NRC FORM 366 (6-89) | U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WTH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
James A. FitzPatrick Nuclear Power Plant	0 5 0 0 0 3 3 3	1 OF 2 7

TITLE (4) Normal and Emergency Service Water Corrosion, Silting and Check Valve Problems

EVENT DATE (5) MONTH	DAY	YEAR	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	REPORT DATE (7) MONTH	DAY	YEAR	OTHER FACILITIES INVOLVED (8) FACILITY NAMES	DOCKET NUMBER(S)
		9 0	9 0	0 1 2	0 2	0 3	0 3	9 3		0 5 0 0 0
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OPERATING MODE (9): N

POWER LEVEL (10): 0 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Mr. Verne Childs, Senior Licensing Engineer	AREA CODE 315 349-6071

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE) | X NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

UPDATED REPORT - PREVIOUS REPORT DATE 8/29/90
EIIS Codes are in []

During the 1990 Refuel Outage, 61 check valves in the Normal and Emergency Service Water (ESW) [KG, BI] were opened and visually inspected. 37 valves were from the ASME Section XI IST Program and 24 were from the Preventive Maintenance (PM) Program. 20 IST and 10 PM program valves were initially declared inoperable due to failing the inspection criteria. The IST check valves were shown to be operable by actual flow test or calculation. Other efforts included internal inspection of 500 feet of piping and 10 safety-related coolers and Air Handling Units (AHUs). 2 AHUs were found to have 25 percent tube plugging with silt/sand, but were shown able to remove design basis heat load. Of the 500 feet of piping, 200 feet were found 10 to 30 percent restricted in cross-sectional area, but a calculation demonstrated that flow control valves were hydraulically limiting. Except for the potential loss of control room/relay room [NA] cooling, ESW was considered capable of performing the design safety function. The valves, coolers, and piping were cleaned/replaced as necessary and returned to service. Intake bays were also cleaned. Periodic flushing/performance testing prevents recurrence. LERs 88-005, 88-009, and 89-015 are related.

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UPDATE REPORT - PREVIOUS REPORT DATE 8/29/90

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Description

The 1990 Refuel Outage initial scope of check valves to be disassembled and visually inspected as part of the ASME Section XI In-Service Testing (IST) Program included 18 check valves in, or that interface with, the Emergency Service (ESW) [BI] or Normal Service Water (NSW) [KG] system. Upon disassembly, 11 of the 18 valves were initially declared inoperable due to failing the visual inspection criteria.

The subsequent (follow-on) scope of check valve disassembly required by the established IST program resulted in the disassembly and inspection of 19 additional ESW/NSW safety-related check valves. Of the 19, nine (9) were initially declared inoperable due to failing the visual inspection criteria.

In parallel with the IST program scope, the check valve preventive maintenance program had initially scoped three (3) non-IST ESW/NSW check valves for disassembly and inspection. These three (3) valves were also initially declared inoperable due to failing the visual inspection criteria. Twenty-one (21) follow-on ESW/NSW non-safety-related and balance-of-plant check valves were disassembled. Of these 21, seven (7) were initially declared inoperable due to failure of the visual inspection criteria.

Table 1 summarizes the valves initially declared inoperable. Upon discovery of the initial check valve visual inspection failures, a site Service Water Task Force (SWTF) was established to investigate these and other areas of possible concern.

The following discussion provides a description, analysis, and completed corrective action section arranged by safety-related heat load.

A. Electric Bay Coolers

Description

These heat exchangers provide cooling for portions of the 4KV, 120 VAC, and 600 VAC switchgear [EA, EB, EC, ED], the Reactor Protection System (RPS), and Uninterruptible Power Supply (UPS) [EF] located in the west electric bay (Safety Division 1) (see Figure 1) and the east electric bay (Safety Division 2) (see Figure 2).

The coolers are designed to remove the normal heat load, which is greater than the post-accident heat load, as well as the post-accident heat load. The coolers are counterflow air to water heat exchangers. The tube side of each heat exchanger is normally provided with NSW via a 3 inch line that branches off the NSW main header. Teeing into the 3 inch NSW line just downstream of a 3 inch swing check (46SWS-67A(B))* are two 2 inch ESW supply lines. One ESW supply line is normally valved-in and is considered safety-related. This 2 inch ESW supply line is approximately 3 feet long and contains a 2 inch piston check valve (46ESW-19A(20B)). The other 2 inch ESW line teeing-in is normally valved-out and is considered non-safety-related except for pressure boundary purposes. This line is also 3 feet long and contains a 2 inch piston check valve (46ESW-20A(19B)). From the ESW tee-in, the common ESW/NSW 3 inch piping tees off again just before the heat exchanger into two 2-1/2 inch lines. The lines enter the cooler waterbox. The two (2) ESW/NSW return lines from the cooler are 2-1/2 inch pipes which each contain a balance valve throttled to control flow through the cooler. The 2-1/2 inch return lines then reconnect to a 3 inch return.

*Note: Component numbers in parenthesis refer to the east side or train B.

Upon the loss of NSW with ESW initiated (manually or automatically), the 2 inch piston check valve, 46ESW-19A(20B), opens to allow ESW flow to the cooler, and the 3 inch swing check valve, 46ESW-67A(B), closes to prevent the diversion of ESW.

As part of the follow-on check valve disassembly program, check valves 46ESW-19A, 19B, 20A, and 20B (2 inch ESW piston check valves) were disassembled and found sticking shut due to silt and corrosion product build-up in the valve bore. Prior to being reworked, the valve bonnets were replaced, and the valves were successfully flow tested with ESW using an existing surveillance test. This surveillance test had been used quarterly during normal operations to verify operability of the valves. Following the test, the valves again disassembled and found not to be sticking shut. Also, as part of the follow-on IST check valve disassembly program, swing check valves 46SWS-67A and 67B (3 inch NSW check valves) were found sticking open.

Visual inspection of the 2 inch ESW supply line upstream of the piston check valves revealed no significant corrosion or silt build-up. The 2 inch pipe downstream of the piston check valves up to the tee-in to the 3 inch NSW pipe (3 feet in length) was found to have 30 percent reduction in cross-sectional flow area due to corrosion build-up. Approximately 5 feet of the 3 inch NSW supply to the cooler was inspected and revealed general corrosion with less than 10 percent reduction in cross-sectional flow area. Inspection of the cooler 2-1/2 inch ESW/NSW supply and return lines revealed areas of general to heavy corrosion with a 10 to 30 percent reduction in cross-sectional flow area. The length of each of these areas of general to heavy corrosion as estimated to be 8 feet in length.

The coolers were disassembled and found to have very minor tube plugging due to silt/sand.

<u>Analysis</u>

Heat transfer tests on the electric bay area coolers were performed using NSW prior to and during the inspections, and the units were demonstrated to satisfy the normal heat load which are 50 to 80 percent greater than the post-accident heat loads. The ESW system normally operates at a pressure higher than NSW which infers that the cooling units would have performed their safety function with ESW cooling supply also. As a result, no safety concern for the coolers existed.

An engineering calculation evaluated the past cooler performance test results generated by periodic surveillance tests at postulated accident conditions and determined that the coolers would be capable of removing the design basis heat load and the piping would allow sufficient ESW flow. Furthermore, an engineering calculation indicated the position of the balance valves in the ESW/NSW return line were more hydraulically limiting than the reduction in the cross-sectional flow area of the small bore pipe (2-1/2 inch Nominal Pipe Size (NPS) and less). Therefore, no safety concern for the electric bay small bore piping existed.

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A potential concern existed for the 3 inch swing check in the NSW supply line (46SWS-67A and 67B) to each electric bay cooler. Based on discussions with the attending maintenance personnel, no excessive force was required to close the valve for rework. An engineering calculation was performed to determine the amount of closing force that would have been available as a result of losing NSW with ESW injection. A differential pressure of 60 psi would have resulted, with a resulting closing force of 150 pounds. This force was considered more than adequate to close the valves if required. Therefore, no safety concern existed.

As discussed above, the 2 inch piston check valves (46ESW-19A, 19B, 20A, and 20B) in the ESW supply lines to the electric bay coolers were initially found sticking shut. The valve bonnet was replaced and satisfactory flow tested with ESW, reopened, and found to be operable as defined by the visual inspection criteria. This indicated that the normally aligned safety-related valves (46ESW-19A and 20B) would have been capable of performing the open safety function and no safety concern existed. During post-work testing the east electric bay normal ESW supply check valve (46ESW-20B) was found to stick open on the first attempt to backflow test.

<u>Corrective Actions Prior to Start-up</u>

1. All unsatisfactory valves were cleaned and restored to service.

2. The electric bay coolers were cleaned and restored to service.

3. Degraded piping was cleaned or replaced and restored to service.

4. Test connections were added adjacent to 46SWS-67A and 67B, 46ESW-19A, 19B, 20A, and 20B to facilitate in-situ operability testing of these check valves.

5. Y-strainer meshes were sized up to prevent clogging.

6. The electric bay coolers were satisfactorily performance tested with ESW as part of a coordinated ESW system test. The test results were compared to thermal hydraulic model projections.

B. Cable Tunnel Coolers

Description

These heat exchangers provide cooling for portions of the 4KV, 120 VAC, and 600 VAC switchgear [EA, EB, EC, ED] bus, cables, and lighting located in the west cable tunnel (Safety Division 1) (see Figure 3) and the east cable tunnel (Safety Division 2) (see Figure 4), as well as the Safety Divisions 1 and 2 emergency diesel generator [EK] switchgear rooms [NB].

The coolers are designed to remove the normal heat load, which is greater than the post-accident heat load, as well as the post-accident heat load. The coolers are counterflow air to water heat exchangers. The tube side of each heat exchanger is normally provided with NSW via a 3 inch line that branches off the NSW main header. Teeing into the 3 inch NSW line just downstream of a 3 inch swing check (46SWS-68(69)) are two 2 inch ESW supply lines. One ESW supply line is normally valved-in and is considered safety-related. This 2 inch ESW supply line is about 4 feet long and contains a 2 inch piston check valve (46ESW-22A(21B)). The other 2 inch ESW line teeing-in is normally valved-out and is considered non-safety-related. This line is 3 feet long and also contains a 2 inch piston check valve (46ESW-21A(22B)). From the ESW tee-in, the common ESW/NSW 3 inch piping tees of again just before the heat exchanger into two 1-1/2 inch lines. The lines enter the cooler waterboxes. The two (2) ESW/NSW return lines from the cooler are 1-1/2 inch pipes which each contain a balance valve throttled to control flow through the cooler. The 1-1/2 inch return lines then reconnect to a 3 inch return.

Upon the loss of NSW with ESW initiated (manually or automatically), the 2 inch piston check valve, 46ESW-22A(21B), opens to allow ESW flow to the cooler, and the 3 inch swing check valve, 46ESW-68(69), closes to prevent the diversion of ESW.

As part of the initial IST check valve disassembly program scope, check valves 46ESW-21A, 21B, 22A, and 22B (2 inch ESW piston check valves) were disassembled and found sticking shut due to silt and corrosion product build-up in the valve bore. The valves were initially declared inoperable due to failing the visual inspection criteria. Also as part of the initial IST check valve disassembly program scope, swing check valves 46SWS-68 and 69 (3 inch NSW check valves) were found sticking open.

Visual inspection of the 2 inch ESW supply line upstream of the piston check valves revealed no significant corrosion or silt build-up. The 2 inch pipe downstream of the piston check valves up to the tee-in to the 3 inch NSW pipe was found to have 30 percent reduction in cross-sectional flow area due to corrosion build-up. Approximately 7 feet of the 3 inch NSW supply to the cooler was inspected and revealed general corrosion with less than a 10 percent reduction in cross-sectional flow area. Inspection of the cooler 1-1/2 inch ESW/NSW supply and return lines revealed areas of general to heavy corrosion with a 30 percent reduction in cross-sectional flow area. The length of each of these areas of general to heavy corrosion is no more than 8 feet in length.

The coolers were disassembled and found to have very minor tube plugging due to silt/sand.

Analysis

Heat transfer tests on the cable tunnel area coolers performed using NSW prior to and during the inspections, and the units were demonstrated to satisfy the normal heat load which are approximately 350 to 450 percent greater than the post-accident heat loads. The ESW system normally operates at a pressure higher than NSW which infers that the cooling units would have performed their safety function with ESW cooling supply also. As a result, no safety concern for the cooler existed.

An engineering calculation evaluated the past cooler performance test results generated by periodic surveillance tests (like that performed on January 31, 1990) at postulated accident condition and determined that the cooler would be capable of removing the design basis heat load and the piping would allow sufficient ESW flow. Furthermore, an engineering calculation indicated the position of the balance valves in the ESW/NSW return line were more hydraulically limiting than the reduction in the cross-sectional flow area of the small bore pipe (2-1/2 inch NPS and less). Therefore, no safety concern for the cable tunnel small bore piping existed.

A potential concern existed for the 3 inch swing check in the NSW supply line (46SWS-68 and 69) to each cable tunnel cooler. Based on discussions with the attending maintenance personnel, no excessive force was required to close the valve for rework. An

engineering calculation was performed to determine the amount of closing force that would have been available as a result of losing NSW with ESW injection. A differential pressure of 60 psid would have resulted, with a resulting closing force of 150 pounds. This force was considered more than adequate to close the valves if required. Therefore, no safety concern existed.

As discussed above, the 2 inch piston check valves (46ESW-21A, 21B, 22A, and 22B) in the ESW supply lines for the cable tunnel coolers were initially found sticking shut. However, based on the similarity of the as-found condition of these 2 inch piston checks to the electric bay cooler 2 inch piston checks and the satisfactory response of the electric bay piston checks, it is considered that the cable tunnel piston checks would have responded similarly. These cable tunnel piston check valves were also subjected to quarterly surveillance tests where ESW was flushed through the valves to demonstrate operability. As a result, it is concluded that the valves were cable of performing their safety function.

<u>Corrective Actions Prior to Start-Up</u>

1. All unsatisfactory valves were cleaned and restored to service.

2. The cable tunnel coolers were cleaned and restored to service.

3. All the piping inspected was cleaned or replaced and restored to service.

4. Test connections were added adjacent to 46SWS-68 and 69, 46ESW-21A, 21B, 22A, and 22B to facilitate in-situ operability testing of these check valves.

5. Y-strainer meshes were sized up to prevent clogging.

6. The cable tunnel coolers were satisfactorily performance tested with ESW as part of a coordinated ESW system test. The test results were compared to thermal hydraulic model projections.

C. Control Room/Relay Room Ventilation

Description

The control room/relay room ventilation system is divided into train A (safety Division 1) (see Figure 5) and train B (Safety Division 2) (see Figure 6). Each train consists of a ventilation chiller condenser (70RWC-2A(B)), a control room air handing unit (70AHU-3A(B)), a relay room air handling unit (70AHU-12A(B)), and a chiller condenser room air handling unit (70AHU-19A(B)).

AHUs 70AHU-3A(B) and 12A(B) are normally supplied with a glycol water mixture via a chilled water system and an ESW back-up supply via a normally shut 4 inch manual supply valve (46ESW-101(102)) and a 4 inch manual return valve (46ESW-103(104)).

Chiller condenser 70RWC-2A(B) removes the heat in the glycol water mixture. The chiller condenser is normally cooled by a 6 inch NSW (46(70)SWS-101(102)). Teeing into the 6 inch NSW supply line just downstream of 46(70)SWS-101(102) is a 6 inch ESW supply line. This section of 6 inch ESW piping contains a 6 inch swing check (46ESW-7A(B)). On train B, downstream of the ESW tee-in, are two (2) tee-offs to 1-1/2 inch lines that provide NSW/ESW to the chiller condenser room AHUs (70AHU-19A and B).

On both trains, a 4 inch line tees-off to provide back-up ESW or NSW to control room AHU 70AHU-3A(B) and relay room AHU 70AHU-12A(B). Then the 6 inch ESW/NSW line reduces to a 4 inch pipe and reaches the chiller condenser (70RWC-2A(B)). The 70RWC-2A(B) ESW/NSW return is a 4 inch line that reconnects with a 6 inch ESW/NSW return header. The condenser chiller room AHUs (70AHU-19A and 19B) remove the heat generated by the glycol water mixture pumps and 70RWC-2A and 2B.

The normal operation heat loads in the control room, relay room, and chiller condenser room equal the design basis accident heat load. NSW flows through the 6 inch NSW supply check 46(70)SWS-101(102) to 70RWC-2A(B) and 70AHU-19A(B), and the glycol water mixture is circulated by a pump through 70AHU-3A(B) and 70AHU-12A(B) to 70RWC-2A(B).

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
James A. FitzPatrick Nuclear Power Plant	0 5 0 0 0 3 3 3	9 0	— 0 1 2	— 0 2	1 0 OF 2 7

TEXT (If more space is required, use additional NRC Form 366A's) (17)

Upon the initiation of ESW, ESW supply check valve 46ESW-7A(B) opens to provide ESW to 70RWC-2A(B) and 70AHU-19A(B) and 46(70)SWS-101(102) shuts to prevent the diversion of ESW. The glycol water mixture pump continues to operate. In the event that the glycol water mixture pump fails or is unable to circulate the mixture, back-up ESW can be provided to cool the control room AHU 70AHU-3A(B) and relay room AHU 70AHU-12A(B) by opening manual valves 46ESW-101(102) and 46ESW-103(104) and securing flow to 70RWC-2A(B) and 70AHU-19A and 19B.

As part of the initial IST check valve disassembly program scope, check valves 46(70)SWS-101 and 102 and 46ESW-7A and 7B were opened and visually inspected. 46ESW-7A and 7B passed the visual inspection criteria and declared operable. NSW supply vales 46(70)SWS-101 and 102 were found to be able to move freely through full travel but were not able to completely seat due to silt and corrosion product build-up in the valve body. The valves were initially declared inoperable due to failing the visual inspection criteria.

Boroscopic inspection of 6 inch pipe showed only slight surface corrosion. The 4 inch back-up ESW supply line to 70AHU-3A and 70AHU-12A found the line totally plugged with sand and silt for a length of approximately 5 feet up to manual valve 46(70)ESW-101. The 4 inch pipe in the back-up ESW supply to 70AHU-3B and 12B and the back-up ESW return from 70AHU-3A(B) and 12A(B) was found to be half-full of watery deposits that ran out on the floor when the pipes were opened. The 1-1/2 inch ESW/NSW supply to and return from chiller condenser air handling units 70AHU-19A and 19B were found to have a 10 to 30 percent reduction in cross-sectional area for up to a maximum of 30 feet.

The train B chiller condenser for 70RWC-2B was disassembled and found to be in excellent condition. The train A chiller condenser 70RWC-2A had previously been disassembled before the start of the outage for retubing. The control room AHU (70AHU-3A(B)) and relay room AHU (70AHU-12A(B)) are normally glycol water mixture supplied. Control and relay room AHUs 70AHU-3A and 12A were partially disassembled and found to be very clean. The chiller condenser room AHUs (70AHU-19A and 19B) were disassembled and found to have approximately 25 percent tube plugging due to silt and sand build-up. During this inspection it was discovered that both 70AHU-19A and 19B were connected to ESW train B.

Analysis

An engineering calculation has shown that chiller condenser AHUs 70AHU-19A and 19B had adequate margin to remove the design basis heat load which is equal to the normal heat load despite the 25 percent tube plugging. Furthermore, operating experience has shown that these AHUs have been able to maintain the chiller condenser room temperature. The issue of both AHUs being supplied by the B ESW train is not a safety concern because the purpose of the AHUs is to maintain the chiller condenser room temperature, and the chiller condensers provided a redundant cooling for the control room and relay room AHUs.

The control room and relay room AHUs 70AHU-3A and 70AHU-12A were found to be clean and no safety concern existed. Based on the train A inspection results, the train B control and relay room AHUs were not inspected.

The control room ventilation chiller condensers 70RWC-2A and 2B have been able to remove design basis heat load since initial plant start-up and no safety concern existed. The chiller condensers have been recently downgraded to a non-safety related cooling load.

The 6 inch ESW/NSW supply line were found to be clean and no safety concern existed.

The 4 inch ESW supply line to 70AHU-3A and 12A that was found plugged with sand and silt was safety significant for postulated or actual conditions that result in the loss of ESW cooling to redundant Air Handling Units 70AHU-3B and 12B. While these conditions are not known to have existed, and the examination of the redundant cooling water supply line (for ESW B supply to 70AHU-3B and 12B) revealed only very soft silt deposits which would have been flushed from the piping by ESW flow, any planned or forced unavailability of the ESW B supply would have resulted in the inability to provide cooling for the control room and relay room in a manner discussed in the Final Safety Analysis Report (FSAR) sections 9.7.1.3 and 9.9.3.11. Discussions note that the control room and relay room cooling function, which is necessary for all plant operating modes, is normally provided by the air conditioning equipment and can also be provided by Normal Service Water or ESW cooling water flow directly to either of the redundant Air Handling Units 70AHU-3A(3B) and 70AHU-12A(12B). Since it cannot be determined when or for how long the ESW system A supply line was plugged any unavailability of the

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
James A. FitzPatrick Nuclear Power Plant	0 5 0 0 0 3 3 3	9 0	— 0 1 2	— 0 2	1 2 OF 2 7

TEXT (If more space is required, use additional NRC Form 366A's) (17)

ESW B supply, as the result of a forced or planned system outage for any reason, would have resulted in no ESW cooling of the control room and relay room during the time period that the ESW system A supply was plugged. This situation is analogous to finding or making one subsystem in any system which contains two subsystems in a two safety division design (e.g., Core Spray [BM] or Standby Gas Treatment [BH]) inoperable and then postulating failure of the remaining system. This postulated failure of the remaining system results in a postulated loss of function.

The loss of the control room and relay room cooling function is a condition outside the design basis discussed in the FSAR and could also result in the failure of systems needed to maintain the reactor in a safe shutdown condition, remove residual heat, control the release of radioactive material, and mitigate the consequences of an accident. These conditions are similar to the reporting requirements contained in 10CFR50.73 (a)(2)(ii)(B) and 50.73(a)(2)(v).

The 4 inch back-up ESW supply to and return from 70AHU-3B and 12B were found with very soft deposits that ran out on the floor when the pipe was cut. Consequently, this piping was considered flushable if flow had been initiated and no safety concern resulted. Manual valves 46(70)ESW-101 through 104 (ESW back-up supply and return from AHUs) were cycled satisfactorily.

An engineering calculation demonstrated that the balancing valves in the 1-1/2 ESW/NSW supply line to chiller condenser room AHUs 70AHU-19A and 19B to be more hydraulically limiting than the 10 to 30 percent reduction in cross-sectional flow area. Furthermore, as noted above, the AHUs had been able to maintain the room temperature since initial plant start-up indicating adequate flow through the AHU was achievable. Therefore, no safety concern existed. The AHUs have also subsequently been downgraded to a non-safety related cooling load.

A potential concern existed for the 6 inch swing check in the NSW supply line (46(70)SWS-101 and 102) due to inability to seat perfectly. After evaluation, they were considered capable of preventing significant ESW flow diversion and would have maintained adequate cooling. During post-work testing, 46(70)SWS-102 was found unable to seat during backflow testing. Upon opening, the valve disc was determined to be misaligned due to initial improper reassembly. The valve was properly reassembled and passed the subsequent backflow test.

Corrective Actions Prior to Start-up

1. All unsatisfactory valves except 46(70)SWS-101 were cleaned and restored to service. 46(70)SWS-101 was also found to have a number of manufacturing defects/valve body corrosion and was replaced with a 6 inch stainless steal Velan swing check.

2. The AHUs and chiller condensers were cleaned and restored to service.

3. All the 4 inch piping found completely or partially plugged was cleaned or replaced and restored to service. Seventeen feet of the flow restricted 1-1/2 inch supply piping and 30 feet of the flow restricted 1-1/2 inch return piping was replaced. The remainder was cleaned and returned to service. Periodic inspection and chemical cleaning reduce the potential for recurrence.

4. Test connections were added adjacent to 46(70)SWS-101 and 102 to facilitate in-situ operability testing of these check valves.

5. Y-strainer meshes were increased to prevent clogging.

6. The chiller condenser room AHUs and the chiller condensers were satisfactorily flow tested with ESW as part of a coordinated ESW system test. The test results were compared to thermal hydraulic model projections.

D. Crescent Cooler Unit Coolers

Description

These heat exchangers provide cooling for portions of the Emergency Core Cooling System (ECCS) [BJ, BM, BN, BO] equipment located in the reactor building west crescent (Safety Division 1) and the reactor building east crescent (Safety Division 2) (see Figures 7 and 8).

The coolers are arranged in a bank of five (5) in each crescent and are designed such that four (4) of the five (5) are sufficient to remove the design basis heat load.

Each cooler is a counterflow air to water heat exchanger. The tubes of each heat exchanger is normally provided with NSW by a 6 inch header that tees off into two 4 inch headers (1 per divisic·). The 4 inch header contains a 4 inch swing check valve (46SW -60A(B)). Downstream of 46SWS-60A(B), the header tees-off five times into a 2-1/2 inch line that carries NSW to each cooler. Just after the third 2-1/2 inch tee-off, there is a 3 inch ESW tee-in that contains 3 inch swing check 46ESW-13A(B). Just before each cooler, the 2-1/2 inch supply line tees off into two 2 inch lines to the cooler waterboxes. On the outlet of the cooler are two 2 inch return lines that contain a throttled balance valve. These 2 inch lines tee into a 2-1/2 inch return line that eventually returns to a 6 inch return header. Upon initiation of ESW, ESW supply check valve 46ESW-13A(B) opens to provide ESW to the crescent area unit coolers and NSW supply check valve 46SWS-60A(B) closes to prevent the diversion of ESW flow.

The crescent unit coolers were flushed to minimize silt build-up and since December 1988, the coolers have been periodically tested to demonstrate satisfactorily performance and the test data is trended. They are only disassembled and inspected when satisfactory performance testing is not achieved. Boroscopic inspection of the 3 inch and 4 inch lines revealed no concerns. Piping was found to be clean and in good condition.

As part of the initial IST check valve disassembly scope, 4 inch NSW supply check valves 46SWS-60A and B were opened and found sticking through full travel, but able to seat. The valves were initially declared inoperable due to failing the visual inspection criteria. ESW supply 3 inch swing check valves 46ESW-13A and 13B were opened, passed the visual inspection criteria, and declared operable.

Analysis

The crescent area unit coolers have been performing satisfactorily and the associated piping was clean. No safety concern existed.

The NSW supply check valves 46SWS-60A and 60B, while not able to move freely through full travel, were able to shut and prevent the diversion of ESW flow. Therefore, no safety concern existed.

Corrective Action Prior to Start-up

1. NSW supply check valves 46SWS-60A and 60B were cleaned and restored to service.

2. A test connection was added upstream of 46SWS-60A and 60B to facilitate in-situ operability testing of these check valves.

3. The crescent area unit coolers were satisfactorily performance tested with ESW as apart of a coordinated ESW system test. The test results were compared to thermal hydraulic model projections.

E. Overall

1. Cause

The overall cause of the problems identified include: general corrosion build-up, microbiologically induced corrosion, and accumulation of silt and sand due to original design deficiency and component location.

2. Short-Term Corrective Actions

In addition to those cleaning and replacement activities described above, piping modifications were made to facilitate functional testing of safety-related check valves during normal operation. In addition, procedures were developed and implemented to permit performance testing of safety-related coolers with ESW while the plant is operating. One potential source of excessive silt build-up was the NSW/ESW pump suction forebays which were cleaned to remove excessive silt/sand/mud deposits.

3. Long-Term Actions

a. System testing will continue to better monitor functional performance.

b. The internals of various check valves were replaced with component parts less likely to corrode.

c. Chemical cleaning of the service water systems is being conducted to remove existing corrosion and reduce the potential for future corrosion.

d. A chlorine injection system to minimize potential service water degradation from zebra mussel infestation was installed and placed in service in the Spring of 1991.

Additional Information

Valve Manufacturer: Velan Valve Corporation

Manufacturer NPRD Code: V085

Unsatisfactory Components: 4 inch Swing Check Valves
3 inch Swing Check Valves
2 inch Spring Assisted Piston Check Valves
1.5 inch Sprint Assisted Piston Check Valves
All Bolted Bonnet

Valve Model Numbers: B10-0114B-2T
W7-234B-2TY
W8-234B-2TY

Unsatisfactory Components: 6 inch Swing Check Valve
4 inch Swing Check Valve
Bolted Bonnet

Valve Manufacturer: Pacific Valve Corporation

Manufacturer NPRD Code: P032

Valve Model Numbers: Not Available

Valve Manufacturer: Chapman Valve and Mfg.

Manufacturer NPRD Code: C255

Unsatisfactory Component: 6 inch Swing Check Valve Bolted Bonnet

Valve Model Number: 151AWE

Similar Events:

LERs 88-005 and 88-009 reported similar events in which check valves in the service water flow path were not operable due to accumulation of sediment and corrosion of valve parts. LER-89-015 reports similar problems with air operated piston-in-cage valves in the reactor building closed loop cooling system. [CC]

Reason for Update:

Revision 2 to this LER is submitted to correct the event analysis section for the problems associated with the control room [NA] and relay room [NA] cooling functions. NRC Inspection 50-333/92-81 noted that the Event Analysis did not address the potential loss of cooling as a result of the Emergency Service Water (ESW) cooling water supply being found plugged with silt for Safety Division 1 (System A) and the potential coincident loss of the Safety Division 2 (System B) ESW system. This condition would result in a loss of the control room and relay room cooling function. A vertical bar in the right-hand margin indicates text changes made in this revision except where minor typographic or editorial changes were made.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
James A. FitzPatrick Nuclear Power Plant	0 5 0 0 0 3 3 3	90	— 0 1 2	— 0 2	1 8 OF 2 7

TEXT (If more space is required, use additional NRC Form 366A's) (17)

Page 1 of Table 1

RAW WATER CHECK VALVES INITIALLY DECLARED INOPERABLE

VALVE	VENDOR	APPLICATION VALVE TYPE	DR	1990 INSPECTION RESULTS	SAFETY FUNCTION	AS-FOUND CONDITION
ELECTRIC BAY COOLERS						
46SWS-67A	VELAN	ELEC. BAY UC-16A 3"/CS/SWING	90-109	U	CLOSE	60-70% OPEN
46SWS-67B	VELAN	ELEC. BAY UC-16B 3"/CS/SWING	90-109	U	CLOSE	60-70% OPEN
46ESW-19A	VELAN	ELEC. BAY UC-16A SUPPLY 2"/SS/PISTON	90-108	U	OPEN	STICKING SHUT
46ESW-19B	VELAN	ELEC. BAY UC-16B SUPPLY 2"/SS/PISTON	90-108	U	NONE	STICKING SHUT
46ESW-20A	VELAN	ELEC. BAY UC-16A SUPPLY 2"/SS/PISTON	90-108	U	NONE	STICKING SHUT
46ESW-20B	VELAN	ELEC. BAY UC-16B SUPPLY 2"/SS/PISTON	90-108 90-164	U	OPEN	STICKING SHUT
CABLE TUNNEL COOLERS						
46SWS-68	VELAN	CABLE TUNNEL E-11 3"/CS/SWING	90-095	U	CLOSE	50-60% OPEN
46SWS-69	VELAN	CABLE TUNNEL E-14 3"/CS/SWING	90-095	U	CLOSE	50% OPEN
46ESW-21A	VELAN	CABLE TUNNEL E-11 SUPPLY 2"/SS/PISTON	90-088	U	NONE	STICKING SHUT
46ESW-21B	VELAN	CABLE TUNNEL E-14 SUPPLY 2"/SS/PISTON	90-093	U	OPEN	STICKING SHUT
46ESW-22A	VELAN	CABLE TUNNEL E-11 SUPPLY 2"/SS/PISTON	90-089	U	OPEN	STICKING SHUT
46ESW-22B	VELAN	CABLE TUNNEL E-14 SUPPLY 2"/SS/PISTON	90-090	U	NONE	STICKING SHUT
CONTROL ROOM AND RELAY ROOM VENTILATION						
46(70)SWS-101	PACIFIC	CR VENT "A" 6"/CS/SWING	90-136 90-155 90-162	U	CLOSE	SLIGHT BINDING WOULD NOT SEAT DUE TO SILT IN VALVE BASE
46(70)SWS-102	CHAPMAN	CR VENT "B" 6"/CS/SWING	90-137 90-157 90-160 90-161	U	CLOSE	75% OF FULL OPEN TRAVEL WOULD NOT SEAT DUE TO SILT IN VALVE BASE
CRESCENT AREA UNIT COOLERS						
46SWS-60A	VELAN	WEST CRESCENT SW SUPPLY 4"/CS/SWING	90-133	U	CLOSE	FULL TRAVEL OPEN LIMITED SEAT SLIGHTLY FOULED
46SWS-60B	PACIFIC	EAST CRESCENT SW SUPPLY 4"/CS/SWING	90-133	U	CLOSE	FULL TRAVEL OPEN LIMITED

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

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James A. FitzPatrick Nuclear Power Plant	0 5 0 0 0 3 3 3	9 0	0 1 2	0 2	1 9 OF 2 7

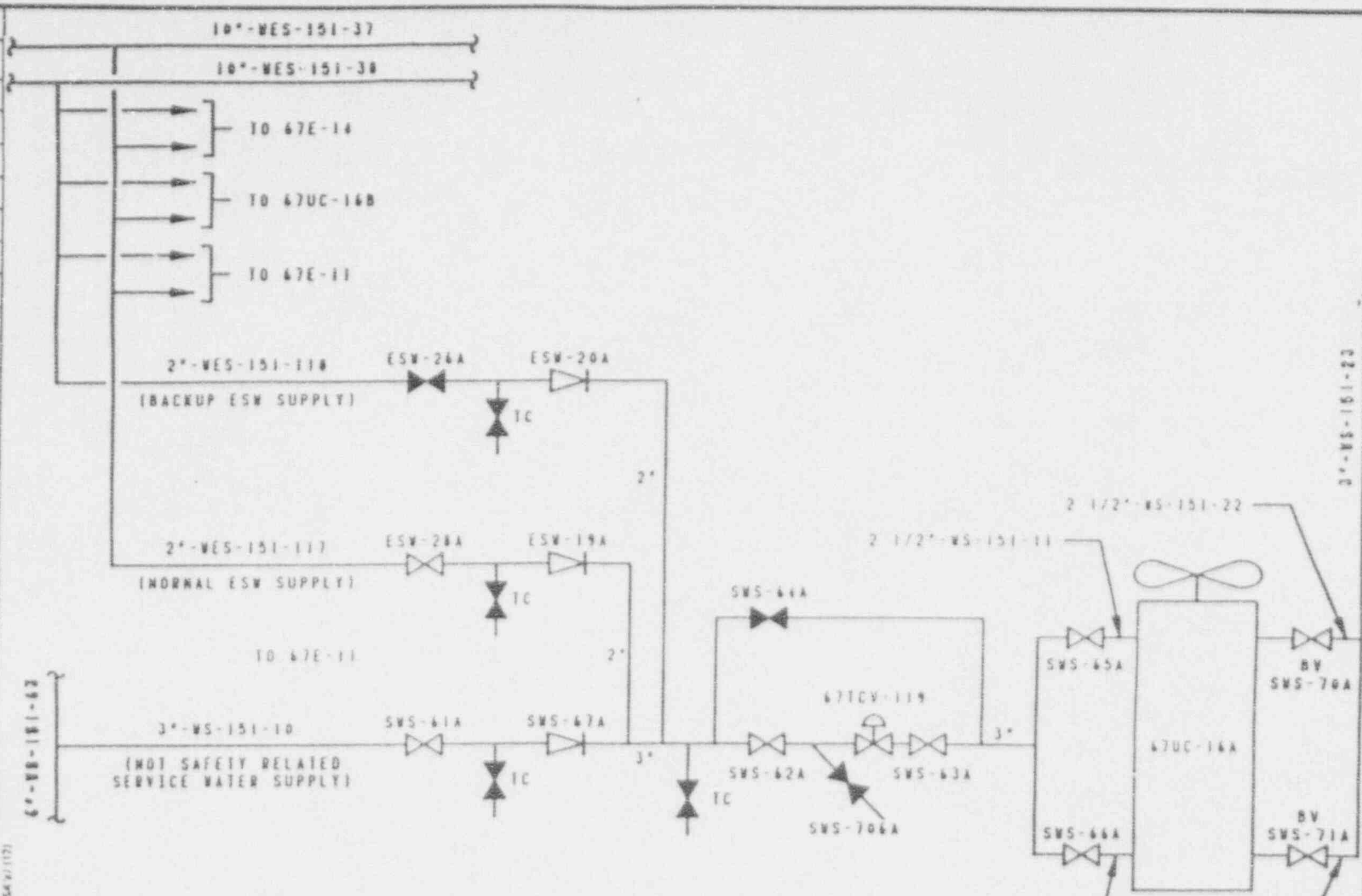
TEXT (If more space is required, use additional NRC Form 366A's) (17)

Page 2 of Table 1

RAW WATER CHECK VALVES INITIALLY DECLARED INOPERABLE

VALVE	VENDOR	APPLICATION VALVE TYPE	DR	1990 INSPECTION RESULTS	SAFETY FUNCTION	AS-FOUND CONDITION
MISCELLANEOUS NON-SAFETY RELATED HEAT LOADS AND EQUIPMENT						
10RHR-431A	VELAN	SW TO RHR SW KEEP FULL 1.5"/SS/PISTON	90-165	U	NONE	STUCK OPEN
10RHR-431B	VELAN	SW TO RHR SW KEEP FULL 1.5"/SS/PISTON	90-166	U	NONE	STUCK OPEN 3/16-1/4"
15RBC-24B	VELAN	RBCLC D/W COOLER SUPPLY 4"/CS/SWING		U	CLOSE	STUCK SHUT
15RBC-35B	VELAN	RHR PUMP 10P-3B COOLER 1.5"/SS/PISTON	90-112	U	NONE	CUT ON SEAT
15RBC-38A	VELAN	CRD PUMP COOLER 1.5"/SS/PISTON	90-126	U	CLOSE	STUCK SHUT
46SWS-12	VELAN	ADMIN. BUILDING SW SUPPLY 6"/CS/SWING		U	NONE	WOULD NOT SEAT
46SWS-15	VELAN	CR AIR COND. INLET 6"/CS/SWING		U	NONE	WOULD NOT SEAT
46SWS-22	VELAN	RX BLDG UNIT SUPPLY 8"/CS/SWING		U	NONE	WOULD NOT SEAT
46ESW-11A	VELAN	"A" CRD PUMP COOLER SUPPLY 1.5"/CS/PISTON		U	NONE	STICKING SHUT
46ESW-18A	VELAN	RHR PUMP 10P-3A COOLER 1.5"/SS/PISTON	90-086	U	NONE	STICKING SHUT
46ESW-18C	VELAN	RHR PUMP 10P-3C COOLER 1.5"/SS/PISTON	90-087	U	NONE	STICKING SHUT
76FPS-63	VELAN	JOCKEY PUMP DISCHARGE 2"/CS/PISTON		U	NONE	STUCK SHUT
76FPS-60	VELAN	PRESSURE TANK OUTLET 2"/CS/PISTON		U	NONE	STUCK SHUT

Figure 1



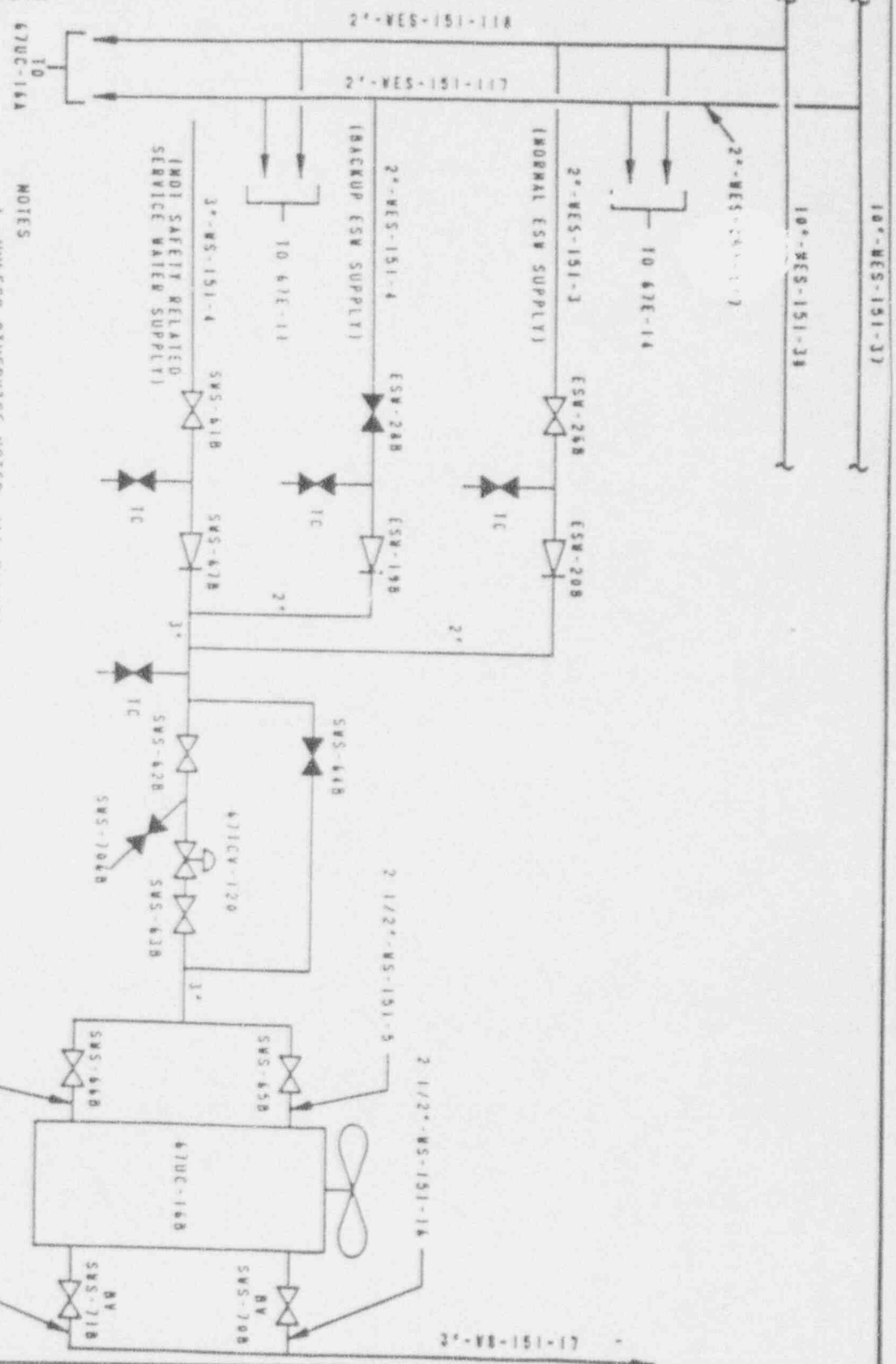
NOTES

1. UNLESS OTHERWISE NOTED, ALL VALVES PREFIXED 46
2. T.C. - TEST CONNECTION
3. B.V. - BALANCE VALVE

ELECTRIC BAY UNIT COOLERS

67UC-16A

Figure 2



NOTES
1. UNLESS OTHERWISE NOTED, ALL VALVES PREFIXED 46
2. T.C. - TEST CONNECTION
3. B.V. - BALANCE VALVE

ELECTRIC BAY UNIT COOLERS

67UC-16B

NRC FORM 366A (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

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James A. FitzPatrick Nuclear Power Plant	0 5 0 0 0 3 3 3	9 0	— 0 1 2 —	0 2	2 2 OF 2 7

TEXT (If more space is required, use additional NRC Form 366A's) (17)

Figure 3

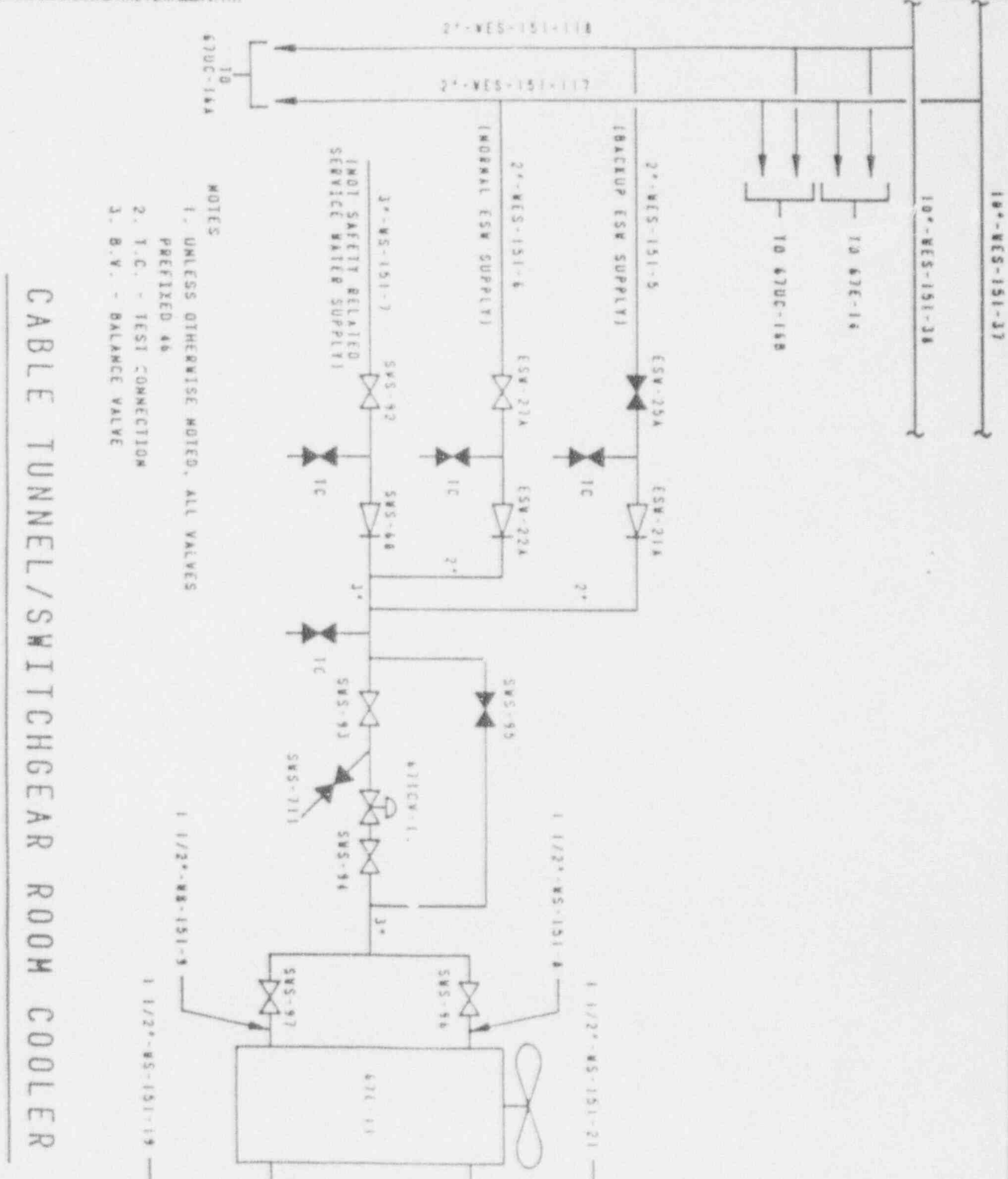

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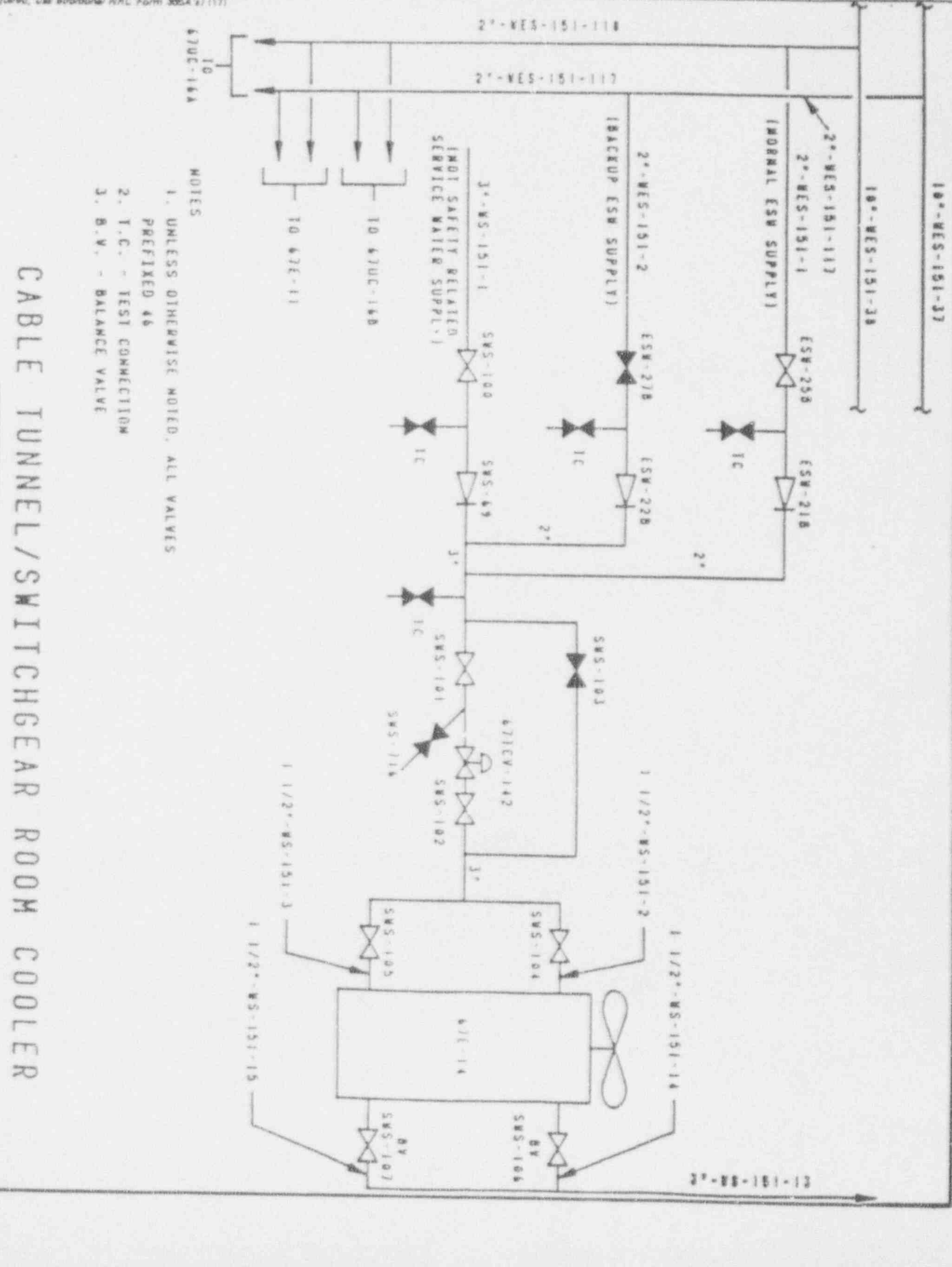
Figure 4



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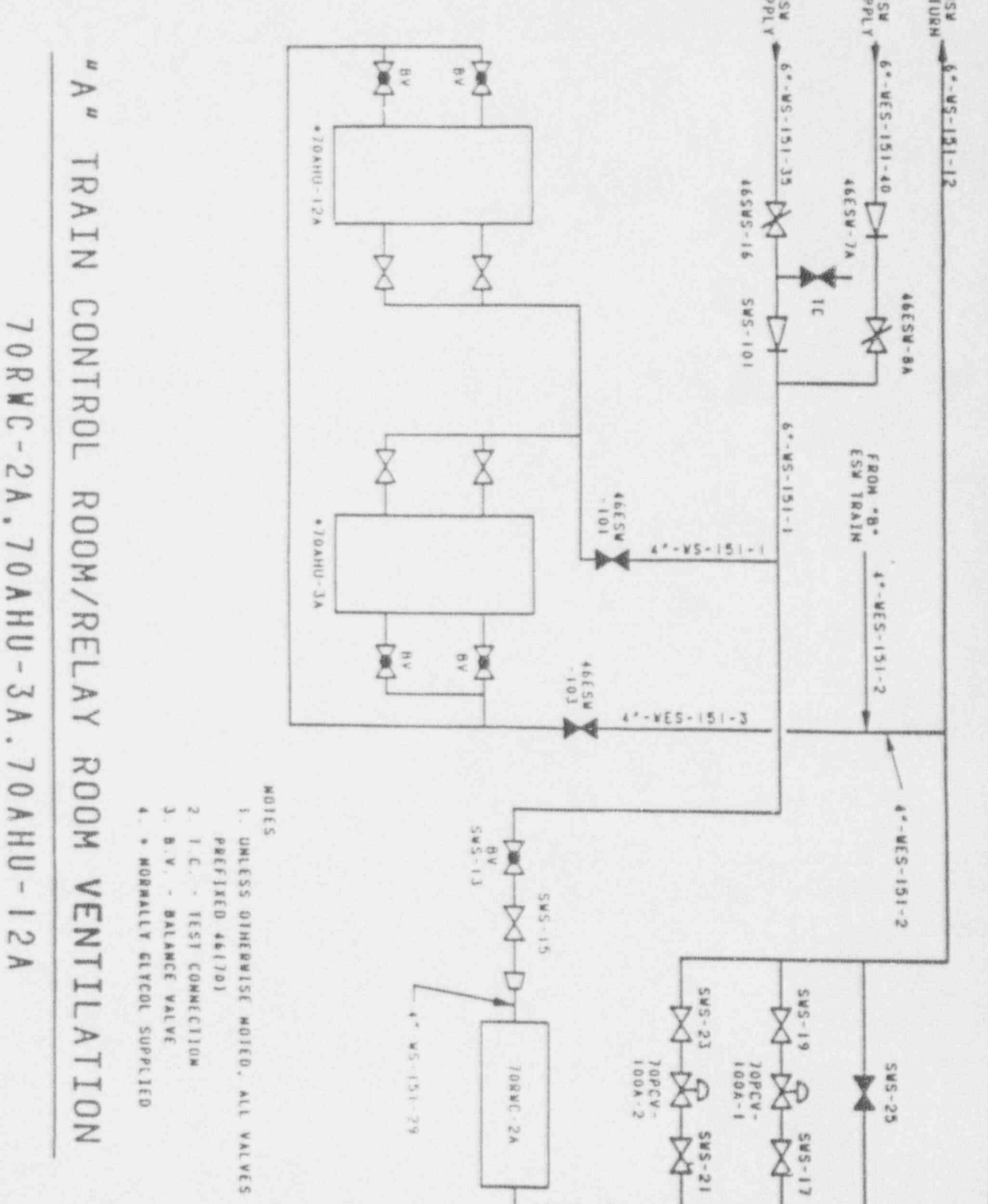
TEXT (If more space is required, use additional NRC Form 366A's) (17)

Figure 5



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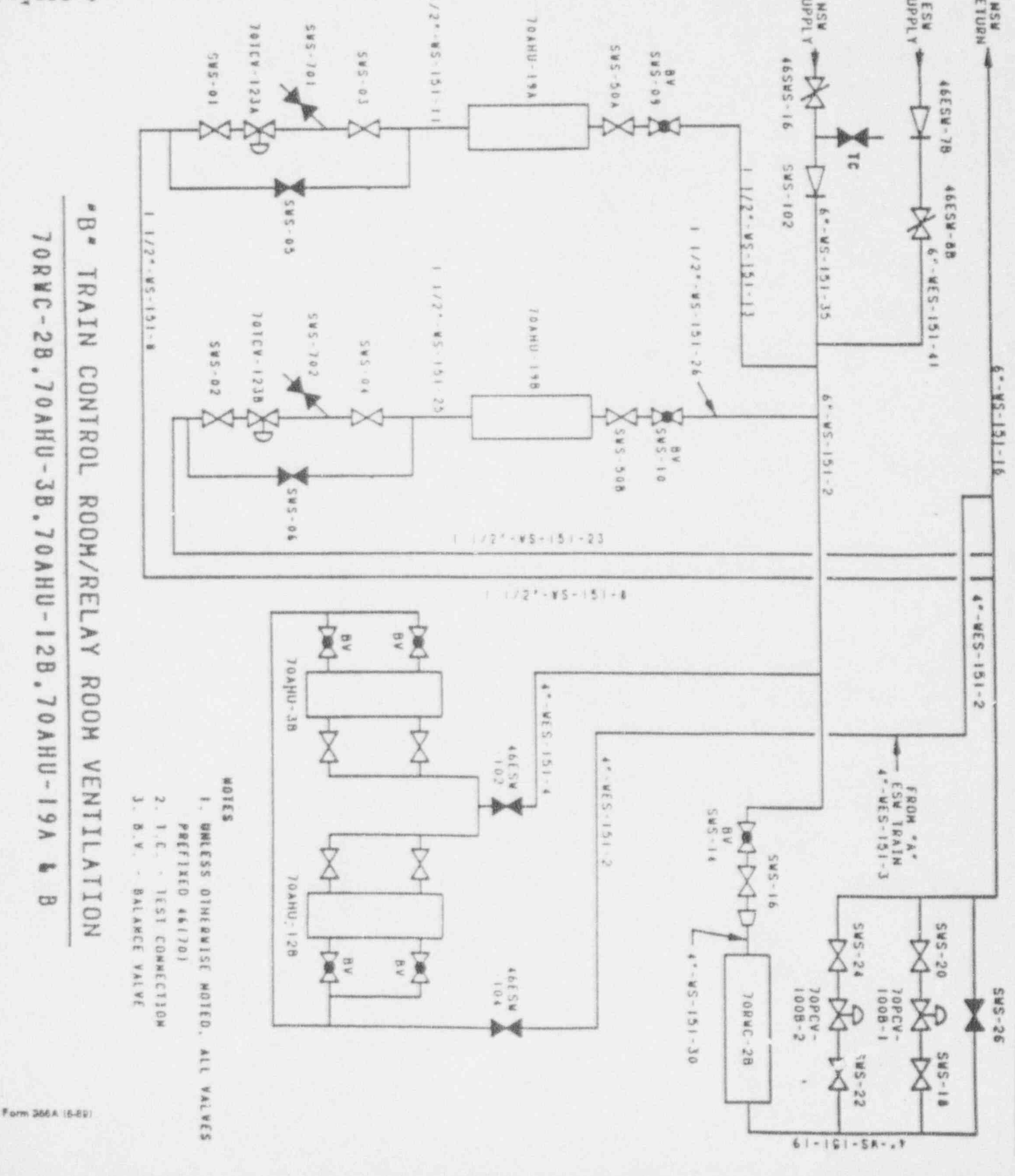
TEXT (If more space is required, use additional NRC Form 366A's) (17)

Figure 6



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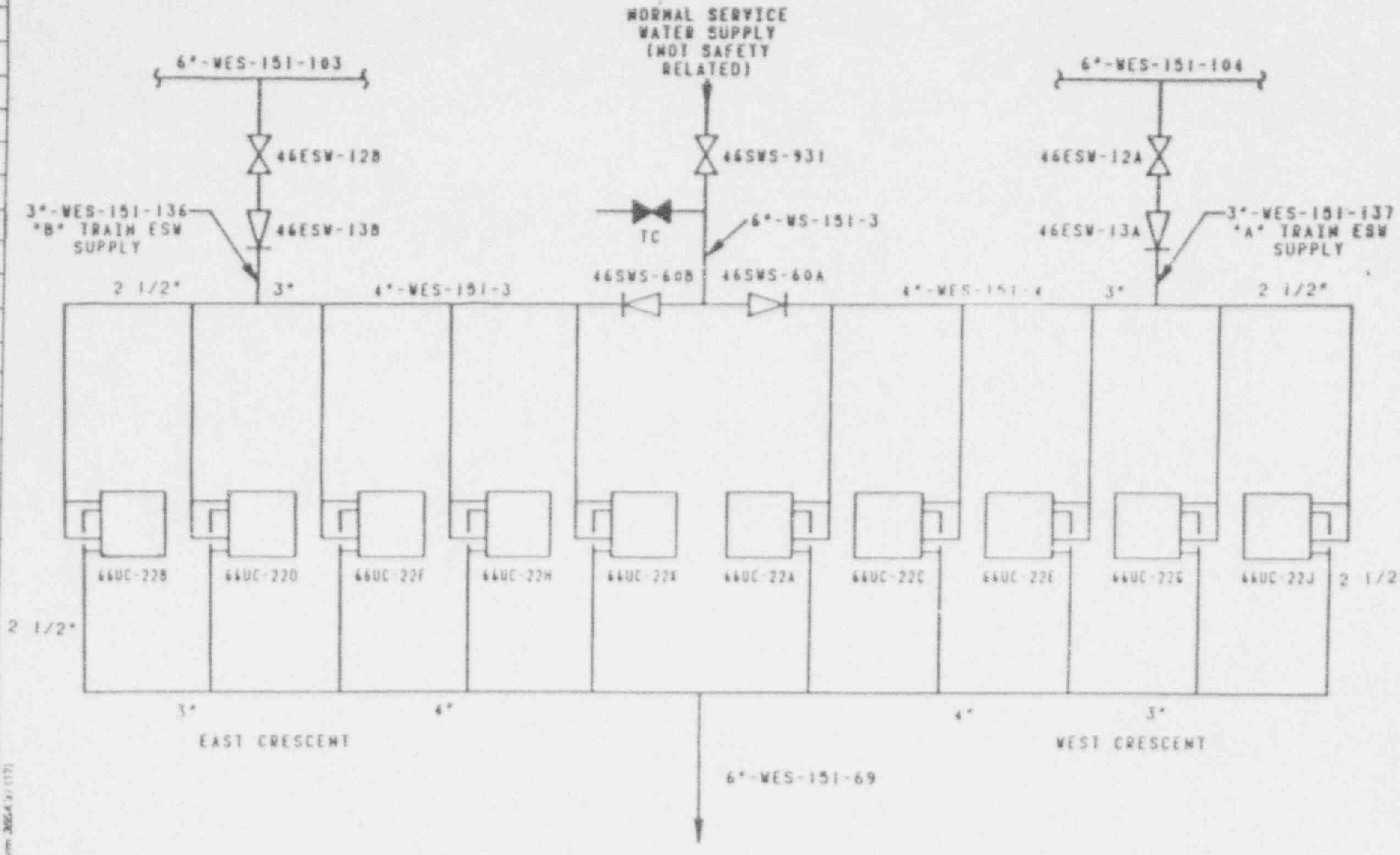
James A. FitzPatrick Nuclear Power Plant	0 5 0 0 0 3 3 3	9 0	0 1 2	0 2	2 6 OF 2 7

TEXT (If more space is required, use additional NRC Form 366A's) (17)

Figure 7



TO SERVICE WATER RETURN

NOTES

1. SEE NEXT PAGE FOR TYPICAL CRESCENT UNIT COOLER DETAIL
2. T.C. - TEST CONNECTION
3. B.V. - BALANCE VALVE (SEE NEXT PAGE)

CRESCENT UNIT COOLERS

NRC FORM 366A (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

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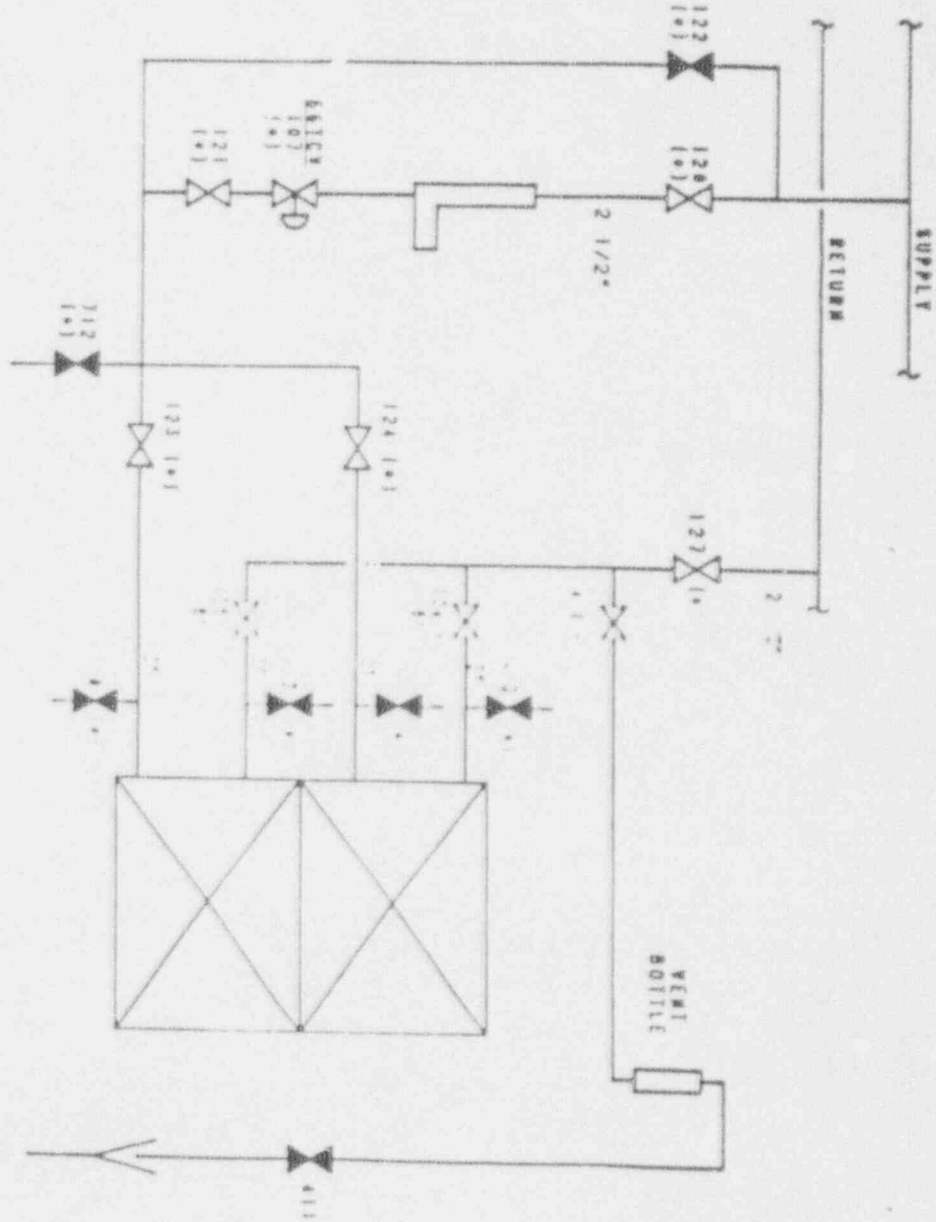
James A. FitzPatrick Nuclear Power Plant	0 5 0 0 0 3 3 3	9 0	— 0 1 2	— 0 2	2 7 OF 2 7

TEXT (If more space is required, use additional NRC Form 366A's) (17)

Figure 8



NOTES
1. ALL VALVES PREFIXED 46SWS UNLESS OTHERWISE NOTED
2. (*) DENOTES UC-A THRU K

DETAIL OF TYPICAL CRESCENT AREA UNIT COOLER (66UC-22A to K)