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Reference
Use

CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

PLANT OPERATING MANUAL

VOLUME 6

PART 2

PROCEDURE TYPE: System Description (SD)

NUMBER: SD-139

TITLE: Service Water System

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1.0 SYSTEM PURPOSE

The Service Water System is made up of two separate systems, the Emergency Service Water System (ESWS) and the Normal Service Water System (NSWS). The ESWS circulates water from the ultimate heat sink (UHS) through plant components required for safe shutdown of the reactor following an accident, and returns the water to the UHS. The ESWS performs its cooling function following a loss-of-coolant accident (LOCA) or loss of off-site power, automatically and without operator action. Redundancy built into the system provides protection for a single active or single passive failure.

The ESWS also provides an emergency source of water for the Auxiliary Feedwater System (AFWS), Essential Services Chilled Water System (ESCWS), and the Fire Protection System (FPS).

The Normal Service Water System circulates water from the Cooling Tower (CT) and Cooling Tower Makeup System through plant auxiliary components and back to the Cooling Tower. The NSWS serves no safety function, but does provide cooling water to the ESW headers during normal operation. NSW temperature is influenced by lake water temperature due to continuous Cooling Tower Makeup. The winter average temperature is in the sixties and the summer is in the nineties.

2.0 SYSTEM FUNCTION

2.1 Emergency Service Water (ESW) System

The Emergency Service Water System consists of two intake structures (one on the auxiliary reservoir and one on the main reservoir); two emergency service water pumps, valves, and strainers; two emergency service water booster pumps; two 30-inch diameter safety-related supply headers (A&B) with all associated branches and heat exchangers; two safety-related return headers; and the discharge structure for the return of water to the auxiliary reservoir. These components are arranged into two completely independent redundant trains (A&B) each capable of supplying sufficient cooling water for plant safety. Figures 7.1 and 7.2 provide simplified flow diagrams of the Emergency Service Water System and Figure 7.4 shows the general location of ESW yard piping.

2.1.1 ESW Main Flow Path

The water source to the Emergency Service Water (ESW) System originates from the auxiliary reservoir (preferred source) or the main reservoir (backup source). The preferred supply flows from the auxiliary reservoir through the ESW intake canal to the ESW intake screening structure. As the water enters the structure, the flow is divided by the structure into separate bays. In each bay, the water flows through a trash rack and a traveling screen (Reference SD-140) to remove debris greater than 7/16 inch, and through a normally-open, manually-operated butterfly valve. The water exits the bay through a 30-inch diameter coated (inside is epoxy paint, outside is coal tar) steel pipe and gravity flows to the respective ESW pump bay in the ESW and Cooling Tower Make-Up (CTMU) Intake Structure. The ESW backup source of water flows from the main reservoir via the ESW and CTMU intake canal to the ESW and CTMU Intake Structure where the flow is divided by the structure into bays. Within each intake bay, the water flows through a trash rack and a finer traveling screen as in the ESW intake screening structure. The main reservoir

2.1.1 ESW Main Flow Path (continued)

water is stopped from flowing into the ESW pump suction bay by a normally-shut, manually-operated rectangular butterfly valve. The ESW pumps discharge through a check valve and a self-cleaning strainer that removes debris larger than 1/16 inch. During normal plant operation, the Normal Service Water System supplies cooling water to heat loads on the Emergency Service Water Header. The ESW pump discharge check valve prevents NSW System backflow through the pump to the auxiliary reservoir. From the strainer, the water exits the ESW and CTMU Intake Structure through underground 30-inch diameter coated steel pipes (one pipe per safety train). The two supply headers enter the tank building and drop down into the elevation 216′ pipe tunnel that runs the entire length of the reactor auxiliary building. Branch lines from supply header A provide cooling water to all safety train A components. Similarly, branch lines from supply header B provide cooling water to all safety train B components. When the ESW System is required [safety injection signal occurred, loss of off-site power, or cooling water inlet (auxiliary reservoir) temperature <35°], both headers are supplied with water. Containment cooling and auxiliary reservoir makeup requirements to avoid Tech Spec LCOs may result in running both ESW pumps/trains during the summer months.

The heated water returns by branch lines to the train A or B return header (30-inch diameter) located in the elevation 216′ pipe tunnel. The headers exit the plant area via motor-operated butterfly valves (1SW-270 and 1SW-271) and are routed underground to the ESW discharge structure. In addition to supplying cooling water, the ESW System provides a source of water to the Screen Wash System (SD-140) and is a backup source of water to the Essential Chilled Water System, Auxiliary Feedwater System, and to the Fire Protection System. Supply water to the Auxiliary Feedwater System can be controlled from the Main Control Room.

Four 4″ drain valves (gate) are provided on the ESW system for rapid draining of the supply and return headers. These are 1SW-1495, 1SW-1496, 1SW-1497, and 1SW-1498.

The ESW System alternate suction path from the main reservoir is the result of NRC Regulatory Guide 1.27 requirements. Two 8' x 10', manually-operated butterfly valves are located in the seismic Category 1 wall separating the main reservoir intake from the Emergency Service Water pump chamber. In order to shift suction, the 30-inch, manually-operated butterfly valves (1SW-1 and 1SW-2) in the suction lines from the Auxiliary Reservoir and the 8' x 10' valves (1SW-3 and 1SW-4) from the Main Reservoir are repositioned. With both suction valves in an ESW train open (1SW-1, 1SW-3 for "A" Train; 1SW-2, 1SW-4 for "B" Train), water will flow from the Auxiliary Reservoir to the Main Reservoir due to the difference in the reservoir levels.

2.1.2 ESW Interconnections

The ESW System's supply headers cannot be cross-connected. For example, ESW Pump 1A-SA cannot supply water to the B train supply header and vice versa. Some components can be aligned to either header since, during normal operation, only one emergency service header may be in service and is supplied by the Normal Service Water System. Service water supply to the turbine-driven auxiliary feedwater pump is normally isolated, but may be aligned to either header in the event of an emergency. The charging pump oil coolers have their supply and return isolation valves aligned such that each pump is supplied by only one service water train, A or B, depending on the respective pump's electrical lineup. Valve alignment for the C charging pump depends on its electrical lineup.

2.1.3 ESW Branch Flow Paths

2.1.3.1 CVCS Chiller

The branch to the CVCS chiller contains air-operated valves that shut automatically on a Safety Injection (SI) signal. Thus, during an emergency this flow path would be isolated. During normal operation, the CVCS chiller is aligned to only one train at a time.

2.1.3.2 Auxiliary Feed Pump

The turbine-driven auxiliary feed pump branch contains normally-shut, motor-operated valves. In the event Emergency Service Water is needed for auxiliary feedwater, the control room operator would select which ESW header to use, open the appropriate supply valves, and have an auxiliary operator shut the associated loop seal line isolation valve. The valves from both headers would not be opened at the same time since a piping failure on one service water train could affect the flow in the other train.

2.1.3.3 Charging Pump Oil Coolers

The charging pump oil cooler branches contain only manual isolation valves. These lines are sized (1½ inch diameter) such that a failure of these lines would not materially affect the service water flows to other components.

2.1.3.4 Component Cooling Water Heat Exchangers, Diesel Generator Coolers, RAB HVAC Chiller

The branch flow path from the A supply header to the component cooling heat exchanger, diesel generator jacket water coolers, and auxiliary building HVAC chiller condensers is independent of the B service water header. There are manual butterfly isolation valves with this equipment.

2.1.3.5 Containment Fan Cooler Units

The branch flow path to the containment fan cooler units contains the service water booster pump, which starts on an emergency (SI) signal. During normal operation, service water flow bypasses the idle booster pump, enters containment through the motor-operated butterfly isolation valves, flows through the fan cooler coils and back to the ESW return header through the containment isolation valves and a flow control orifice. This flow control orifice has an air-operated, normally-open bypass valve in parallel such that if the booster pump is off, the flow restriction is minimal. However, when the booster pump starts, this valve shuts, forcing all the fan cooler return flow through the orifice. The purpose of the booster pump and orifice is to ensure that, during a design basis Loss of Coolant Accident, the service water pressure inside containment is higher than containment pressure. This ensures any leakage will be from service water into containment and will prevent the release of containment radioactivity via the ESW System.

2.1.3.6 Post Accident Sampling System (PASS)

Branch flow from the A and B supply headers is supplied to the PASS. Manual isolation valves are provided for the supply and return lines. Only one train of supply and return valves (A or B train) may be open at any time to prevent cross-connection of safety trains following an accident.

2.1.3.7 Plant Air Compressors

Emergency Service Water can be aligned to supply cooling water to all three plant air compressor aftercoolers. Either train can be aligned to supply the air compressor aftercoolers with cooling water. When in Modes 1 through 4, the ESW header supplying the air compressor aftercoolers is declared inoperable. At no time should both trains be aligned to the air compressor aftercoolers as this would cross connect the ESW headers.

2.2 Normal Service Water (NSW) System

The Normal Service Water System supplies cooling water from the cooling tower basin and Cooling Tower Makeup System to various plant components and systems. The Normal Service Water System consists of the intake structure, the distribution header, two 100 percent capacity pumps, self-cleaning strainers, motor-operated valves, and the supply and return headers to/from the Waste Processing Building, Turbine Building, Reactor Auxiliary Building, and the Containment Building. Figure 7.3 provides a flow diagram of the NSW system and identifies the components supplied by NSW.

2.2.1 NSW Main Flow Path

Water from the cooling tower basin is supplied to the NSW intake chamber by a 6-foot diameter underground concrete conduit. The NSW intake chamber is located north of the cooling tower. Additional water is supplied to this conduit from a 3-foot diameter Cooling Tower Makeup Line. One of the two 100 percent capacity NSW pumps (design flow 50,000 gpm) takes suction on the water in the chamber and pumps it through a motor-operated discharge valve and into a 48-inch diameter steel pipe which contains a self-cleaning strainer. This strainer is designed to filter debris down to 1/16-inch diameter and contains isolation and bypass valves to allow maintenance without interruption of NSW flow.

From the strainer, the NSW flows through approximately 1200 feet of 4-foot diameter steel pipe to the power block area of the plant where branch headers go to the Turbine Building, Waste Processing Building, and the Reactor Auxiliary Building. The NSW supply header in the Reactor Auxiliary Building divides to supply the containment non-safety ventilation fan coil units and to ESW safety train A and/or B supply header via a motor-operated isolation valve to provide cooling water to the safety-related components in the Containment Building (i.e., containment fan coolers) and in the Reactor Auxiliary Building. The NSW System supply to ESW Safety train A and/or B is selectable from the main control board in the control room.

During normal operation, the NSW return flows from the branch headers (including the ESW header), with the exception of the Waste Processing Building, are discharged into the circulating water return lines in the Turbine Building north of the main condenser. The return flow from the Waste Processing Building joins the circulating water lines in the yard between the Turbine Building and the Cooling Tower.

Upon the start of an ESW Pump, the NSW supply to the ESW header (that will be supplied by the running ESW Pump) is automatically isolated. In addition, the return flow from the ESW header is automatically realigned to discharge to the Auxiliary Reservoir instead of the Cooling Tower.

The general location of NSW System piping between the plant buildings and the cooling tower is shown in Figure 7.4.

2.2.2 NSW Branch Flow Paths

The NSW supply header splits into four major headers, the ESW supply header A or B, the Turbine Building supply header, the Waste Processing supply header, and the Containment Fan Coil units supply.

The branch flows from the ESW headers are as described in Section 2.1.3.

2.2.2.1 Turbine Building

The Turbine Building service water header is a 24-inch branch off the main 48-inch normal service water supply line. The branch flow paths to the larger Turbine Building heat exchangers contain air-operated temperature control valves that throttle the service water to maintain the shell side fluid at the proper temperature. These loads are as follows:

1. Turbine Lube Oil Coolers
2. Turbine Generator Hydrogen Coolers
3. Hydrogen Seal Oil Unit
4. Air Compressor Aftercoolers (No air-operated TCV)
5. Generator Exciter Cooler
6. Turbine DEH Unit Coolers

There are also a number of small heat exchangers in the Turbine Building which have manual throttle/isolation valves to control the service water flow. These loads are as follows:

1. Condensate Pump Motor Oil Coolers
2. Condensate Booster Pump and Hydraulic Coupling Oil Coolers
3. Heater Drain Pump Motor Oil Coolers
4. Main Feed Pump Oil Coolers
5. Main Generator Bus Duct Cooling Unit
6. Condenser Vacuum Pump Heat Exchangers

The Turbine Building service water header also supplies makeup water to the condensate polisher area evaporative air cooler.

2.2.2.2 Waste Processing Building

The Waste Processing Building service water header is a 24-inch branch off of the main NSW supply line. The major flow demand on this header is the Waste Processing Building closed Cooling Water heat exchanger. There is no automatic temperature control of the shell side fluid of this heat exchanger. Manual butterfly valves are provided for service water throttling/isolation.

The Waste Processing Building HVAC chiller condenser is also supplied with service water cooling from this header. The service water components and controls for this equipment are described in the Waste Processing Chilled Water System Description (SD-146). The Waste Processing Building service water header also supplies makeup water to the Waste Processing Building evaporative air coolers.

2.2.2.3 Containment Fan Coil Units

The branch flows to the Containment Fan coil units contain Containment isolation valves in both the supply and return lines. These valves are remote, air-operated, butterfly valves that automatically shut on a Phase A containment isolation signal.

2.2.3 NSW Interconnections

The NSW System provides a backup source of water to the ESW headers, as described in Section 2.1.1.

3.0 COMPONENTS

3.1 Emergency Service Water System

3.1.1 Emergency Service Water Pumps

The 1A-SA and 1B-SB Emergency Service Water Pumps are Ingersol-Dresser Model 35LKX-2. They are vertical-turbine, mixed-flow pumps with a closed-impeller arrangement involving two stages with single suction. Designed capacity is 20,000 gpm at 225 ft head; runout is 25,000 gpm at 140 ft; minimum recirculation is 7500 gpm at 300 ft; shut off head is equal to 360 ft. These pumps are nuclear safety class 3 and the motors are class IE. The motors are General Electric 6.9 KV, 1300 horsepower, 885 RPM induction type. Pumps 1A-SA and 1B-SB are powered from 6.9 KV Emergency Bus 1A-SA CUB 9 and 1B-SB CUB 1, respectively. The two pumps are located in the Emerency Service Water and Cooling Tower Makeup Intake Structure.

An unusual feature of these pumps is their setting length. The large difference in reservoir elevation [252' mean sea level (MSL) for the auxiliary reservoir and 220' MSL for the main reservoir] results in a total length from the suction bell to mounting flange of over 70 feet. Minimum submergence of 6 ft over the suction bell is required. The pump bearings are water-lubricated by the pumped fluid. A portion of the ESW screen wash flow is diverted through a cyclone separator to remove particles 100 microns and larger, and then supplied to the pump bearing and seal water system. Refer to OST 1214 & 1215 and calculation SW-0051, Attachment 5, for pump performance data.

3.1.2 Emergency Service Water Self-Cleaning Strainers

The two automatic self-cleaning strainers are nuclear safety class 3 and are manufactured by R. P. Adams Company. They are designed to continuously remove particles 1/16 inch in diameter or larger at a flow rate of 21,500 gpm at 150 psig at 140°F with a 5 psi differential. They are located inside the Emergency Service Water and Cooling Tower Makeup Intake Structure. Each unit is equipped with a controlled automatic strainer backwashing system capable of providing continuous or intermittent backwash of 650 gpm at 20 psid without interruption of the main flow stream. The 1A-SA and 1B-SB strainers are powered from 480V MCC-1A325A COMPT.1E and 480V MCC-1B32SB COMPT.1E, respectively.

3.1.3 Service Water Booster Pumps

The Service Water Booster Pumps are Goulds Model 3405 12X14-12, single-stage, horizontal split case, double-suction, centrifugal pumps with a closed impeller. Their design capacity is 4,250 gpm at 120 ft. head; minimum recirculation is 750 gpm at 150 ft. head; runout is 6500 gpm at 74 ft. head with a shutoff head of 170 ft; and design pressure is 225 psig. The pump is nuclear safety class 3. Their motors, made by Siemens-Allis, are each rated at 480 VAC, 200 horsepower, 1770 RPM, and are safety class IE. They are located on the 236' elevation of the Reactor Auxiliary Building in the vicinity of the component cooling heat exchangers. No special lubrication or cooling systems are required for the pump or motor bearings. The booster pumps 1A-SA and 1B-SB are powered from 480V Emergency Busses 1A2-SA and 1B2-SB, respectively. Refer to OST-1214 & 1215 and calculation SW-0051, Attachment 5, for pump performance data.

3.1.4 ESW System Valves

The majority of 4-inch and larger valves installed in ESW piping are carbon steel, lug-body butterfly valves, manufactured by Jamesbury Valve Company. However, several of the most critical valves have been replaced with stainless steel wafer type valves manufactured by Anchor/Darling. Some of the check valves have been replaced with stainless steel valves manufactured by Atwood & Morrill. For 2-inch and smaller diameter ESW piping, the majority of the valves are manufactured by Yarway or Rockwell International; these valves are predominantly globe valves.

3.2 Normal Service Water System

3.2.1 Normal Service Water Pumps

The Normal Service Water Pumps are Peerless Model 48HH and are not nuclear safety related. They are two-stage, vertical-turbine, mixed-flow pumps with closed impellers. The design capacity is 50,000 gpm at 203 ft. head; runout capacity is 72,000 gpm at 72 ft. head; the minimum continuous flowrate is 17,500 gpm (reference 8.4.1); and the minimum submergence is 8'3". The motors are induction motors made by Siemens-Allis and are rated at 6.6 KV, 3,000 horsepower, and 712 RPM. Two 100 percent capacity pumps are located on the Normal Service Water Intake Structure next to the Cooling Tower.

3.2.2 Normal Service Water Self-Cleaning Strainer

The NSW self-cleaning strainer is a Zurn Industries Model 596. Its design flow rate is 50,000 gpm at 150 psig at a temperature of 140°F. The maximum expected pressure differential across the 1/16-inch screen (clean)is 2.5 psid. The strainer is located outdoors on the NSW intake structure. The strainer is equipped with a controlled automatic strainer backwashing system capable of providing backwash of 1630 gpm without interrupting the main flow stream. The strainer is backwashed on a timed cycle. The strainer will also be automatically backwashed between the timed backwashes if a high differential pressure across the strainer is experienced. The backwash motor, made by General Electric, is rated at 480VAC, 2 horsepower, 1725 RPM, and has a final backwash shaft speed of 3.83 RPM.

Corrosion protection for the strainer internals is provided by sacrificial anodes. These anodes have been known to break loose and cause a clanking noise in the vicinity of the strainer.

4.0 OPERATIONS

4.1 Normal Operation

4.1.1 Normal Service Water System

During normal plant operations the Normal Service Water System has one pump supplying the Normal Service Water System and the Emergency Service Water System. This pump supplies the Turbine Building, Waste Processing Building, Containment Fan Coil units, and Emergency Service Water System headers.

4.1.2 Emergency Service Water System

During normal plant operations the Emergency Service Water System is in a standby mode except as described in Section 2.1.1. The pumps are not running, but the system headers and loads are lined up to be supplied by the NSWS. Typically, both ESW headers are in service to minimize stagnant conditions and provide chemical treatment for biological control. The supply and return valves for the header(s) in service are open. If one ESW header is placed in standby, the supply valve for the idle header is open and the return valve is shut in order to keep the idle header pressurized.

4.2 Start-Up and Cooldown

4.2.1 Normal Service Water System

Most start-ups and cooldowns can be accomplished with the Normal Service Water System supplying both Normal Service Water System and Emergency Service Water System loads. However, if a rapid cooldown is desired (primary system), the second Normal Service Water System Pump and the second safety-related service water header must be placed in service. This is because two component cooling water heat exchangers are needed and because flows through the other normal service water loads are assumed to be close to the respective design flows.

Dry start-up of the NSW system requires special valve line-ups to avoid water-hammer damage. Current operating procedures require the isolation of the WPB supply header, turbine generator exciter coolers, and turbine generator hydrogen coolers. An automatic priming mode also helps prevent water-hammer. This is initiated by taking the pump start switch to START and quickly releasing. In this mode, the NSW pump discharge valve opens 10 percent for seven minutes. After seven minutes the valve fully opens.

If one pump is already running at normal flow and pressure and the second pump is to be started, the automatic priming mode may be bypassed by holding the pump start switch in the START position. In this mode the discharge valve can be taken full open, bypassing the seven-minute hold point.

Each NSW pump has "anti-pump" protection in the starting logic. Once the control switch is taken to START (either in priming or in priming-bypass mode), the sequence to close the pump breaker begins and cannot be restarted for at least 15 seconds. Any attempt to restart the pump within the 15-second period is blocked. This logic is intended to prevent multiple, rapid closures of the pump breaker, such as might occur with a breaker fault.

4.2.2 Emergency Service Water System

During start-ups and cooldowns the Emergency Service Water System remains in a standby condition with Normal Service Water supplying the loads of the Emergency Service Water headers. If a rapid cooldown of the primary systems is desired, both A and B headers are placed in service to supply the two component cooling water heat exchangers.

4.3 Abnormal Operations

4.3.1 Normal Service Water System

Whenever service water temperature exceeds 90°F, all four containment fan coolers are placed in service. The second Normal Service Water Pump may be needed if the other loads are drawing close to design flows. The second Emergency Service Water Header must be placed in service due to the containment fan coolers. Loss of normal service water will result in plant shutdown due to loss of cooling to essential secondary components.

4.3.2 Emergency Service Water System

This safety-related system is required to be operable to support cooling requirements following an accident (LOCA, loss of off-site power). If this should happen the Emergency Service Water System will isolate from the Normal Service Water System, the pumps start automatically, and valves cycle to their safeguards positions.

The Technical Specification Minimum Main Reservoir level is 215 feet. This limit is to insure that all components are capable of their design basis heat removal capacities.

If the Emergency Service Water intake water temperature falls below 35°F, the Emergency Service Water pumps should be started to minimize the potential for icing the Emergency Service Water intake.

The Emergency Service Water pumps and booster pumps are operated on a periodic basis to ensure proper flows in accordance with the Technical Specifications surveillance requirements.

It should be noted that nearly all of the ESW heat loads do not contain automatic throttling valves for temperature control of the shell side fluid. This situation makes it necessary to conduct a flow balance to determine the position of the manual heat exchanger outlet valves, such that proper service water flows are maintained in the system.

4.4 Technical Specifications

At least two independent Emergency Service Water loops shall be OPERABLE.

5.0 INTERFACE SYSTEMS

5.1 Systems Required for Support

5.1.1 Emergency Service Water System

The following systems are required for support of the Emergency Service Water System:

1. Instrument Air for valve operation

2. Emergency Service Water Screen Wash System and Emergency Service Water Traveling Screens

3. Reservoirs, Intake Canals and Structures, Discharge Canals and Structures

4. Various electrical systems

5.1.2 Normal Service Water System

The following systems are required for support of the Normal Service Water System:

1. Instrument Air for valve operation
2. Potable Water for pump bearing and seal flushing
3. Circulating Water for return of the service water to the cooling towers
4. Cooling Tower and Cooling Tower Makeup System
5. Various electrical circuits and panels

5.2 System-to-System Crossties

The ESW System is cross-connected with the NSW System, the Auxiliary Feedwater System, and the Fire Protection System.

6.0 TABLES

6.1 Typical Service Water Loads by Building

Table 6.1

Typical Service Water Loads by Building

Normal Service Water

WASTE PROCESSING BUILDING HEADER	LOAD (gpm)
Waste Processing Bldg. Component Cooling Water Heat Exchangers	10,000
Waste Processing Bldg. Chiller Condenser	5,200
Waste Processing Bldg. Evaporative Air Cooler	
CONTAINMENT / RAB	
Containment Air Handling Units (AH 37, 38, 39)	2,400
Makeup to RAB Evaporator Air Coolers (Auto Isolation on SIAS)	10
TURBINE BUILDING HEADER	
Turbine Building Header	11,032
Turbine Lube Oil Cooler	3,500
Generator Hydrogen Cooler	4,500
Hydrogen Seal Oil Coolers	360
Condensate Booster Pump Hydraulic Coupling and Motor Coolers	600
Condensate Vacuum Pump Coolers	354
Main Generator Leads Cooler (Isolated Bus Duct Coolers)	230
Main Feed Pump Oil Coolers	30
Condensate Pump Motor Coolers	34
Turbine Bldg. Evaporator Air Coolers	20
Turbine Electrohydraulic Control System Coolers	20
Air Compressor Aftercoolers	45***
Heater Drain Pump Motors	27
Generator Exciter Coolers	300
Radiation Monitor Coolers	60

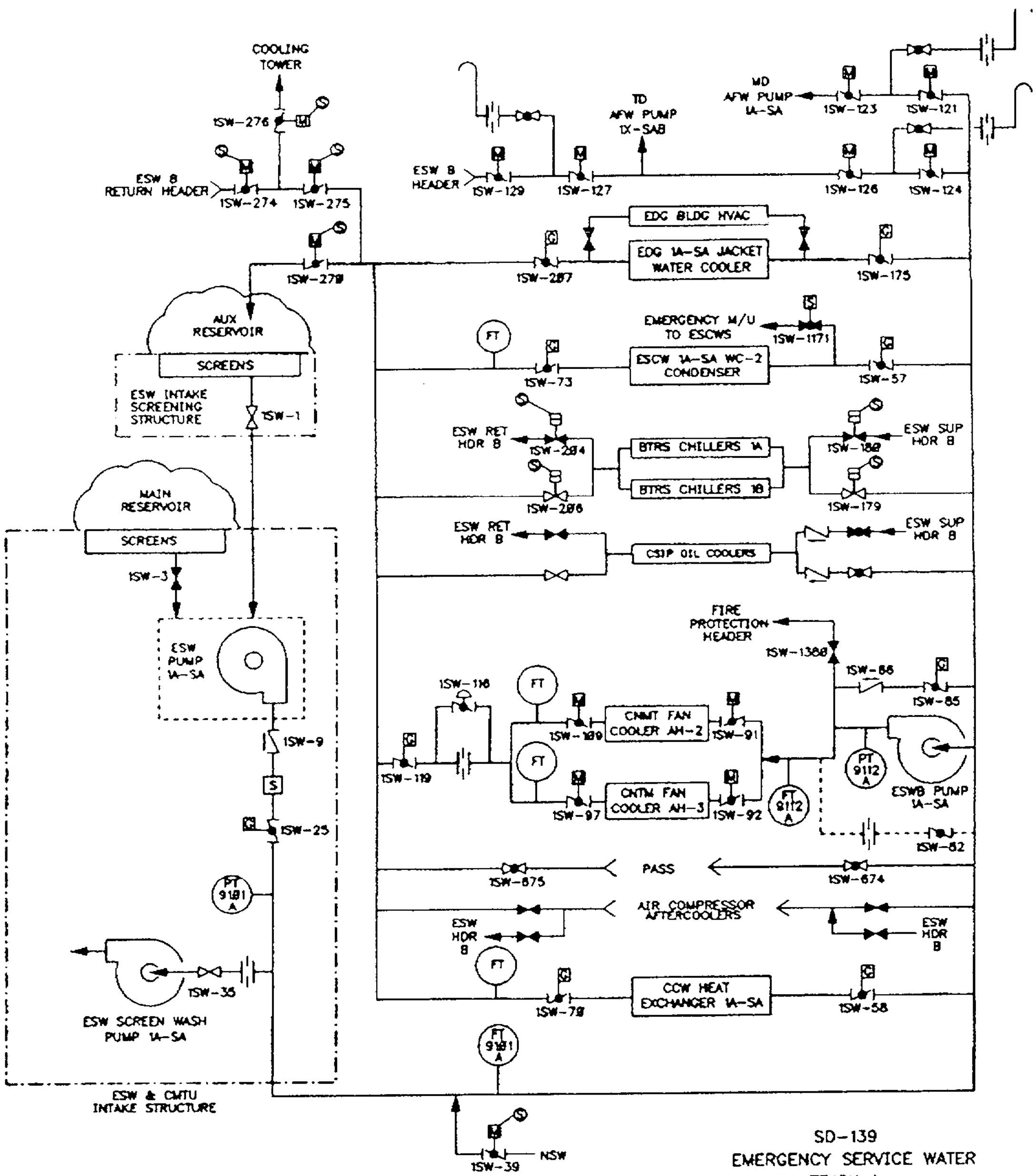
Emergency Service Water*	LOAD PER TRAIN (gpm)
Boron Thermal Regeneration System Chillers NNS	414
Air Compressor Aftercoolers (Normally from NSWS Emergency can be ESWS)	45***
ESCWS Chiller Condenser	2,500
Containment Air Coolers Air Handling Units	3,000
Component Cooling Water System Heat Exchanger	11,000
Diesel Generator Jacket Water Cooler	1,000
Charging and Safety Injection Pumps Oil Cooler	60
Emergency Makeup to Motor-Driven AFW Pump	900
Emergency Makeup to Turbine-Driven AFW Pump	900
Emergency Service Unit Intake Screen Wash Pump	270
ESWS Strainer Backwash	650
PASS Cooler	**87

* Values are approximate based on system flow balance & design data. Reference calcs SW-0078 & SW-0080 for min. flow limits.
** From DBD-139.
*** 45 gpm is for all 3 aftercoolers.

7.0 FIGURES

Figure 7.1

Emergency Service Water System, Train A



SD-139
EMERGENCY SERVICE WATER
TRAIN A
FIGURE 7.1

Figure 7.2
Emergency Service Water System, Train B

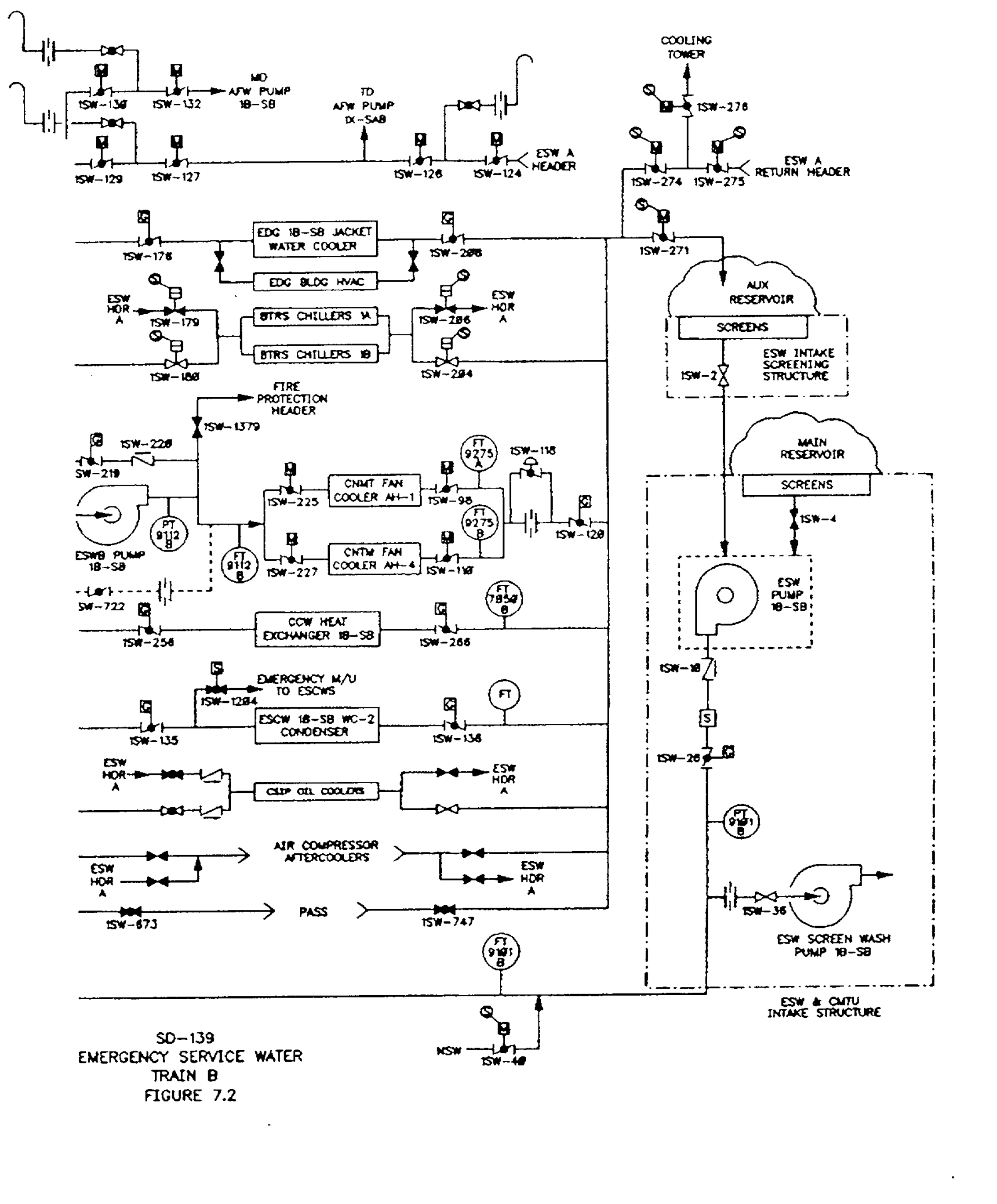


Figure 7.3

Normal Service Water System

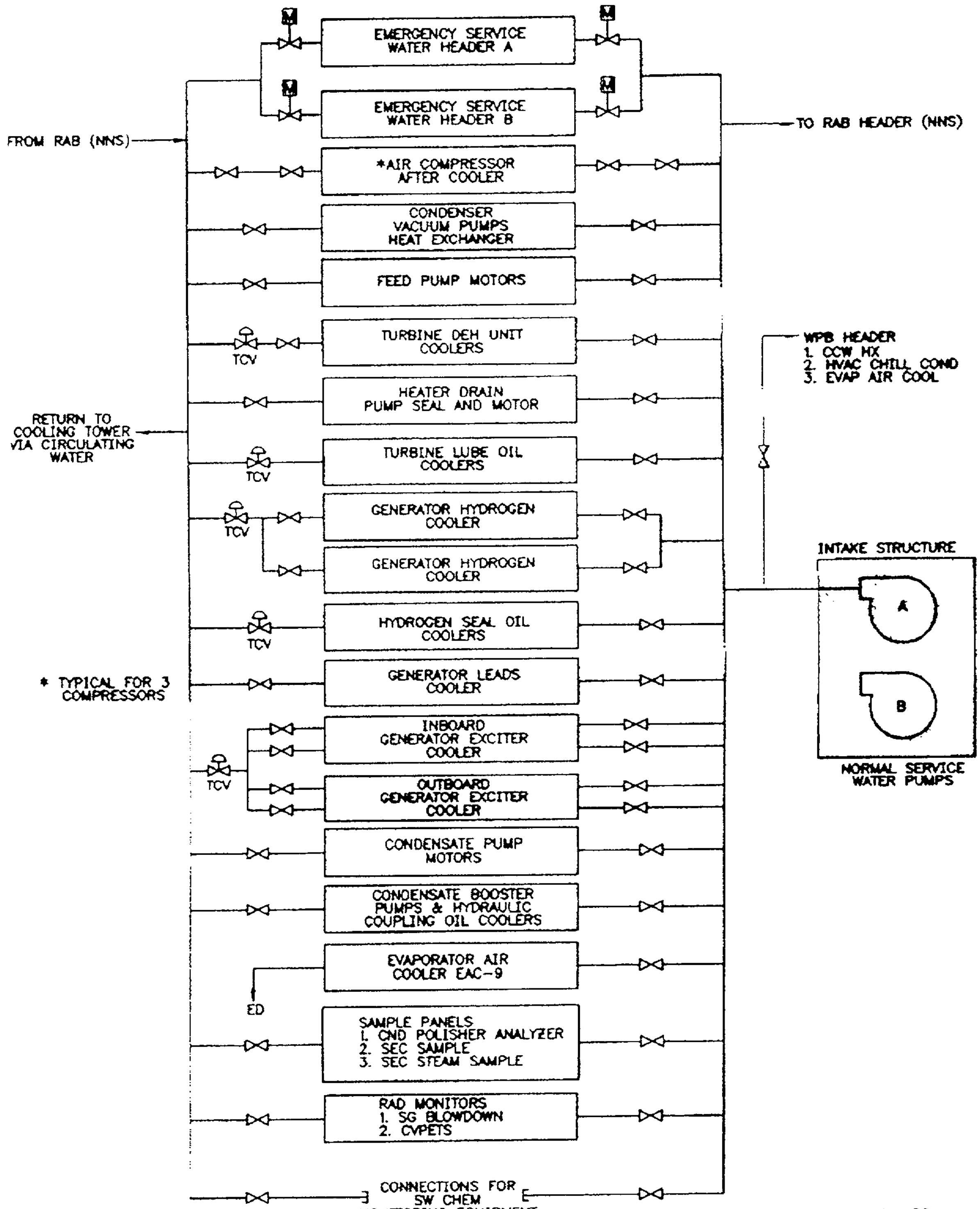
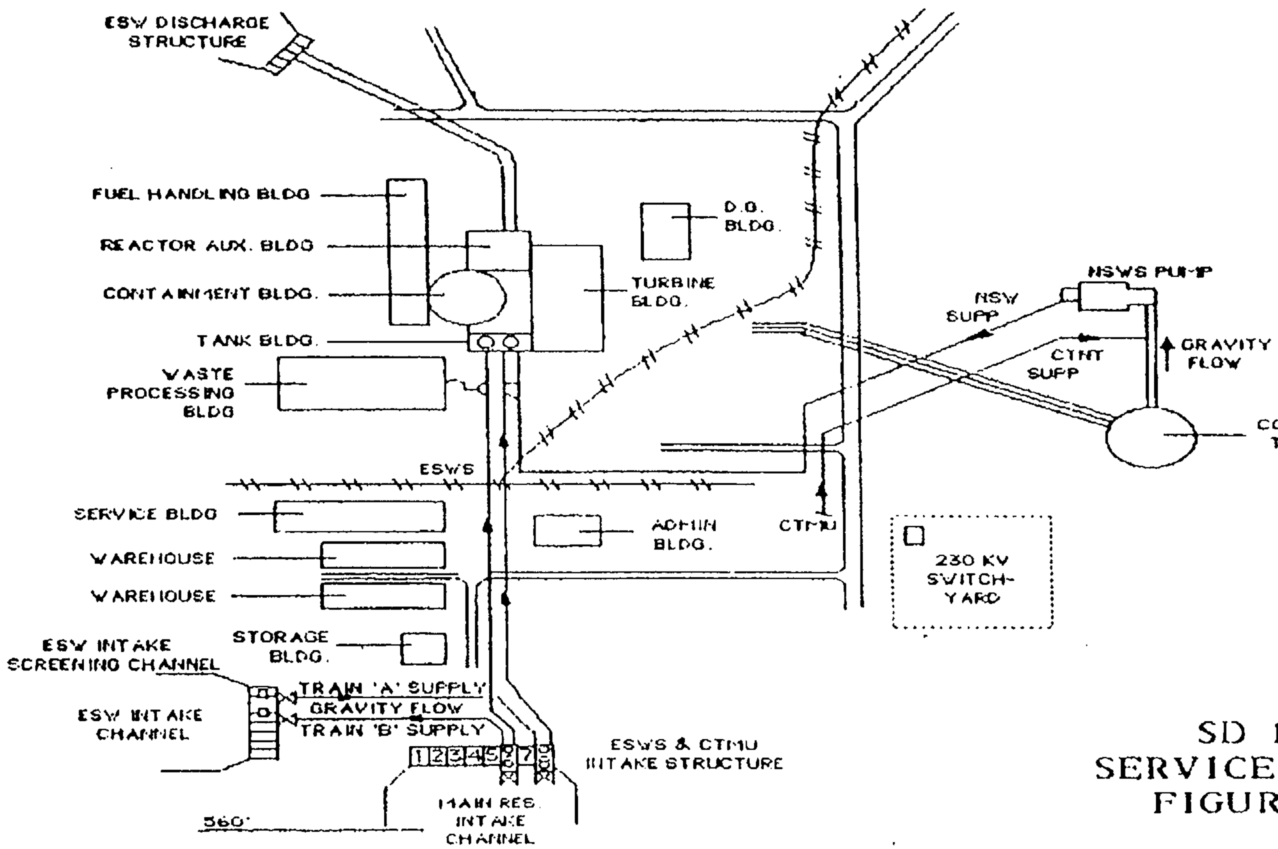


Figure 7.4

Service Water System Yard Piping



SD 139
SERVICE WATER
FIGURE 7.4

Figure 7.5

NSW Bearing Lubrication and Motor Cooling

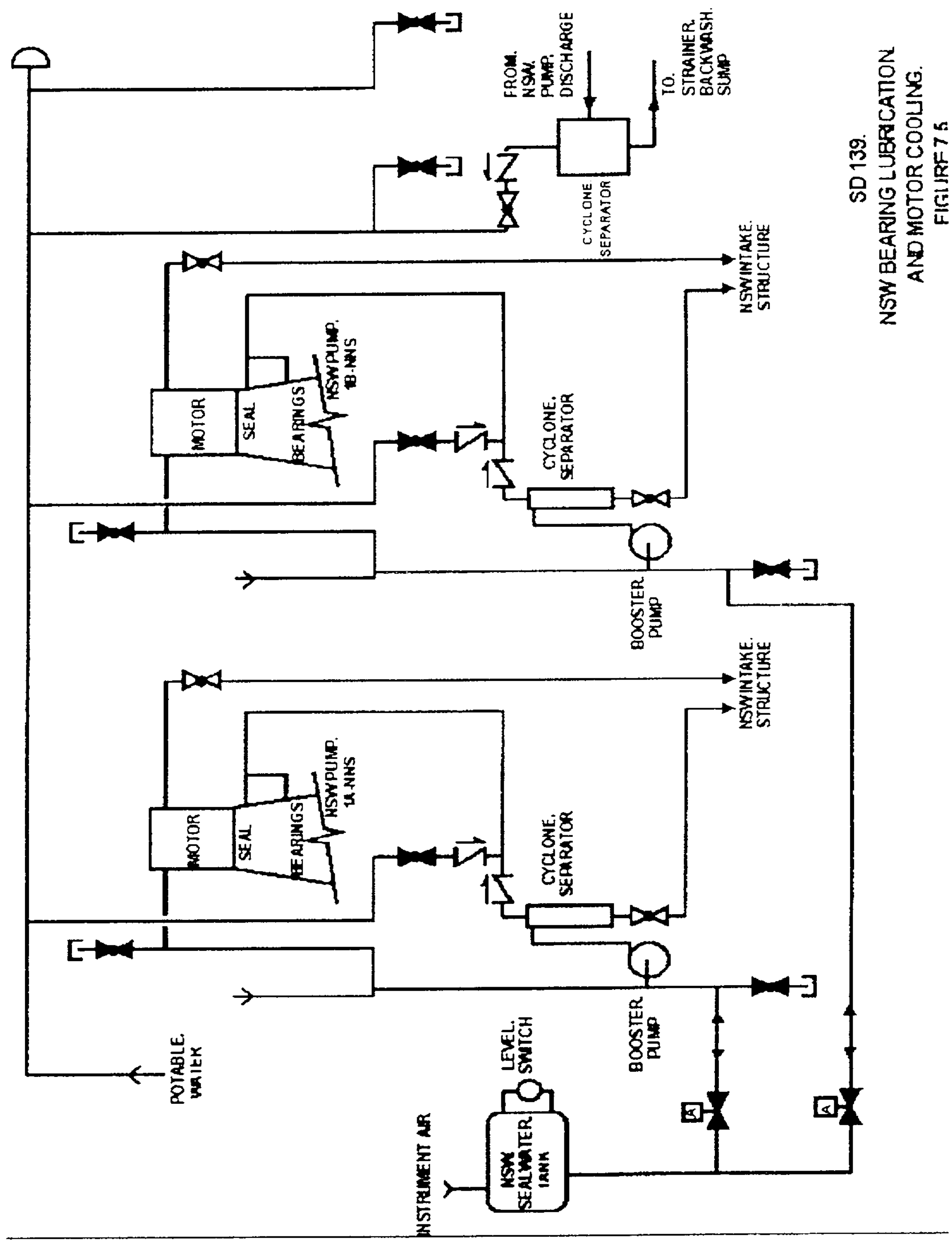
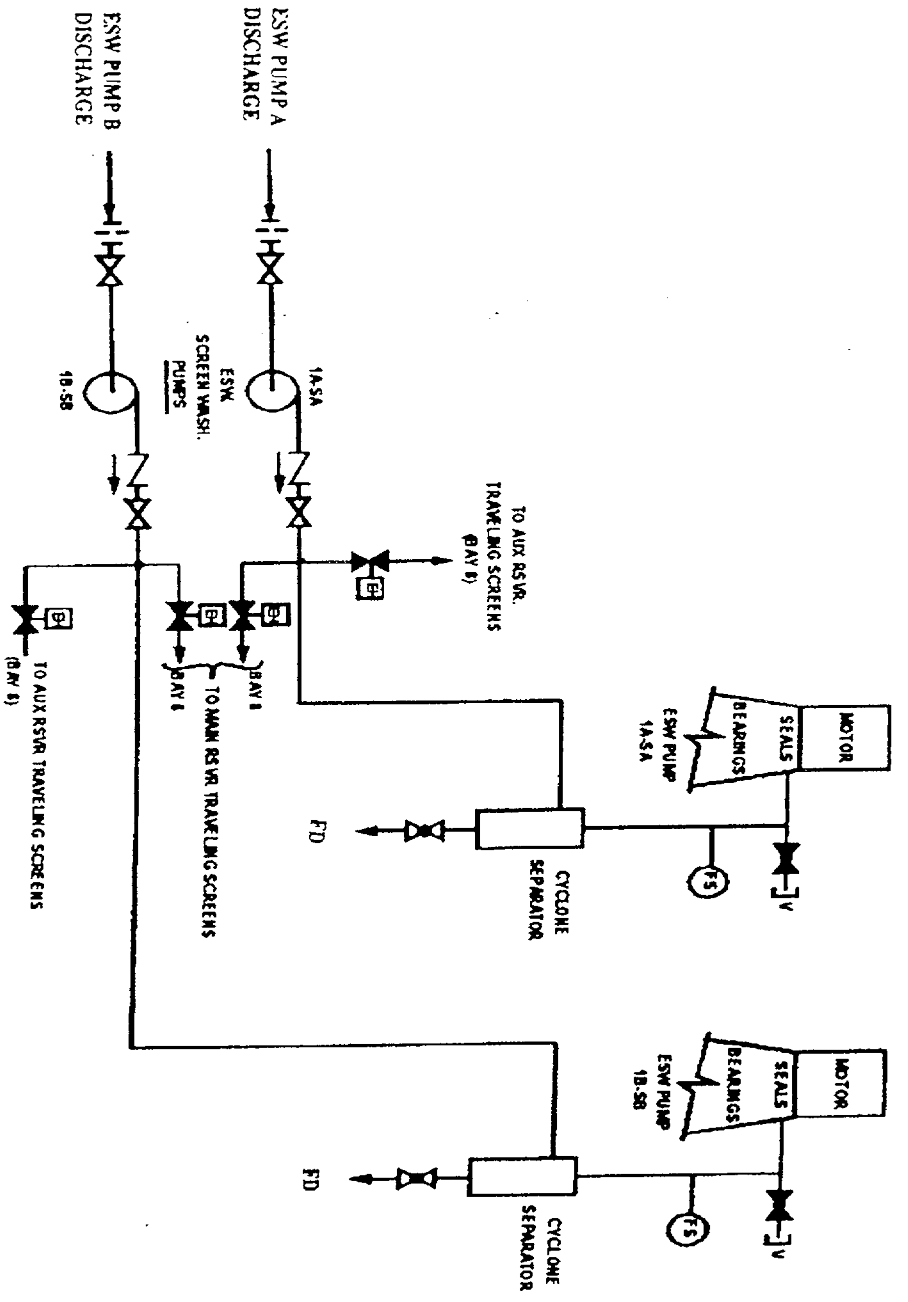


Figure 7.6
ESW Pump Seal/Bearing Water



SD 139
ESW PUMP SEAL/BEARING WATER
FIGURE 7.6

8.0 REFERENCES

8.1 Drawings

8.1.1 System Drawings

Drawing Number	Title
2165-G-047	Flow Diagram - Circulating and Service Water System, Sheet 1, Unit 1
2165-G-048	Flow Diagram - Circulating and Service Water System, Sheet 2, Unit 1
2165-G-436	Flow Diagram - Intake Structures Pump Seal, Bearing Lubrication and Motor Cooling Water Systems
2165-G-876	Flow Diagram - Cooling Water System for Waste Processing Building, Sheet 1
2165-G-133	Flow Diagram - Diesel Generator Systems, Unit 1
2165-S-0547	Simplified Flow Diagram - Circulating and Service Water Systems, Sheet 1, Unit 1
2165-S-0548	Simplified Flow Diagram - Circulating and Service Water Systems, Sheet 2, Unit 1
2165-S-0936	Simplified Flow Diagram - Intake Structures Pump Seal, Bearing Lubrication and Motor Cooling Water Systems, Unit 1
2165-S-1376	Simplified Flow Diagram - Cooling Water System for Waste Processing Building, Sheet 1, Unit 1
2165-S-0633	Simplified Flow Diagram - Diesel Generator Systems, Unit 1
2166-G-425S01	Service Water Pumps, Discharge Header Valves and Service Water Booster Pumps Instrument Schematics and Logic Diagram, Unit 1
2166-G-425S02	Service Water Pumps, Discharge Header Valves and Service Water Booster Pumps Instrument Schematics and Logic Diagram, Unit 1
2168-G-497S02	HVAC - Non-Essential Chilled Water - Condenser Flow Diagram - WPB
2168-G-498S02	HVAC - Essential Services Chilled Water -Condenser Flow Diagram - Unit 1 - SA
2168-G-499S02	HVAC - Essential Services Chilled Water -Condenser Flow Diagram - Unit 1 - SB

8.1.2 Control Wiring Diagrams

Drawing Number		Title
2166-B-401	Sheet	
	2181	NSW Pump 1A-NNS Sheet 1
	2182	NSW Pump 1B-NNS Sheet 1
	2183	NSW Pumps Instrumentation
	2185	NSW Pump 1A Dischg. Valve 7SW-B37-1
	2186	NSW Pump 1B Dischg. Valve 7SW-B38-1
	2188	NSW Pumps Strainer 7SW-S23-1 & Va. 7SW-H1-1
	2189	NSW Pump 1A-NNS Sheet 2
	2190	NSW Pump 1B-NNS Sheet 2
	2191	NSW Seal & Brg. Clg Wtr Booster Pump 1A-NNS
	2192	NSW Seal & Brg. Clg Wtr Booster Pump 1B-NNS
	2197	Exciter Cooler Outlet Valve (TCV-0951)
	2198	Hydrogen Cooler Outlet Valve (TCV-0950)
	2199	H2 Seal Oil & DEH Cooler Instrumentation
	2201	Turbine Lube Oil Coolers Outlet Valve (TCV-4750)
	2202	Turbine Gen. Cooler Valves Indication
	2207	NSW Supply Hdr "A" Isol. Valve 3SW-B5SA-1
	2208	NSW Supply Hdr "B" Isol. Valve 3SW-B6SB-1
	2211	ESW Pump 1A-SA
	2212	ESW Pump 1B-SB
	2213	ESW Pumps Instrumentation
	2216	ESW Pump 1B-SB Inlet Va. - Main Reservoir - 3SW-B4SB-1 & Aux. Reservoir 3SW-B2SB-1
	2217	ESW Pump 1A-SA Inlet Va. - Main Reservoir - 3SW-B3SA-1 & Aux. Reservoir 3SW-B1SA-1
	2220	Main Reservoir Level Instrumentation

8.1.2 Control Wiring Diagrams (continued)

Drawing Number Sheet	Title
2221	ESW Pump 1A-SA Strainer 3SW-S21SA-1 & Valve 3SW-H2SA-1
2222	ESW Pump 1B-SB Strainer 3SW-S22SB-1 & Valve 3SW-H3SB-1
2223	ESW Pump 1A-SA Dischg. Valve 3SW-B7SA-1
2224	ESW Pump 1B-SB Dischg. Valve 3SW-B9SB-1
2227	Service Water Sys. "A" Misc. Alarms Sh. 1
2228	Service Water Sys. "B" Misc. Alarms Sh. 2
2229	Service Water Sys. "A" & "B" Misc. Alarms, Sh. 3
2231	Service Water System "A" Misc. Alarms, Sh. 4
2232	Service Water Sys. "B" Misc. Alarms, Sh. 5
2233	Service Water Booster Pump 1A-SA
2234	Service Water Booster Pump 1B-SB
2235	Service Water Booster Pumps Instrumentation (Pressure & Flow)
2237	Contmt. Service Water "A" & "B" Return Orifice Bypass Valves 3SW-B64SA-1 & 3SW-B65SB-1
2241	Serv. Water from Containment Fan Coolers AH-2 (SA) & AH-3 (SA) Instrumentation
2242	Serv. Water from Containment Fan Coolers AH-1 (SB) & AH-4 (SB) Instrumentation
2245	Serv. Water to Containment Fan Cooler AH-3 Inlet Valve 2SW-B46SA-1
2246	Serv. Water from Containment Fan Cooler AH-3 Outlet Valve 2SW-B47SA-1
2247	Service Water to Containment Fan Cooler AH-2 Inlet Valve 2SW-B45SA-1
2248	Service Water from Containment Fan Cooler AH-2 Outlet Valve 2SW-B49SA-1

8.1.2 Control Wiring Diagrams (continued)

Drawing Number Sheet	Title
2249	Service Water to Containment Fan Cooler AH-1 Inlet Valve 2SW-B52SB-1
2250	Service Water from Containment Fan Cooler AH-1 Outlet Valve 2SW-B48SB-1
2251	Service Water to Containment Fan Cooler AH-4 Inlet Valve 2SW-B51SB-1
2252	Service Water from Containment Fan Cooler AH-4 Outlet Valve 2SW-B50SB-1
2253	Service Water to Containment Fan Coil Units Isol. Va. 2SW-B88SAB-1
2254	Service Water Return from Containment Fan Coil Units Isol. Valve 2SW-B89SA-1
2255	Service Water Return from Containment Fan Coil Units Isol. Valve 2SW-B90SB-1
2257	Hdr. "A" Service Water Backup to AFWP 1X-SAB Supply Valve 3SW-B70SA-1
2258	Hdr. "A" Service Water Backup to AFWP 1X-SAB Supply Valve 3SW-B71SA-1
2259	Hdr. "B" Service Water Backup to AFWP 1X-SAB Supply Valve 3SW-B73SB-1
2260	Hdr. "B" Service Water Backup to AFWP 1X-SAB Supply Valve 3SW-B72SB-1
2261	SW Backup to AFWP 1A-SA Supply Valve 3SW-B75SA-1
2262	SW Backup to AFWP 1A-SA Supply Valve 3SW-B74SA-1
2263	SW Backup to AFWP 1B-SB Supply Valve 3SW-B77SB-1
2264	SW Backup to AFWP 1B-SB Supply Valve 3SW-B76SB-1
2267	SW to & from Component Clg. Wtr. HX "A" Instr. & Alarms

8.1.2 Control Wiring Diagrams (continued)

Drawing Number Sheet	Title
2268	SW to & from Component Clg. Wtr. HX "B" Instr. & Alarms
2272	Serv. Wtr./CVCS Chiller Isolation Valves 3SW-V266SA-1 & 3SW-V237SA-1
2273	Serv. Wtr./CVCS Chiller Isolation Valves 3SW-V267SB-1 & 3SW-V238SB-1
2280	"A" Service Water Hdr. Return to Normal Service Water Hdr. 3SW-B13SA-1
2282	"B" Service Wtr. Hdr. Return to NSW Hdr. 3SW-B14SB-1
2284	Reactor Aux. Bldg. Return SW Main Hdr. Isolation Valve 3SW-B8SB-1
2286	Service Water Return Hdr. A Shutoff Valve to Aux. Reservoir 3SW-B15SA-1
2287	Service Water Return Hdr. B Shutoff Valve to Aux. Reservoir 3SW-B16SB-1
2290	Service Water Manual Return Valve 7SW-B53-1 Indication
2451	Air Compressor 1A-NNS
2598	Chiller WC-2 (1A-SA) Chilled Water Alarms, Sh. 1
2599	Chiller WC-2 (1B-SB) Chilled Water Alarms, Sh. 1
2601	Chiller WC-2 (1A-SA) Compressor, Sh. 1
2605	Chiller WC-2 (1A-SA) Condenser Water Recirculating Pump P7 (1A-SA)
2612	Chiller WC-2 (1A-SA) Condenser Water Supply Valve 3SW-B300SA-1
2617	Water Chiller WC-2 (1A-SA) Emergency Makeup Water Supply Valve 3SW-V868SA-1

8.1.3 SW System Component Instr. Schematics and Logic Diagrams

Drawing Number		Title
2166-B-430	Sheet	
	13.1	DEH & Lube Oil Coolers
	13.2	Hydrogen Seal Oil Coolers
	13.3	Hydrogen & Exciter Coolers
	21.1	Serv. Wtr. for Aux. F. Wtr. Pumps
	21.2	Serv. Wtr. to & from Comp. Clg. Wtr. HX
	21.3	Serv. Wtr. to & from Containment Fan Coolers AH-2&3
	21.4	Serv. Wtr. to & from Containment Fan Coolers AH-1&4
	21.5	Serv. Wtr. to & from Air Compressors & Aftercoolers
	21.7	Serv. Wtr. to & from Containment Fan Coil Units
	21.12	Serv. Wtr. to Aux. Bldg HVAC Chillers WC-2

8.1.4 Manufacturer's Drawing

Drawing Number	Title
1364-3957	ESW Self-Cleaning Strainer Control Panel
1364-4553	Dresser Instruments - Thermometer, Model 50EI60E
1364-5229	Masoneilan Int'l - Pneumatic Actuator Models 33-37310 & 8005A
1364-5899	Valtek - Mark I Valve Actuators
1364-4010	Rosemount - Pressure Transmitter, Model 1153B
1364-4009	Rosemount - Temperature Transmitter, Model 444
1364-6431	Weed Instr. - Thermocouple Type E4B250G-(L)AS
1364-4178	Mercoid - Pressure Switch Model DAW-7043-804B
1364-4761	Mercoid - Pressure SW Diff., Model DPAW-7033-804B
1364-2127	Versa Pac Motor Outline - NSW Pump
1364-3189	Siemens-Allis - SW Bstr. Pump
1364-1996	Weston - Temperature Gage, Models 4300 & 4310

8.1.4 Manufacturer's Drawing (continued)

Drawing Number	Title
1364-16589	General Electric - ESW Pump Motor
1364-2900	Jamesbury Valve - 30" Wafer Sphere 150# Flanged
1364-5201	Pyco - Temperature Gages Model 23-7156
1364-41808	United Electric - Press. Diff. SW Model J27KB
1364-4763	Pyco - Temperature Ind. SW. - Model 23-7148
1364-96530,S01,S02	Anchor/Darling Valve - 30" Wafer Butterfly, 150#
1364-96531,S01,S02	Anchor/Darling Valve - 36" Wafer Butterfly, 150#
1364-7370	ESW Pump General Arrangement Dwg.
1364-43477	ESW Pump Cross-Sectional Dwg.
1364-43475	ESW Pump BOM
1364-43476	ESW Pump Spare Parts
1364-96537	ESW Pump Lower Seismic Support
1364-45840	ESW Pump 1A-SA Performance Curve
1364-45839	ESW Pump 1B-SB Performance Curve
1364-98013	Wafer Check Valve 14 inch 150 LB. SS
1364-98014	Wafer Check Valve 30 inch 150 LB. SS

Notes:

1. The drawing number listed is not applicable to all applications of the instrument in the Service Water System. Consult the Instrument List for the applicable EMDRAC drawing number.

8.2 Specifications

Specification No.	Title
IN-01	Electronic Instrumentation
IN-03	Orifices
IN-04	Thermocouple Assemblies
IN-07	Local Pressure Gages

8.2 Specifications (continued)

Specification No.	Title
IN-08	Local Dial Thermometers
IN-09	Temperature Switches
IN-10	Pressure Switches
IN-33	Level Transmitters
IN-35	Low Range Flow Switches
M-12	Miscellaneous Pumps
M-32P	2 1/2 Inch & Larger Valves
M-34	2 Inch & Smaller Valves
M-44	Butterfly Valves
M-49M	Strainers
M-60	Self-Cleaning Strainers
M-66	Miscellaneous Control Valves
M-67H	NSW & Clg Twr M/U Pumps
M-67P	ESW Pumps
M-78	ESW Intake Structure Butterfly Valves
E-13	Auxiliary Motors
CPL-HNP1-M-029	Emergency Service Water Butterfly Valves

8.3 Technical Manuals

Equipment Name	Manual	Manufacturer
Emergency S. W. Pumps	KIS	Hayward Tyler
ESW Self-Cleaning Strainer	JCE	R. P. Adams Co., Inc.
SW Booster Pumps	BHQ	Gould Pumps, Inc.
ESW Pump Motor	IJX	General Electric
SW Booster Pump Motor	IJU	Siemens-Allis
NSW Flushing Wtr. Bstr Pump	IJR	Peerless
NSW Flushing Wtr. Bstr Pump Motor	IJR	Peerless

8.3 Technical Manuals (continued)

Equipment Name	Manual	Manufacturer
NSW Pump	IJR	Peerless
NSW Pump Motor	IJU	Allis-Chalmers
SW Sys. Check Valves	BIV	TRW Mission
Masoneilan Control Valves	BJW	Masoneilan
2" & Smaller Valves	BKP	Yarway
2" & Smaller Valves	NWD, BKK	Rockwell Int'l
Misc. Butterfly Valves (ESW & NSW)	BKG	Jamesbury Corp.
NSW Self-Cleaning Strainer	BHY	Zurn
ESW-2 1/2" & Larger Valves	BKA	Pacific
30" and 36" Butterfly Valves	BKB	Anchor/Darling

8.4 Other References

8.4.1 ESR 97-00321, "Minimum Flow for NSW Pumps."

Revision Summary

Revision 12 - Revised per ESR 99-00145