

**SAFETY INJECTION AND REFUELING WATER TANK DESIGN PARAMETERS**

Nominal Volume	285,000 Gallons	
Contained Liquid	Boric Acid (1,720-2,500ppm)	
Minimum During Operation	250,000 Gallons	
Liquid Temperature	40°F-105°F	
Diameter/Height	46 Feet/24 Feet	
Material	Aluminum	
Design Temperature	125°F	
Design Pressure	Atmospheric	

**LOW PRESSURE SAFETY INJECTION PUMP DATA SUMMARY**

Quantity	2
Type	Single Stage, Horizontal, Centrifugal
Design Pressure	500 psig
Design Temperature	350°F
Design Flow Rate	3,000 gpm
Design Head	350 ft
Pumped Fluid	1% Boric Acid, Nominal <15,000 ppm Boric Acid, Maximum (Design)
Temperature of Pumped Fluid	40° - 325°F
Shutoff Head	410 ft
Maximum Flow	4,500 gpm
Head at Maximum Flow	250 ft
Basic Material	316 SS (see Table 6-10)
Horsepower	400
Seals	Mechanical
Acceleration Time	4 Seconds
Minimum Flow	163 gpm
NPSH Required at 3,000 gpm	11 ft
Maximum Normal Suction Pressure	270 psia

**HIGH PRESSURE SAFETY INJECTION PUMP DATA SUMMARY**

Quantity	2
Type	Multistage, Horizontal, Centrifugal
Design Pressure	1,750 psig
Design Temperature	350°F
Design Flow Rate	300 gpm
Design Head	2,500 ft
Pumped Fluid	1% Boric Acid, Nominal <15,000 ppm Boric Acid, Maximum (Design)
Temperature of Pumped Fluid	40° - 300°F
Shutoff Head	2,800 ft
Maximum Flow	680 gpm
Head at Maximum Flow	850 ft
Material	Stainless Steel
Horsepower	400
Shaft Seal	Mechanical
Acceleration Time	4 Seconds
Normal/Minimum Recirc Flow	30 gpm/25 gpm
NPSH Required at 600 gpm	17 ft
Maximum Suction Pressure	250 psig

**SHUTDOWN COOLING HEAT EXCHANGER DATA SUMMARY**

Quantity	2
Type	Shell and Tube
Code	ASME, Section III, Class C, 1965, TEMA, Class R
Tube Side	
Fluid	Primary Coolant, 1% Boric Acid, Nominal <15,000 ppm Boric Acid, Maximum (Design)
Design Pressure	500 psig
Design Temperature	400°F
Pressure Loss, 1,500,000 lb/h	5 psi
Materials	Austenitic Stainless Steel
Shell Side	
Fluid	Component Cooling Water
Design Pressure	150 psig
Design Temperature	200°F
Pressure Loss, 2,000,000 lb/h	10 psi
Materials	Carbon Steel
<u>Operating Parameters</u>	(27.5 Hours After Shutdown Assuming an Infinitely Irradiated Core)
Tube Side	
Flow	1,500,000 lb/h
Inlet Temperature	130°F
Outlet Temperature	111.7°F

---

**SHUTDOWN COOLING HEAT EXCHANGER DATA SUMMARY**

## Shell Side

Flow	2,000,000 lb/h
Inlet Temperature	90°F
Outlet Temperature	103.5°F
Heat Transfer	27,500,000 Btu/h

**SAFETY INJECTION TANK DESIGN PARAMETERS**

Quantity	4	
Type	Vertical Right Cylinder	
Design Pressure	250 psig	
Design Temperature	200°F	
Liquid Volume (min/max)	1040/1176 ft <sup>3</sup> /Tank	
Combined Liquid Discharge	30,000 Gallons	
Pressuring Cover Gas	Nitrogen	
Height	34 Feet 6 Inches	
Outside Diameter	9 Feet 2 Inches	
Material	Carbon Steel With Type 304L Stainless Steel Clad	
Contained Liquid	1720 ppm Boric Acid, Nominal 15,000 ppm Boric Acid, Maximum (Design)	

**CONTAINMENT SPRAY SYSTEM COMPONENT DESCRIPTION**

1. Containment Spray Pumps

Number of Units - 3

Type - Vertically Split, Horizontal Centrifugal With Mechanical Seals and Backup Packed Gland

Material - 316 Stainless Steel

Code - Motor, NEMA; Pump, Standards of the Hydraulics Institute, 11th Edition, 1965, ASA B31.1-1955; ASA B16.5-1961

	<u>Injection</u>	<u>Recirculation</u>
Design Capacity (Each)	1,340 gpm	1,800 gpm
Design Head	450 ft	405 ft
Design NPSH Required	13.2 ft	17.8 ft
Temperature Transient	40° - 300°F in 5 Seconds	
Motor	250 hp, 3 Ph, 60 Hz, 2,300 V	
Pumps Acceleration Time	4 Seconds at 70% Voltage	
Pumped Fluid	1% Boric Acid, Nominal 15,000 ppm Boric Acid, Maximum (Design)	

2. Shutdown Cooling Heat Exchangers

Number of Units - 2

Capacity (Each) -  $83.5 \times 10^6$  Btu/h Based on 4,000 gpm of Cooling Water at 114°F Inlet Temperature and 1,420 gpm of Spray Water at 283°F Inlet Temperature

**CONTAINMENT SPRAY SYSTEM COMPONENT DESCRIPTION**

3. Piping, Fittings and Valves

A. Suction Material - Type 304 Stainless Steel

<u>Pipe Sizes</u>	<u>Wall Thickness</u>
2" and Smaller	Sch 40S
2-1/2" Through 12"	Sch 10S
14" Through 20"	0.250" Nominal Wall
24"	0.375" Nominal Wall

Design Pressure - 60 psig

Design Temperature – 300°F

Construction	2-1/2" and Larger	- Butt-Welded Except at Flanged Equipment
	2" and Smaller	- Socket Welded Except at Screwed Equipment
Valves	2" and Larger	- Stainless Steel, Butt-Welded, 150 lb
	1-1/2" and Smaller	- Stainless Steel, Socket Welded, 150 lb
Testing		- 100% Radiography of Welded Joints
Code		- ASA B31.1-1955 and Code Cases N2 and N10

B. Discharge Material - Type 304 Stainless Steel

<u>Pipe Sizes</u>	<u>Wall Thickness</u>
8" and Smaller	Sch 40S
10" Through 14"	0.250" Nominal Wall

Design Pressure - 500 psig

Design Temperature – 350°F

Valves	2" and Larger	- Stainless Steel, Butt-Welded, 300 lb
	1-1/2" and Smaller	- Stainless Steel, Socket Welded, 600 lb
Testing		- 100% Radiography of Welded Joints
Code		- ASA B31.1-1955 and Code Cases N2 and N10



**CONTAINMENT SPRAY SYSTEM COMPONENT DESCRIPTION**4. Spray Nozzles

Type	- Sprayco, Model 1713A
Material	- 304 Stainless Steel
Number	- 77 Nozzles on A Spray Header - 83 Nozzles on B Spray Header
Maximum Spray Droplet Size	- 1800 microns at 16 psid (Mass Mean Diameter)
Capacity	- Refer to FSAR Figure 6-7

**CONTAINMENT AIR COOLER COMPONENT DESCRIPTION**

Coils (VHX-1, VHX-2 and VHX-3 Safety Related & VHX-4 Non-Safety) |

Coils per Cooler Unit	4
Rows of Tubes per Coil	12
Face Area of Each Coil	20.54 ft <sup>2</sup>
Total Coil Face Area per Cooler Unit	82.16 ft <sup>2</sup>
Tubes per Row	36
Tube Description	5/8" OD Copper x 0.049" Wall
Tube Design Pressure	150 psig
Fin Description	3/8" High x .012 Thick Copper Plate with 9.4 Fins per Inch (Mechanical Bond)
Normal Pressure Drop Across Coil (Air Side)	1.54 in. wg
Maximum Pressure Drop Across Coil (Air Side, Accident Condition)	1.68 in. wg
Normal Pressure Drop Through Coil (Water Side)	16 ft H <sub>2</sub> O
Maximum Pressure Drop Through Coil (Water Side, Accident Condition)	12.7 ft H <sub>2</sub> O

Fans (V1, V2, V3 and V4)

Fan Speed	1,750 r/min
Number of Fans per Cooler Unit	2
Fan Capacity (Each)	
"A" 75 HP (accident)	30,000 ft <sup>3</sup> /min at 4.5" H <sub>2</sub> O
"B" 30 HP (normal)	30,000 ft <sup>3</sup> /min at 4.0" H <sub>2</sub> O
Total Airflow Through Cooler(Normal)	60,000 ft <sup>3</sup> /min
Total Airflow Through Cooler(Accident)	30,000 ft <sup>3</sup> /min (VHX-1, 2 and 3)

**CONTAINMENT AIR COOLER COMPONENT DESCRIPTION**

Motor Design	Totally Enclosed Air Overcooled
Insulation	NEMA Class H for Fans Rated for the Post-DBA Condition
	NEMA Class B for Fans Rated for Normal Duty
Rating	75 hp for Fans Rated for the Post-DBA Condition
	30 hp for Fans Rated for Normal Duty
Filters (VF-1, VF-2, VF-3, VF-4)	
Capacity	60,000 ft <sup>3</sup> /min at 0.33" H <sub>2</sub> O
Differential Pressure Drop (Clean)	0.33" H <sub>2</sub> O
Size of Each Filter Module	19.25" x 19.25" x 1.75" Thick
Number of Filter Modules per Cooler Unit	32
Efficiency	65%
Type	Stainless Steel Mesh, Framed

**CONTAINMENT AIR COOLERS PERFORMANCE DATA FOR NORMAL OPERATION**

VHX-1, VHX-2, and VHX-3 Coolers in Operation

Total Heat Removal Capacity	5.94 x 10 <sup>6</sup> Btu/h
Total Airflow	180,000 ft <sup>3</sup> /min
Total Motor hp (6 Fans)	315 bhp (nameplate)
Total Cooling Water Flow (Modulated)	1500-6000 gpm
Air Temperature, Inlet/Outlet	115°F/83.5°F
Water Temperature, Inlet	81.5°F
Each Cooler, Capacity	1.98 x 10 <sup>6</sup> Btu/h
Airflow, Each Cooler	60,000 ft <sup>3</sup> /min (2 Fan Operation)
Cooling Water Flow, Each	500 gpm to 2000 gpm

**NOTE:** The values above are for three coolers at assumed conditions only. Initial conditions for accident analyses are contained in Chapter 14.

VHX-4 Cooler in Operation

Total Heat Removal Capacity	1.98 x 10 <sup>6</sup> Btu/h	
Total Airflow	60,000 ft <sup>3</sup> /min	
Total Motor hp (2 Fans)	105 bhp (Nameplate)	
Total Cooling Water Flow	up to 2000 gpm (Nominal)	
Air Temperature, Inlet/Outlet	115°F/84°F (Design)	
Water Temperature, Inlet	81.5°F (Design)	

**NOTE:** Although VHX-4's temperature control valve is failed closed, the cooler can be used for cooling during normal operation by opening its high-capacity outlet valve.

**CONTAINMENT AIR COOLERS PERFORMANCE DATA FOR POST-DBA CONDITIONS**

3 Coolers Operating

Total Heat Removal Capacity at 283°F, 55 psig	261.6 x 10 <sup>6</sup> Btu/h
Total Airflow (Cooler Design)	90,000 ft <sup>3</sup> /min
Total Fan hp (3 Fans)	225 bhp (Nameplate)
Total Cooling Water Flow (3 Coolers)	Set per RO-216
Air Temperature, Inlet/Outlet	283°F/276°F
Req. Water Temperature, Inlet/Outlet	Based on Flow from RO-216

Each Cooler (VHX 1, 2, 3)

Capacity at 283°F, 55 psig	87.2 x 10 <sup>6</sup> Btu/hr
Airflow (Cooler Design)	30,000 ft <sup>3</sup> /min
Coil Differential Pressure Drop (Air Side)	1.45" H <sub>2</sub> O
Fan Differential Pressure	6.15" H <sub>2</sub> O TP
Water Flow	Set per RO-216
Water Side Differential Pressure Drop	5.5 psi
Total Fan hp (1 Fan)	75 bhp (Nameplate)

**ECCS COMPONENT SYSTEMS**

Piping - Stainless Steel-304  
 Valves - Stainless Steel or other equivalent corrosion resistant material  
 Gaskets - Asbestos or Grafoil Grade GT<sup>TMB</sup> (eg, Flexitallic or Flexicarb) with 300 Series SS

<u>Component</u>	<u>LP Pump</u>	<u>HP Pump</u>	<u>Spray Pump</u>
Casing	ASTM A351 SS, Mod CF8A	ASTM A351 SS, Mod CF8	SS, CF8M
Impeller	ASTM A217 SS, CF8	ASME SA 351, Grade CA15 SS	SS, CF8M
Casing Wear Ring	ASTM A479, Gr S21800	17-4 PH	SS, CF8M
Shaft	A479, 316 SS	AISI 416	316 SS
Shaft Sleeve	ASTM A479, 316 SS	-	316 SS
Gland Seal	-	-	316 SS
Pumping Ring	P-67A - Internal to Seal Cartridge P-67B - 18-8 SS on Shaft Sleeve	-	18-8 SS
Seal Cartridge	316 SS	316 SS	316 SS
Face Seal Rotating Element	Carbon	316 SS with Tungsten Carbide	Carbon
Face Seal Stationary Element	P-67A - Silicon Carbide P-67B - Tungsten Carbide	Carbon	Tungsten Carbide
Throttle Bushing	P-67A - Bronze P-67B - Carbon	-	Carbon
Backup Ring	-	Viton	-
Valves and Piping	304 SS	304 SS	304 SS
Gaskets	Asbestos or Grafoil Grade GT <sup>TMB</sup> (eg, Flexitallic Flexicarb) with 300 Series SS	Asbestos or Grafoil Grade GT <sup>TMB</sup> (eg, Flexitallic Flexicarb) with 300 Series SS	Flexitallic with 300 Series SS

---

**ECCS COMPONENT SYSTEMS****SHUTDOWN HEAT EXCHANGERS**

<u>Component</u>	<u>Material</u>
Head Gasket	304 SS Jacket Asbestos
Tubes	ASME SA 249, Grade TP-304
Tube Sheet Cladding	304 SS
Channel Cover	304 SS
Channel Partition	ASME SA 240, Type 304 SS

Deleted



**ISI MAJOR COMPONENTS AND/OR SYSTEMS LIST**

ASME CLASS 1

Components

Reactor Pressure Vessel, N-50

Reactor Pressure Vessel Closure Head, N-50

Steam Generators - Primary Side, E-50A and E-50B

Pressurizer, T-72

Regenerative Heat Exchangers, E-56A and E-56B

Piping

Primary Coolant System

Engineering Safeguards System

Chemical and Volume Control System

Pumps

Primary Coolant Pumps, P-50A, B, C, D

Valves

ASME CLASS 2

Components

Safety Injection and Refueling Water Tank, T-58 |

Safety Injection Tanks, T-82A, B, C, D

Steam Generators - Secondary Side, E-50A, B |

Regenerative Heat Exchangers, E-56A, B

Shutdown Cooling Heat Exchangers, E-60A, B

**ISI MAJOR COMPONENTS AND/OR SYSTEMS LIST**Piping

Main Steam System

Feedwater System

Engineered Safeguards System

Chemical and Volume Control System

Component Cooling System

Pumps

Containment Spray Pumps, P-54A, B, C

High-Pressure Safety Injection Pumps, P-66A, B

Low-Pressure Safety Injection Pumps, P-67A, B

SIRW Recirculation Pump, P-74

ASME CLASS 3Components

Letdown Heat Exchanger, E-58

Condensate Storage Tank, T-2

Component Cooling Surge Tank, T-3

Spent Fuel Pool Heat Exchangers, E-53A, B

Component Cooling Heat Exchangers, E-54A, B

Shutdown Cooling Heat Exchangers, E-60A, B

Engineered Safeguards Room Coolers, VHX-27A, B

Control Room Air Conditioning Units, VC-10, VC-11

Containment Air Coolers, VHX-1, 2, 3, 4

Condensate Storage Tank Heat Exchanger, E-27

---

**ISI MAJOR COMPONENTS AND/OR SYSTEMS LIST****Piping**

Main Steam System

Feedwater System

Chemical and Volume Control System

Service Water System

Component Cooling System

Spent Fuel Pool System

Condensate System

Diesel Jacket Water Cooling System

**Pumps**

Service Water Pumps, P-7A, B, C

Auxiliary Feedwater Pumps, P-8A, B, C

Fuel Pool Cooling Pumps, P-51A, B

Component Cooling Pumps, P-52A, B, C

Diesel Generator Cooling Pumps P-211A, B

**INSERVICE PUMP TEST PROGRAM SUMMARY**

<b><u>PUMP</u></b>	<b><u>ASME SAFETY CLASS</u></b>	<b><u>P&amp;ID</u></b>	<b><u>TEST PROCEDURES</u></b>
P-7A, B, and C - Service Water	3	M-213	QO-14/RO-144
P-8A - AFW (Constant Speed)	3	M-207	QO-21/RO-145
P-8B - AFW (Variable Speed)	3	M-205	QO-21/RO-145
P-8C - AFW (Constant Speed)	3	M-205	QO-21/RO-145
P-52A, B, and C - Component Cooling	3	M-209	QO-15/RO-146
P-54A, B, and C - Containment Spray	2	M-204	QO-16/RO-98
P-67A and B - LPSI & Shutdown Cooling	2	M-204	QO-20/RO-98
P-66A and B - HPSI	2	M-204	QO-19/RO-147

**NOTE:** See Site Engineering Program SEP-PLP-IST-102, "Inservice Testing of Selected Safety-Related Pumps," for more detail on the pump test program.

**TECHNICAL SPECIFICATION 3.6.3,**  
**“CONTAINMENT ISOLATION VALVES,” APPLICABILITY**

Penetration Number	Equipment ID	Penetration Number	Equipment ID
MZ-1A	CV-1805 CV-1806 MV-VA506	MZ-18	MZ-18 MZ-18A
MZ-1B	MV-VA100 MV-VA101 MV-VA507	MZ-21	SV-2415A SV-2415B MV-WG531B
MZ-1C	CV-1807 CV-1808 MV-VA508	MZ-21A	SV-2413A SV-2413B MV-WG531A
MZ-10	MV-CA122 MV-CA142 MV-CA728	MZ-25	CV-1064 CV-1065 MV-CRW512
MZ-11	CV-0939 CK-CD401 MV-CD536	MZ-26	CV-1358 CK-N2/400 MV-N2/581
MZ-14	CK-CC910 CV-0910 MV-CC507	MZ-27	MO-P1 MV-VA604 MZ-27-1
MZ-15	CV-0911 CV-0940 MV-CC508	MZ-33	MV-ES3234 MV-ES3234A MV-ES3348A
MZ-17	MV-VA1802B MV-VA1802C MV-VA1804B MV-VA1804C MV-VA1812A MV-VA1812C MV-VA1814A MV-VA1814B	MZ-36	CV-2009
MZ-17A	MV-VA1814F MV-VA1814G	MZ-37	CV-1001 CK-CRW403 MV-CRW503
		MZ-40	CV-1910 CV-1911 MV-PC1170A

SEP-APJ-PLP-101, “Mechanical Containment Penetrations Basis Program Section,” identifies bases for all penetrations. See FSAR Figure 6-5 (P&ID M-232), “Containment Penetrations”, for piping diagrams.

**TECHNICAL SPECIFICATION 3.6.3,**  
**“CONTAINMENT ISOLATION VALVES,” APPLICABILITY**

Penetration Number	Equipment ID	Penetration Number	Equipment ID
MZ-40A	SV-2414A SV-2414B MV-WG530B	MZ-49	CV-1036 CV-1038 MV-CRW513
MZ-40B	SV-2412A SV-2412B MV-WG530A	MZ-52	CV-1103 CV-1104 MV-DRW500
MZ-41	CV-1004 CK-CRW407 MV-CRW506	MZ-52A	MV-DRW618C MV-DRW618D MV-DRW618E MV-DRW618F MV-DRW618G MV-DRW618H
MZ-42	CV-0155 CK-PC155B MV-PC1126	MZ-52B	MV-DRW619C MV-DRW619D MV-DRW619E MV-DRW619F MV-DRW619G MV-DRW619H
MZ-44	CV-2083 CV-2099 MV-CVC2083	MZ-56	MV-VA606B MV-VA606C
MZ-46	CV-1101 CV-1102 MV-WG511	MZ-64	MV-SFP120 MV-SFP121 MV-SFP514
MZ-47	CV-1002 CV-1007 MV-CRW502	MZ-65	CK-CA400 MV-CA612
MZ-48	MV-VA1801B MV-VA1801C MV-VA1803B MV-VA1803C MV-VA1805A MV-VA1805C MV-VA1815A MV-VA1815B	MZ-66	MV-VA-L-6 MV-VA601 MV-VA602 MV-VA603

SEP-APJ-PLP-101, “Mechanical Containment Penetrations Basis Program Section,” identifies bases for all penetrations. See FSAR Figure 6-5 (P&ID M-232), “Containment Penetrations”, for piping diagrams.

**TECHNICAL SPECIFICATION 3.6.3,**  
**“CONTAINMENT ISOLATION VALVES,” APPLICABILITY**

Penetration Number	Equipment ID
MZ-67	CV-1037 CK-CRW408 MV-CRW515
MZ-68	CV-1813 CV-1814 MV-VA505
MZ-69	CV-1044 CV-1045 MV-CRW518
MZ-72	MV-SFP117 MV-SFP118 MV-SFP515

SEP-APJ-PLP-101, “Mechanical Containment Penetrations Basis Program Section,” identifies bases for all penetrations. See FSAR Figure 6-5 (P&ID M-232), “Containment Penetrations”, for piping diagrams.