2.8.6 Main Feedwater System

Design Description

1.0 System Description

The main feedwater system (MFWS) is a non-safety-related system with portions that are safety related. It transports and controls feedwater from the deaerator/feedwater storage tank to the steam generators (SG). It includes the startup/shutdown feedwater supply. The MFWS is safety related from the connections to the SGs to the fixed seismic restraint in each main feedwater line and to the fixed seismic restraint in each startup/shutdown feedwater line.

The MFWS provides the following safety-related function:

- Shut off main feedwater supply and startup/shutdown feedwater supply.

The MFWS provides the following non-safety-related functions:

- The MFWS supplies feedwater to the SGs for power operation.
- A startup/shutdown system supplies feedwater to the SGs for low-power operation.

2.0 Arrangement

2.1 The functional arrangement of the MFWS is as described in the Design Description of Section 2.8.6, Tables 2.8.6-1—MFWS Equipment Mechanical Design and 2.8.6-2—MFWS Equipment I&C and Electrical Design, and as shown on Figure 2.8.6-1—MFWS Functional Arrangement.

2.2 Deleted.

2.3 Physical separation exists between divisions of the safety-related portions of MFWS as shown on Figures 2.1.1-23 and 2.1.1-36.

3.0 Mechanical Design Features

3.1 Valves listed in Table 2.8.6-1 will be functionally designed and qualified such that each valve is capable of performing its intended function under the full range of fluid flow, differential pressure, electrical conditions, and temperature conditions up to and including design basis accident conditions.

3.2 Check valves listed in Table 2.8.6-1 will function to change position as listed in Table 2.8.6-1 under normal operating conditions.

3.3 Deleted.

3.4 Equipment identified as Seismic Category I in Table 2.8.6-1 can withstand seismic design basis loads without a loss of safety function(s).

3.5 ASME Code Class 2 and 3 piping systems are designed in accordance with ASME Code Section III requirements.

3.6 As-built ASME Code Class 2 and 3 components listed in Table 2.8.6-1 are reconciled with the design requirements.

3.7 Pressure-boundary welds in ASME Code Class 2 and 3 components listed in Table 2.8.6-1 meet ASME Code Section III non-destructive examination requirements.

3.8 ASME Code Class 2 and 3 components listed in Table 2.8.6-1 retain their pressure-boundary integrity at their design pressure.

3.9 ASME Code Class 2 and 3 components listed in Table 2.8.6-1 are fabricated, installed, and inspected in accordance with ASME Code Section III requirements.

3.10 Deleted.

3.11 Deleted.

3.12 Deleted.

3.13 Deleted.

3.14 Deleted.

4.0 Instrumentation and Control (I&C) Design Features, Displays, and Controls

4.1 Displays listed in Table 2.8.6-2 are indicated on the PICS operator workstations in the MCR and the RSS.

4.2 Controls on the PICS operator workstations in the MCR perform the function listed in Table 2.8.6-2.

4.3 Equipment listed as being controlled by a priority and actuator control system (PACS) module in Table 2.8.6-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.

5.0 Electrical Power Design Features

5.1 Equipment designated as Class 1E in Table 2.8.6-2 are powered from the Class 1E division as listed in Table 2.8.6-2 in a normal or alternate feed condition.

5.2 The main feedwater full load isolation valves (MFWFLIV) fail closed on loss of hydraulic pressure in each redundant dump line.

5.3 Deleted.

6.0 Environmental Qualifications

6.1 Equipment designated as harsh environment in Table 2.8.6-2 can perform the function listed in Table 2.8.6-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.

7.0 Equipment and System Performance

7.1 Class 1E valves listed in Table 2.8.6-2 will function to change position as listed in Table 2.8.6-1 under normal operating conditions.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.8.6-3 lists the MFWS ITAAC.

Table 2.8.6-1—MFWS Equipment Mechanical Design
Sheet 1 of 2

Description	Tag Number(1)	Location	ASME Code Section III	Function	Seismic Category
Main Feedwater Full Load Isolation Valves (MFWFLIV)	30LAB60AA001 30LAB70AA001 30LAB80AA001 30LAB90AA001	1UJE26001 2UJE26001 3UJE26001 4UJE26001	Yes	Close	I
Main Feedwater Full Load Control Valves (MFWFLCV)	30LAB60AA101 30LAB70AA101 30LAB80AA101 30LAB90AA101	1UJE26001 2UJE26001 3UJE26001 4UJE26001	Yes	Close	I
Main Feedwater Isolation Valves (MFWIV)	30LAB60AA002 30LAB70AA002 30LAB80AA002 30LAB90AA002	1UJE26001 2UJE26001 3UJE26001 4UJE26001	Yes	Close	I
Main Feedwater Check Valves (MFWCKV)	30LAB60AA003 30LAB70AA003 30LAB80AA003 30LAB90AA003	Reactor Building Reactor Building Reactor Building Reactor Building	Yes	Close	I
Main Feedwater Low Load Isolation Valves (MFWLLIV)	30LAB64AA001 30LAB74AA001 30LAB84AA001 30LAB94AA001	1UJE26001 2UJE26001 3UJE26001 4UJE26001	Yes	Close	I
Main Feedwater Low Load Control Valves (MFWLLCV)	30LAB64AA101 30LAB74AA101 30LAB84AA101 30LAB94AA101	1UJE26001 2UJE26001 3UJE26001 4UJE26001	Yes	Close	I

Table 2.8.6-1—MFWS Equipment Mechanical Design
Sheet 2 of 2

Description	Tag Number(1)	Location	ASME Code Section III	Function	Seismic Category
Main Feedwater Very Low Load Control Valves (MFWVLLCV)	30LAB64AA102 30LAB74AA102 30LAB84AA102 30LAB94AA102	1UJE26001 2UJE26001 3UJE26001 4UJE26001	Yes	Close	I
Deaerator/Feedwater Storage Tank	30LAA10BB001	Turbine Building	N/A	N/A	N/A
High-Pressure Feedwater Heaters	N/A	Turbine Building	N/A	N/A	N/A
Main Feedwater Pump	30LAC11AP001	Turbine Building	N/A	N/A	N/A
Main Feedwater Pump	30LAC12AP001	Turbine Building	N/A	N/A	N/A
Main Feedwater Pump	30LAC13AP001	Turbine Building	N/A	N/A	N/A
Main Feedwater Pump	30LAC14AP001	Turbine Building	N/A	N/A	N/A
Startup/Shutdown Feedwater Pump	30LAJ10AP001	Turbine Building	N/A	N/A	N/A

1. Equipment tag numbers are provided for information only and are not part of the certified design.

Table 2.8.6-2—MFWS Equipment I&C and Electrical Design
Sheet 1 of 2

Description	Tag Number(1)	Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR/RSS Displays	MCR/RSS Controls
Main Feedwater Full Load Isolation Valves (MFWFLIV)	30LAB60AA001	SB 1	3^N, 1^N 4^A, 2^A	Yes	Yes	Position / Position	Close / Close
	30LAB70AA001	SB 1	4^N, 2^N 3^A, 1^A				
	30LAB80AA001	SB 4	1^N, 3^N 2^A, 4^A				
	30LAB90AA001	SB 4	2^N, 4^N 1^A, 3^A				
Main Feedwater Full Load Control Valves (MFWFLCV)	30LAB60AA101	SB 1	1^N, 2^A	Yes	Yes	Position / Position	Close / Close
	30LAB70AA101	SB 1	2^N, 1^A				
	30LAB80AA101	SB 4	3^N, 4^A				
	30LAB90AA101	SB 4	4^N, 3^A				
Main Feedwater Isolation Valves (MFWIV)	30LAB60AA002	SB 1	1^N, 2^A	Yes	Yes	Position / Position	Close / Close
	30LAB70AA002	SB 1	2^N, 1^A				
	30LAB80AA002	SB 4	3^N, 4^A				
	30LAB90AA002	SB 4	4^N, 3^A				

Table 2.8.6-2—MFWS Equipment I&C and Electrical Design
Sheet 2 of 2

Description	Tag Number(1)	Location	IEEE Class 1E (2)	EQ – Harsh Env.	PACS	MCR/RSS Displays	MCR/RSS Controls
Main Feedwater Low Load Isolation Valves (MFWLLIV)	30LAB64AA001	SB 1	3^N, 4^A	Yes	Yes	Position / Position	Close / Close
	30LAB74AA001	SB 1	4^N, 3^A				
	30LAB84AA001	SB 4	1^N, 2^A				
	30LAB94AA001	SB 4	2^N, 1^A				
Main Feedwater Low Load Control Valves (MFWLLCV)	30LAB64AA101	SB 1	1^N, 2^A	Yes	Yes	Position / Position	Close / Close
	30LAB74AA101	SB 1	2^N, 1^A				
	30LAB84AA101	SB 4	3^N, 4^A				
	30LAB94AA101	SB 4	4^N, 3^A				
Main Feedwater Very Low Load Control Valves (MFWVLLCV)	30LAB64AA102	SB 1	1^N, 2^A	Yes	Yes	Position / Position	Close / Close
	30LAB74AA102	SB 1	2^N, 1^A				
	30LAB84AA102	SB 4	3^N, 4^A				
	30LAB94AA102	SB 4	4^N, 3^A				

1. Equipment tag numbers are provided for information only and are not part of the certified design.

2. ^{N} denotes the division equipment is normally powered from; ^{A} denotes the division equipment is powered from when alternate feed is implemented.

Table 2.8.6-3—Main Feedwater System ITAAC
Sheet 1 of 6

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The functional arrangement of the MFWS is as described in the Design Description of Section 2.8.6, Tables 2.8.6-1 and 2.8.6-2, and as shown on Figure 2.8.6-1.	An inspection of the as-built MFWS functional arrangement will be performed.	The MFWS conforms to the functional arrangement as described in the Design Description of Section 2.8.6, Tables 2.8.6-1 and 2.8.6-2, and as shown on Figure 2.8.6-1.
2.2	Deleted.	Deleted.	Deleted.
2.3	Physical separation exists between divisions of the safety-related portions of MFWS as shown on Figures 2.1.1-23 and 2.1.1-36.	An inspection will be performed to verify that the as-built safety-related portions of the MFWS are located in separate valve rooms in Safeguard Buildings 1 and 4.	The divisions of the safety-related portions of the MFWS are located in separate valve rooms in Safeguard Buildings 1 and 4 as shown on Figures 2.1.1-23 and 2.1.1-36.
3.1	Valves listed in Table 2.8.6-1 will be functionally designed and qualified such that each valve is capable of performing its intended function under the full range of fluid flow, differential pressure, electrical conditions, and temperature conditions up to and including design basis accident conditions.	Tests or type tests of valves will be performed to demonstrate that the valves function under the full range of fluid flow, differential pressure, electrical conditions, and temperature conditions up to and including design basis accident conditions.	A report concludes that the valves listed in Table 2.8.6-1 are capable of performing their intended function under the full range of fluid flow, differential pressure, electrical conditions, and temperature conditions up to and including design basis accident conditions.
3.2	Check valves listed in Table 2.8.6-1 will function to change position as listed in Table 2.8.6-1 under normal operating conditions.	Tests will be performed to verify the ability of check valves to change position under normal operating conditions.	The check valves change position as listed in Table 2.8.6-1 under normal operating conditions.
3.3	Deleted.	Deleted.	Deleted.

Table 2.8.6-3—Main Feedwater System ITAAC
Sheet 2 of 6

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.4	Equipment identified as Seismic Category I in Table 2.8.6-1 can withstand seismic design basis loads without a loss of function(s).	a. Type tests, analyses, or a combination of type tests and analyses will be performed on the equipment identified as Seismic Category I in Table 2.8.6-1 using analytical assumptions, or under conditions, which bound the Seismic Category I design requirements.	a. Test/analysis reports conclude that the equipment identified as Seismic Category I in Table 2.8.6-1 can withstand seismic design basis loads without a loss of safety function(s).
		b. An inspection will be performed of the as-built equipment identified as Seismic Category I in Table 2.8.6-1 to verify that the equipment, including anchorage, are installed in a condition bounded by the tested or analyzed condition.	b. Inspection reports conclude that the equipment identified as Seismic Category I in Table 2.8.6-1, including anchorage, are installed in a condition bounded by the tested or analyzed condition.
3.5	ASME Code Class 2 and 3 piping systems are designed in accordance with ASME Code Section III requirements.	An inspection of piping design and analysis documentation required by ASME Code Section III will be performed. {{DAC}}	ASME Code Section III Design Report(s) exist that meet the requirements of NCA-3550 and conclude that the design of ASME Code Class 2 and 3 piping systems complies with the requirements of ASME Code Section III. {{DAC}}

Table 2.8.6-3—Main Feedwater System ITAAC
Sheet 3 of 6

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.6	As-built ASME Code Class 2 and 3 components listed in Table 2.8.6-1 are reconciled with the design requirements.	A reconciliation analysis of ASME Code Class 2 and 3 components will be performed.	ASME Code Design Report(s) exist that meet the requirements of NCA-3550, conclude that the design reconciliation has been completed for as-built ASME Code Class 2 and 3 components listed in Table 2.8.6-1, and document that the results of the reconciliation analysis comply with the requirements of ASME Code Section III.
3.7	Pressure-boundary welds in ASME Code Class 2 and 3 components listed in Table 2.8.6-1 meet ASME Code Section III non-destructive examination requirements.	An inspection of the as-built pressure-boundary welds in ASME Code Class 2 and 3 components will be performed.	ASME Code reports(s) exist that conclude that ASME Code Section III requirements are met for non-destructive examination of pressure-boundary welds in ASME Code Class 2 and 3 components. listed in Table 2.8.6-1
3.8	ASME Code Class 2 and 3 components listed in Table 2.8.6-1 retain their pressure-boundary integrity at their design pressure.	A hydrostatic test will be conducted on ASME Code Class 2 and 3 components that are required to be hydrostatically tested by ASME Code Section III.	ASME Code Data Report(s) exist and conclude that the results of the hydrostatic test of ASME Code Class 2 and 3 components listed in Table 2.8.6-1 comply with the requirements of ASME Code Section III.
3.9	ASME Code Class 2 and 3 components listed in Table 2.8.6-1 are fabricated, installed, and inspected in accordance with ASME Code Section III requirements.	An inspection of the as-built construction activities and documentation for ASME Code Class 2 and 3 components will be conducted.	ASME Code Data Report(s) exist that conclude that ASME Code Class 2 and 3 components listed in Table 2.8.6-1 are fabricated, installed, and inspected in accordance with ASME Code Section III requirements.
3.10	Deleted.	Deleted.	Deleted.
3.11	Deleted.	Deleted.	Deleted.
3.12	Deleted.	Deleted.	Deleted.
3.13	Deleted.	Deleted.	Deleted.

Table 2.8.6-3—Main Feedwater System ITAAC
Sheet 4 of 6

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.14	Deleted.	Deleted.	Deleted.
4.1	Displays listed in Table 2.8.6-2 are indicated on the PICS operator workstations in the MCR and the RSS.	a. Tests will be performed to verify that the displays listed in Table 2.8.6-2 are indicated on the PICS operator workstations in the MCR. b. Tests will be performed to verify that the displays listed in Table 2.8.6-2 are indicated on the PICS operator workstations in the RSS.	a. Displays listed in Table 2.8.6-2 are indicated on the PICS operator workstations in the MCR. b. Displays listed in Table 2.8.6-2 are indicated on the PICS operator workstations in the RSS.
4.2	Controls on the PICS operator workstations in the MCR perform the function listed in Table 2.8.6-2.	Tests will be performed using controls on the PICS operator workstations in the MCR.	Controls on the PICS operator workstations in the MCR perform the function listed in Table 2.8.6-2.
4.3	Equipment listed as being controlled by a PACS module in Table 2.8.6-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.	A test will be performed using test input signals to verify equipment controlled by a PACS module responds to the state requested and provides drive monitoring signals back to the PACS module.	Equipment listed as being controlled by a PACS module in Table 2.8.6-2 responds to the state requested and provides drive monitoring signals back to the PACS module. The PACS module will protect the equipment by terminating the output command upon the equipment reaching the requested state.

Table 2.8.6-3—Main Feedwater System ITAAC
Sheet 5 of 6

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
5.1	Equipment designated as Class 1E in Table 2.8.6-2 are powered from the Class 1E division as listed in Table 2.8.6-2 in a normal or alternate feed condition.	a. Testing will be performed by providing a test input signal in each normally aligned division. b. Testing will be performed by providing a test input signal in each division with the alternate feed aligned to the divisional pair.	a. The test input signal provided in the normally aligned division is present at the respective Class 1E equipment identified in Table 2.8.6-2. b. The test input signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E equipment identified in Table 2.8.6-2.
5.2	The MFWFLIVs fail closed on loss of hydraulic pressure in each redundant dump line.	Tests will be performed to verify that the MFWFLIVs fail closed on loss of hydraulic pressure in each redundant dump line.	Following loss of hydraulic pressure in each redundant dump line, the MFWFLIVs fail closed.
5.3	Deleted.	Deleted.	Deleted.

Table 2.8.6-3—Main Feedwater System ITAAC
Sheet 6 of 6

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
6.1	Equipment designated as harsh environment in Table 2.8.6-2 can perform the function listed in Table 2.8.6-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions.	a. Type tests or type tests and analysis will be performed to demonstrate the ability of the equipment designated as harsh environment in Table 2.8.6-2 to perform the function listed in Table 2.8.6-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions. b. An inspection will be performed of the as-built equipment designated as harsh environment in Table 2.8.6-2 to verify that the equipment, including the associated cables, wiring, and terminations located in a harsh environment, are bounded by the type test or combination of type tests and analyses.	a. EQDPs conclude that the equipment designated as harsh environment in Table 2.8.6-2 can perform the function listed in Table 2.8.6-1 under normal environmental conditions, containment test conditions, anticipated operational occurrences, and accident and post-accident environmental conditions, including the time required to perform the listed function. b. A report exists and concludes that the equipment designated as harsh environment in Table 2.8.6-2, including the associated cables, wiring, and terminations located in a harsh environment, are bounded by the type test or combination of type tests and analyses.
7.1	Class 1E valves listed in Table 2.8.6-2 will function to change position as listed in Table 2.8.6-1 under normal operating conditions.	Tests will be performed to verify the ability of Class 1E valves to change position under normal operating conditions.	Class 1E valves listed in Table 2.8.6-2 change position as listed in Table 2.8.6-1 under normal operating conditions.

Next File