ATTACHMENT 3 TO TXX-94116

AFFECTED TECHNICAL SPECIFICATION PAGES
(NUREG - 1468)

(Pages 3/4 7-3 and 3/4 7-4)

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AUXILIARY FEEDWATER SYSTEM

LIMITING CONDITION FOR OPERATION

3.7.1.2 At least three independent steam generator auxiliary feedwater pumps and associated flow paths shall be OPERABLE with:

a. Two motor-driven auxiliary feedwater pumps, each capable of being powered from separate emergency busses, and

b. One steam turbine-driven auxiliary feedwater pump capable of being powered from two OPERABLE steam supplies.

APPLICABILITY: MODES 1, 2, and 3.

ACTION:

a. With one auxiliary feedwater pump or associated flow path inoperable, restore the required auxiliary feedwater pump or associated flow path to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

b. With two auxiliary feedwater pumps or associated flow paths inoperable, be in at least HOT STANDBY witin 6 hours and in HOT SHUTDOWN within the following 6 hours.

c. With three auxiliary feedwater pumps or associated flow paths inoperable, immediately initiate corrective action to restore at least one auxiliary feedwater pump or associated flow path to OPERABLE status as soon as possible.

d. With only one OPERABLE steam supply system capable of providing power to the turbine-driven auxiliary feedwater pump, restore the required OPERABLE steam supplies within 7 days or be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.

SURVEILLANCE REQUIREMENTS

4.7.1.2 Each auxiliary feedwater pump and associated flow path shall be demonstrated OPERABLE:

b. ~~a.~~ At least once per ~~31~~ 92 days on a STAGGERED TEST BASIS by:

1) Verifying that each motor-driven pump develops a differential pressure of greater than or equal to 1372 psid at a flow of greater than or equal to 430 gpm;

SURVEILLANCE REQUIREMENTS (Continued)

2) Verifying that the steam turbine-driven pump develops a differential pressure of greater than or equal to 1450 psid at a test flow of greater than or equal to 860 gpm when the secondary steam supply pressure is greater than 532 psig. The provisions of Specification 4.0.4 are not applicable for entry into MODE 3;

a. At least once per 31 days by:

1) Verifying that each non-automatic valve in the flow path that is not locked, sealed, or otherwise secured in position is in its correct position; and

2) Verifying that each auxiliary feedwater flow control and isolation valve in the flow path is in the fully open position whenever the Auxiliary Feedwater System is in standby for auxiliary feedwater automatic initiation or when above 10% RATED THERMAL POWER.

c. At least once per 18 months during shutdown by:

1) Verifying that each automatic valve in the flow path actuates to its correct position upon receipt of an Auxiliary Feedwater Actuation test signal, and

2) Verifying that each auxiliary feedwater pump starts as designed automatically upon receipt of an Auxiliary Feedwater Actuation test signal. The provisions of Specification 4.0.4 are not applicable to the turbine driven auxiliary feedwater pump for entry into MODE 3.

ENCLOSURE 1 TO TXX-94116

NUREG 1366, "Improvements to Technical Specification Surveillance Requirements," Enclosure 1, Section 9.1, Auxiliary Feedwater Pump and System Testing (PWR), Pages 49 and 50

9 PLANT SYSTEMS

9.1 Auxiliary Feedwater Pump and System Testing (PWR)

The Standard Technical Specifications and most plant Technical Specifications require the monthly testing of auxiliary feedwater (AFW) pumps. The Boiler and Pressure Vessel Code of the American Society of Mechanical Engineers (ASME Code), Section XI, Paragraph IWP-3400, requires the testing of Class 1, 2, and 3 centrifugal pumps "normally every three months." AFW pumps are the only pressurized water reactor (PWR) pumps required by Technical Specifications to be tested more frequently than required by the ASME Code.

The Technical Specifications do not require the testing to be as thorough as required by the ASME Code. Table 9.1 compares inservice testing required by the ASME Code with that required by Technical Specifications.

Another difference in the testing is that, at some plants, one group may perform the monthly testing required by the Technical Specifications, and a different group will perform the ASME Code testing every third month.

In both types of tests, the AFW pump takes suction from the condensate storage tank and returns the water to the condensate storage tank through a recirculation line. In most plants, the recirculation line is sized between 5% and 15% of the best estimate point flow (NP-4264, Vol. 1). This size was derived from considering temperature rise in the pump. Pump manufacturers are now recommending that standby pumps be tested at a flow no less than 25% of the best efficiency point flow (NUREG/CR-4597). This is based on "hydraulic instability" of the pump. This is a term for unsteady flow phenomena which can cause degradation of the pump and which become more pronounced as the pump operates further away from its best efficiency point.

Two studies have been done of the AFW system. Report NP-4264 is an Electric Power Research Institute (EPRI) study that used data from the time period early 1979 to late 1982. NUREG/CR-4597 is a study done for the NRC's Nuclear Plant Aging Research (NPAR) Program.

Both studies concluded that a significant cause of failures of AFW pumps is testing the pump by recirculating flow through a minimum flow line which is not adequately sized. Both studies deduced this from a review of licensee event report (LER) data and other data on the types of failures that occurred. This was reinforced by experience with feed pumps at fossil power plants; these are also horizontal multistage centrifugal pumps similar to AFW pumps.

Both reports recommend, among other things, that the size of the recirculation lines be increased. In many cases, this can be achieved by modifying the orifice in the recirculation line although, as the flow increases through the recirculation line, adequate flow to the steam generators must still be maintained. This could require a complicated interlock which would close valves on the recirculation line when an actual demand signal is present.

Although a change in recirculation flow from approximately 10% to approximately 25% is the best solution to this problem, a reduction in the frequency of testing of the AFW pumps from monthly to quarterly (the frequency specified in the ASME Code, Section XI), could be a reasonable step to reducing the rate of wear.

This problem should be put in perspective. Using the EPRI data, 236 LERs reporting failures of turbine-driven AFW pumps were found over the period from early 1979 through late 1982. Of these, 163 (69%) reported failures related to the turbine (a figure which NP-4264 [Vol. 1] states is roughly consistent with previous EPRI studies on the high-pressure coolant injection [HPCI] and reactor core isolation cooling [RCIC] systems in boiling water reactors [BWRs]) and 73 (31%) were pump related. Of those that are pump related, 23% were failures of the "rotating element" as opposed to instrumentation and controls or valves. Thus, at the most, 23% of the failures

Table 9.1 Inservice testing required by Standard Technical Specifications and ASME Code

ASME Code	Standard Technical Specifications
Inlet pressure	–
Differential pressure	–
Flow rate	Flow rate
Vibration amplitude	–
Lubricant level and pressure	–
Bearing temperature	–
–	Discharge pressure

could be reduced by decreasing the surveillance frequency for the turbine-driven AFW pumps.

For the motor-driven AFW pump, the "rotating element" accounted for 13 of 50 (26%) reported failures (instrumentation and controls, as well as valves, were the other major contributors to failure of the motor-driven AFW pump). Thus, for the motor-driven AFW pump, at the most, 26% of the failures could be reduced by less frequent surveillance or by decreasing the flow resistance of the recirculation line.

Another consideration is that, according to the NRC report NUREG/CR-4597, 42% of the AFW pump failures were found during surveillance testing and 29% were found during operation (6% were found during maintenance and, for 23%, the method of detection was not stated). Thus, surveillance testing is important in detecting failures in the AFW system. However, surveillance testing also contributes to the problem. The availability of the AFW pump, while related to the conduct of surveillance testing, is not continuously linearly related to surveillance testing. That is, at some point an increase in surveillance testing (i.e., reducing the surveillance test interval) will not contribute to an increase in availability, and in fact could contribute to equipment unavailability. Analysis of AFW pump failures indicates that a monthly surveillance test interval (STI) may be contributing to AFW pump unavailability through failures and equipment degradation. The changing of the AFW pump STI to quarterly, on a staggered basis, is consistent with this analysis. Conducting the tests on a staggered basis will permit system testing monthly, while reducing AFW pump testing to quarterly, thereby maintaining a consistent degree of reliability. The recommended change in testing frequency to quarterly is also consistent with the requirements of the ASME Code.

Findings

- The ASME Code requires Class 2 pumps (such as AFW pumps) to be tested quarterly.
- Technical Specifications require testing such pumps monthly.
- AFW pump wear is caused by recirculating water during tests through a line that has a smaller diameter than presently recommended by pump manufacturers.
- A review of LERs shows that, at most, 23% of turbine-driven AFW pumps and 26% of the motor-driven AFW pumps had failures due to the "rotating element" itself, as opposed to valves, controls, and so forth.
- 42% of pump failures were found during surveillance testing.
- AFW/EFW pump and valve surveillances have high risk impact per NUREG/CR-5200.
- The licensee burden is increased by monthly testing.
- AFW pump availability is increased by quarterly testing on a staggered basis.

Recommendation

Change frequency of testing AFW pumps to quarterly on a staggered test basis.

9.2 Main Steam Line Isolation Valve (MSIV) Surveillance Testing

9.2.1 Pressurized Water Reactors

The ASME Code, Section XI, Article IWV-3000 states that "valves shall be exercised to the position required to fulfill their function unless such operation is not practical during plant operation. If only limited operation is practical during plant operation the valve shall be part-stroke exercised during plant operation and full-stroke exercised during cold shutdown."

Since closing a main steam line isolation valve (MSIV) during operation would result in a plant trip, licensees do partial-stroke testing quarterly as specified by the ASME Code.

The purpose of this test is to demonstrate that an MSIV is capable of movement.

The test is being done in several different ways. The valve may be closed rapidly in response to a close signal while being tested. In this case, the valve closes until it is stopped by a limit switch at 10% closed (or less, depending on the distance that the valve disc can be placed into the steam line without fully closing because of the force of the steam flow).

Another method is to drain hydraulic fluid to reduce system pressure which in turn tends to close the valve. The operator must respond to the valve closure and secure the bleeding at the 10% closed level. If the operator overshoots this level or if the test equipment fails, the MSIV will close and the plant will trip. Likewise, if the limit switch fails, the valve will completely close, causing a trip.

The MSIVs were not designed to be tested by the latter testing method. The hydraulic fluid outlets were designed to be used for maintenance and not for periodic testing.

A review of operating experience with MSIVs (from information in NPE-4) shows many cases in which MSIVs could not be closed because of problems with the valves' actuators or mechanical binding of the valves (as opposed

ENCLOSURE 2 TO TXX-94116

GL 93-05, "Line-Item Technical Specifications Improvements to Reduce Surveillance Requirements for Testing During Power Operation," Section 9.1, Auxiliary Feedwater Pump and System Testing (PWR), Page 21

(TS 4.6.7.1, Cont.)

The ice condenser shall be determined OPERABLE:

a. (No change.)

b. <u>Once each refueling interval</u> by chemical analyses which verify that at least nine representative samples of stored ice have a boron concentration of at least 1800 ppm as sodium tetraborate and a pH of 9.0 to 9.5 at 20 degrees-C.

(Combined item b and b.1, with the surveillance interval being "Once each refueling interval" rather than "At least once per 9 months.")

<u>c.</u> At least once per 9 months by: (Renumbered item b as item c.)

(No change to items c.1 and c.2. Renumbered items b.2 and b.3 as items c.1 and c.2.)

<u>d.</u> (No change to this item. Renumbered item c as item d)

<u>9.1 Auxiliary Feedwater Pump and System Testing (PWR)</u>

Recommendation: Change frequency of testing AFW pumps to quarterly on a staggered test basis.

3/4.7 Plant Systems - Auxiliary Feedwater, [CE STS (Typ)] TS 4.7.1.2:

Each auxiliary feedwater pump shall be demonstrated OPERABLE:

a. At least once per 31 days by:

1. Verifying that each valve (manual, power-operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

(Renumbered items a.1 and a.2 as items b.1 and b.2 below, and renumbered item a.3 as a.1.)

b. <u>At least once per 92 days on a STAGGERED TEST BASIS by:</u>

1. Verifying that each motor-driven pump develops a discharge pressure of greater than or equal to ____ psig at a flow of greater than or equal to ____ gpm.

2. Verifying that the turbine-driven pump develops a discharge pressure of greater than or equal to ____ psig at a flow of greater than or equal to ____ gpm when the secondary steam supply pressure is greater than ____ psig. The provisions of Specification 4.0.4 are not applicable for entry into MODE 3.

(Added item b. Renumbered items a.1 and a.2 as items b.1 and b.2.)

ENCLOSURE 3 TO TXX-94116

NUREG 1431, "Standard Technical Specifications, Westinghouse Plants,
TS 3.7.5, "Auxiliary Feedwater (AFW) System"
Pages 3.7-11 through 14

3.7 PLANT SYSTEMS

3.7.5 Auxiliary Feedwater (AFW) System

LCO 3.7.5 [Three] AFW trains shall be OPERABLE.

[-------------------------NOTE-------------------------
Only one AFW train, which includes a motor driven pump, is required to be OPERABLE in MODE 4.
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APPLICABILITY: MODES 1, 2, and 3,
MODE 4 when steam generator is relied upon for heat removal.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
[A. One steam supply to turbine driven AFW pump inoperable.	A.1 Restore steam supply to OPERABLE status.	7 days AND 10 days from discovery of failure to meet the LCO]
B. One AFW train inoperable in MODE 1, 2 or 3 [for reasons other than Condition A].	B.1 Restore AFW train to OPERABLE status.	72 hours [AND 10 days from discovery of failure to meet the LCO]

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time for Condition A [or B] not met. OR Two AFW trains inoperable in MODE 2 or 3.	C.1 Be in MODE 3. AND C.2 Be in MODE 4.	6 hours [18] hours
D. [Three] AFW trains inoperable in MODE 1, 2, or 3.	D.1 ---------NOTE-------- LCO 3.0.3 and all other LCO Required Actions requiring MODE changes are suspended until one AFW train is restored to OPERABLE status. -------------------- Initiate action to restore one AFW train to OPERABLE status.	Immediately
E. Required AFW train inoperable in MODE 4.	E.1 Initiate action to restore AFW train to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.5.1	Verify each AFW manual, power operated, and automatic valve in each water flow path, [and in both steam supply flow paths to the steam turbine driven pump,] that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.7.5.2	------------------NOTE------------------ Not required to be performed for the turbine driven AFW pump until [24 hours] after ≥ [1000] psig in the steam generator. -- Verify the developed head of each AFW pump at the flow test point is greater than or equal to the required developed head.	[31] days on a STAGGERED TEST BASIS
SR 3.7.5.3	Verify each AFW automatic valve actuates to the correct position on an actual or simulated actuation signal when in MODE 1, 2, or 3.	[18] months
SR 3.7.5.4	------------------NOTE------------------ Not required to be performed for the turbine driven AFW pump until [24 hours] after ≥ [1000] psig in the steam generator. -- Verify each AFW pump starts automatically on an actual or simulated actuation signal when in MODE 1, 2, or 3.	[18] months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
[SR 3.7.5.5	Verify proper alignment of the required AFW flow paths by verifying flow from the condensate storage tank to each steam generator.	Prior to entering MODE 2, whenever unit has been in MODE 5 or 6 for > 30 days]