the Residual Heat Removal system is to remove heat energy from the Reactor core and RC system during plant cooldown and refueling operations. The system is also utilized as part of the Safety Injection System of paragraph 2.5. Rev. 2

2.5 SAFETY INJECTION SYSTEM

The Safety Injection System (SI) is shown on Flow Diagrams 2323-M-0261, 0262 and 0263 of Appendix 1.

This system provides emergency core cooling in the event of a break in either the Reactor Coolant, Main Steam or Steam Generator Feedwater systems. Fluid with a high boron content is injected into the RC system to counteract any core reactivity resulting from the pipe break. Fluid with a lower boron content is then employed for subsequent injection into the RC system to cool the reactor core and to prevent the possibility of an uncontrolled return to criticality. Rev. 2

2.6 LIQUID WASTE PROCESSING SYSTEM

The Liquid Waste Processing System (WP) is shown on Flow Diagrams 2323-M-0264, 0265, 0266, 0267 and 0268 of Appendix 1.

This system collects potentially radioactive waste liquids, discharged from the various plant systems and processes the waste as required to permit recycle, discharge, and solidification for removal from the plant.

2.7 GASEOUS WASTE PROCESSING SYSTEM

The Waste Gas System (GH) is shown on Flow Diagrams 2323-M-0269 and 0270 of Appendix 1.

This system collects the potentially radioactive and hazardous gases discharged from the various plant equipment and processes the gases prior to their release from the plant.

2.8 MAIN STEAM, REHEAT AND STEAM DUMP SYSTEM

The Main Steam System (MS) is shown on Flow Diagram 2323-M-0202 and M-0202-01 of Appendix 1.

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The system conveys steam from the outlet of the steam generators to the various steam components throughout the turbine building. The steam is primarily used to drive the main turbine and for heating service in the Main Steam Reheaters (MSR's). It is also used for various auxiliary services.

2.9 STEAM GENERATOR FEEDWATER SYSTEM

The Feedwater System (FW) is shown on Flow Diagram 2323-M-0203 of Appendix 1.

The system is designed to supply the feedwater required for various loads at steady-state operation and to maintain this flow, as required, during the steam dump conditions following a large load reduction. The system is designed to maintain uniform feedwater flow to all steam generators under all conditions and to maintain proper steam generator water levels automatically during steady-state and transient conditions. Rev. 2

2.10 AUXILIARY FEEDWATER SYSTEM

The Auxiliary Feedwater System (AF) is shown on Flow Diagram 2323-M-0206 of Appendix 1.

The system is designed to provide a supply of high-pressure feedwater to the secondary side of the steam generators for reactor coolant heat removal following a loss of normal feedwater. It provides an alternate to the main feedwater during hot shutdown, cooldown, and startup operations. It also provides a cooling source in the event of a loss-of-coolant accident (LOCA) for small breaks. Furthermore, the system is used in the event of a main steam line break, feedwater line break, Control Room evacuation, and steam generator tube rupture. Rev. 2

2.11 DIESEL GENERATOR AUXILIARY SYSTEMS

The Diesel Generator Fuel Oil Storage and Transfer System (DO) is shown on Flow Diagram 2323-M-0215 of Appendix 1.

The system is designed to supply a reliable source of fuel oil for the four emergency diesel generator sets for a period of not less than seven days. Rev. 2

2.12 PROCESS SAMPLING SYSTEM

The Process Sampling System (PS) is shown on Flow Diagram 2323-M-0228 of Appendix 1. This system collects for manual analysis, various plant primary and secondary fluids. The system discharges into the waste processing and the condensate system.

2.13 COMPONENT COOLING WATER SYSTEM

The Component Cooling Water System (CC) is shown on Flow Diagrams 2323-M-0229, 0230 and 0231 of Appendix 1.

The Component Cooling Water system provides an intermediate barrier between radioactive or potentially radioactive heat sources and the station service water system. It is designed to remove rejected heat from various plant components in a manner which precludes direct leakage of radioactive fluids into the safe shutdown impoundment (SSI). Rev. 2

2.14 CONTAINMENT SPRAY SYSTEM

The Containment Spray System (CT) is shown on Flow Diagram 2323-M-0232 of Appendix 1.

The system is designed to remove heat from the Containment environment following a LOCA, a main steam line break accident, or a feedwater line break accident. Rev. 2

2.15 STATION SERVICE WATER

The Station Service Water System (SW) is shown on Flow Diagrams 2323-M-0233 and 0233-01.

The system removes heat from the component cooling water heat exchangers and the emergency diesel generators, and supplies cooling water to the safety injection and centrifugal charging pump lube oil coolers. In conjunction with the component cooling water system, the service water system supplies cooling water to meet the plant cooling requirements during normal operation, shutdown, and during or after a postulated loss-of-coolant accident (LOCA) of either unit. The required cooling water is taken from the safe shutdown impoundment (SSI), which is the ultimate heat sink. The SSWS also acts as a backup water supply for the Auxiliary Feedwater System, if the normal supply is unavailable. Rev. 2

2.16 SPENT FUEL POOL COOLING AND CLEANUP SYSTEM

The Spent Fuel Pool Cooling and Cleanup System (SF) is shown on Flow Diagram 2323-M-0235 of Appendix 1.

The system is designed to remove heat generated by stored spent fuel elements from the station's spent fuel pools and to maintain the clarity and purity of water in the spent fuel pools, the transfer canals, the Refueling Water Storage Tank and the refueling cavities. Rev.2

2.17 DEMINERALIZED AND REACTOR MAKEUP WATER SYSTEM

The Demineralized and Reactor Makeup Water System (DD) is shown on Flow Diagram 2323-M-0241 and 0242 of Appendix 1. The lines classified to be ASME Section III piping are limited to the Reactor Makeup Water Storage Tank piping and the discharge into the RC, CS, SF and CC systems. The system provides the demineralized and deaerated water supply to the above systems.

2.18 HVAC - NUCLEAR SAFETY RELATED CHILLED WATER SYSTEM

The HVAC Nuclear Safety Related Chilled Water System (CH) is shown on Flow Diagram 2323-M-0311 of Appendix 1. The chilled water system consists of refrigeration water chillers, recirculation pumps, fan-coil units, surge tank and associated piping. Chilled water is supplied at 65 F to the Engineered Safety Feature (ESF) fan-coil units located throughout the plant and is returned to the refrigeration water chiller at 85 F. The system's primary function is to remove heat generated in the ESF pump rooms during the plant "loss of offsite power" and "loss of coolant" accidents.

2.19 COMPRESSED AIR SYSTEM

The Plant Compressed Air System is divided into two subsystems, Instrument Air (IA) and Service Air (SA) as shown on Flow Diagram 2323-M-0216.

These systems provide compressed air to various equipment and instrumentation throughout the plant and are not relied upon to perform any plant safety function and are as such not classified to conform to ASME Section III requirements.

However, the portions of these systems which penetrate the containment buildings are classified as ASME Section III Class 2 as shown on the flow diagrams of Appendix 1 in order to ensure containment pressure boundary integrity.

2.20 STEAM GENERATOR BLOWDOWN SYSTEM Rev.2

The Steam Generator Blowdown System (SB) is shown on flow diagram 2323-M-0239 of Appendix 1.

The system is designed to maintain optimum secondary-side water chemistry in the recirculating steam generators and to control radioactivity levels associated with nonvolatile radionuclides.

Each system is designed to continuously treat 100 percent of the blowdown from each unit. The treated blowdown is returned to the condenser or heater drain tank for reuse as secondary coolant.

2.21 HYDROGEN PURGE SYSTEM

The Hydrogen Purge System (VA) is shown on flow diagram 2323-M-0300 of Appendix 1.

The Hydrogen Purge System functions as a backup system for the electric hydrogen recombiners. This system provides the hydrogen removal capacity required by NRC Regulatory Guide 1.7, which defines a concentration limit for hydrogen accumulation following a LOCA.

2.22 HYDROGEN ANALYZING SYSTEM

The Hydrogen Analyzing System (HA) is shown on flow diagram 2323-M-0300 of Appendix 1.

The Hydrogen Analyzing System measures the concentration of combustible gases in several well-ventilated areas of the Containment Building in order to obtain a typical value for hydrogen gas concentration.

2.23 RADIATION MONITORING SYSTEM

The Radiation Monitoring System (RM) is shown on flow diagram 2323-M-0300 of Appendix 1.

The radiation monitoring system, which performs airborne radioactivity monitoring, is designed to measure and record airborne radioactivity levels, to alarm on high radioactivity levels, and, when required, to control the release of radioactive gases and particulates produced in the operation of the plant. Rev. 2

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TABLE 2.0

System	FSAR Sections/Figures
Reactor Coolant (RC)	5.1/5.1-1
Chemical and Volume Control (CCS)	9.3.4/9.3-10
Boron Recycle (BR)	9.3.4/9.3-11
Residual Heat Removal (RH)	5.4.7.6.3/5.4-6
Safety Injection (SI)	6.3/6.3-1
Liquid Waste Processing (WP)	11.2/11.2-2 through 7
Gaseous Waste Processing (GH)	11.3/11.3-1
Main Steam Reheat and Steam Dump (MS)	10.3/10.3-1
Steam Generator Feedwater (FW)	10.4.7/10.4-9
Auxiliary Feedwater (AF)	10.4.9/10.4-11
Diesel Generator Auxiliary Systems (DO)	9.5.4 through 9.5.8/9.5-52, through 57
Process Sampling (PS)	9.3.2/9.3-4
Component Cooling Water (CC)	9.2.2/9.2-3
Containment Spray (CT)	6.2.2/6.2.2-1
Station Service Water (SW)	9.2.1/9.2-1
Spent Fuel Pool Cooling and Cleanup (SF)	9.1.3/9.1-13
Demineralized and Reactor Make-up Water (DD)	9.2.3/9.2-5
HVAC Nuclear Safety Related Chilled Water (CH)	9.4/9.4-12
Compressed Air (CI)	9.3.1/9.3-1, 2, 3

TABLE 2.0 (continued)

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System	FSAR Sections/Figures
Steam Generator Blowdown	10.4.8/10.4-10
Hydrogen Purge (VA)	6.2.5.1.3, 6.2.5.2.3/9.4-6
Hydrogen Analyzing (HA)	6.2.5.1.4, 6.2.5.2.4/9.4-6
Radiation Monitoring (RM)	12.3.4/9.4-6

3.0 DESIGN INFORMATION

3.1 PIPING IDENTIFICATION

3.1.1 GENERAL

a. Pipeline designations are assigned to indicate unit number, line identification and the following design parameters for the pipelines and are as such used to identify the piping.

1. Size
2. System
3. Piping Category
4. Code (safety) Class (ASME B&PV Code, Section III, Class 1, 2, or 3).

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b. The pipe lines are designated as follows:

PIPELINE DESIGNATION EXAMPLE

6 -	CC -	1 -	01 -	152	R -	3
Size (6")	System (Component Cooling Water System)	Unit No. (1)	Line No. (1)	Piping Category (Piping Category 152)	Potentially Radioactive	Code Safety Class (Class 3)

c. Detailed information from the designation shall be interpreted as follows:

1. Size - Engineers' composite drawings (Appendix 1)
2. System - Table 3.1-1
3. Unit No. - Engineer's composite drawings (Appendix 1)
4. Line No. - Engineer's composite drawings (Appendix 1)
5. Piping Category - (Piping Specification Sheets Appendix 1 to Specification 2323-MS-43A & B, Appendix 3 this Specification)

6. Pipe Containing Potentially Radioactive Fluid-Engineer's composite drawings (Appendix 1)

7. Safety Class - Engineer's composite drawings — Rev. 2

3.1.2 PIPING SYSTEM DESIGNATION

Systems that are designated as nuclear piping systems are shown in Table 3.1-1, "System Service Designation". For interfaces with non-nuclear piping systems, refer to the Engineer's drawings.

3.1.3 PIPING CATEGORY

a. Piping category classifications are detailed in the Piping Specification Sheets of Appendix 1 to Specifications 2323-MS-43A&B (Appendix 3 to this Specification).

b. The pipe specification sheets indicate the maximum permissible pressure and temperature combination, and pipe sizes for the category. Flanges and fittings compatible with the pipe category are also indicated on the specification sheets.

c. ASME material specification references are listed in the specification sheets.

3.1.4 PIPING SAFETY CLASS

Piping systems are classified in accordance with ANSI N18.2. Corresponding ASME code requirements are shown in Table 3.1-2 "Classification Summary".

3.1.5 HIGH ENERGY PIPING

For the purposes of this specification, high energy piping is defined as those systems or portions of systems that during normal plant conditions are either in operation or maintained pressurized under conditions where either or both of the following conditions are met:

a. Maximum temperature exceeds 200 F

b. Maximum pressure exceeds 275 psig.

High energy piping is identified in the High Energy Piping Line List of Appendix 12 to this specification. Rev.2

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TABLE 3.1-1
SYSTEM SERVICE DESIGNATION

SYSTEM DESIGNATION	SYSTEM
AF	Auxiliary Feedwater
BR	Boron Recycle
CA	Compressed Air - Service Air
CC	Component Cooling Water
CH	Chilled Water
CI	Compressed Air - Instrument Air
CS	Chemical and Volume Control
CT	Containment Spray
DD	Demineralized and Reactor Make-up Water
DO	Diesel Generator Fuel Oil
FW	Steam Generator Feedwater
GH	Waste Processing - Gas
HA	Hydrogen Analyzing
MS	Main Steam, Reheat and Steam Dump
PS	Process Sampling - Primary Plant
RC	Reactor Coolant
RH	Residual Heat Removal
RM	Radiation Monitoring
SB	Steam Generator Blowdown and Cleanup
SF	Spent Fuel Pool Cooling and Cleanup

TABLE 3.1-1 (Continued)
SYSTEM SERVICE DESIGNATION

Rev. 2

SYSTEM DESIGNATION	SYSTEM
SI	Safety Injection
SW	Station Service Water
VA	Hydrogen Purge
WP	Waste Processing - Liquid

TABLE 3.1-2
CLASSIFICATION SUMMARY

Rev.2

QUALITY GROUP CLASSIFICATION[1]	CODE	LOCATION OF EQUIPMENT	SEISMIC CATEGORY	SUBJECT TO Q.A. PROGRAM	ANS CLASSIFICATION[2]
Group A Piping	ASME B&PV Code Section III Class 1	Containment	I	Yes	1
Group B Piping	ASME B&PV Code Section III Class 2	Containment Safeguard Bldg. Auxiliary Bldg.	I	Yes	2
Group C Piping	ASME B&PV Code Section III Class 3	Containment Safeguard Bldg. Auxiliary Bldg. Fuel Bldg. Outdoors	I	Yes	3
Group D Piping	Outside the scope of this specification				

[1]Refer to USNRC Regulatory Guide 1.26
[2]Refer to ANSI N18.2

3.2 PIPING ENVIRONMENTAL DESIGN REQUIREMENTS

The piping covered by this specification shall be designed to withstand the environmental conditions delineated in this section. Rev. 2

3.2.1 AMBIENT DESIGN CONDITIONS

The ambient atmospheric design conditions for the various plant areas are shown in paragraph 3.4 and Table 3.4-1 of Specification 2323-MS-43A.

3.2.2 DESIGN RADIATION DOSE

a. The localized maximum anticipated radiation dose due to internal radioactive process fluids shall be considered as 10^9 rads over the 40 years plant life.

b. For the piping design, this value shall be added to the ambient radiation doses of paragraph 3.1.1 above to achieve the total radiation dose.

3.2.3 WATER AND GAS CHEMISTRY

3.2.3.1 PLANT OPERATING LIQUIDS

The water chemistry for the various plant liquids circulated within the piping covered by this specification are shown in Tables 3.2-1 thru 3.2-13. Rev.2

3.2.3.2 TESTING AND CLEANING FLUIDS

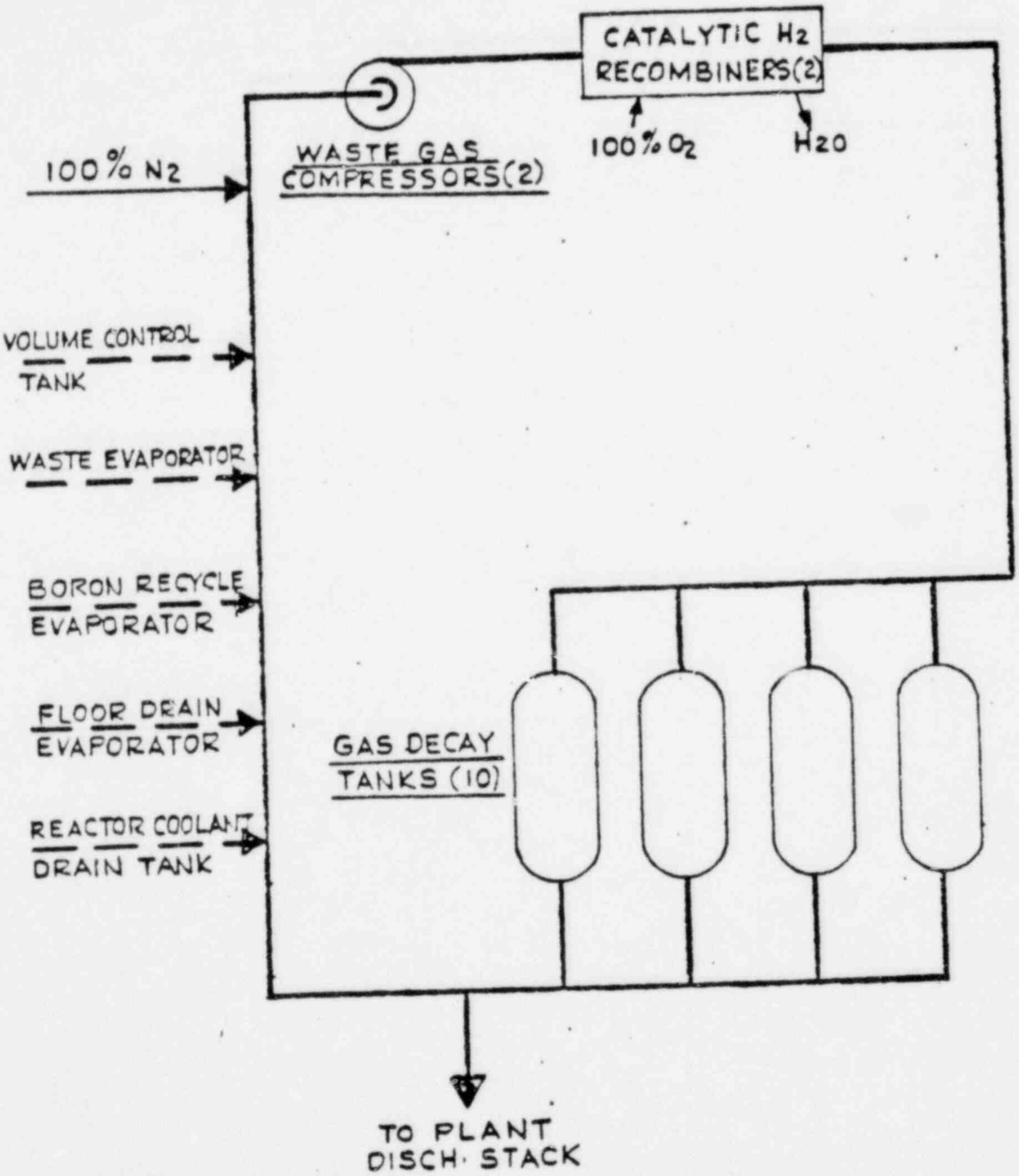
The water chemistry requirements for the various hydrostatic testing and system flushing fluids are given in Specification 2323-MS-100 of Appendix 3.

3.2.3.3 PLANT GAS SYSTEM CHEMISTRY

The Plant Waste Gas System chemistry is shown in Figure 3.1-1.

ALL SOLID LINES IN THE FIG. SHOWN BELOW CARRYES N2 WITH A FRACTIONAL PERCENTAGE OF RADIOACTIVE GASES, H_2 AND IMPURITIES, SATURATED AT 130F.

ALL DASHED LINES IN THE FIG BELOW CARRYES H_2 WITH RADIOACTIVE GASES AND IMPURITIES, SATURATED AT 180F.



WASTE GAS CHEMISTRY

Gibbs & Hill, Inc.
ENGINEERS, DESIGNERS, CONSTRUCTORS
NEW YORK

JOB NO. 2323

SCALE: ~

FIG. 3.1-1

ISSUE NO.	DATE	ISSUED FOR
2		REV. 2 CF MS 200
1	11/3/75	TUSI APPROVAL

TABLE 3.2-1
DEMINERALIZED WATER

Rev. 2

1.	Cation conductivity, microMhos/cm	1.0
2.	Soluble silica, as SiO_2, ppm	0.2
3.	Sodium, as Na, ppm	0.01
4.	Dissolved oxygen, Concentration	saturated /a
5.	Carbon dioxide as CO_2 Concentration ppm	1.0
6.	Suspended solids, ppm	0.1
7.	pH, at 25 C	6.0 - 8.0

/a Oxygen will be removed by vacuum deaeration before transfer to the Reactor Makeup Water Storage Tank and the Condensate Storage Tank.

TABLE 3.2-2
REACTOR MAKEUP WATER | Rev.2

1. Specific Cation conductivity	Less than 2.0 Mhos/cm at 25 C	Rev.2
2. pH	6.0 to 8.0 at 25C	
3. Oxygen /a	Less than 0.10 ppm	
4. Chloride and fluoride (total)	Less than 0.10 ppm	Rev.2
5. Silica, total	Less than 0.10 ppm	
6. Potassium	Less than 0.01 ppm	
7. Sodium	Less than 0.01 ppm	
8. Aluminum, total	Less than 0.02 ppm	
9. Calcium	Less than 0.02 ppm	
10. Magnesium	Less than 0.02 ppm	
11. Suspended Solids	Less than 0.10 ppm	
12. Total Solids /b	Less than 0.5 ppm	
13. Carbon dioxide	Less than 2.0 ppm	
14. Particulates	Filtered to less than 25 microns	
15. Specific activity	Less than 0.005 microcurie/cc (Ci/cc) Beta - Gamma, excluding Tritium which should be ≤2.5 Ci/cc	
16. Boric Acid	Less than 20 ppm as B	Rev.2

/a Oxygen concentration must be below 0.1 ppm if reactor coolant is above 250 F.

/b Excluding boric acid.

REV 2

TABLE 3.2-3
REACTOR COOLANT

1. Electrical Conductivity	Determined by the concentration of boric acid and alkali present. Expected range will be 1 to 40 Mhos/cm at 25 C.	
2. Solution pH	Expected value range between 4.2 (high boric acid concentration) to 10.5 (low boric acid concentration) at 25 C.	
3. Oxygen, ppm, max.[/a]	0.10	
4. Chloride, ppm, max.[/c]	0.15	
5. Fluoride, ppm, max.[/c]	0.15	REV 2
6. Silica, ppm, max	0.2	REV 2
7. Aluminum, ppm, max	0.05	REV 2
8. Calcium, ppm, max	0.05	REV 2
9. Magnesium, ppm, max	0.05	REV 2
10. Hydrogen, cc (STP)/kg H_2O[/b]	25-35	REV 2
11. Total Suspended Solids, ppm, max.	1.0	
12. pH Control Agent (Li^7OH)	0.3×10^{-4} to 3.2×10^{-4} molal (equivalent to 0.22 to 2.2 ppm Li^7).	REV 2
13. Boric Acid, as ppm B	Variable from 0 to 4000.	REV

/a Oxygen concentration must be below 0.1 ppm for reactor coolant at or above 130 F. Oxygen concentration will be below 0.005 ppm during power operation when hydrogen is maintained in the coolant.

/b Hydrogen must be maintained in the reactor coolant for all plant operation with nuclear power above 1 MWt.

/c Halogen concentractions must be maintained within the specified valves at all times, whether the coolant is at ambient or high temperature.

REV.2

TABLE 3.2-4
FEEDWATER

1.	pH at 25 C	8.8 - 9.2
2.	Free Caustic	0
3.	Dissolved Oxygen, O_2	<0.005 mg/l
4.	Iron and Copper	<0.01 mg/l each
5.	Hydrazine	0.01 mg/l residual minimum
6.	Chlorides	0.0 - 0.5 mg/l maximum
7.	Total Dissolved Solids	<1.0 mg/l

Rev. 2

TABLE 3.2-5
STEAM GENERATOR BLOWDOWN WATER

1.	pH at 25 C	8.5 - 9.2
2.	Free hydroxide	0.15 maximum
3.	Chloride as ppm Cl	0.15 maximum
4.	Cation conductivity microMhos/cm	2.0 maximum
5.	Suspended solids, ppm	1.0 maximum
6.	Silica, as ppm SiO_2	5.0 maximum

Rev 2

TABLE 3.2-6
RESIDUAL HEAT REMOVAL WATER

1.	Electrical conductivity	Determined by the concentration of boric acid and alkali present. Expected range will be 1 to 40 microMhos/cm at 25 C.
2.	Solution pH	As for conductivity. Expected values 4.5 at 25 C.
3.	Oxygen, ppm max[/a]	0.10
4.	Chloride, ppm max	0.15
5.	Fluoride, ppm, max	0.15
6.	Silica, ppm, max	0.30
7.	Aluminum, ppm, max	0.08
8.	Calcium, ppm, max	0.08
9.	Magnesium, ppm, max	0.08
10.	Total Suspended Solids, ppm, max	2.0
11.	Boric Acid, as ppm B	Variable 2000 to 4000.

Rev 2

/a Oxygen concentration must be below 0.1 ppm for any plant condition above 180 F, the oxygen limit is not in effect.

NOTE: This chemistry is applicable both during operation and during standby of the Residual Heat Removal system. In essence, the only difference which will be limited for oxygen as given in a footnote.

Rev. 2

TABLE 3.2-7
SPENT FUEL POOL WATER

1.	Solution pH	Determined by concentration of boric acid present. Tolerable limits are 4.0 to 4.7.
2.	Boric Acid as ppm B	2500 /a
3.	Chloride, ppm, max	0.15
4.	Fluoride, ppm, max	0.15
5.	Calcium, ppm, max	1.0
6.	Magnesium, ppm, max	1.0

Rev 2

a/ Determined by specific design of spent fuel storage facilities. Expected range is from 2000 to 4000 ppm B.

TABLE 3.2-8
BORIC ACID STORAGE

1.	Boric Acid, Concentration, weight %	12 ±0.5%
2.	Electrical Conductivity	Determined by the concentration of boric acid present.
3.	Solution pH	Determined by the concentration of boric acid present. Expected range is 4.0 to 4.5.
4.	Chloride, ppm, max.	0.15
5.	Fluoride, ppm, max. /a	0.25
6.	Silica, ppm, max /b	0.70 and 2.1
7.	Aluminum, ppm, max /b	0.22 and 0.66
8.	Calcium, ppm, max /b	0.22 and 0.66
9.	Magnesium, ppm, max /b	0.22 and 0.66
10.	Makeup Water	Shall meet Reactor Coolant Makeup Water specification, Table 3.2-2

Rev.2

/a Limit based on maximum allowable chloride limit in reactor coolant makeup water and boric acid.

/b Lower limit pertains to 4% solution, upper limit to 12% solution.

Rev

Rev 2

TABLE 3.2-9
CONTAINMENT SPRAY WATER

1.	Solution pH at 25 C	8.5 to 10.0 /a
2.	Boric acid as ppm B	2000 - 4000 /b
3.	Chloride, ppm	0.15 max
4.	Fluoride, ppm	0.15 max
5.	Sodium hydroxide	varies /c

/a The final pH after long term recirculation will be about 8.6.

/b The average boric acid concentration is expected to be 2500 ppm B.

/c The sodium hydroxide concentration is maintained to give an average pH of 8.6. The ratio of NaOH to Boron will vary from 1 to 3 (average value will be 1.0).

Rev. 2

TABLE 3.2-10
MAIN STEAM

pH, at 25 C	8.8 - 9.2
Cation Conductivity, micromhos/cm	2.0 maximum
Silica, ppm as SiO_2	0.5

Rev

TABLE 3.2-11
SERVICE WATER /a

1.	Calcium as ppm $CaCO_3$	360 - 940
2.	Magnesium as ppm $CaCO_3$	80 - 410
3.	Sodium and Potassium as ppm $CaCO_3$	1810 - 2220
4.	Bicarbonate as ppm $CaCO_3$	200 - 210
5.	Carbonate as ppm $CaCO_3$	0 - 28
6.	Chloride as ppm $CaCO_3$	1630 - 2310
7.	Sulfate as ppm $CaCO_3$	620 - 1040
8.	Total Dissolved Solids as ppm $CaCO_3$	2450 - 3570
9.	Silica as ppm SiO_2	8 - 68
10.	pH at 25 C	8.0 - 8.3
11.	Iron as ppm Fe	Less than 1.0
12.	Manganese as ppm Mn	0.0
13.	Turbidity as Jackson Units	5 - 10

/a The composition of this water is based on predicted average values for the Squaw Creek Reservoir. The peak values may be somewhat higher than the above values.

Rev:

TABLE 3.2-12
COMPONENT COOLING WATER

1.	Corrosion Inhibitor /a	Suitable non-chromate, non-phosphate corrosion inhibitor will be used according to manufacturer's recommendation
2.	pH at 25 C	8.0 to 8.5
3.	Chloride, ppm, max	0.15
4.	Fluoride, ppm, max	0.15

/a The following corrosion inhibitors will be considered:

1. Drew Chemical's Drewgard - 100
2. Calgon Corporation's LS - 16
3. Betz Laboratories' Orocol - 252
4. Potassium Dichromate

Rev.

TABLE 3.2-13
REACTOR COOLANT - LEAKS/BLEEDS/DRAINS

1.	Nitrogen, N_2 Concentration	0 to saturation
2.	Oxygen, O_2 Concentration	0 to saturation
3.	Hydrogen cc(stp)/Kg H_2O	0 to 35
4.	Boron, as ppm B	0 to 4,000
5.	Misc. corrosion products	10 ppm max.
6.	pH	4.2 to 10.5 @25 C
7.	Chloride, as Cl ppm	0.15 max.
8.	Fluoride, as F ppm	0.15 max.

 REV 2

3.2.4 VALVE IDENTIFICATION

For purposes of analysis, all valve information including valve tag number, valve generic type, end to end dimensions and actual valve weights are included in Appendix 10 to this specification.

3.3 MATERIALS AND FABRICATION

3.3.1 MATERIAL, FABRICATION AND INSTALLATION REQUIREMENTS

Material supply requirements are delineated in Specification 2323-MS-43A of Appendix 3. Fabrication, examination, inspections, cleaning, stamping, and packaging requirements are delineated in Specifications 2323-MS-43A and 2323-MS-43B. Installation requirements are delineated in Specification 2323-MS-100. REV 2

3.3.2 REQUIREMENTS FOR CONTAINMENT PRESSURE BOUNDARY PIPING REV 2

a. Piping forming part of the containment pressure boundary shall in addition to the requirements of the ASME B&PV Code Section III subsections NA and NC, meet all the requirements of subsection NE.

b. The boundary of this piping is described in paragraph 1.3.c of this specification. REV 2

c. Where conflicts between subsection NC and NE occur, the requirements of subsection NC shall apply. REV 2

d. Impact testing of these materials shall be in accordance with subsection NC as detailed in paragraph 3.7.3.7 of Specification 2323-MS-43A of Appendix 3. REV 2

3.4 SPRING CONSTANTS (STIFFNESSES) OF PIPING SUPPORTS REV 2

The spring constants shown in Table 3.4-1 shall be used for modeling the effects of pipe supports in the seismic and thermal analyses of piping systems.

3.5 INSULATION DATA

The thickness of the piping insulation corresponding to the size of the pipe and insulation class is determined from the insulation schedule included in Appendix 11 to this specification. The pipe line size and insulation class is obtained from the specific system line list included in Appendix 7 to this specification. Rev. 2

The densities of the insulation used may also be obtained from the tables included in Appendix 11 to this specification.

Rev.2

TABLE 3.4-1
SPRING CONSTANTS (STIFFNESS) OF PIPING SUPPORTS

(Application for Seismic and Thermal Analyses.)

1) RIGID RESTRAINTS

NOMINAL PIPE SIZE (in)	TRANSLATIONAL STIFFNESS Kt (lb/in)	ROTATIONAL STIFFNESS Kr (in-lb/rad)
UNDER 6	2×10^5	1×10^7
6 to 14	1×10^6	1×10^8
OVER 14	5×10^6	1×10^9

2) MECHANICAL SHOCK ARRESTOR

NOMINAL PIPE SIZE (in)	RATED LOAD (lbs)	STIFFNESS K (lbs/in)
UNDER 2	1,000	1×10^5
2 to 6	3,000	2×10^5
8,10,12	10,000	3×10^5
OVER 12	35,000	1.35×10^6

4.0 ENVIRONMENTAL EFFECTS

a. All ASME B&PV Code Section III piping covered by this specification is located indoors or outdoors as shown on the composite piping drawings of Appendix 2.

b. The indoor environmental conditions of paragraph 3.1.1 is not considered detrimental to any of the piping materials shown in Appendix 1 of Specification 2323-MS-43A of Appendix 3 to this specification.

c. Buried piping shall be protected from soil corrosion by a combination of exterior protective coating as required in Specifcations 2323-MS-43A, 43B and 100 and by a cathodic protection system. All buried piping shall be designed to provide electric continuity by an adequate metal to metal contact at all pipe joints. Where rubber gasketing is used in the buried portion, electrical jumper cables shall be installed across the joint to provide this continuity. | Rev.2

d. The design radiation dose (internal and ambient) of paragraph 3.1.2 is considered deleterious to rubber and rubber bonded gasketing materials to be used in any of the plants process systems or high radiation areas. Flexitallic gaskets (asbestos bonded metal gaskets) shall be used on all ASME Section III flanged joints except for the Service Water system which shall utilize either rubber or rubber bonded asbestos gaskets to prevent damage to the systems interior lining.

e. Carbon steel materials exposed to the fluids are designed to considering a 1/16-inch corrosion allowance. | Rev.2

f. Austenitic stainless steel materials shall not consider any corrosion allowance. | Rev.2

g. Service water piping materials (category 150 of Specification 2323-MS-43A of Appendix 3) shall not consider any corrosion.

Rev.

5.0 DESIGN REQUIREMENTS

a. All piping covered under this specification shall be designed in accordance with the ASME B&PV Code, Section III, Subsections NC or ND, as applicable.

b. The minimum thickness of pipe wall required for design pressures and temperatures shall be calculated by the use of the following formula:

$$tm = \frac{PDo}{2(SE+Py)} + A$$

where:

- tm = minimum required wall thickness (in.)
- P = internal design pressure (psi)
- Do = outside diameter of pipe (in.)
- S = maximum allowable stress in the material at the design temperature (psi)
- E = efficiency of welded joint and casting factor
- A = an additional thickness, in inches, to account for threading, mechanical strength or corrosion allowance
- Y = coefficient of 0.4

After the pipe minimum wall thickness is determined by the above formula, the minimum thickness shall be increased to the next heavier commercial wall thickness, selected from the standard thickness schedules, as specified in ANSI B36.10. The selected wall thickness for each piping category is indicated in Appendix 1 to Specification 2323-MS-43A (Appendix 3 to this specification).

c. The minimum wall thickness for piping specified to nominal wall, at any point, shall not be more than 10 mils below 12.5 percent under the specified nominal wall thickness for seamless or welded without filler metal pipe. For welded pipe, the minimum wall thickness shall be as dictated by the material specification sheets of Appendix 1 to Specification 2323-MS-43A (Appendix 3 of this Specification). In any instance, whenever piping used is 10 mils below the 12.5 percent under the nominal wall thickness, the stress analysis should be revised accordingly to account for this wall thickness deficiency.

The analyses of ASME Safety Class 2 and 3 piping having wall thickness deficiencies will be performed as follows: REV 2

1) For High Energy piping, as identified in paragraph 3.1.5 of this specification, the actual locations of the minimum wall violations shall be identified by the Owner on a case by case basis. The maximum stress values obtained from the stress analysis and used to determine the break locations, shall be multiplied by the stress intensification factor to determine the effect on the break locations. In some instances, a third break postulation point may be introduced or a shift in the existing break location may result. The problem of new break locations will be resolved by the Engineer on a case by case basis.

(2) For the remainder of the ASME Safety Class 2 or 3 piping, the maximum stress values obtained from the stress analysis performed shall be multiplied by the stress intensification factor and compared to the allowable stresses permitted by the applicable sections of the ASME Section III Code. When the revised stresses exceed the code allowable stresses, the actual locations of the wall thickness violations shall be identified by the owner on a case by case basis for disposition by the Engineer.

5.1 DESIGN CODES AND DOCUMENTS

The design and analysis of all piping covered by this design specification shall meet all the requirements of the following applicable documents referenced herein:

a. The ASME Boiler and Pressure Vessel Code, Section II, parts A and B, 1974 edition, including the Summer 1974 addenda. Rev.

b. The ASME Boiler & Pressure Vessel Code, Section III Subsections NA, NC, ND and NE, 1974 edition including the Summer 1974 Addenda.

c. The ASME Boiler and Pressure Vessel Code, Code Cases as explicitly referenced herein and in NRC Regulatory Guide 1.84. Rev.

d. The Comanche Peak Steam Electric Station Safety Analysis Report (CPSES/FSAR).

e. American National Standard N18.2 (1973 edition) Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactors Plants. Rev.2

5.2 PIPING SYSTEM OPERATING CONDITIONS

a. The system operating conditions are designated in accordance with the requirements of the ASME Section III Code. These conditions are used to group the various loading combinations as shown in Table 5.2-1.

b. The system operating temperatures corresponding to the various plant modes of system operation are shown on Appendix 8.

5.2.1 SYSTEM NORMAL OPERATING CONDITIONS

Normal conditions are defined as any condition in the course of system startup, operation in the design power range, hot standby and system shutdown, other than upset, emergency, faulted, or testing conditions.

5.2.2 SYSTEM UPSET OPERATING CONDITIONS

Upset conditions are defined as any deviation from normal conditions anticipated to occur often enough to require that the design include a capability to withstand the conditions without operational impairment. The upset conditions include those transients which result from any single operator error or control malfunction transients caused by a fault in a system component requiring its isolation from the system, and transients due to loss of load or power. Upset conditions include any abnormal incidents not resulting in a forced outage and also forced outages for which the corrective action does not include any repair of mechanical damage.

5.2.3 SYSTEM EMERGENCY OPERATING CONDITIONS

Emergency conditions are defined as those deviations from normal conditions which require shutdown for correction of the conditions or repair of damage in the systems. 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 postulated occurrences for such events shall not cause more than 25 stress cycles having an alternating stress value greater than that for 10^6 cycles from the applicable fatigue design curves. Rev.2

5.2.4 SYSTEM FAULTED OPERATING CONDITIONS

Faulted conditions are defined as those combinations of conditions associated with extremely low probability, postulated events whose consequences are such that the integrity and operability of the system may be impaired to the extent that conditions of public health and safety are involved. Such considerations require compliance with safety criteria as may be specified by jurisdictional authorities.

5.2.5 TESTING CONDITIONS

a. This condition is considered a system normal operating condition and shall not require separate piping analysis and will be the responsibility of the hanger vendor subject to the provisions of paragraph 1.1.2.g. the design of piping component supports shall evaluate the system hydrostatic testing condition, where the pipe shall be assumed filled with 40F water.

b. During testing, all safety/relief valves shall be closed to prevent actuation. The lines shall be protected by a safety valve located in the testing fixture. There shall be no live loads acting concurrently with the sustained loads.

c. Component supports stresses shall not exceed the allowable stresses for normal operation during this condition.

TABLE 5.2-1

LOADING COMBINATIONS AND STRESS LIMITS FOR
ASME III CLASSES 2 & 3 PIPING

System Condition	Loading Combination	Load Definition	Allowable Stresses (Paragraphs NC and ND - 3650)			
						Rev2
Normal operating condition	Design pressure Deadweight	Sustained	S_h (eq 8)	$S_h + S_A$ (eq 11)		Rev2
	Temperature	Thermal expansion	S_A (eq 10)			Rev2
Upset [1] operating condition	Design press.[4] Deadweight	Sustained	S_h (eq 8)	1.2 S_h (eq 9)	$S_h + S_A$ (eq 11)[7]	Rev2
	1/2 SSE inertia 1/2 SSE anchor movement [3] Dynamic Upset Events [6]	Occasional				Rev2
	Temperature 1/2 SSE Anchor Movement [3]	Thermal expansion	S_A (eq 10)			Rev2

System Condition	Loading Combination	Load Definition	Allowable Stresses (Paragraphs NC and ND - 3650)	
				Rev. 2
Emergency operating condition	Design press.[4)] Deadweight	Sustained		Rev. 2
	SSE Inertia Jet impingement loads Dynamic Emergency Events [5)] Pipe Impact Loads[(8)]	Occasional	1.8 S_h (eq 9)	Rev. 2
Faulted [2)] operating condition	Design press. [4)] Deadweight	Sustained		Rev. 2
	SSE Jet impingement loads Dynamic Faulted Events Pipe Impact Loads[(8)]	Occasional	2.4 S_h (eq 9)	

Notes

1. Boundaries and allowable stresses for the containment isolation system and break exclusion areas are delineated in paragraph 5.3.2 of this specification. Rev. 2

2. Based on ASME Code Case 1606-1 "Stress Criteria Section III, Class 2 & 3 piping subject to upset, emergency and faulted operating conditions." Rev. 2

3. Anchor movement to be included in Equation (10) if omitted from Equation (9) Rev. 2

4. Design pressure is used since peak pressure and earthquake are not taken to be acting concurrently.

5. For essential piping only, as identified in Table 5.2-3.

6. Relief Valve Actuation, Steam/Water hammer, etc.

7. Does not include occasional loads. Equation (11) = Equation (8) + Equation (10)

8. Pipe impact loads shall be considered, where applicable. The pipe impact loads shall be considered in emergency conditions for systems required for safe shutdown of the plant during an earthquake. If not required, the pipe impact loads shall be considered in the faulted conditions.

TABLE 5.2-2 REV 2

FLUID SYSTEMS BETWEEN CONTAINMENT ISOLATION VALVES

Description	Line	Start	Stop
RCP Seal Inj. Loop 2	2-CS-1-106-2501R-2	MIII-8	Moment Restrai CP1-CSSSMR-02 (typ.)
RCP Seal Inj. Loop 3	2-CS-1-104-2501R-2	MIII-9	CP1-CSSSMR-03
RCP Seal Inj. Loop 4	2-CS-1-108-2501R-2	MIII-10	CP1-CSSSMR-04
RCP Seal Inj. Loop 1	2-CS-1-102-2501R-2	MIII-7	CP1-CSSSMR-05
CVCS Charging	3-CS-1-077-2501R-2	CP1-CSSSMR-14	CP1-CSSSMR-06
CVCS Letdown	3-CS-1-012-601R-2	CP1-CSSMR-07	MII-1
CVCS Letdown	3-CS-1-012-601R-2	MII-1	CP1-CSSSMR-09
RCP Seal Inj. Loop 1	2-CS-1-092-2501R-2	CP1-CSSSMR-10	MIII-7
RCP Seal Inj. Loop 2	2-CS-1-095-2501R-2	CP1-CSSSMR-11	MIII-8
RCP Seal Inj. Loop 3	2-CS-1-098-2501R-2	CP1-CSSSMR-12	MIII-9
RCP Seal Inj. Loop 4	2-CS-1-101-2501R-2	CP1-CSSSMR-13	MIII-10
Main Steam Loop 1	32-MS-1-01-1303-2	CP1-MSMEMR-01	MI-1
Main Steam Loop 2	32-MS-1-02-1303-2	CP1-MSMEMR-02	MI-2
Main Steam Loop 3	32-MS-1-03-1303-2	CP1-MSMEMR-03	MI-3
Main Steam Loop 4	32-MS-1-04-1303-2	CP1-MSMEMR-04	MI-4
SI To RCS H.L. SI To RCS H.L.4	4-SI-1-052-2501R-2 2-SI-1-058-2501R-2	MIII-4	CP1-SISSMR-01
SI To RCS H.L. SI To RCS H.L.1	4-SI-1-052-2501R-2 2-SI-1-307-2501R-2	MIII-4	CP1-SISSMR-02

TABLE 5.2.2 (Continued)

REV 2

Description	Line	Start	Stop
SI To RCS H.L.	4-SI-1-051-2501R-2	MIII-3	CP1-SISSMR-03
SI To RCS H.L.2	2-SI-1-057-2501R-2		
SI To RCS H.L.2	2-SI-1-301-2501R-1		
SI To RCS H.L.2	6-SI-1-101-2501R-1		
SI To RCS H.L.	4-SI-1-051-2501R-2	MIII-3	CP1-SISSMR-04
SI To RCS H.L.	2-SI-1-055-2501R-2		
SI To RCS H.L.1	2-SI-1-302-2501R-1		
SI To RCS H.L.1	6-SI-1-102-2501R-1		
SI To SIS C.L.	10-SI-1-082-2501R-2	MII-4	CP1-SISSMR-05
SI To SIS C.L.1	6-SI-1-304-2501R-2		
SI To SIS C.L.	4-SI-1-060-2501R-2	MIII-5	CP1-SISSMR-05
SI To SIS C.L.1	2-SI-1-062-2501R-2		
SI To SIS C.L.1	2-SI-1-063-2501R-1		
SI To SIS C.L.	10-SI-1-082-2501R-2	MII-4	CP1-SISSMR-06
SI To SIS C.L.2	8-SI-1-087-2501R-2		
SI To SIS C.L.2	6-SI-1-327-2501R-2		
SI To SIS C.L.2	6-SI-1-328-2501R-1		
SI To SIS C.L.2	8-SI-1-090-2501R-1		
SI To SIS C.L.	10-SI-1-083-2501R-2	MII-5	CP1-SISSMR-07
SI To SIS C.L.3	8-SI-1-088-2501R-2		
SI To SIS C.L.3	6-SI-1-329-2501R-2		
SI To SIS C.L.3	6-SI-1-330-2501R-1		
SI To SIS C.L.	10-SI-1-083-2501R-2	MII-5	CP1-SISSMR-08
SI To SIS C.L.4	6-SI-1-305-2501R-2		
Auxiliary Feedwater to SG1	4-AF-1-105-2002-3	CP1-AFSSMR-01	MV-18
	4-AF-1-52-2003-2		
	4-AF-1-17-1303-2		
	6-FW-1-95-1303-2		

TABLE 5.2.2 (Continued)

Description	Line	Start	Stop	
Auxiliary Feedwater to SG1	4-AF-1-104-2002-3 4-AF-1-21-2003-2 4-AF-1-52-2003-2 4-AF-1-17-1303-2 6-FW-1-95-1303-2	CP1-AFSSMR-02	MV-18	REV 2
Auxiliary Feedwater to SG2	4-AF-1-107-2002-3 4-AF-1-53-2003-2 4-AF-1-18-1303-2 6-FW-1-96-1303-2	CP1-AFSSMR-03	MV-19	
Auxiliary Feedwater to SG2	4-AF-1-106-2002-3 4-AF-1-22-2003-2 4-AF-1-53-2003-2 4-AF-1-18-1303-2 6-FW-1-96-1303-2	CP1-AFSSMR-04	MV-19	
Auxiliary Feedwater to SG3	4-AF-1-109-2002-3 4-AF-1-54-2003-2 4-AF-1-19-1303-2 6-FW-1-97-1303-2	CP1-AFSSMR-05	MV-20	
Auxiliary Feedwater to SG3	4-AF-1-108-2002-3 4-AF-1-23-2003-2 4-AF-1-54-1303-2 4-AF-1-19-1303-2 6-FW-1-97-1303-2	CP1-AFSSMR-06	MV-20	
Auxiliary Feedwater to SG4	4-AF-1-111-2002-3 4-AF-1-55-2003-2 4-AF-1-20-1303-2 6-FW-1-98-1303-2	CP1-AFSSMR-07	MV-17	

TABLE 5.2.2 (Continued)

Description	Line	Start	Stop	
Auxiliary Feedwater to SG4	4-AF-1-110-2002-3 4-AF-1-124-2002-3 4-AF-1-55-2003-2 4-AF-1-20-1303-2 6-FW-1-98-1303-2	CP1-AFSSMR-08	MV-17	REV 2
Main Feedwater, SG1	18-FW-1-36-2003-2 18-FW-1-19-1303-2	CP1-FWSSMR-01	MI-5	
Main Feedwater, SG2	18-FW-1-35-2003-2 18-FW-1-18-1303-2	CP1-FWSSMR-02	MI-6	
Main Feedwater, SG3	18-FW-1-34-2003-2 18-FW-1-17-1303-2	CP1-FWSSMR-03	MI-7	
Main Feedwater, SG4	18-FW-1-37-2003-2 18-FW-1-20-1303-2	CP1-FWSSMR-04	MI-8	
Auxiliary Feedwater, SG1	1-1/2-FW-1-32-1303-2 6-FW-1-95-1303-2	CP1-FWSSMR-13	MV-18	
Auxiliary Feedwater, SG2	1-1/2-FW-1-31-1303-2 6-FW-1-96-1303-2	CP1-FWSSMR-14	MV-19	
Auxiliary Feedwater, SG3	1-1/2-FW-1-30-1303-2 6-FW-1-97-1303-2	CP1-FWSSMR-15	MV20	
Auxiliary Feedwater, SG4	1-1/2-FW-1-33-1303-2 6-FW-1-98-1303-2	CP1-FWSSMR-16	MV-17	

TABLE 5.2.2 (Continued)

Description	Line	Start	Stop	
Main Steam Blowdown, SG-3	3-MS-1-76-1303-2	MI-9	CP1-MSSSMR-01	REV 2
Main Steam Blowdown, SG-2	3-MS-1-75-1303-2	MI-10	CP1-MSSSMR-02	
Main Steam Blowdown, SG-1	3-MS-1-74-1303-2	MI-11	CP1-MSSSMR-03	
Main Steam Blowdown, SG-4	3-MS-1-73-1303-2	MI-12	CP1-MSSSMR-04	
Main Steam to Auxiliary Feedwater Pump	32-MS-1-01-1303-2 4-MS-1-25-1303-2	MI-1	CP1-MSSSMR-05	
Main Steam to Auxiliary Feedwater Pump	32-MS-1-04-1303-2 4-MS-1-26-1303-2	MI-4	CP1-MSSSMR-06	
Main Steam Drain	2-MS-1-05-1303-2	Drain Pot MS-25	CP1-MSSSMR-07	
Main Steam Drain	2-MS-1-10-1303-2	Drain Pot MS-24	CP1-MSSSMR-08	
Main Steam Drain	2-MS-1-15-1303-2	Drain Pot MS-23	CP1-MSSSMR-09	
Main Steam Drain	2-MS-1-20-1303-2	Drain Pot MS-26	CP1-MSSSMR-10	

TABLE 5.2-3

LIST OF ESSENTIAL PIPING

Line	Penetration	Service	Remarks	
32-MS-1-01-1303-2	MI-1	MS from SG1	All unbroken MS lines most remain functional. E.g. If the line connected to MI-1 is broken then MI-2, MI-3 and MI-4 must remain functional.	REV 2
32-MS-1-02-1303-2	MI-2	MS from SG2	All unbroken MS lines most remain functional. E.g. If the line connected to MI-2 is broken then MI-1, MI-3 and MI-4 must remain functional.	
32-MS-1-03-1303-2	MI-3	MS from SG3	All unbroken MS lines most remain functional. E.g. If the line connected to MI-3 is brok then MI-2, MI-1 and MI-4 must remain functional.	
32-MS-1-04-1303-2	MI-4	MS from SG4	All unbroken MS lines most remain functional. E g. If the line connected to MI-4 is broken then MI-2, MI-3 and MI-1 must remain functional.	

TABLE 5.2-3 (Continued)

Line	Penetration	Service	Remarks
12-RH-1-004-601R-2	MII-2	RHR from H.L. (Loop 4)	If the MS line connected to SG#1 is broken, MII-2 is required and if the MS line connected to SG#4 is broken MII-3 is required. If the MS line connected to either SG#2 or SG#3 is broken MII-2 and MII-3 are both required. REV 2
12-RH-1-003-601R-2	MII-3	RHR from H.L. (Loop 1)	If the MS line connected to SG#1 is broken, MII-2 is required and if the MS line connected to SG#4 is broken MII-3 is required. If the MS line connected to either SG#2 or SG#3 is broken MII-2 and MII-3 are both required.
10-SI-1-082-2501R-2 6-SI-1-304-2501R-2 8-SI-1-087-2501R-2 6-SI-1-327-2501R-2	MII-4	RHR from C.L. (Loops 1 and 2)	Required for unbroken loop only and MS breaks
10-SI-1-083-2501R-2 6-SI-1-305-2501R-2 8-SI-1-088-2501R-2 6-SI-1-329-2501R-2	MII-5	RHR from C.L. (Loops 3 and 4)	Required for unbroken loop only and MS breaks

TABLE 5.2-3 (Continued)

Line	Penetration	Service	Remarks	
4-SI-1-051-2501R-2 2-SI-1-057-2501R-2 2-SI-1-055-2501R-2	MIII-3	SI TO H.L. (Loops 2 and 3)	Required for unbroken loop only	Rev. 2
4-SI-1-052-2501R-2 2-SI-1-307-2501R-2 2-SI-1-058-2501R-2	MIII-4	SI to H.L. (Loops 1 and 4)	Required for unbroken loop only	
2-SI-1-062-2501R-2	MIII-5	SI to C.L. (Loops 1,2,3,4)	Required for unbroken loop only and MS breaks	
3-SI-1-176-2501R-2	MIII-2	Boron Inj. to RC Loops #2 and #3 Boron Inj. to RC Loops #1 and #4	Required for unbroken loop only and all MS line breaks	
10-SI-1-095-2501R-2 6-SI-1-171-2501R-2 6-SI-1-170-2501R-2	MIII-23	RHR to H.L. (Loops 2 and 3)	Required for unbroken loop only	
18-FW-1-37-2003-2 6-FW-1-94-2003-2 6-FW-1-98-1303-2	MV-17	FW to SG4	Required for unbroken loop only	
18-FW-1-36-2003-2 6-FW-1-91-2003-2 6-FW-1-95-1303-2	MV-18	FW to SG1	Required for unbroken loop only	
18-FW-1-35-2003-2 6-FW-1-92-2003-2 6-FW-1-96-1303-2	MV-19	FW to SG2	Required for unbroken loop only	
18-FW-1-34-2003-2 6-FW-1-93-2003-2 6-FW-1-97-1303-2	MV-20	FW to SG3	Required for unbroken loop only	

5.3 LOADING COMBINATIONS AND STRESS LIMITS

5.3.1 LOADING COMBINATIONS

The loading combination to be used in the analysis of the ASME B&PV Code piping covered under this specification shall be in accordance with the requirements of Table 5.2-1.

Following is an interpretation of the detailed requirements of this table.

5.3.1.1 JET IMPINGEMENT LOADS

Rev. 2

Jet impingement loads shall be developed in accordance with the requirements of Section 3.6 of the CPSES/FSAR.

HOLD 2 Jet impingement loads shall be included in the piping analysis wherever an adjacent pipe subject to rupture or cracks, can cause an impingement on the line being analyzed. Only one location of impingement need to be considered at one time.

Jet impingement need not be considered for the pipe subject to the rupture or crack.

Impingement forces need not be considered where it can be demonstrated that the jet impingement is of insufficient magnitude to cause stresses in the piping being analyzed.

5.3.1.2 PIPE WHIP IMPACT LOADS

Rev. 2

HOLD 2 Pipe whip impact loads shall be incuded in the analysis wherever a postulated break can result in a pipe impacting on the line being analysed.

5.3.1.3 SEISMIC LOADS

Seismic analyses shall be performed where required by the loading combinations of Table 5.2.-1. These analyses shall be performed in accordance with Section 3.7 of the CPSES FSAR and shall utilize the applicable instructure response spectra for 1/2 SSE and SSE of Appendix 5 to this specification.

5.3.1.4 LOCA LOADS Rev. 2

LOCA loads shall be used in accordance with the requirements of USNRC Regulatory Guide 1.48. LOCA loads shall be included in the piping analyses when required by the loading combinations of Table 5.2-1.

LOCA and SSE loads shall be combined by the square root of the sum of the Squares (SRSS) and this resultant shall be combined by absolute sums with occasional loads.

5.3.1.5 OTHER OCCASIONAL LOADS

Wind and snow loads need not be considered in the analyses.

The upset operating condition system analyses shall consider the simultaneous discharge of all relief/safety valves located in the system.

5.3.2 STRESS LIMITS Rev. 2

a. The stress limits for the system normal, upset emergency and faulted conditions shall satisfy the requirements of Table 5.2-1 except as modified in paragraphs b. through e. below. Rev. 2

b. Piping located within the boundaries defined in Table 5.2-2, shall have the stresses limited to 0.8 (1.2Sh + Sa) as calculated by equations (9) and (10) of paragraph NC-3652 of the ASME Section III Code, considering normal and upset plant conditions and 1/2 SSE. The maximum stress, as calculated by Eq. (9) in Paragraph NC-3652 under the loadings resulting from a postulated piping failure of fluid system piping beyond these portions of piping, should not exceed 1.8Sh. Rev. 2

c. The stress limits specified in Article NC or ND-3611.3(c) of the ASME B&PV Code, as applicable, shall not be exceeded when the piping component is subjected to either of the following:

   1. Concurrent loadings associated with either the normal plant condition and the vibratory motion of ½ SSE or the upset plant condition and the vibratory motion of ½ SSE.

2. Loadings associated with the emergency plant conditions. Rev.2

d. The stress limits specified in Article NC or ND-3611.3(c) of the ASME B&PV Code, as applicable shall not be exceeded when the essential component is subjected to the concurrent loadings associated with the normal plant condition, the vibratory motion of the SSE and the dynamic system loadings associated with the faulted plant condition.

e. The stress limits specified in ASME Code Case 1606-1 for faulted operating conditions should not be exceeded when the non-essential component is subjected to concurrent loadings associated with the normal plant condition, the vibratory motion of the SSE, and the dynamic system loadings associated with the faulted plant conditions.

f. Essential Piping is identified in Table 5.2-3 of this specification.

5.4 DESIGN CONDITIONS

The design pressures and temperatures delineated below shall be considered the maximum permissible for each line. Line conditions exceeding these values are permitted for short durations, provided the requirements of paragraphs NC-3612.3 or ND-3612.3 of the ASME Code as applicable are met. Rev.2

5.4.1 DESIGN PRESSURE

a. The line design pressure shall be equivalent to or higher than the highest pressure encountered during any mode of system normal or upset operating condition. Rev.2

b. Where the line is protected by a pressure relieving device, the design pressure shall be equivalent to or higher than the set or rupture pressure of the relief device.

c. Pressure/temperature rated components shall be selected based on the most severe coinciding pressure and temperature given for any system normal or upset operating condition. Rev.2

d. The design pressures are indicated on the line lists of Appendix 7. Rev.2

Rev.2

5.4.2 DESIGN TEMPERATURE

The design temperature shall be equivalent to the highest fluid temperature encountered during any system operating condition shown in paragraph 5.2. This temperature is shown in the applicable system modes of operation of Appendix 8 to this Specification.

5.5 DESIGN RESPONSIBILITIES

Rev.2

a. The piping analysis shall verify that the allowable nozzle loads for safety related equipment, as given in the equipment specifications except as modified by the documents of Appendix 14, are not exceeded during all conditions specified.

b. The following information shall be included in the analyses of all ASME Section III components (other than in-line equipment):

   1. Thermal and seismic displacement of nozzles, where applicable

   2. Seismic displacements

      a) Where the first natural frequency of the equipment is ≤ 33CPS, the component shall be classified as flexible and the supplier shall provide a dynamic model of the component. The displacements for the model shall be considered at the support of the component.

      b) Where the first natural frequency is > 33CPS, the equipment shall be considered rigid and the nozzle displacement shall be taken as equivalent to the structure's displacement.

c. The impact on the piping pressure boundary from any welded attachment shall be verified to be within the limitations of the ASME code on an item-by-item basis, and based upon loads, materials, sizes and locations of the attachments supplied by the hanger vendor.

d. Equipment specifications encompassing ASME Section III components shall include design nozzle loads. The subsequent piping analyses shall verify that the calculated piping loads do not exceed the component allowable loads of the safety related equipment specifications listed in Appendix 4, during all conditions specified. Rev.:

5.6 METHODS OF ANALYSIS

5.6.1 COMPUTER ANALYSIS

All ASME safety Class 2 and 3 piping, except as described in Sections 5.6.2 and 5.6.3 shall be analyzed using Engineer approved computer programs. Applicable stress problem numbers for piping being computer analyzed are included in the Piping Information Tracking System (PITS) of Appendix 13 to this specification.

5.6.1.1 MODELING

The piping system shall be idealized as mathematical models consisting of lumped masses connected by elastic members. In order to adequately represent the dynamic and elastic characteristics of the piping systems, lumped masses shall be located at carefully selected points. In the modeling of the piping systems, valves, reducers, tee and branch connections attached to the pipe shall be included. The location and type of supports provided shall be reviewed and included in the analysis. The final support locations must be indicated on the mathematical models.

The material, size and schedule of pipe for the system considered and the thickness of insulation, if any, may be obtained from the G&H Line List of Appendix 7 to this Specification. The weight and density of the insulation is obtained from Paragraph 3.5 of this Specification. The type of fluid contained in the pipe is, in most cases, apparent from knowledge of the system's functions and the pressure and temperature data presented in the line list provided in Appendix 7. The weight per unit length of pipe and the density of the contained fluid may be obtained from recognized industrial standards or manufacturer's data.

5.6.1.2 THERMAL EXPANSION AND ANCHOR MOVEMENT ANALYSIS

For the themal analysis, temperature for all service conditions for different portions of the piping system are tabulated in the system modes of operation, Appendix 8 to this Specification.

5.6.1.3 DEADWEIGHT ANALYSIS Rev.2

A static analysis shall be performed for the system to evaluate the stress contribution under the action of the self-weight of the pipe, contents and insulation.

5.6.1.4 SEISMIC ANALYSIS

a. The dynamic seismic analysis shall be performed for the system using the In-Structure Frequency Response Spectra of Appendix 5 to this specification.

b. In the cases where piping systems are routed between different elevations or different buildings, the method of superimposing all applicable In-Structure Frequency Response Spectras shall be utilized.

c. The frequencies and mode shapes for all significant modes of vibration shall be included in the analysis.

5.6.1.5 SEISMIC DISPLACEMENT ANALYSIS

Piping stresses resulting from this loading category depend on the magntiude of relative displacements between supports. The movements of the interior structures are provided in Appendix 5.

5.6.1.6 OCCASSIONAL LOADS

Pipe stresses due to the application of occassional loads such as LOCA, other pipe ruptures, safety/relief valve blowdown, etc. shall be considered, as identified in the Loading Combinations shown in Table 5.2.-1 of this specification.

5.6.1.7 OTHER LOADS

Other loads shall be considered in the analysis, as required by the loading combinations shown in Table 5.2-1 of this Specification.

5.6.2 NON-COMPUTER ANALYSIS Rev. 2

Analysis of piping 4 inches and smaller in size may be accomplished by the use of non-computer methods as dicated by the Piping Information Tracking System (PITS) of Appendix 13 to this specification.

5.6.2.1 SIMPLIFIED METHOD

Analysis of piping smaller than 4-inches in size, with operating temperatures less than 200 F, may be accomplished by the use of a simplified method included in Appendix 9 to this specification. A listing of lines being analyzed by the simplified method is included in the PITS listing of Appendix 13 to this specification.

5.6.2.2 ALTERNATE ANALYSIS

Analysis of piping 4 inches and smaller in size may also be accomplished by non-computer methods as detailed in the Alternate Analysis of Appendix 9 to this specification. Guidelines for the use of the Alternate Analysis are included in Appendix 9 to this specification. A listing of lines being analyzed by the Alternate Analysis method is included in the PITS listing of Appendix 13 to this specification.

6.0 OVERPRESSURE PROTECTION

6.1 GENERAL REQUIREMENTS

a. Piping within the scope of this specification shall be adequately protected from overpressurization due to any fluid transient exceeding the limitations of paragraph 5.4.1. Rev.2 Rev.2

b. This protection shall be accomplished by installation of pressure relieving devices, adequately sized to discharge any quantity of fluid, gas or steam required to keep the pressure below the line design pressure of paragraph 5.4.1. Rev.2 Rev.2

c. Pressure relieving devices need not be installed where the line design pressure exceeds the maximum conceivable operating pressure transient of the system. Rev.2

6.2 INSTALLATION OF SAFETY/RELIEF DEVICES

a. The location of the pressure safety/relief in the piping systems shall meet all the requirements of paragraphs NC-7150 or ND-7150, as applicable, of the ASME Code Section III.

b. Pressure relief/safety devices shall be installed in the suction and discharge lines of all pumps, when these lines may be subjected to a pressure higher than the piping design pressure.

c. Pressure relief/safety devices shall be installed in heat exchangers and similar components that contain fluids at different pressures in order to protect the lower pressure boundary against overpressure in case of failure of the higher pressure boundary.

d. Pressure thermal relief valves shall be installed at all locations where an isolated volume of fluid can be subjected to a thermal transient.

e. Inlet and discharge piping of all pressure relieving devices shall conform to the requirements of paragraphs NC-3677 and ND-3677, as applicable, of the ASME B&PV Code Section III.

6.3 PIPING DESIGN DUE TO SAFETY/RELIEF VALVE ACTUATION

a. The design of the piping system shall consider the effects of safety/relief valve actuation. These occasional loads are to be analyzed under the system upset operating condition as defined in Table 5.2-1 of this specification. | Rev.2

b. In open systems valves venting to atmosphere, the design of the piping for the relief/safety valve shall be performed in accordance with ASME Code Case 1569 implemented by the following:

1. Where more than one valve is located on the same run of piping, the sequence of valve actuation shall be the sequence which is evaluated to induce the maximum instantaneous stress value at that location.

2. Stresses induced by the safety/relief valve operation shall satisfy the stress limits cited in Code Case 1569 for all components of the run pipe and connecting | Rev.2

systems, the pressure relief valve station including supports and all connecting welds between these components.

3. A value of 2.0 may be used for the dynamic load factor where the static analysis method is used in accordance with Code Case 1569.

c. For closed discharge systems, open systems with long discharge piping and discharge systems with a slug flow of water, the design of the piping shall be in accordance with subsection 3.9B.3.3.2b of the CPSES/FSAR in which the methods for establishing and evaluating transient loads due to valve actuation are presented. Rev.2

d. An overpressure protection analysis report shall be prepared for the Main Steam and Feedwater systems in accordance with the requirements of Article NC-7200 of the ASME Section III Code. Rev.2

e. Piping downstream of closed relief valve systems and systems with slug flow or open relief valve discharge systems with long discharge piping shall be anlayzed for time-forcing transients in accordance with section 3.4 of the CPSES/FSAR.

f. Relief valves 2-inches and smaller in size having operating temperatures less than 200 F and/or operating pressures less than 275 psig may be analyzed by non-computer methods, as described in section 5.6.2 of this specification.

7.0 TESTING

7.1 GENERAL

All ASME Section III Class 2 and 3 piping shall be subjected to hydrostatic pressure tests. Shop and field pressure tests shall be preformed to meet ASME Code requirements.

7.2 SHOP HYDROSTATIC TESTING

Prior to fabrication, a hydrostatic pressure test shall be performed on each length of pipe and each fitting. The test pressure and duration shall be as required by the pipe material specification and/or specification SA-530 of the ASME Code, Section II as applicable. The temperature of the testing fluid shall not be less than 70F to avoid brittle fracture failures.

7.3 FIELD HYDROSTATIC TESTING

Prior to initial operation, the installed piping system shall be subjected to a field hydrostatic pressure test. The test shall be performed in accordance with the requirements of paragraphs NC-6200 or ND-6200 of the ASME Code Section III as applicable and as required by specification 2323-MS-100 of Appendix 3.

APPENDIX 1

PIPING DESIGN SPECIFICATION
2323-MS-200

FLOW DIAGRAMS

LISTING OF FLOW DIAGRAMS

Number	Title	
2323-M1-0200	Mechanical Symbols and Notes	
2323-M1-0202	Main Steam Reheat and Steam Dump	
2323-M1-0202-01	Main Steam Reheat and Steam Dump	Rev. 2
2323-M1-0203	Steam Generator Feedwater	
2323-M1-0203-01	Steam Generator Feedwater	Rev. 2
2323-M1-0206	Auxiliary Feedwater System	
2323-M1-0215	Diesel Generator Auxiliary Systems	Rev. 2
2323-M1-0216	Compressed Air System	
2323-M1-0228	Process Sampling System	
2323-M1-0229	Component Cooling Water System	Rev. 2
2323-M1-0230	Component Cooling Water System	
2323-M1-0231	Component Cooling Water System	Rev. 2
2323-M1-0232	Containment Spray System	
2323-M1-0233	Station Service Water	
2323-M1-0233-01	Station Service Water	Rev. 2
2323-M1-0235	Spent Fuel Pool Cleanup and Storage	
2323-M1-0239	Steam Generator Blowdown Systems	
2323-M1-0241	Demineralized and Reactor Makeup Water System	
2323-M1-0242	Demineralized and Reactor Makeup Water System	Rev. 2
2323-M1-0250	Reactor Coolant System	Rev. 2
2323-M1-0251	Reactor Coolant System	
2323-M1-0253	Chemical and Volume Control System	

LISTING OF FLOW DIAGRAMS

Number	Title	
2323-M1-0254	Chemical and Volume Control System	
2323-M1-0255	Chemical and Volume Control System	
2323-M1-0256	Chemical and Volume Control System	
2323-M1-0257	Chemical and Volume Control System	
2323-M1-0258	Boron Recycle System	
2323-M1-0259	Boron Recycle System	
2323-M1-0260	Residual Heat Removal	
2323-M1-0261	Safety Injection System	
2323-M1-0262	Safety Injection System	
2323-M1-0263	Safety Injection System	
2323-M1-0264	Liquid Waste Processing System	
2323-M1-0265	Liquid Waste Processing System	
2323-M1-0266	Liquid Waste Processing System	
2323-M1-0267	Liquid Waste Processing System	
2323-M1-0268	Liquid Waste Processing System	
2323-M1-0269	Gaseous Waste Processing System	
2323-M1-0270	Gaseous Waste Processing System	
2323-M1-0300	Ventilation - Containment	Rev. 2
2323-M1-0311	HVAC - Nuclear Safety Related Chilled Water System	
2323-M2-0200	Mechanical Symbols and Notes	
2323-M2-0202	Main Steam Reheat and Steam Dump	
2323-M2-0202-01	Main Steam Reheat and Steam Dump	Rev. 2

LISTING OF FLOW DIAGRAMS

Number	Title	
2323-M2-0203	Steam Generator Feedwater	
2323-M2-0203-01	Steam Generator Feedwater	Rev. 2
2323-M2-0206	Auxiliary Feedwater System	
2323-M2-0215	Diesel Generator Auxiliary Systems	Rev. 2
2323-M2-0216	Compressed Air System	
2323-M2-0228	Process Sampling System	
2323-M2-0229	Component Cooling Water System	Rev. 2
2323-M2-0230	Component Cooling Water System	
2323-M2-0231	Component Cooling Water System	
2323-M2-0232	Containment Spray System	
2323-M2-0233	Station Service Water	
2323-M2-0233-01	Station Service Water	
2323-M2-0235	Spent Fuel Pool Cleanup and Storage	
2323-M2-0239	Steam Generator Blowdown System	
2323-M2-0241	Demineralized and Reactor Makeup Water System	
2323-M2-0242	Demineralized and Reactor Makeup Water System	Rev. 2
2323-M2-0250	Reactor Coolant System	
2323-M2-0251	Reactor Coolant System	
2323-M2-0253	Chemical and Volume Control System	
2323-M2-0254	Chemical and Volume Control System	
2323-M2-0255	Chemical and Volume Control System	
2323-M2-0256	Chemical and Volume Control System	

LISTING OF FLOW DIAGRAMS

Number	Title
2323-M2-0257	Chemical and Volume Control System
2323-M2-0258	Boron Recycle System
2323-M2-0259	Boron Recycle System
2323-M2-0260	Residual Heat Removal
2323-M2-0261	Safety Injection System
2323-M2-0262	Safety Injection System
2323-M2-0263	Safety Injection System
2323-M2-0264	Liquid Waste Processing System
2323-M2-0265	Liquid Waste Processing System
2323-M2-0266	Liquid Waste Processing System
2323-M2-0267	Liquid Waste Processing System
2323-M2-0268	Liquid Waste Processing System
2323-M2-0269	Gaseous Waste Processing System
2323-M2-0270	Gaseous Waste Processing System
2323-M2-0300	Ventilation - Containment
2323-M2-0311	HVAC - Nuclear Safety Related Chilled Water System

Rev. 2

APENDIX 2

PIPING DESIGN SPECIFICATION
2323-MS-200

COMPOSITE PIPING DRAWINGS

LISTING OF PIPING COMPOSITE DRAWINGS

Number	Title	
2323-M1-0500	Containment Equipment Lay Down Study Sh. 1	
2323-M1-0501	Containment Equipment Lay Down Study Sh. 2	
2323-M1-0502	Reactor Containment Penetration	
2323-M1-0503	Reactor Containment Penetrations Details	
2323-M1-0503-01	Reactor Containment Penetration Details	Rev. 2
2323-M1-0504	Containment Spray Piping Above El. 905'-9"	
2323-M1-0504-01	Containment Spray Piping Arrangement	Rev. 2
2323-M1-0504-02	Containment Spray Piping Arrangement	
2323-M1-0504-03	Containment Spray Piping Arrangement	
2323-M1-0504-04	Containment Spray Piping Arrangement	
2323-M1-0505	Containment - Plan Below El. 905'-9"	
2323-M1-0506	Containment - Plan Below El. 894'-9" & Part-Plans	
2323-M1-0506-01	Containment Plan at El. 860'-0" and Sections	Rev. 2
2323-M1-0507	Containment - Plan Below El. 860'-0"	
2323-M1-0508	Containment - Plan Below El. 832'-6"	
2323-M1-0509	Containment - Part Plans & Sections	
2323-M1-0510	Containment Spray Piping Arrgt. Sections	
2323-M1-0511	Containment - Penetration Area Below 832'-6"	

LISTING OF PIPING COMPOSITE DRAWINGS

Number	Title	
2323-M1-05[illegible]1-01	Containment - Piping - Penetration Area Above El. 832'-6"	Rev. 2
2323-M1-0512	Containment - Plan at El. 816'-0" & Below	
2323-M1-0513	Containment Steam Generator Compartments at Platform El. 836'-0"	
2323-M1-0513-01	Containment Steam Generator Compartments Below El. 836'-0"	
2323-M1-0513	Containment Steam Generator Compartments at Plan El. 836'-0"	
2323-M1-0514	Containment Pressurizer Compartments-Plans & Sects.	
2323-M1-0515	Containment-Sections	Rev. 2
2323-M1-0517	Containment Penetration Area - Section	Rev. 2
2323-M1-0520	Reactor Coolant Loop Layout & Details	
2323-M1-0522	Containment-Recirculation Sumps & Piping Penetration & Details	
2323-M1-0600	Safeguards Bldg. - Plan Below El. 896'-6"	
2323-M1-0601	Safeguards Bldg. - Plan Below El. 873'-6"	
2323-M1-0601-01	Safeguards Bldg. - Sections	
2323-M1-0602	Safeguards Bldg. - Plan Below El. 852'-6"	
2323-M1-0603	Safeguards Bldg. - Plan Below El. 831'-6"	Rev. 2
2323-M1-0604	Safeguards Bldg. - Plan Below El. 810'-6"	
2323-M1-0605	Safeguards Bldg. - Plan Below El. 798'-6"	

LISTING OF PIPING COMPOSITE DRAWINGS

Number	Title
2323-M1-0606	Safeguards Bldg. - Plan Below El. 790'-6"
2323-M1-0607	Safeguards Bldg. - Plan Below El. 785'-6"
2323-M1-0608	Safeguards Bldg. - Plan Below El. 852'-6" Penet
2323-M1-0609	SG-Bldg - Plan & Sections Below 852'-6" Penet
2323-M1-0610	SG-Bldg.- Plan & Sections Below 852'-6" Penet
2323-M1-0611	SG-Bldg. - Sections Below 852'-6" & 831'-6"
2323-M1-0612	SG-Bldg. - Plan Penetration-Area Below 831'-6"
2323-M1-0613	SG-Bldg. - Sections & Details Below 831'-6" Penet
2323-M1-0614	SG-Bldg. - Plans Below 831'-6"
2323-M1-0615	SG-Bldg. - Sections Below 831'-6"
2323-M1-0616	SG-Bldg. - Enlarged Plan Below 790'-6"
2323-M1-0617	SG-Bldg. - Sections Below 831'-6"
2323-M1-0618	SG-Bldg. - Bldg. - Sections
2323-M1-0619	SG-Bldg. - Sections
2323-M1-0630	Emergency Diesel Generator CP1-MEDGEE-01 Plan and Sections - El. 810'-6"
2323-M1-0631	Emergency Diesel Generator CP1-MEDGEE-02 El. 810'-6"
2323-M1-0632	Emergency Diesel Generator CP1-MEDGEE-01 El. 884'-0" and 865'-0"

Rev. 2

LISTING OF PIPING COMPOSITE DRAWINGS

Number	Title	
2323-M1-0633	Emergency Diesel Generator CP1-MEDGEE-02 El. 844'-0" and 865'-0"	Rev. 2
2323-M1-0700	Auxiliary Bldg. - Plan Below El. 894'-6"	
2323-M1-0701	Auxiliary Bldg. - Plan Below El. 873'-6"	
2323-M1-0702	Auxiliary Bldg. - Plan Below El. 852'-6"	
2323-M1-0703	Auxiliary Bldg. - Plan Below El. 831'-6"	
2323-M1-0703-01	Auxiliary Building Plan and Section Below El. 831'-6"	Rev. 2
2323-M1-0703-02	Auxiliary Building Plan and Section Below El. 831'-6",	
2323-M1-0703-03	Auxiliary Building Plan Below El. 831'-6"	
2323-M1-0703-04	Auxiliary Building Section Below El. 831'-6"	
2323-M1-0704-05	Auxiliary Plan and Section Below El. 831'-6"	
2323-M1-0704	Auxiliary Building - Plan Below El. 810'-6"	
2323-M1-0704-01	Auxiliary Building Plan Below El. 810'-6"	Rev. 2
2323-M1-0704-02	Auxiliary Building Plan Below El. 810'-6",	
2323-M1-0704-03	Auxiliary Building Plan Below El. 810'-6"	
2323-M1-0704-04	Auxiliary Building Plan Below El. 810'-6"	
2323-M1-0705	Auxiliary Bldg. - Plans & Sections El. 873'-6"	

LISTING OF PIPING COMPOSITE DRAWINGS

Number	Title	
2323-M1-0705-01	Auxiliary Building - Part Plans and Sections	
2323-M1-0706	Auxiliary Bldg. - Plans & Below El. 873'-6"	
2323-M1-0707	Auxiliary Bldg. - Plans & Sect Below El. 873'-6"	
2323-M1-0708	Aux. Bldg. Plan North Side At El. 831'-6"	
2323-M1-0709	Aux. Bldg. Plan North Side At El. 852'-6"	Rev. 2
2323-M1-0710	Aux. Bldg. Plan South Side At 831'-6"	
2323-M1-0711	Aux. Bldg. Plan South Side Below El. 852'-6"	
2323-M1-0712	Aux.-Bldg. Floors El. 831'-6" To El. 852'-6" - Sect.	
2323-M1-0713	Aux.-Bldg. Floors El. 831'-6" To El. 852'-6" - Sect.	
2323-M1-0714	Auxiliary Bldg. Demin-Area Sections	
2323-M1-0715	Aux. Bldg. - Plan & Sect Below El. 831'-6"	
2323-M1-0716	Aux. Bldg. - Plan & Sect Below El. 831'-6"	
2323-M1-0716-01	Auxiliary Building - Unit 2 Plan and Section Below El. 831'-6"	Rev. 2
2323-M1-0717	Aux. Bldg. - Plan & Sect Below El. 844'-6"	
2323-M1-0718	Aux. Bldg. - Plan & Sect Below El. 831'-6"	
2323-M1-0719	Aux. Bldg. - Sections	

LISTING OF PIPING COMPOSITE DRAWINGS

Number	Title	
2323-M1-0720	Auxiliary Building - Sections	Rev. 2
2323-M1-0721	Aux. Bldg. - Sections	
2323-M1-0726	Aux. Bldg. - Sections	
2323-M1-0727	Aux. Bldg. - Sections	
2323-M1-0728	Electrical and Control Building-Sections	Rev. 2
2323-M1-0729	Elect & Control Bldg. El. 778'-0"	
2323-M1-0729-01	Electrical and Control Building (Chemical Area)	Rev. 2
2323-M1-0730	Elect & Control Bldg. Sections	
2323-M1-0730-01	Electrical and Control Building-Secondary Sampling Room	Rev. 2
2323-M1-0732	Secondary Sampling Room	
2323-M1-0733	Vents, Drains, and Misc. Piping-Auxiliary Building Plan - El. 778'-0" and El. 790'-6"	
2323-M1-0733-01	Vents Drains, and Misc. Piping-Auxiliary Building Plan - El. 810'-6" and El. 842'-6"	
2323-M1-0733-02	Vents, Drains and Misc Piping - Auxiliary Building - Plan El. 873'-6" and El. 886'-6"	
2323-M1-0740	Miscellaneous Details	
2323-M1-0740-01	Miscellaneous Details	
2323-M1-0740-02	Miscellaneous Details - Unit 2	
2323-M1-1000	Yard Piping - Site Plan	
2323-M1-1001	Yard Piping - Plot Plan	
2323-M1-1002	Yard Piping - Enlarged Plan View	

LISTING OF PIPING COMPOSITE DRAWINGS

Number	Title	
2323-M1-1003	Yard Piping - Sections	
2323-M1-1004	Yard Piping - Enlarged Plan View Sections & Details	
2323-M1-1005	Yard Piping - Sections & Details	
2323-M1-1006	Yard Piping - Details	Rev. 2
2323-M1-1103	Service Water Pumphouse	
2323-M1-1103-01	Service Water Intake Piping-Sections	Rev. 2
2323-M2-0500	Containment Equipment Lay Down Study Sh. 1	
2323-M2-0501	Containment Equipment Lay Down Study Sh. 2	
2323-M2-0502	Reactor Containment Penetration	
2323-M2-0503	Reactor Containment Penetrations Details	
2323-M2-0503-01	Reactor Containment Penetrations Details	
2323-M2-0504	Containment Spray Piping Above El. 905'-9"	
2323-M2-0504-01	Containment Spray Piping Arrangement	Rev. 2
2323-M2-0504-02	Containment Spray Piping Arrangement	Rev. 2
2323-M2-0504-03	Containment Spray Piping Arrangement	Rev. 2
2323-M2-0504-04	Containment Spray Piping Arrangement	Rev. 2
2323-M2-0505	Containment - Plan Below El. 905'-9"	
2323-M2-0506	Containment - Plan Below El. 894'-9" & Part-Plans	

LISTING OF PIPING COMPOSITE DRAWINGS

Number	Title	
2323-M2-0506-01	Containment - Plan At El. 860'-0" Sect.	Rev. 2
2323-M2-0507	Containment - Plan Below El. 860'-0"	
2323-M2-0508	Containment - Plan Below El. 832'-6"	
2323-M2-0509	Containment - Part Plans & Sections	
2323-M2-0510	Containment Spray Piping Arrgt. Sections	
2323-M2-0511	Containment - Penetration Area Below 832'-6"	
2323-M2-0511-01	Containment - Penetration Area Above 832'-6"	
2323-M2-0512	Containment - Plan At El. 816'-0" & Below	
2323-M2-0513	Cont-Steam Generator Compartments Plan At El. 836'-0"	
2323-M2-0513-01	Cont-Steam Generator Compartments Plan At El. 836'-0"	Rev. 2
2323-M2-0514	Containment Pressurizer Compartments Plans & Sects.	
2323-M2-0515	Containment - Sections	Rev. 2
2323-M2-0517	Containment Penetration Area - Sections	
2323-M2-0520	Reactor Coolant Loop Layout & Details	
2323-M2-0522	Containment-Recirculation Sumps & Piping Penet & Details	
2323-M2-0600	Safeguards Bldg. - Plan Below El. 896'-6"	

LISTING OF PI[illegible]G COMPOSITE DRAWINGS

Number	Title
2323-M2-[illegible]01	Safeguards Bldg. - Plan Below El. 873'-6"
2323-M2-0601-01	Safeguard Bldg. Sections
2323-M2-0602	Safeguards Bldg. - Plan Below El. 852'-6"
2323-M2-0603	Safeguards Bldg. - Plan Below El. 831'-6"
2323-M2-0604	Safeguards Bldg. - Plan Below El. 810'-6"
2323-M2-0605	Safeguards Bldg. - Plan Below El. 798'-6"
2323-M2-0606	Safeguards Bldg. - Plan Below El. 790'-6"
2323-M2-0607	Safeguards Bldg. - Plan Below El. 785'-6"
2323-M2-0608	Safeguards Bldg. - Plan Below El. 852'-6" Penet
2323-M2-0609	SG-Bldg. - Plan Sections Below 852'-6" Penet
2323-M2-0610	SG-Bldg. - Plan Sections Below 852'-6" Penet
2323-M2-0611	SG-Bldg. - Sections Below 852'-6" & 831'-6"
2323-M2-0612	SG-Bldg. - Plan Penet-Area Below 831'-6"
2323-M2-0613	SG-Bldg. - Sects & Details Below 831'-6" Penet
2323-M2-0614	SG-Bldg. - Plans Below 831'-6"
2323-M2-0615	SG Bldg. - Sections Below 831'-6"
2323-M2-0616	SG Bldg. - Enlarged Plan Below 790'-6"

LISTING OF PIPING COMPOSITE DRAWINGS

Number	Title	
2323-M2-0617	SG Bldg. - Sections Below 831'-6"	
2323-M2-0618	SG-Bldg. - Sections	
2323-M2-0619	SG Bldg. - Sections	
2323-M2-0630	Emergency Diesel Generator CP2-MEDGEE-01 - Plan and Sections - El. 810'-6"	Rev. 2
2323-M2-0631	Emergency Diesel Generator CP2-MEDGEE-02 - Plan and Section - El. 810'-6"	
2323-M2-0632	Emergency Diesel Generator CP2-MEDGEE-01 - Plan and Section - El. 844'-0" and 865'-0"	
2323-M2-0633	Emergency Diesel Generator CP2-MEDGEE-02 - Plan and Section - El. 844'-0" and 865'-0"	
2323-M2-1002	Yard Piping - Enlarged Plan View	
2323-M2-1003	Yard Piping - Sections	
2323-M2-1006	Yard Piping - Details	Rev. 2

APPENDIX 3

PIPING DESIGN SPECIFICATION
2323-MS-200

SPECIFICATIONS

SPECIFICATION 2323-MS-43A REV. 3 |Rev. 2
(NUCLEAR PIPING - SHOP FABRICATION OF PIPING 8-INCH NOMINAL DIAMETER AND LARGER AND PIPING MATERIAL SUPPLY REQUIREMENTS)

SPECIFICATION 2323-MS-43B REV. 3 |Rev. 2
(NUCLEAR PIPING - SHOP FABRICATION OF PIPING IN THE FIELD)

SPECIFICATION 2323-MS-100 REV. 4 |Rev. 2
(PIPING ERECTION)

APPENDIX 4

PIPING DESIGN SPECIFICATION
2323-MS-200

LISTING OF EQUIPMENT FOR DETERMINATION OF NOZZLE LOADS

Rev. 2

APPENDIX 5

PIPING DESIGN SPECIFICATION
2323-MS-200

RESPONSE SPECTRA

IN-STRUCTURE RESPONSE SPECTRA FOR INTERNAL CORE STRUCTURE Rev. 2
IN-STRUCTURE RESPONSE SPECTRA FOR CONTAINMENT BUILDING
IN-STRUCTURE RESPONSE SPECTRA FOR SAFEGUARD BUILDINGS
IN-STRUCTURE RESPONSE SPECTRA FOR AUXILIARY BUILDING
IN-STRUCTURE RESPONSE SPECTRA FOR ELECTRICAL BUILDING
IN-STRUCTURE RESPONSE SPECTRA FOR FUEL BUILDING.

APPENDIX 6

PIPING DESIGN SPECIFICATION
2323-MS-200

SYSTEM TECHNICAL DESCRIPTIONS

LISTING OF TECHNICAL DESCRIPTIONS

NUMBER	TITLE	
2323-TD-0202	MAIN STEAM REHEAT & STEAM DUMP SYSTEM	
2323-TD-0203	STEAM GENERATOR FEEDWATER SYSTEM	
2323-TD-0206	AUXILIARY FEEDWATER SYSTEM	
2323-TD-0215	DIESEL GENERATOR AUXILIARY SYSTEMS	Rev. 2
2323-TD-0216	COMPRESSED AIR SYSTEM	
2323-TD-0228	PROCESS SAMPLING SYSTEM	
2323-TD-0230	COMPONENT COOLING WATER SYSTEM	
2323-TD-0232	CONTAINMENT SPRAY SYSTEM	
2323-TD-0233	STATION SERVICE WATER SYSTEM	
2323-TD-0235	SPENT FUEL POOL CLEANUP & STORAGE SYSTEM	
2323-TD-0239	STEAM GENERATOR BLOWDOWN & CLEANUP SYSTEM	Rev. 2
2323-TD-0241	DEMINERALIZED AND REACTOR MAKEUP WATER SYSTEM	
2323-TD-0300	VENTILATION HYDROGEN ANALYZING SYSTEM HYDROGEN PURGE SYSTEM RADIATION MONITORING SYSTEM	Rev. 2
2323-TD-0311	HVAC - NUCLEAR SAFETY RELATED CHILLED WATER SYSTEM	

APPENDIX 7

PIPING DESIGN SPECIFICATION
2323-MS-200

SYSTEM LINE LISTS

LISTING OF SYSTEM LINE LISTS

REACTOR COOLANT SYSTEM (CLASS 2 AND 3 LINES ONLY)
CHEMICAL & VOLUME CONTROL SYSTEM
BORON RECYCLE SYSTEM
RESIDUAL HEAT REMOVAL SYSTEM
SAFETY INJECTION SYSTEM
WASTE PROCESSING SYSTEMS (LIQUID AND GAS)
MAIN STEAM, REHEAT & STEAM DUMP SYSTEM
STEAM GENERATOR FEEDWATER SYSTEM
AUXILIARY FEEDWATER SYSTEM
DIESEL GENERATOR AUXILIARY SYSTEMS
COMPRESSED AIR SYSTEM
PROCESS SAMPLING SYSTEM - PRIMARY PLANT
COMPONENT COOLING WATER SYSTEM
CONTAINMENT SPRAY SYSTEM
STATION SERVICE WATER SYSTEM
SPENT FUEL POOL COOLING AND CLEANUP SYSTEM
DEMINERALIZED AND REACTOR MAKEUP WATER SYSTEM
HVAC - NUCLEAR SAFETY RELATED CHILLED WATER SYSTEM
HYDROGEN ANALYZING SYSTEM
RADIATION MONITORING SYSTEM
STEAM GENERATOR BLOWDOWN & CLEANUP SYSTEM
HYDROGEN PURGE SYSTEM

Rev. 2

Rev. 2

APPENDIX 8

PIPING DESIGN SPECIFICATION
2323-MS-200

SYSTEM MODES OF OPERATION

APPENDIX 9

Rev. 2

PIPING DESIGN
2323-MS-200

METHODS FOR NON-COMPUTER ANALYSIS OF PIPING

1. SIMPLIFIED METHOD FOR DESIGN AND ANALYSIS OF SMALL SIZE PIPING
2. ALTERNATE ANALYSIS

Rev. 2

APPENDIX 10

PIPING DESIGN SPECIFICATION
2323-MS-200

VALVE INFORMATION

VALVE LIST - UNIT 1, UNIT 2, UNIT COMMON
AS-BUILT VALVE WEIGHTS

APPENDIX 11

Rev. 2

PIPING DESIGN SPECIFICATION
2323-MS-200

INSULATION TABLES

TABLE A11-1 SCHEDULE OF THERMAL INSULATION THICKNESS
TABLE A11-2 SCHEDULE OF ANTI-SWEAT INSULATION THICKNESS
TABLE A11-3 TABLE OF REFLECTIVE INSULATION THICKNESS
TABLE A11-4 SCHEDULE OF ESTIMATED THERMAL INSULATION WEIGHTS
TABLE A11-5 TABLE OF REFLECTIVE INSULATION WEIGHTS

Rev. 2

APPENDIX 12

PIPING DESIGN SPECIFICATION
2323-MS-200

LIST OF HIGH ENERGY PIPING

APPENDIX 13

Rev. 2

PIPING DESIGN SPECIFICATION
2323-MS-200

PIPING INFORMATION TRACKING SYSTEM (PITS)

Rev. 2

APPENDIX 14

PIPING DESIGN SPECIFICATION
2323-MS-200

MISCELLANEOUS CORRESPONDENCE

END OF DOCUMENT112323001-349h ***001***4110 LINES***END OF DOCUME

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PROBLEM NO. 1-3 ISSUE 2 DATE 11/29/79

1. LIST OF GENERAL REFERENCES

1. PIPE DRAWINGS — No. 2323-M1-0505 REV. 6
   2323-M1-0506 — 8

2. ISO's DRAWINGS — No. 2323-M2-3202-04 REV. H
   2323-M2-3202-05 — G

3. FLOW DIAGRAM 2323-M1 No. 0202 & 01 ISSUE Rev. 6

4. LINE LIST MAIN STEAM REV. 5. DATE 11-10-78

5. INSULATION TABLES (C.S.) NO MEMO ___ DATE ___
   (REFLECTIVE) YES. MEMO G&H DATE 11/27/79

6. PIPE SPECIFICATION 2323-MS-43B REV. ___ DATE 6/15/77
   FRB-5R 8/76

7. SEISMIC RESPONSE SPECTRA FRB-6R ISSUE ___ DATE 8/76

8. SEISMIC MOVEMENT G & H ISSUE ___ DATE 9/75

HIGH ENERGY LINE — YES ✓ — NO

(T> 200F or P> 275 psi
NORMAL OPERATION)

5

PROBLEM NO. 1-3 ISSUE 2 DATE 11/29/79

2.1 VALVE TABLE 1-A (INCLUDE FLOWMETERS, ETC.)

LINE NO. PIPE SIZE & SCH	VALVE TYPE & NO	WEIGHT (lbs.)	C.G. L(in)	a(in)	b(in)	c(in)	RELATION OF a,b,c AND $\Delta x, \Delta y, \Delta z$ (ft),(ft),(ft)	MIN. WALL t_v (in)	EQUIV. PIPE THERMAL $D=I.D.+4t_p$ $t=3t_p$	SEISMIC $D=I.D.+2t_r$ $t=t_r$	VENDOR DRWG. NO. OR OTHER REFERENCE
		NOT REQUIRED									

6.1.2 EQUIPMENT ANCHORS (E.A.) - EQUIPMENT NOZZLE - TABLE 5-A

TYPE OF EQUIP.	VENDOR DRWG. NO.	BLDG.	ELEV.	ISO. NO.	POINT NO.	COMPLEMENTARY PROBLEM NO. (FOR PUMP NOZZLE)	ISO NO.	POINT NO.
MAIN STEAM GENERATOR # 3	WESTINGHOUSE 1106J-62	CONT.	895.79	3202-04	78	NONE		

PROB. NO. 1-3 ISSUE 2 DATE 11/29-79

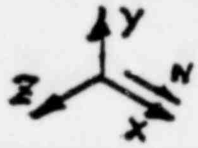
Filing Code 2323-200-1-3-2

Filing Code 2323-200-1-3-2

?

PROBLEM NO. 1-3 ISSUE 2 DATE 11/29/79

6.4 ANCHOR MOVEMENT TABLE 8-A



RADIANS

POINT NO.	ISO NO. (1) ANCHOR TYPE	(2) TYPE OF MOVEMENT	DEFLECTIONS (IN) ΔX	ΔY	ΔZ	ROTATIONS [redacted] ΔX	ΔY	ΔZ
78	2323-MI-3202-04	THERMAL *(1) (NORM & UPSET)	.6476	2.5768	1.8797	.000319	-.000110	-.000027
78	EQUIPMENT	1/2 SSE *(2)	.3504	.0294	.4112	.000847	.001088	.000801
78	EQUIPMENT	LOCA (3)	0.11	0.12	0.15	.0003	.0023	.0002
1080	PENETRATION	SAM (4)	.2836	.11087	.30989			
78	EQUIPMENT	SSE (5)	.4018	.0493	.4092	.000843	.001346	.000920

SEE: (1) PAGE 16 A OF 27
(2) PAGE 16 B OF 27
(3) PAGE 16 C OF 27
(4) PAGE 16 D OF 27
(5) PAGE 16 E OF 27

(1) ANCHOR TYPE: STRUCTURAL, BRANCH, EQUIPMENT, DYNAMIC

(2) TYPE OF MOVEMENT:

THERMAL (NORMAL OR UPSET), 1/2 SSE-XQUAKE, 1/2 SSE-YQUAKE, 1/2 SSE-ZQUAKE, OTHER (SPECIFY)

DISPLACEMENT ARE TAKEN FROM WPT-1691 (5-13-77)

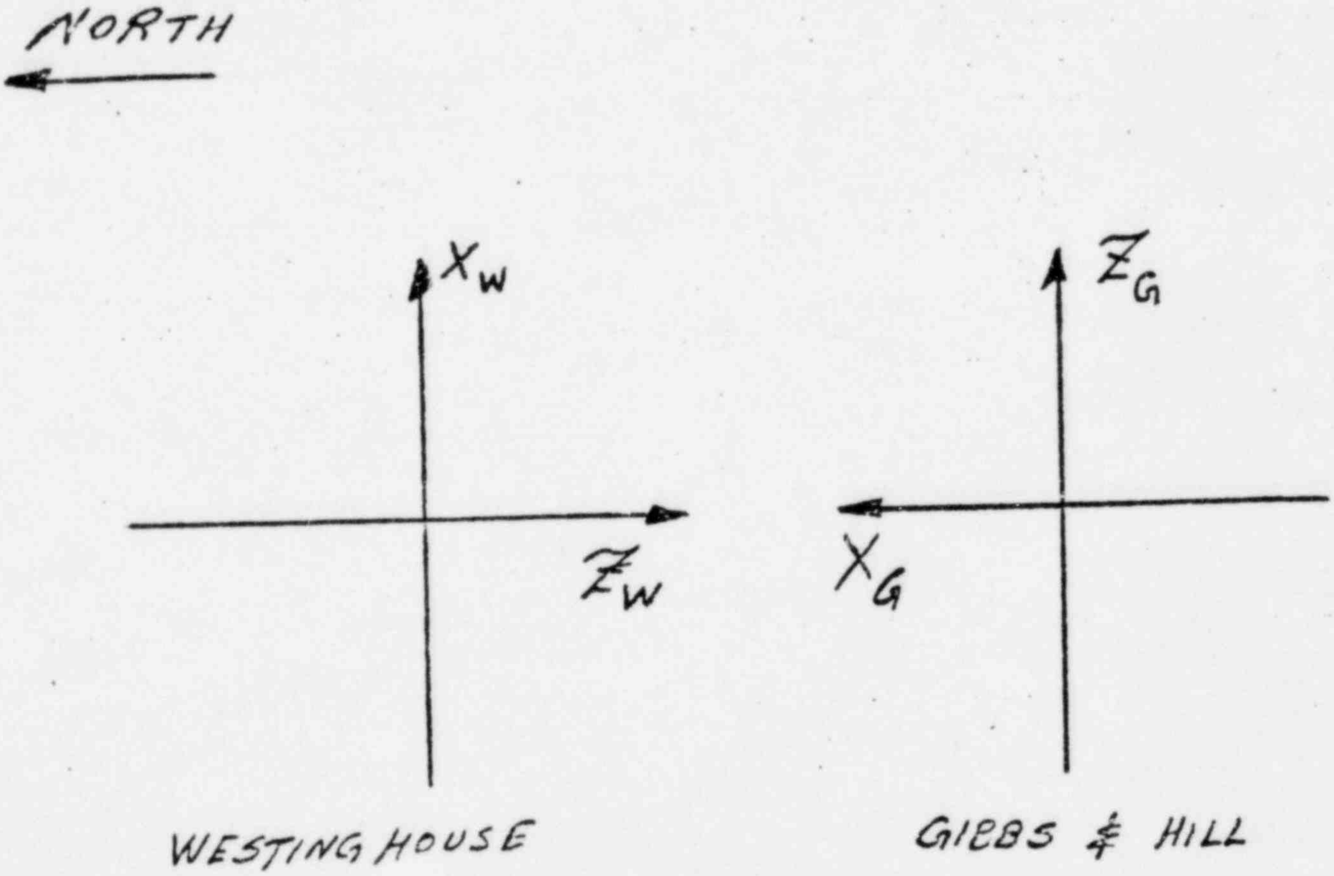
Filing Code 2323-200-1-3-2
Sheet No. 21B Of 27

Date 3/11/77 | **Gibbs & Hill, Inc.** ENGINEERS, DESIGNERS, CONSTRUCTORS NEW YORK | Filing Code .... Sheet No. 1 of 2

Calc By SKP

Chk'd/Apprd. By MRC | G & H Job No. 2323-001

Subject TRANSFORMATION OF NOZZLE DISPLACEMENT VALUES FROM WESTINGHOUSE GLOBAL COORDINATES TO G&H COORDINATES. | Rel. Dwg./Spec. No. ANALYSIS-1,2,3 & 4



COORDINATE SYSTEMS

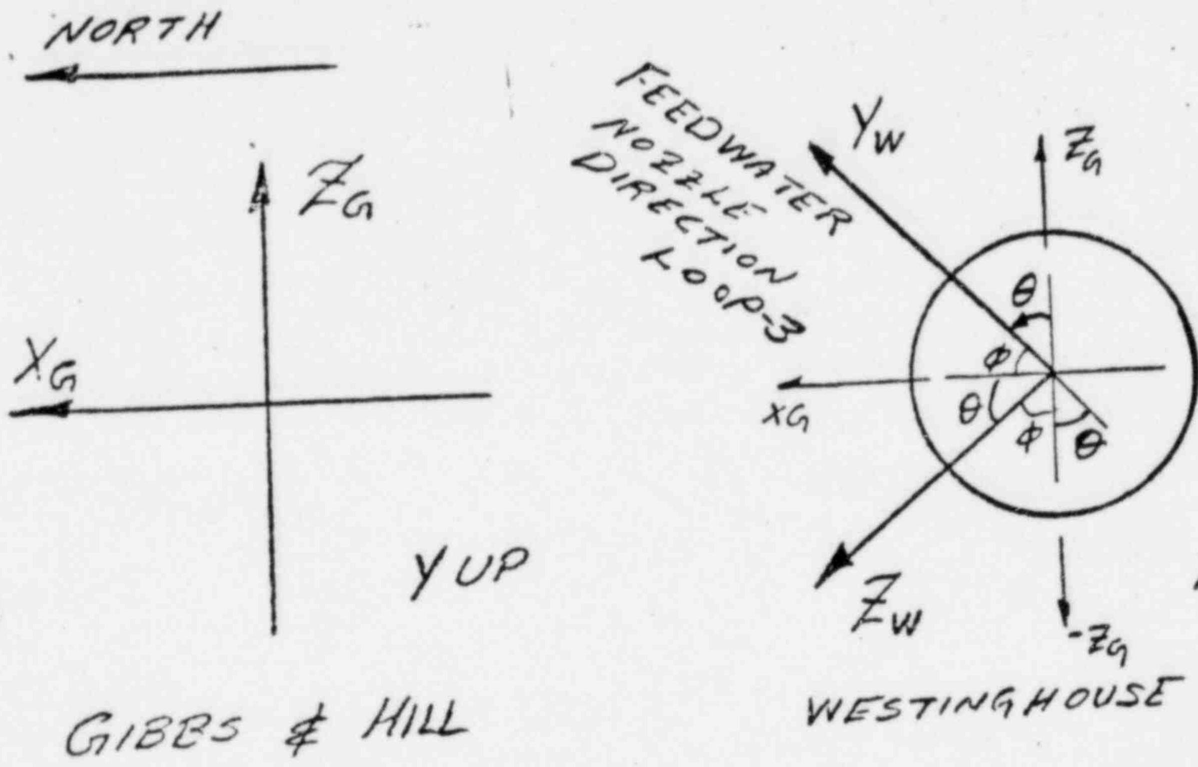
TRANSFORMATION IS GIVEN BY -

$$X_G = -Z_W \; ; \quad Y_G = Y_W$$

$$\& \quad Z_G = X_W$$ (SEE APPENDIX - PAGE-2)

Subject (CONTINUED)

LOOP-3



COORDINATES -

$\theta = 58^\circ - 30'$ ✓

$\phi = 31^\circ - 30'$ ✓

STEAM GENERATOR DESIGN LOADS
Filing Code 2323-200-1-3-2
Sheet No. 21J Of 27
MODEL-D

FEEDWATER NOZZLE

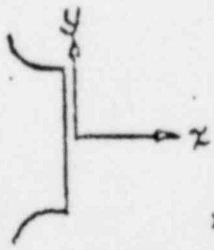
Loading	Fx (kips)	Fy (kips)	Fz (kips)	Mx (in-kips)	My (in-kips)	Mz (in-kips)
Thermal	±10	±50	±10	±1500	±1100	±3500
Weight	±2	±15	±5	±250	±100	±600
Seismic OBE	±40	±25	±25	±1100	±1250	±1250
Seismic SSE	±50	±30	±50	±1450	±1500	±1600
LOCA	±50	±30	±50	±4800	±4100	±4650
Pipe Rupture*	±500	± 354	±354	±13600	±7990	±7990

Pressure Loading: F_x = operating pressure x cross sectional area of nozzle (F_x = PA); other force components are negligible.

*The nozzle safe-end does not require evaluation for this loading case.

STEAM NOZZLE ✓

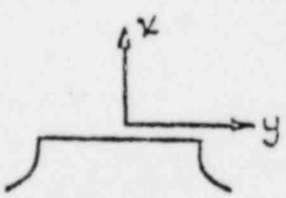
Loading	Fx (kips)	Fy (kips)	Fz (kips)	Mx (in-kips)	My (in-kips)	Mz (in-kips)
Thermal	±50	±30	±20	±2000	±3000	±3300
Weight	±15	±10	±5	±300	±500	±750
Seismic OBE	±25	±60	±50	±3750	±2600	±2750
Seismic SSE	±50	±140	±120	±7450	±4200	±3600
LOCA	±1300	±240	±500	±6850	±7000	±8400
Pipe Rupture*	±1900	±1343	±1343	±71500	±42073	±42073



(z by RHR)

x-y plane is vertical

Feedwater Nozzle



(in direct... FW nozzle

Steam Nozzle

3.1 SPRING CONSTANTS (STIFFNESS) OF PIPING SUPPORTS *RIGID RESTRAINTS*

Application for Seismic and Thermal analyses.

1) RIGID RESTRAINTS

NOMINAL PIPE SIZE (in)	TRANSLATIONAL STIFFNESS Kt (lb/in)	ROTATIONAL STIFFNESS Kr (in-lb/rad)
UNDER 6	2×10^5	1×10^7
6 to 14	1×10^6	1×10^8
OVER 14	5×10^6	1×10^9

2) MECHANICAL SHOCK ARRESTOR

NOMINAL PIPE SIZE (in)	RATED LOAD (lbs)	STIFFNESS K (lbs/in)
UNDER 2	1,000	1×10^5
2 to 6	3,000	2×10^5
8, 10, 12	10,000	3×10^5
OVER 12	35,000	1.35×10^6

ATTACHMENT "A"

Filing Code 2323-200-1-3-2

Sheet No. 6 of 18 4 copies

Telephone Conversation Record

Date: 11-2-79

REBa/MS46A, MS46A.1 PRR, EH, ARu/AJJB, ADL
IS, GSi, B, 048 OUTGOING

Time: 10:30A.M.

GTN-41464 Date: 11/8/79

Call by: ISRAEL STEIN (Name) of G&H, Inc. (Company)

Answer by: R. KELLY (Name) of WNES (Company)

Contract No: 11-2323-001

Subject discussed: Nozzle Loads on Main Steam Generator

SUMMARY OF DISCUSSION, DECISIONS AND COMMITMENTS.

Questions

1. Can we combine allowable thermal and deadweight for normal condition.

2. Thermal and deadweight and seismic (obe) for upset condition.

3. Thermal and deadweight and seismic (sse) for faulted condition.

Answer

G&H can combine loads as asked and also combine srss Fy & Fz as resultant shear force, and srss My & Mz as combined bending moment.

ARU/HRR/IS:llo

ATTACHMENT "B"

Filing Code 2323-200-1-3-2

Sheet No. 1 Of 5

Date 11/26/79
Calc By SW
Chk'd/Apprd. By AOL
Subject MS

Gibbs & Hill, Inc.
ENGINEERS, DESIGNERS, CONSTRUCTORS
NEW YORK

Filing Code 2323-200-1-
Sheet No. 1 of 5
G & H Job No. 11-2323-001
App. Mech. Prob# 1-1,2,3,4

LIST OF GENRAL REFERENCES [X]   Mode of Operations of Equipment [X]

1) PIPING COMPOSITE DWGS.

No.	Latest Rev.
2323- M1- 0505	6
2323- M1- 0506	8
2323- M1-	
2323- M1-	
2323- M1-	
2323- M1-	
2323- M1-	

2) Flow Diagrams .

No.	Latest Rev.
2323- M1- 0201	6
2323- M1- 0202-01	6
2323- M1-	
2323- M1-	

4) LINE LIST

See attached mode of operation

5) INSULATION TABLES

G&H Memo dated 11-27-78 (reflective) [X]

G&H memo dated 4/8/77 (Non-reflective) [ ]

6) PIPING SPECIFICATION

2323-MS-43B dated 6/15/77

SEISMIC RESPONSE SPECTRA

Building: Containment FRB-5R 8/76 [ ]   Turbine (N/A) [ ]

Building: Auxiliary FAB-3R 6/76 [ ]   Reactor FRB6R 8/76 [X]

Service Wat. FIS-2R 6/76 [ ]   Safeguard FSB-3R 5/76 [ ]

FSB-4R 1/77 [ ]

8) RELATIVE SEISMIC DISPLACEMENTS

Building: REACTOR, SAFEGUARD, AUXILIARY, DATE: 9/75 [X]

Building: FUEL, SERVICE WATER, INTAKE DATE: 12/76 [ ]

ATTACHMENT "B"

Filing Code 2323-200-1-3-2
Sheet No. 2 Of 5

Gibbs & Hill, Inc.
ENGINEERS, DESIGNERS, CONSTRUCTORS
NEW YORK

Date 11/26/79
Calc By SLH
Chk'd/Apprd. By ADh
Subject MS .... App. Mech. Prob.# 1-3

Filing Code ....
Sheet No. 2 Of 5
G & H Job No. 2323

VALVE TABLE

Line No. Pipe Size Schedule	Valve No.	Vendor DWG# or Other	C.G. Location Available	Weight (lb.)	Comments
No valves.					

ATTACHMENT "B"

Filing Code 2323-200-1-3-2
Sheet No. 3 Of 5

Date 11/26/79
Calc By SIU
Chk'd/Apprd. By APL
Subject MS

Gibbs & Hill, Inc.
ENGINEERS, DESIGNERS, CONSTRUCTORS
NEW YORK

Filing Code
Sheet No. 3 Of 5
G & H Job No. 11-2323-001
App. Mech. Prob. # 1-1,2,34

10) EQUIPMENT

Name & Number	Vendor DWG. or Other Reference	Size of Nozzle	Allow-able Loads	Nozzle Movement	Comments
STEAM Gen. -04 -03 -02 TBX-RCPCSG-01	(W) 1106J-62	See Dwg.	E Spec See G252124 attached Equip. Spec.	See WPT-1691 ed	
		See Dwg.	See attached Equip. Spec	to be Calculated	
		See Dwg.	See attached Equip. Spec.	to be Calculated	
		See Dwg.	See attached Equip. Spec	to be Calculated	
		See Dwg.	See attached Equip. Spec.	to be Calculated	
		See Dwg.	See attached Equip. Spec.	to be Calculated	

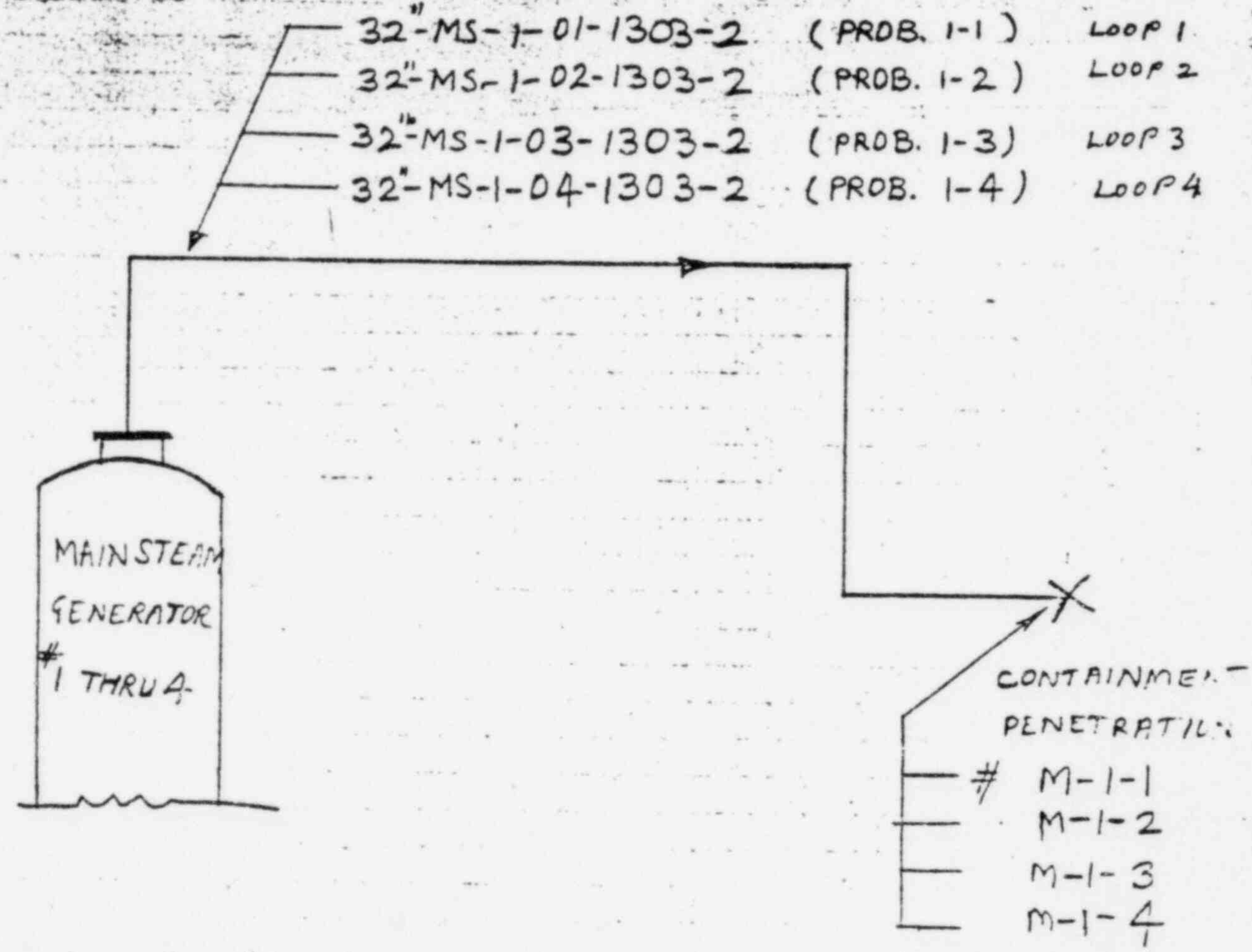
ATTACHMENT "B"

Filing Code 2323-200-1-3-2
Sheet No. 4 Of 5

Gibbs & Hill, Inc.
ENGINEERS, DESIGNERS, CONSTRUCTORS
NEW YORK

Date 9-7-78
Calc By MRK
Chk'd/Apprd. By ADL
SIU 11/27/79

Filing Code
Sheet No. 4 of 5
G & H Job No. 112323001
Subject
Ref. Dwg./Spec. No. PROB. 1-1 THRU 1-4



ATTACHMENT "B"

Filing Code 2323-200-1-3-2
Sheet No. 5 Of 5

Gibbs & Hill, Inc.
ENGINEERS, DESIGNERS, CONSTRUCTORS
NEW YORK

Date 11/13/79
Calc By
Chk'd/Apprd. By DMK 11-15-79
Subject

Filing Code
Sheet No. 5 of 5
G & H Job No. 11-2323-001
Ref. Dwg./Spec. No.

LINE NOS.	A	B	C	D	REMARK
32"-MS-1-01-1302-2 -02 -03 -04	545°F	577°F	557°F	AMBIENT (SEE NOTE)	PRESSURES ARE AT THE SATURATED STEAM TEMPERATURE.

A = RATED POWER OUTPUT (100% LOAD)
B = PLANT UPSET CONDITION
C = NO LOAD CONDITION
D = START UP ⇒ ① PORTIONS OF PIPING WILL IN THE CONTAINMENT EXPERIENCE ~120°F
② PORTIONS OF PIPING IN THE SAFEGUARDS BUILDING WILL EXPERIENCE ~104°F

CLI. 2 251
PLANT CPSES
JOB NO. 11-2323-001

Gibbs & Hill, Inc.
ENGINEERS DESIGNERS CONSTRUCTORS
New York

PIPELINE DESIGNATION LIST
SYSTEM MAIN STEAM
FLOW DIAG NO 2323-M1-0202 REV. 5 -0202-01
SHEET NO. 1
ISSUE NO. 4
DATE 1-4-78 11-10-78 3-4-79

LINE DESIGNATION: SIZE	SYSTEM DESIGNATION	UNIT No.	SEQ. No.	PIPE CAT.	SAFET. CLASS	INSUL. CLASS	FLOWING MEDIUM	PIPE DESIGN (1) PRESS. PSIG	PIPE DESIGN (1) TEMP. °F	DESIGN FLOW CONDITIONS (2) PRESS. PSIG	TEMP. °F	FLOW W = LB/HR G = GPM C = CFM	ΔP PSI/100FT	VELOCITY S = FT/SEC M = FT/MIN	HEAT TRACING YES	HEAT TRACING NO	INSERVICE INSPECTION YES	INSERVICE INSPECTION NO	HYDRO TEST PRESS. PSIG	REMARKS	ISSUE NO.
32	MS	1	01	1303	2	C	STEAM	1185	600	1092	557					✓			1778	P WAS PSIA TEST P REV.	4
32	MS	1	02	1303	2	C										✓					
32	MS	1	03	1303	2	C										✓					
32	MS	1	04	1303	2	C	↓									✓					
2	MS	1	05	1303	2	B-5	SAT. WATER									✓					
3/8	MS	1	06	2505	2		SAT. WATER									✓					
34	MS	1	07	13026	—	B-5	STEAM									✓					
3/8	MS	1	08	25054	—	—										✓					
3/8	MS	1	09	25054	—	—	↓									✓					
2	MS	1	10	1303	2	B-5	SAT. WATER									✓					
3/8	MS	1	11	SS-25054	TUBING B	—	SAT. WATER									✓					
34	MS	1	12	13026	—	B-5	STEAM									✓					
3/8	MS	1	13	25054	—	—	STEAM									✓					
3/8	MS	1	14	25054	—	—	STEAM									✓					
2	MS	1	15	1303	2	B-5	SAT. WATER									✓					
3/8	MS	1	16	SS 2505	TUBING B	—	SAT. WATER									✓					
34	MS	1	17	13026	—	B-5	STEAM									✓					
16	MS	1	18	13026	—		STEAM									✓					
			19													✓					
2	MS	1	20	1303	2	↓	SAT. WATER									✓					
3/8	MS	1	21	2505	2	—	SAT. WATER									✓					
34	MS	1	22	13026	-	B-5	STEAM									✓					
16	MS	1	23	13026	-											✓					
			24													✓					
4	MS	1	25	1303	2											✓					
4	MS	1	26	1303	2											✓					
4	MS	1	27	1302	3											✓					
4	MS	1	28	1302	3											✓					
4	MS	1	29	1302	3	↓	↓	↓	↓	↓	↓					✓			↓	↓	↓

(1) SYSTEM DESIGN CONDITIONS
(2) PIPE DIAMETER DESIGN BASIS
"5" IN SAFETY CLASS DENOTES NON-NUCLEAR PIPE / R[illegible]

(A)

C.C. EH. ADL. (MVG) ARu, CIC, GST, IS, GVe. BKCh. FAC
PRR

Gibbs & Hill, Inc.

Interoffice Memorandum

TO: ARu/ATTB

DATE: 10/30/79

FROM: EH/ADL/SIU

JOB NO: 2323

SUBJECT: Wt & Thickness of Insulation Assemblies

REF. NO:

Ref 1. MVG to ARu Memo 4-8-77
Ref 2. MVG to ARu Memo 11-27-78

Attached please find the estimated weight & thickness of the Reflective, non-reflective and antisweat insulation assemblies. When used with the applicable line list, these should provide AM. with all the required info on insulation to perform piping analysis. Please note that these info have frequently been asked for by individual analyst though they have been transmitted via above memos. Hence the completed package is hereby transmitted to all group leaders.

SIU

A

F-168, 8-78

MEMO

Gibbs & Hill, Inc.

ENGINEERS, DESIGNERS, CONSTRUCTORS
NEW YORK

To: ARu
At: 17 Floor

From: EH/AMan/MVG
At: 8 Floor

Date: 4-8-77

TUSI - Job No. 11-2323-001

Re: Stress Analysis of Class 1, 2 & 3 Piping Systems (Weights of Insulation)

Ref: Memo from ARu to EH dated 4-7-77 "Stress Analysis of Class 1, 2 & 3 Piping"

In response to your request in the referenced memo, enclosed are the following tables:

(1) Table 1.4-1 "Schedule of Minimum Insulation Thickness"
(2) Table 1.4-2 "Schedule of ESTIMATED Insulation Weights".

The two tables are to be used concurrently in performing seismic analyses of piping systems.

Please be advised that an insulation vendor has not yet been selected and therefore the weights of insulation given in Table 1.4-2 may vary between vendors. We are therefore clarifying that these weights are an ESTIMATE only, but should be suitable for analyses purposes.

F-168, 11-66

TABLE 1.4-1

SCHEDULE OF MINIMUM THERMAL INSULATION THICKNESS

Class	B-1	B-2	B-3	B-4	B-5	B-6
Fluid	Hot Water or Steam					
Temp. Range (°F)	140-199	200-299	300-399	400-499	500-599	600-699
Pipe Size	**Minimum Thickness of Insulation - inches**					
3/4	1	1	1	1 1/2	1 1/2	2
1	1	1	1	1 1/2	1 1/2	2
2	1	1	1	1 1/2	2	2
3	1	1	1 1/2	1 1/2	2	2 1/2
4	1	1	1 1/2	1 1/2	2	2 1/2
6	1	1	1 1/2	2	2	2 1/2
8	1 1/2	1 1/2	1 1/2	2	2 1/2	2 1/2
10	1 1/2	1 1/2	1 1/2	2	2 1/2	3
12	1 1/2	1 1/2	1 1/2	2	2 1/2	3
14	1 1/2	1 1/2	1 1/2	2	2 1/2	3
16	1 1/2	1 1/2	1 1/2	2	2 1/2	3
18	1 1/2	1 1/2	1 1/2	2	2 1/2	3
20	1 1/2	1 1/2	1 1/2	2	2 1/2	3
24	1 1/2	1 1/2	1 1/2	2	2 1/2	3
30	1 1/2	1 1/2	1 1/2	2	2 1/2	3
36	1 1/2	1 1/2	1 1/2	2	2 1/2	3
Equipment	1	1	1 1/2	2	3	3 1/2

TABLE 1.4-2

SCHEDULE OF ESTIMATED THERMAL INSULATION WEIGHTS *

Class	B-1	B-2	B-3	B-4	B-5	B-6
Fluid	Hot Water or Steam					
Temp. Range (°F)	140-199	200-299	300-399	400-499	500-599	600-699
Pipe Size	Weights of Insulation - lb/ft					
3/4	0.49	0.49	0.49	0.85	0.85	1.00
1	0.72	0.72	0.72	1.23	1.23	1.94
2	1.01	1.01	1.01	1.71	2.53	2.53
3	1.25	1.25	2.08	2.08	3.01	4.07
4	1.62	1.62	2.55	2.55	3.61	4.66
6	2.11	2.11	3.28	4.57	4.57	6.09
8	4.13	4.13	4.13	5.64	5.64	5.64
10	5.20	5.20	5.20	7.07	7.07	11.0
12	6.04	6.04	6.04	8.13	8.13	12.7
14	6.16	6.16	6.16	8.38	10.7	13.1
16	6.90	6.90	6.90	9.33	12.0	14.6
18	7.73	7.73	7.73	10.4	13.3	16.3
20	8.45	8.45	8.45	11.6	14.6	17.7
24	10.0	10.0	10.0	13.4	17.0	21.0
30	11.9	11.9	11.9	16.1	20.5	25.0
36	14.2	14.2	14.2	19.2	24.2	29.5

* THE WEIGHTS TABULATED OBTAINED FROM "PIPING DESIGN AND ENGINEERING" - ITT GRINNELL, 4TH EDITION, 1973 PAGES 178-201.

MEMO

Gibbs & Hill, Inc.

ENGINEERS, DESIGNERS, CONSTRUCTORS
NEW YORK

Retransmitted 11-29-78 for Legibility

To: A. RUTKOWSKI
At: 17 FLOOR

From: E. HOROVITZ / M.V. GAROFALO
At: 8 FLOOR

Date: 11-27-78

TUSI - JOB NO. 11-2323-001

RE: STRESS ANALYSIS OF CLASS 1, 2 & 3 PIPING SYSTEMS - REFLECTIVE INSUL.

REF: MEMO FROM EH/AMan/MVG TO A. RUTKOWSKI DATED 4-20-77

THE REFERENCED MEMO TRANSMITTED DOCUMENTATION LISTING ESTIMATED WEIGHTS OF REFLECTIVE INSULATION ASSEMBLIES AND ESTIMATED THICKNESSES OF REFLECTIVE INSULATION ASSEMBLIES, FOR USE BY APPLIED MECHANICS IN STRESS ANALYSIS OF PIPING SYSTEMS.

SINCE THE REFERENCED MEMO WAS ISSUED, THE CONTRACT FOR FABRICATION AND DESIGN OF REFLECTIVE INSULATION ASSEMBLIES WAS AWARDED TO DIAMOND POWER SPECIALTY CORP. BASED UPON THIS, THE FOLLOWING REVISED DOCUMENTATION IS HEREBY TRANSMITTED TO APPLIED MECHANICS TO AID THEM IN THEIR ANALYSES OF PIPING SYSTEMS USING REFLECTIVE INSULATION:

ATTACHMENT "A" - TECHNICAL DATA SHEETS (4 SHEETS)
ATTACHMENT "B" - WEIGHTS PER FOOT (LBS.) OF INSULATION (1 SHEET)

THE TWO ATTACHMENTS, WHEN USED WITH THE APPLICABLE SYSTEM LINE LISTS (FOR OPERATING TEMPERATURES) SHOULD PROVIDE APPLIED MECHANICS WITH ALL OF THE REQUIRED INFORMATION TO PERFORM ANALYSES OF PIPING SYSTEMS.

F-168, 11-66

Ambient Temperature
120°F For All Systems

ATTACH[illegible]NT "A"

TECHNICAL DATA SHEETS

	Line Size	Opr. Temp.	Actual Insul. Thickness	Number Reflective Liners	Total Length of Piping	Insul. Surface Area Ft^2	Nominal Insul. Surface Temp.	Heat Loss Btu/Hr	Flux of Insul. Surface Area $Btu/Hr\text{-}Ft^2$
MAIN STEAM									
	32"	557	2.33"	8	744.7'	7408.6	186.3	420,792.2	56.8
	8"	557	2.0"	7	49.4'	176.2	180.3	12,679.3	72.0
	4"	557	2.0"	7	429.1'	1066.7	175.7	67,001.7	62.8
	3"	557	1.33"	5	141.2'	277.3	193.0	23,992.1	86.5
	2"	557	1.33"	5	300.5'	501.6	186.0	38,934.5	77.6
	1"	557	1.33"	5	42.5'	59.1	180.0	4,259.3	72.1
						9489.5		567,659.1	59.9
FEEDWATER									
	18"	446	1.33"	5	889.5'	5123.0	183.0	328,728.0	64.2
	1.5"	446	1.0"	4	9.4'	12.0	166.0	861.6	71.8
						5135.0		329,589.6	64.2
REACTOR COOLANT									
	31"*	616.9	4.33"	14	64.0'	737.3	179.0	53,223.2	72.1
	29"*	616.9	4.0"	13	60.0'	681.7	182.0	43,914.0	64.4
	27.5*	560	3.0"	10	84.0'	857.7	174.0	52,364.9	61.1
	14"	652.7	3.0"	10	69.8'	383.7	189.0	26,362.3	68.7
	12"	616.9	3.0"	10	20.5'	105.9	182.3	7,038.9	66.5
	10"	559.4	2.0"	7	26.0'	107.2	183.5	8,189.0	76.4
	6"	652.7	3.0"	10	92.8'	331.0	178.3	20,743.7	62.7
	6"	616.9	3.0"	10	22.0'	78.5	174.7	4,788.2	61.0
	6"	560	2.0"	7	30.7'	93.4	178.0	5,806.9	62.2
	4"	560	2.0"	7	350.4'	871.4	176.7	52,068.6	59.8
	3"	652.7	2.33"	8	11.6'	28.9	181.5	2,028.1	70.2
	3"	587.8	2.0"	7	168.7'	375.5	188.3	25,565.7	68.1
	3"	559.4	1.33"	5	17.1'	33.6	185.5	2,850.1	84.8

* Pipe I.D.

Ambient Temperature
120°F For All Systems

ATTACHMENT "A"

TECHNICAL DATA SHEETS

Rev. 1
ME-70477
Diamond Power
Page 2 of 4
Dec. 21, 1977

	Line Size	Opr. Temp.	Actual Insul. Thickness	Number Reflective Liners	Total Length of Piping	Insul. Surface Area Ft^2	Nominal Insul. Surface Temp.	Heat Loss Btu/Hr	Flux of Insul. Surface Area $Btu/Hr\text{-}Ft^2$
REACTOR COOLANT (Cont'd)	2"	652.7	2.33"	8	22.0'	48.3	178.3	3,341.3	69.2
	2"	616.9	2.0"	7	113.1'	218.4	178.3	16,083.8	73.6
	2"	587.8	2.0"	7	26.4'	51.0	180.3	3,287.4	64.5
	2"	559.4	1.33"	5	69.3'	115.7	182.7	9,248.2	79.9
	1.5"	559.4	1.33"	5	14.3'	22.2	181.3	1,506.1	67.8
	1"	616.9	2.0	7	24.0'	39.7	173.7	2,656.9	66.9
	1"	560	2.0"	7	15.4'	25.5	159.0	1,420.4	55.7
	.75"	652.7	2.0"	7	10.4'	16.6	184.3	1,148.0	69.2
	.75"	587.8	2.0"	7	26.7'	42.3	179.0	2,432.2	57.5
	.75"	559.4	1.33"	5	37.5'	49.5	173.0	3,654.8	73.8
						5315.0		349,732.7	65.8
CHEMICAL & VOLUME CONTROL	3"	520	1.33"	5	411.5'	861.7	166.0	58,895.1	68.3
	.75"	516	1.33"	5	13.3'	17.6	166.6	1,080.3	61.4
	2"	516	1.33"	5	223.9'	410.5	170.0	25,706.4	62.6
	1"	520	1.33"	5	14.5'	20.2	168.0	1,351.2	66.9
	3"	380	1.0"	4	50.3'	72.4	166.2	4,488.0	52.5
	2"	380	1.0"	4	67.0'	76.8	167.0	4,638.8	49.2
						1489.8		96,159.8	64.5
SAFETY INJECTION & RHR	12"	350	.66"	3	94.8'	397.1	175.2	23,920.3	62.6
	3"	350	.66"	3	8.6'	15.7	179.3	885.7	56.4
	6"	182	.33"	2	12.9	29.2	136.0	686.6	23.5
	1.5"	182	.33"	2	183.9'	187.7	134.0	3,347.3	17.8
						629.7		28,839.9	45.8

Ambient Temperature
120°F For All Systems

ATTACHMENT "A"

TECHNICAL DATA SHEETS

Rev. 1
ME-70477
Diamond Power

Dec. 21, 1977

	Line Size	Opr. Temp.	Actual Insul. Thickness	Number Reflective Liners	Total Length of Piping	Insul. Surface Area Ft^2	Nominal Insul. Surface Temp.	Heat Loss Btu/Hr	Flux of Insul. Surface Area $Btu/Hr\text{-}Ft^2$
STEAM GENERATOR									
BOTTOM HEAD									
Flat		545	3.0"	10	N/A	15	202	912.0	60.8
Cone		545	3.0"	10	N/A	135	193	10,625.0	78.7
TOP HEAD									
Flat		545	3.0"	10	N/A	65	164	4,238.0	65.2
Vertical		545	3.0"	10	N/A	373	193	29,355.0	78.7
SHELL									
Flat		545	3.0"	10	N/A	100	202	6,080.0	60.8
Cone		545	3.0"	10	N/A	280	193	22,036.0	78.7
Vertical		545	3.0"	10	N/A	2140	185	132,252.0	61.8
						3108		205,498.0	
						x 4		x 4	
						12432		821,992.0	66.1
R.C. PUMPS									
Flat		560	3.0"	13	N/A	74	200	4,573.2	61.8
Vertical		560	3.0"	13	N/A	254	190	15,418.0	60.7
						328		19,991.2	
						x 4		x 4	
						1312		79,964.8	60.5

Ambient Temperature
120°F For All Systems

ATTACHMENT "A"

TECHNICAL DATA SHEETS

	Line Size	Opr. Temp.	Actual Insul. Thickness	Number Reflective Liners	Total Length of Piping	Insul. Surface Area Ft^2	Nominal Insul. Surface Temp.	Heat Loss Btu/Hr	Flux of Insul. Surface Area $Btu/Hr-Ft^2$
PRESSURIZER									
BOTTOM HEAD									
Flat		620	4.0"	13	N/A	40	223	2480	62.0
Vertical		620	4.0"	13	N/A	92	188	5971	64.9
TOP HEAD									
Flat		620	4.33"	14	N/A	60	178	3636	60.6
SHELL									
Vertical		620	4.0"	13	N/A	1070	188	69,443	64.9
						1262		81,530	64.6
REGENERATIVE HEAT EXCHANGER	10"	560	2.66"	9	46.6	219.6	189.5	14,002.5	63.8
TOTALS:						37,284.6		2,369,470.4	63.55

65 $Btu/Hr-Ft^2$

Class C. Reflective Insulation

ATTACHMENT "B"

ME-70477

Weights Per Foot (LBS.)

Insulation Thickness (in.) (Actual)

PIPING		1.0"	1.33"	2.0"	2.33"	3.0"	3.33"
3/4" & 1"	O.D.	2.41	3.10	4.25	5.13	6.28	7.32
1-1/2" & 2"	O.D.	2.87	3.87	4.94	5.90	7.12	8.20
3"	O.D.	3.64	4.44	5.63	6.63	7.97	9.12
4"	O.D.	4.17	5.06	6.32	7.39	8.81	11.87
6"	O.D.	5.21	6.20	7.70	10.92	12.64	14.06
8"	O.D.	6.28	9.65	11.41	12.79	14.71	16.24
10"	O.D.	10.65	11.22	14.09	14.67	17.85	18.42
12"	O.D.	12.10	12.75	15.86	16.51	19.95	20.61
14"	O.D.	12.79	14.36	16.74	18.42	20.95	22.83
16"	O.D.	14.25	15.93	18.50	20.30	23.10	25.01
18"	O.D.	15.70	17.46	20.26	22.18	25.12	27.19
20"	O.D.	17.16	19.04	22.02	24.05	27.19	29.41
24"	O.D.	20.03	22.14	25.55	27.77	31.33	33.74
27.5"	I.D.	25.97	28.53	32.82	35.54	39.95	42.86
29"	I.D.	27.42	30.10	34.58	37.42	42.05	45.04
30"	O.D.	24.40	26.81	31.06	33.67	37.88	40.67
31"	I.D.	28.88	31.64	36.35	39.26	44.12	52.59
32"	O.D.	25.77	28.53	32.82	35.54	39.95	42.86

Above Weights Are Based 3 per inch Liner Density.

EQUIPMENT

Insulation Thickness	Liner Density	Weight Per Square Foot
3.0"	4	4.75
3.5"	4	5.10

Class A

TABLE 2

SCHEDULE OF MINIMUM ANTI-SWEAT INSULATION THICKNESS

Building Class Fluid Temp Range (F)	Containment A-1 Cold Water ≤ 108	Auxiliary, Safeguards, Fuel Handling A-2 Cold Water ≤ 94	Turbine A-3 Cold Water ≤ 90.5
Pipe Size	Minimum Thickness of Insulation		
3/4	1	1/2	1 1/2
1	1	1/2	1 1/2
1 1/2	1	1/2	1 1/2
2	1	1/2	1 1/2
2 1/2	1	1/2	1 1/2
3	1	1/2	1 1/2
4	1	1/2	1 1/2
6	1	1/2	1 1/2
8	1	1/2	1 1/2
10	1	1/2	1 1/2
12	1	1/2	1 1/2
14	1	1/2	1 1/2
16	1	1/2	1 1/2
18	1	1/2	1 1/2
20	1	1/2	1 1/2
24	1	1/2	1 1/2
30	1	1/2	1 1/2

Building Class Fluid Temp Range (F)	Containment A-1 Cold Water ≤ 108	Auxiliary, Safeguards, Fuel Handling A-2 Cold Water ≤ 94	Turbine A-3 Cold Water ≤ 90.5
Pipe Size	Minimum Thickness of Insulation		
32	1	1/2	1 1/2
34	1	1/2	1 1/2
36	1	1/2	1 1/2
Equipment	1	1/2	1 1/2

Density of Anti-sweat Insultion: $3\frac{1}{2}$ to $4\frac{1}{2}$ lb/cu ft

Sm