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JAFP-91-0071

United States Nuclear Regulatory Commission
Document Control Desk
Mail Station P1-137
Washington, D.C. 20555

SUBJECT: DOCKET NO. 50-333
LICENSEE EVENT REPORT: 90-025-01
Service Water Check Valves

Dear Sir:

This revised Licensee Event Report is submitted in accordance with 10 CFR 50.73 "Other" as a voluntary report.

This revision reports the failure of two additional check valves to close on December 26th under test conditions similar to those originally reported in this LER for three other service water check valves.

Questions concerning this report may be addressed to Mr. Hamilton Fish at (315) 349-6013.

Very truly yours,

WILLIAM FERNANDEZ

WF:HCF:lar

cc: USNRC, Region I
USNRC Resident Inspector
INPO Records Center
American Nuclear Insurers

Cert No P229764417

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NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

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 0 7

TITLE (4) Five Service Water to Emergency Service Water Swing Check Valves Fail to Close During Testing Due to Corrosion and Silt Accumulation in Hinge

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

OPERATING MODE (9): N

POWER LEVEL (10): 1 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)	X OTHER (Specify in Abstract below and in Text, NRC Form 366A) Voluntary
20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
20.405(a)(1)(iv)	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 (AREA CODE)
Hamilton C. Fish	3 1 5 3 4 9 - 6 0 1 3

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS
X	K G	V	V C 8 5	Y					

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 Voluntary Report - Previous Report Date 12/17/90

EIIS Codes are in []

On 11/15/90 and 12/25/90 the plant was operating at 100% power. During a scheduled ASME Section XI in-service test program surveillance test, three 3-inch swing check valves failed to close on 11/15/90. Two additional valves failed on 12/26/90. Following the initial tests, four of the five valves closed when tapped with a tool handle. The valves supply service water (SWS) [KG] to nine area ventilation unit coolers located in spaces containing safety-related electrical switchgear and emergency core cooling system equipment. The valves are intended to close upon loss of service water pressure to prevent diversion of the emergency service water (ESW) [BI] supply away from the coolers. On 11/16/90 and 12/27/90 carbon steel valve internals were replaced with stainless steel components to avoid corrosion problems which contributed to the sticking condition. The as-found stuck open valve condition would not be expected to result in conditions adverse to safety in the event of an FSAR postulated accident. This is a voluntary report.

Related LERs: 88-055, 88-009, and 90-012.

NRC Form 366 (9-83)

EIIS Codes are in []

Updated Voluntary Report - Previous Report Date 12/17/90

Description

The plant was operating at full power on November 15, 1990 and December 26, 1990. As a part of an accelerated ASME Section XI in-service testing program (IST), a regularly scheduled monthly surveillance test (ST), "Emergency Service Water Check Valve Test" (ST-8R), was being conducted. Three 3-inch swing check valves did not close when reverse flow conditions were simulated on 11/15/90. One 3-inch and one 4-inch valve did not close on 12/26/90.

The ST acceptance criteria require that the valves close when: 1) service water flow through the valve is isolated, and 2) the upstream side of the valve is vented to the atmosphere, and 3) the downstream side of the valve is pressurized by emergency service water (ESW) [BI] flow.

During normal operation service water (SWS) [KG] flows through each of the check valves to supply unit coolers. The unit coolers remove heat from four rooms containing safety-related electrical switchgear and cable and emergency core cooling system equipment. Check valve 46SWS-67B failed to close after two tests at 1045. With the valve isolated from both SWS and ESW, the valve bonnet was tapped with a wrench handle. The valve then closed promptly when reverse flow was initiated for the retest. The other two valves (46SWS-67A and 46SWS-69) were tested with similar results, initially failing at 1200 and 1245 respectively and then closing during the retest after they had been tapped with the wrench handle while they were isolated in the test configuration. Similar results (except that 46SWS-60A did not close) were observed on 12/26/90 when valves 46SWS-68 and 46SWS-60A were tested and initially failed at 2105 and 2130 respectively.

Following notification of each valve failure, the shift supervisor directed closure of the appropriate manual isolation gate valves upstream of check valves in the service water system (SWS) [KG] supply to the affected unit cooler. Cooling water was then supplied to the unit coolers from the emergency service water (ESW) [BI] system.

The day following the failures November 15th, the unit cooler for the west electric bay was removed from service at 0640 to facilitate inspection and repair of valve 46SWS-67A. This placed the plant in a Limiting Condition for Operation (LCO). The internals were replaced with stainless steel components. The valve was retested and closed satisfactorily. The unit cooler was restored to service at 1500 ending the LCO. At 1720 the unit coolers for the east electric bay and the east cable tunnel (which includes cooling for one emergency diesel generator (EDG) [EK] switchgear room) were removed from service to facilitate inspection or repair of valves 46SWS-67B and 46SWS-69. This placed the plant in an LCO. The internals of these two valves were replaced with stainless steel components. The valves were retested and closed satisfactory. The unit coolers were returned to service ending the LCO at 2107.

The day following the valve failures of December 26, 1990, the unit cooler for the west cable tunnel was removed from service at 0950 to facilitate inspection and repair of valve 46SWS-68. This placed the plant in a 24-hour LCO in accordance with Technical Specification Section 3.5. The hinge pin and swing arm were replaced with stainless steel components. The disc and attachment bolt were replaced with carbon steel due to the unavailability of stainless steel parts.

At 1050 the ten unit coolers located in both the east and west crescent areas were removed from service to facilitate inspection and repair of 4-inch header swing check valve 46SWS-60A. This is also an 24-hour LCO in accordance with Technical Specification Sections 3.11.B and 3.5. The internals of this valve were replaced with stainless steel components.

At 1615 the west cable tunnel cooler was returned to service and post-work testing of valve 46SWS-68 was completed satisfactorily. The post-work testing of 46SWS-60A was completed satisfactorily. The ten east and west crescent area unit coolers were returned to service ending the LCOs at 1950.

Cause

The event was caused by the failure of the swing check valve discs to fully close under test conditions. The failure of the discs to swing closed was the result of excessive friction in the hinge pin mechanism of the valve. Opening the valves for inspection revealed the valve parts to be coated with mud, sand, and corrosion products. The hinge pin and hanger arm had a distinct gritty feel to them when they were hand-operated. Therefore, the excess fiction is attributed to the build-up of corrosion products and abrasive mud and sand between the hinge pin and hanger arm. Because accumulations of mud and sand had been cleaned from the service water pump suction bays only four months prior to this event, the sand and mud accumulation in the valves is viewed as an unavoidable result of the naturally occurring storms which cause turbulence and entrainment of sand and silt in the lake water which is the source of the service water. The corrosion between the carbon steel metal hinge and stainless steel hinge pin is an oxidation reaction resulting from the oxygen content and 360 micro mho conductivity of the lake water. The volume of service water flow, coupled with the return of the water to the lake, precludes treatment of the water to reduce the oxygen content or conductivity. The pH of the water is in the 7 to 9 range and is not viewed as a contributing factor to the corrosion.

As reported in LER-90-012, each of these five valves had previously been found stuck in a partially open position during inspection during the spring 1990 outage. They have closed satisfactorily during each of the four monthly surveillance tests prior to 11/15/90 and three times at two week intervals prior to this event on 12/26/90.

Analysis

This event is voluntarily reported under the provisions of 10CFR50.73 as being related to our previous voluntary report, LER-90-012, which involved similar conditions with the same valves. Available ESW flow to some coolers could have been less than the values assumed in the FSAR.

Four valves of this event supply cooling water to three area unit coolers. These heat exchangers provide area ventilation cooling for portions of the 4 KV, 120 VAC, 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), the east electric bay (Safety Division 2), and the east and west cable tunnels (Safety Divisions 1 and 2) including both EDG [EK] switchgear rooms.

The coolers are designed to remove the normal heat load, which is approximately 50% greater than the post-accident heat load for the electric bays and 350% to 450% greater than the post-accident heat load for the cable tunnel and associated EDG switchgear room. The cooler design approximates counterflow air to water heat exchange.

Flow diagrams showing the SWS and ESW supply to each heat exchangers are attached as Figures 1 through 4. The tube side of each heat exchanger is normally provided with service water from a 3-inch line that branches off the SWS main header. Teeing into this line, just downstream of the 3-inch swing check valves (which failed to close in this event), are two 2-inch ESW supply lines. One of these supply lines is normally valved-in and is considered safety-related. The other line is normally valved-out and is not safety-related.

The crescent area unit cooler 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) (see Figure 5).

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

Each cooler approximates a counterflow air to water heat exchanger. The tubes of each heat exchanger are normally provided with service water through a 6-inch header that tees off in two 4-inch headers

(1 per division). The 4-inch header contains the 4-inch swing check valve (46SWS-60A) which initially failed to close under test conditions. Downstream of this valve the header has five tee connections into 2-1/2-inch supply lines to each cooler. The ESW supply also ties into the same header downstream of the failed check valve. Upon initiation of the ESW, the service water check valve 46SWS-60A is designed to close to prevent diversion of ESW from the unit coolers.

The swing check valves in the SWS were operable in the open position and supplied adequate cooling water flow to the electric bay, cable tunnel area ventilation unit coolers and west crescent area coolers. However, it is possible that they may not have closed on reverse flow. If the service water pressure had failed, operators could have manually initiated the ESW system, which would then have injected into these coolers. The SWS swing check valves would then have been required to close to maintain full ESW flow through the unit coolers by preventing ESW flow diversion into the normal SWS. The ESW is not designed to have sufficient pumping capacity to supply both the ESW and SWS systems. Therefore, the ability of the ESW system to remove heat from the components it is designed to supply could have been reduced for a period of time until the SWS supply lines to the unit coolers could have been isolated by closing local manual valves. These isolation valves (for the four SWS check valves supplying the electric bays) are in an accessible portion of the turbine building. The isolation valve for the west crescent area check valve is located in the reactor building. Accessibility could be hindered by a post LOCA environment. Normal operator walk-through monitoring of the spaces cooled by these systems following transfer to the ESW supply would identify any significant flow diversion (due to stuck open check valves) prior to the ambient air temperature exceeding equipment design temperature limits.

It was demonstrated during the surveillance test that a simple tap of a wrench of the valve bonnet was sufficient to result in closure of four of the five valves. An event of sufficient magnitude to shear a 3-inch supply line would probably have been of sufficient force to loosen the valve hinge mechanism and permit valve closure.

The more probable event is loss of SWS pressure due to SWS pump power supply failure. The inherent flow resistance of the SWS system would have resulted in a flow diversion less than that which would have resulted from a pipe break. Because the design heat removal capacity of the coolers for normal operation provides a margin of approximately 50% above the post-accident heat load for the electric bays and at least 350% for the east cable tunnel, the remaining ESW flow to these coolers may have been able to provide sufficient heat removal capacity to avoid a degradation of the safety functions of the equipment located in these spaces.

In contrast to the reduced heat loads during FSAR events in the electric bays and cable tunnels, the crescent area heat loads resulting from events postulated in the FSAR are on the order of five times the heat load present during normal operation. Thus the excess capacity of the electric bay and cable tunnel unit coolers is not present in the crescent area coolers. The available design margin provides for adequate heat removal capacity with four of the five unit coolers in operation. However, this margin is degraded by the flow limiting characteristics of the system piping and location within the ESW system, and by the degraded thermal performance of the unit coolers which was measured at 65 to 75 percent (for the 4 worst of 5 coolers) of the design value two weeks before this event.

Comparison of the measured (12/90) heat removal performance of the four unit coolers with the minimum heat removal required by a revised (1989) engineering calculation of crescent area heat loads during FSAR events, shows a positive margin of 25 percent. However, this assumes availability of design ESW flow. While ultrasonic measurements (12/90) indicate that design ESW flow is currently available, there was no excess flow capacity margin. Thus diversion of ESW flow due to the failure of check valve 46SWS-60A to close during some FSAR postulated events would offset at least a portion of the current 25% margin in heat removal capacity. A determination of the rate of the ESW flow diversion due to failure of the check valve in the open position would require an experimental flow measurement test or performance of a computer modeled engineering analysis. There was, therefore, a possibility of a temperature increase rate in the west crescent area in excess of that assumed in the FSAR conditions, if the crescent area service water supply check valve had stuck open during accident conditions. Based on a generalized engineering evaluation, the impact (due to reduction of west crescent cooling capacity) on the east crescent area temperatures would not be expected to impact operation of the core spray, low pressure coolant injection, and high pressure coolant injection systems that are located there.

The ability to manually isolate any of the check valves which failed would have mitigated the consequences of any event and ensured continued and adequate cooling capacity to the electric bays, cable tunnel, and crescent area. Accordingly, the failure of these five valves to close under test conditions would most probably not have had a significant adverse impact on plant safety in the event of the accident postulated in the FSAR.

Corrective Action

1. The valve internals for four valves were replaced with stainless steel components. Due to a lack of additional stainless steel parts only the hinge and swing arm were replaced with stainless

steel on valve 46SWS-68. It is anticipated that this will increase the service interval for the hinge pin and hanger arm by reducing corrosion between these components and reducing clearances which allow entry of foreign material.

2. In November 1990, the frequency of surveillance testing was increased from once each month to once every two weeks for the eight SWS to ESW swing check valves which are normally held in the open position by service water flow. This accelerated inspection frequency was able to provide earlier identification of degraded check valve performance.

3. These check valves will be replaced with valves having a more appropriate design during the 1991 Refueling Outage.

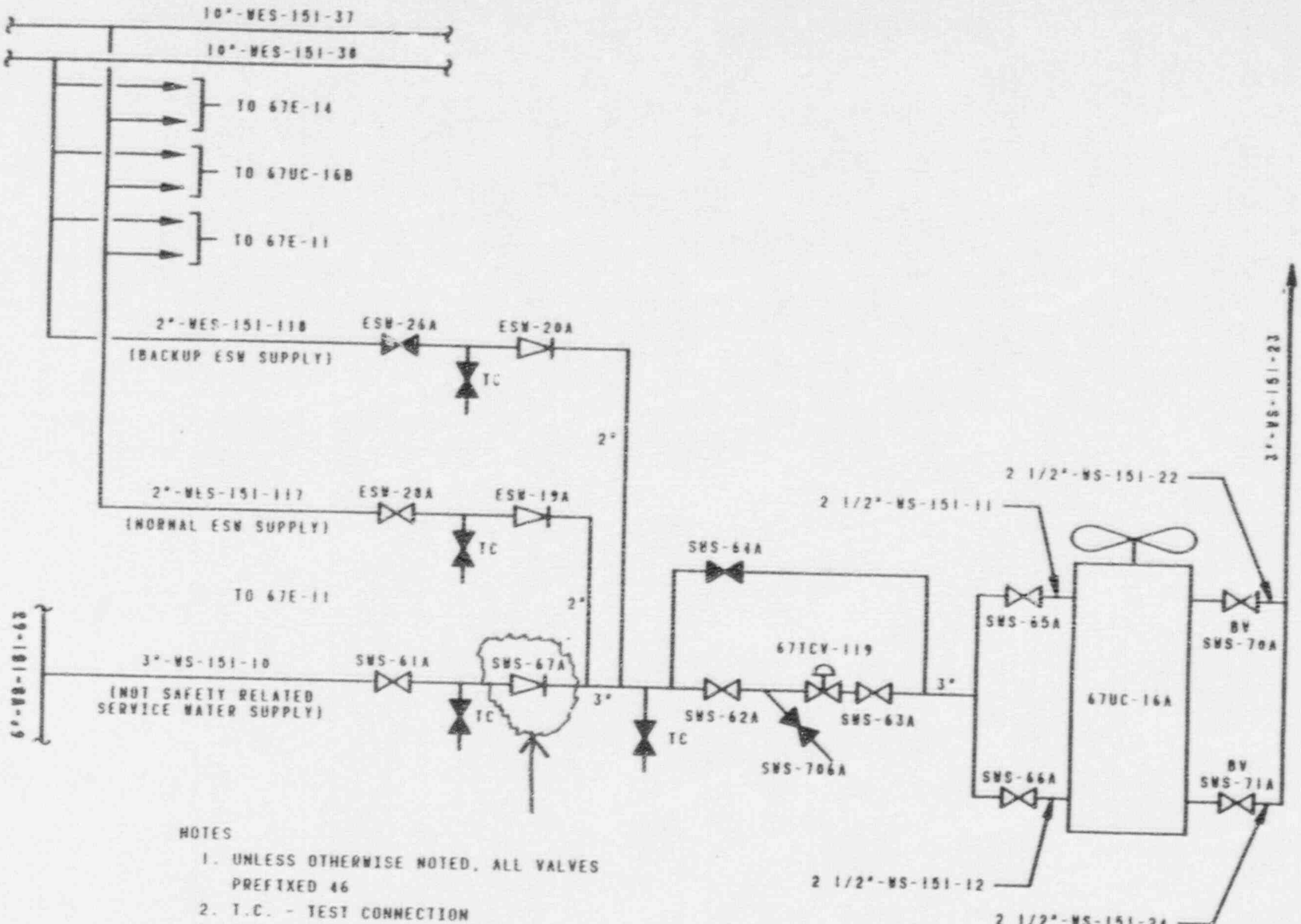
Additional Information

Failed Component Data

Name:	Service Water Check Valves
Description:	Swing Check Valve
Function:	Prevent emergency service water diversion to the normal service water system in the event of low service water pressure.
Plant Component Identification:	46SWS-60A, 67A, 67B, 68, and 69
Manufacturer:	Velan Valve Corporation
Model:	F-10-0114B-2T and B12-0114B-2T
Pressure Rating:	150 psig
Size:	3-Inch and 4-Inch
Material:	Carbon Steel
NPRDS Vendor Code:	V085
NPRDS Component Code:	VALVE
IEEE Component Code:	V

Similar Events

LERs 88-005, 88-009, and 90-012 reported similar events in which ESW isolation swing check valves in the service water flow path were not operable due to accumulation of sediment and corrosion of valve parts.



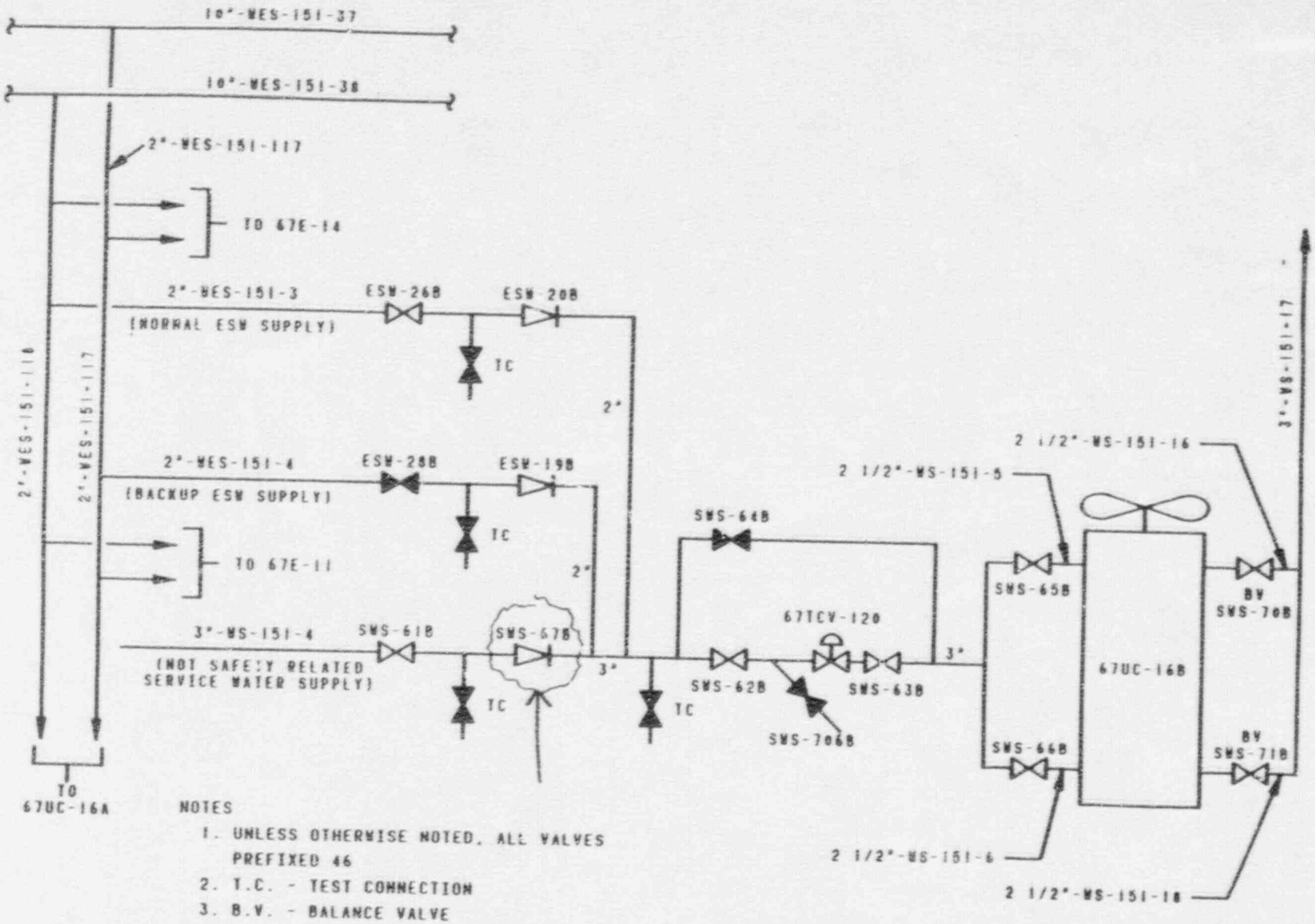
NOTES

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

ELECTRIC BAY UNIT COOLERS

67UC-16A

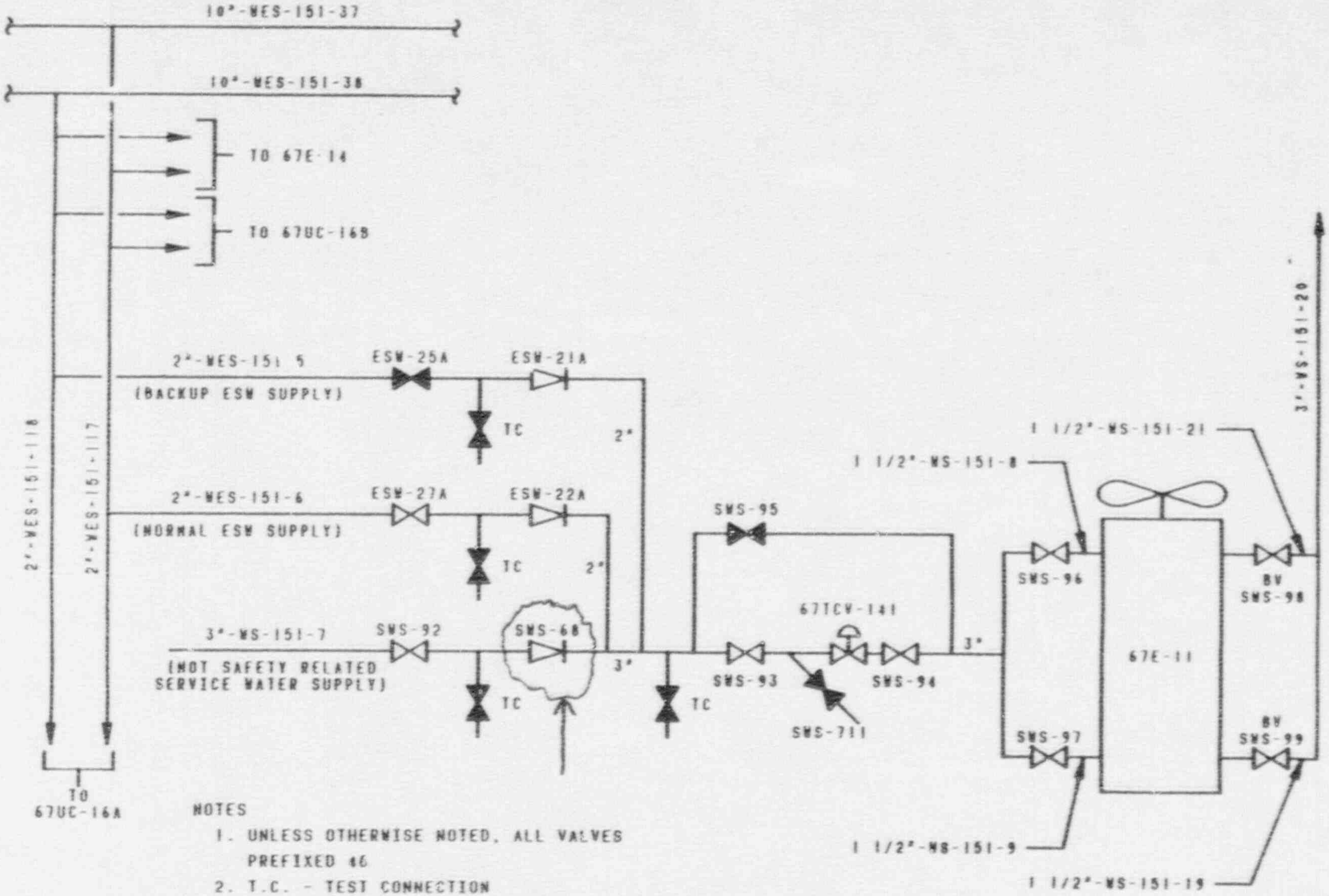
Figure 1 to
LER 90-025-01
Docket No. 50-333



ELECTRIC BAY UNIT COOLERS

67UC-16B

Figure 2 to
LER 90-025-01
Docket No. 50-333



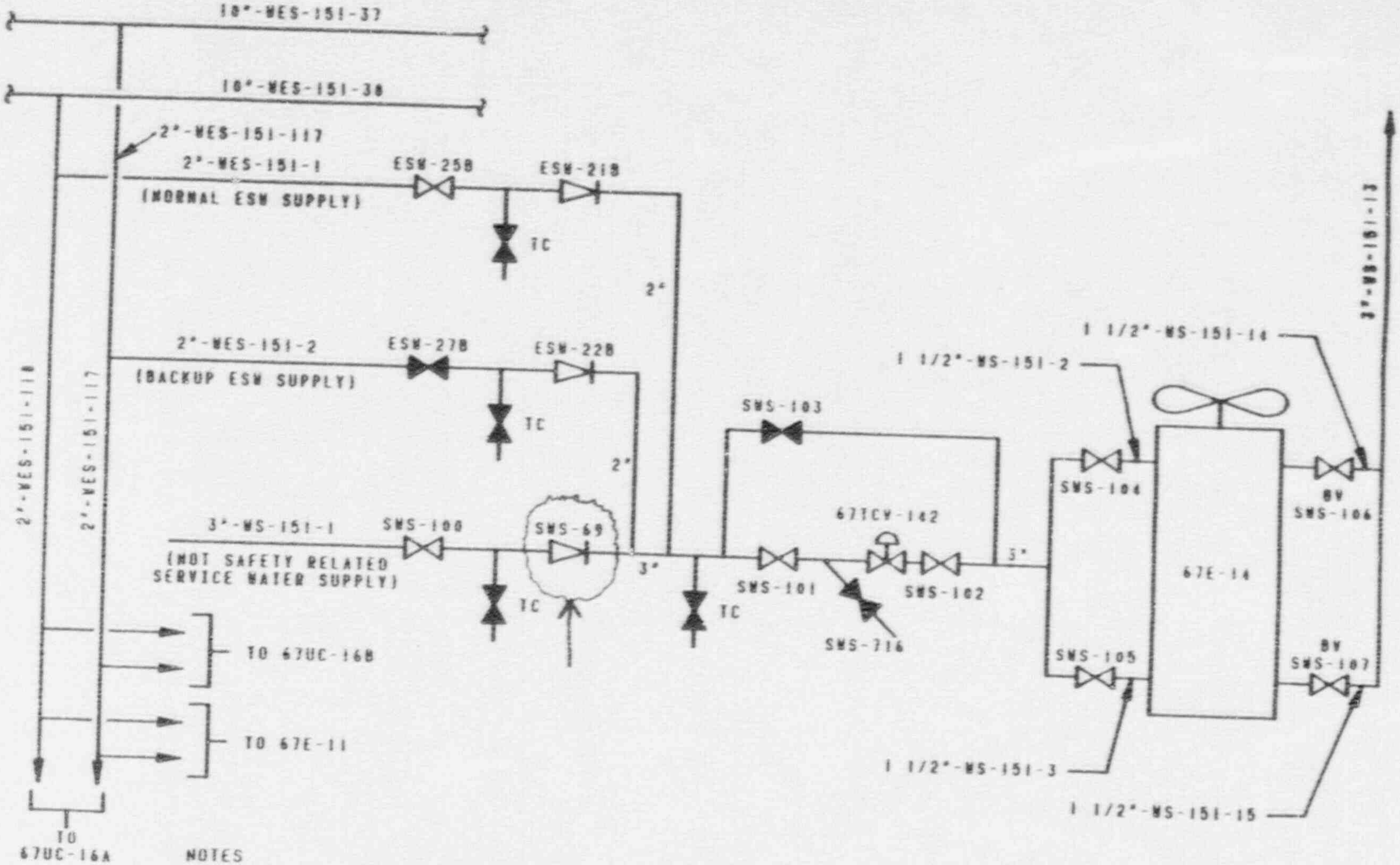
NOTES

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

CABLE TUNNEL/SWITCHGEAR ROOM COOLER

67E-11

Figure 3 to
LER 90-025-01
Docket No. 50-333



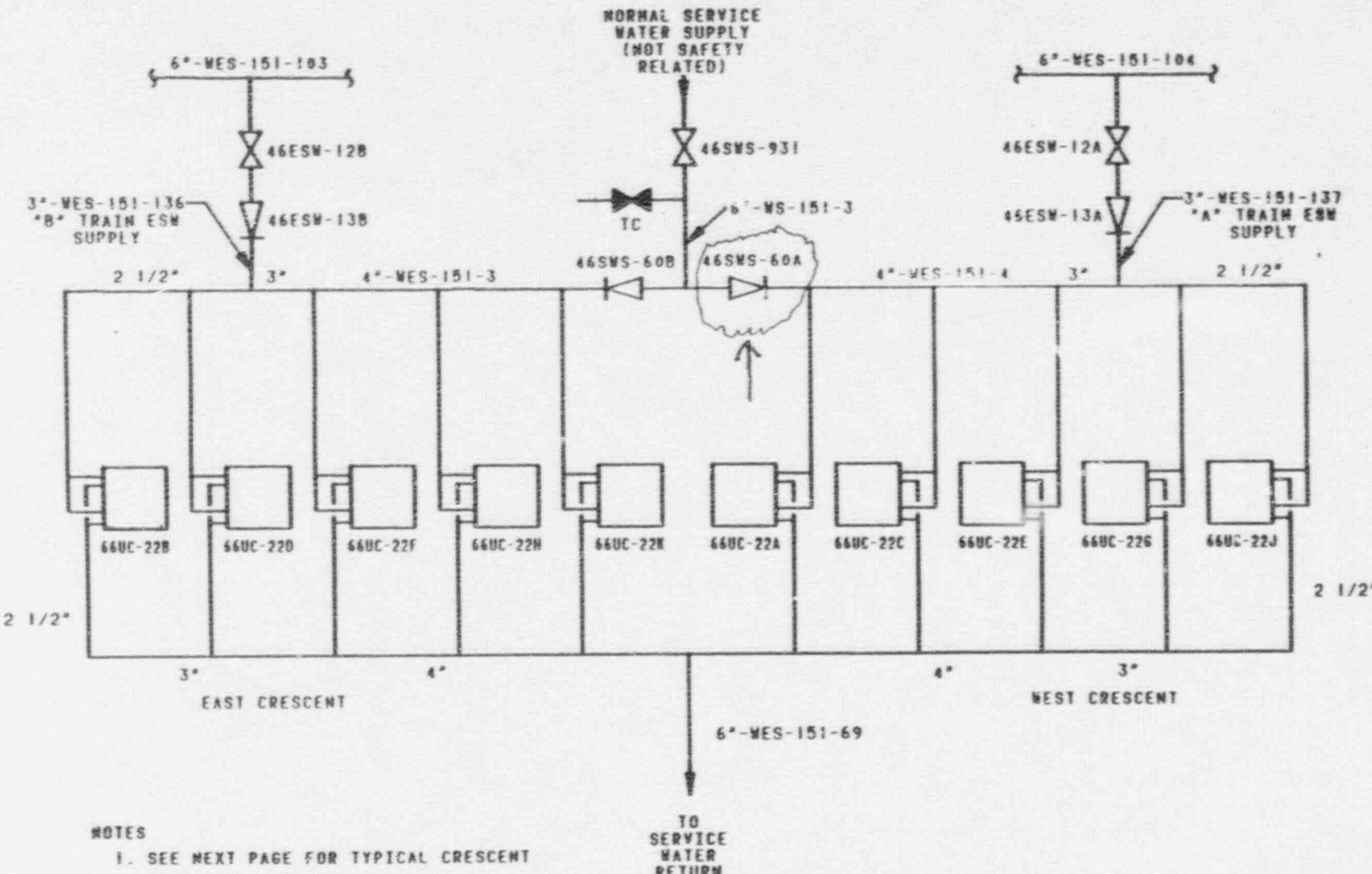
NOTES

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

CABLE TUNNEL/SWITCHGEAR ROOM COOLER

67E-14

Figure 4 to
LER 90-025-01
Docket No. 50-333



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

Figure 5 to
LER 90-025-01
Docket No. 50-333