2.8.6 Main Feedwater System

1.0 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 shown on Figure 2.8.6-1—MFWS Functional Arrangement.

2.2 The location of the MFWS equipment is as listed in Table 2.8.6-1—MFWS Equipment Mechanical Design.

2.3 Physical separation exists between the safety-related main feedwater divisions. The safety-related valves in Divisions 1 and 2 are located in separate valve rooms in Safeguard Building (SB) 1. The safety-related valves in Divisions 3 and 4 are located in separate valve rooms in SB 4.

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 for a full range of system differential pressure and flow, ambient temperatures, and available voltage (as applicable) under conditions ranging from normal operating to design-basis accident conditions.

3.2 Check valves listed in Table 2.8.6-1 will function as listed in Table 2.8.6-1.

3.3 Deleted.

3.4 Components identified as Seismic Category I in Table 2.8.6-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.8.6-1.

3.5 Components listed in Table 2.8.6-1 as ASME Code Section III are designed in accordance with ASME Code Section III requirements.

3.6 Components listed in Table 2.8.6-1 as ASME Code Section III are fabricated in accordance with ASME Code Section III requirements.

3.7 Pressure boundary welds on components listed in Table 2.8.6-1 as ASME Code Section III are in accordance with ASME Code Section III requirements.

3.8 Components listed in Table 2.8.6-1 as ASME Code Section III retain pressure boundary integrity at design pressure.

3.9 MFWS piping shown as ASME Code Section III on Figure 2.8.6-1 is designed in accordance with ASME Code Section III requirements.

3.10 MFWS piping shown as ASME Code Section III on Figure 2.8.6-1 is installed in accordance with an ASME Code Section III Design Report.

3.11 Pressure boundary welds in MFWS piping shown as ASME Code Section III on Figure 2.8.6-1 are in accordance with ASME Code Section III.

3.12 MFWS piping shown as ASME Code Section III on Figure 2.8.6-1 retains pressure boundary integrity at design pressure.

3.13 MFWS piping shown as ASME Code Section III on Figure 2.8.6-1 is installed and inspected in accordance with ASME Code Section III requirements.

3.14 Components listed in Table 2.8.6-1 as ASME Code Section III are installed in accordance with ASME Code Section III requirements.

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

4.1 Displays listed in Table 2.8.6-2—MFWS Equipment I&C and Electrical Design are retrievable in the main control room (MCR) as listed in Table 2.8.6-2.

4.2 The MFWS equipment controls are provided in the MCR as 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 by a test signal.

5.0 Electrical Power Design Features

5.1 The components 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 to the valve actuator.

5.3 Valves listed in Table 2.8.6-2, other than the MFWFLIVs, fail as-is on loss of electric power to the valve actuator.

6.0 Environmental Qualifications

6.1 Components in Table 2.8.6-2, that are designated as harsh environment, will perform the function listed in Table 2.8.6-1 in the environments that exist during and following design basis events.

7.0 Equipment and System Performance

7.1 Class 1E valves listed in Table 2.8.6-2 can perform the function listed in Table 2.8.6-1 under system operating conditions.

8.0 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.8.6-3 lists the MFWS ITAAC.

Table 2.8.6-1—MFWS Equipment Mechanical Design (2 Sheets)

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
Main Feedwater Very Low Load Control Valves (MFWVLLCV)	30LAB64AA102 30LAB74AA102 30LAB84AA102 30LAB94AA102	1UJE26001 2UJE26001 3UJE26001 4UJE26001	Yes	Close	I

Table 2.8.6-1—MFWS Equipment Mechanical Design (2 Sheets)

Description	Tag Number[1]	Location	ASME Code Section III	Function	Seismic Category
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 (2 Sheets)

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	Pos./ N/A	Close/ N/A
	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	Pos./ N/A	Close/ N/A
	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	Pos./ N/A	Close/ N/A
	30LAB70AA002	SB 1	2^N, 1^A				
	30LAB80AA002	SB 4	3^N, 4^A				
	30LAB90AA002	SB 4	4^N, 3^A				
Main Feedwater Low Load Isolation Valves (MFWLLIV)	30LAB64AA001	SB 1	3^N, 4^A	yes	yes	Pos./ N/A	Close/ N/A
	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	Pos./ N/A	Close/ N/A
	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 30LAB74AA102 30LAB84AA102 30LAB94AA102	SB 1 SB 1 SB 4 SB 4	1^{N}, 2^{A} 2^{N}, 1^{A} 3^{N}, 4^{A} 4^{N}, 3^{A}	yes	yes	Pos./ N/A	Close/ N/A

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

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

Table 2.8.6-3— Main Feedwater System ITAAC (5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	The functional arrangement of the MFWS is as shown on Figure 2.8.6-1.	Inspections of the as-built system as shown on Figure 2.8.6-1 will be conducted.	The as-built MFWS conforms with the functional arrangement as shown on Figure 2.8.6-1.
2.2	The location of the MFWS equipment is as listed in Table 2.8.6-1.	An inspection will be performed of the location of the equipment listed in Table 2.8.6-1.	The equipment listed in Table 2.8.6-1 is located as listed in Table 2.8.6-1.
2.3	Physical separation exists between divisions of the safety-related parts of MFWS.	An inspection will be performed to verify that the divisions of the MFWS are located in separate SBs.	The divisions of the MFWS are located in separate SBs as listed in Table 2.8.6-1.
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 for a full range of system differential pressure and flow, ambient temperatures, and available voltage (as applicable) under conditions ranging from normal operating to design-basis accident conditions.	Tests or type tests of the valves listed in Table 2.8.6-1 will be conducted to demonstrate that the pumps and valves function under conditions ranging from normal operating to design-basis accident conditions.	A test report exists and concludes that the valves listed in Table 2.8.6-1 function under conditions ranging from normal operating to design-basis accident conditions.
3.2	Check valves listed in Table 2.8.6-1 will function as listed in Table 2.8.6-1.	Tests will be performed for the operation of the check valves listed in Table 2.8.6-1.	The check valves listed in Table 2.8.6-1 perform the functions listed in Table 2.8.6-1.
3.3	Deleted.	Deleted.	Deleted.
3.4	Components identified as Seismic Category I in Table 2.8.6-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.8.6-1.	a. Type tests, analyses, or a combination of type tests and analyses will be performed on the components 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. Seismic qualification reports (SQDP, EQDP, or analyses) exist and conclude that the Seismic Category I components identified in Table 2.8.6-1 can withstand seismic design basis loads without a loss of the function listed in Table 2.8.6-1 including the time required to perform the listed function.

Table 2.8.6-3— Main Feedwater System ITAAC (5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
		b. Inspections will be performed of the Seismic Category I components identified in Table 2.8.6-1 to verify that the components, including anchorage, are installed as specified on the construction drawings and deviations have been reconciled to the seismic qualification reports (SQDP, EQDP, or analyses).	b. Inspection reports exist and conclude that the Seismic Category I components identified in Table 2.8.6-1, including anchorage, are installed as specified on the construction drawings and deviations have been reconciled to the seismic qualification reports (SQDP, EQDP, or analyses).
3.5	Components listed in Table 2.8.6-1 as ASME Code Section III are designed in accordance with ASME Code Section III requirements.	Inspections of ASME Code Section III Design Reports and associated reference documents will be performed.	ASME Code Section III Design Reports (NCA-3550) exist and conclude that components listed as ASME Code Section III in Table 2.8.6-1 comply with ASME Code Section III requirements.
3.6	Components listed in Table 2.8.6-1 as ASME Code Section III are fabricated in accordance with ASME Code Section III requirements.	An analysis will be performed to verify that deviations to the component design reports (NCA-3550) have been reconciled.	ASME Code Section III Design Reports (NCA-3550) exist and conclude that components listed as ASME Code Section III in Table 2.8.6-1 comply with ASME Code Section III requirements and any deviations to the design report have been reconciled.
3.7	Pressure boundary welds on components listed in Table 2.8.6-1 as ASME Code Section III are in accordance with ASME Code Section III requirements.	Inspections of pressure boundary welds will be performed to verify that welding is performed in accordance with ASME Code Section III requirements.	For components listed as ASME Code Section III in Table 2.8.6-1, ASME Code Section III Data Reports (NCA-8000) exist and conclude that pressure boundary welding has been performed in accordance with ASME Code Section III.

Table 2.8.6-3— Main Feedwater System ITAAC (5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.8	Components listed in Table 2.8.6-1 as ASME Code Section III retain pressure boundary integrity at design pressure.	Hydrostatic tests will be performed on the components.	For components listed as ASME Code Section III in Table 2.8.6-1, ASME Code Section III Data Reports exist and conclude that hydrostatic test results comply with ASME Code Section III requirements.
3.9	MFWS piping shown as ASME Code Section III on Figure 2.8.6-1 is designed in accordance with ASME Code Section III requirements.	Inspections of the ASME Code Section III Design Reports (NCA-3550) and associated reference documents will be performed. **{{DAC}}**	ASME Code Section III Design Reports (NCA-3550) exist and conclude that MFWS piping shown as ASME Code Section III on Figure 2.8.6-1 complies with ASME Code Section III requirements. **{{DAC}}**
3.10	MFWS piping shown as ASME Code Section III on Figure 2.8.6-1 is installed in accordance with an ASME Code Section III Design Report.	Analyses to reconcile as-built deviations to the ASME Code Design Reports (NCA-3550) will be performed.	For MFWS piping shown as ASME Code Section III on Figure 2.8.6-1, ASME Code Data Reports (N-5) exist and conclude that design reconciliation (NCA-3554) has been completed in accordance with the ASME Code Section III for the as-built system. The report(s) document the as-built condition.
3.11	Pressure boundary welds in MFWS piping shown as ASME Code Section III on Figure 2.8.6-1 are in accordance with ASME Code Section III.	Inspections of pressure boundary welds verify that welding is performed in accordance with ASME Code Section III requirements.	ASME Code Section III Data Reports exist and conclude that pressure boundary welding for MFWS piping shown as ASME Code Section III on Figure 2.8.6-1 has been performed in accordance with ASME Code Section III.
3.12	MFWS piping shown as ASME Code Section III on Figure 2.8.6-1 retains pressure boundary integrity at design pressure.	Hydrostatic tests will be performed on the as-built system.	For MFWS piping shown as ASME Code Section III on Figure 2.8.6-1, ASME Code Section III Data Reports exist and conclude that hydrostatic test results comply with ASME Code Section III requirements.

Table 2.8.6-3— Main Feedwater System ITAAC (5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
3.13	MFWS piping shown as ASME Code Section III on Figure 2.8.6-1 is installed and inspected in accordance with ASME Code Section III requirements.	An inspection of the as-built piping will be performed.	For MFWS piping shown as ASME Code Section III on Figure 2.8.6-1, N–5 Data Reports exist and conclude that installation and inspection are in accordance with ASME Code Section III requirements.
3.14	Components listed in Table 2.8.6-1 as ASME Code Section III are installed in accordance with ASME Code Section III requirements.	An inspection of ASME Code Data Reports will be performed.	ASME Code Section III N-5 Data Reports exist and conclude that components listed as ASME Code Section III in Table 2.8.6-1 have been installed in accordance with ASME Code Section III requirements.
4.1	Displays exist or can be retrieved in the MCR as identified in Table 2.8.6-2.	Tests will be performed for the retrievability of the displays in the MCR as listed in Table 2.8.6-2.	The displays listed in Table 2.8.6-2 as being retrieved in the MCR can be retrieved in the MCR.
4.2	Controls exist in the MCR as identified in Table 2.8.6-2.	Tests will be performed for the existence of control signals from the MCR to the equipment listed in Table 2.8.6-2.	The controls listed in Table 2.8.6-2 as being in the MCR exist in the MCR.
4.3	Equipment listed as being controlled by a PACS module in Table 2.8.6-2 responds to the state requested by a test signal.	A test will be performed using test signals.	Equipment listed as being controlled by a PACS module in Table 2.8.6-2 responds to the state requested by the test signal.
5.1	The components 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 for components designated as Class 1E in Table 2.8.6-2 by providing a test signal in each normally aligned division. b. Testing will be performed for components designated as Class 1E in Table 2.8.6-2 by providing a test signal in each division with the alternate feed aligned to the divisional pair.	a. The test signal provided in the normally aligned division is present at the respective Class 1E component identified in Table 2.8.6-2. b. The test signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E component identified in Table 2.8.6-2.

Table 2.8.6-3— Main Feedwater System ITAAC (5 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
5.2	MFWFLIVs fail closed on loss of hydraulic pressure to the valve actuator.	Testing will be performed for the MFWFLIVs to close on loss of hydraulic pressure in each redundant dump line to the valve actuator.	MFWFLIVs fail closed on loss of hydraulic pressure in each redundant dump line to the valve actuator.
5.3	Valves listed in Table 2.8.6-2, other than MFWFLIVs, fail as-is on loss of electric power to the valve actuator.	Testing will be performed for the valves listed in Table 2.8.6-2, other than the MFWFLIVs, to fail as-is on loss of electric power to the valve actuator.	Valves listed in Table 2.8.6-2, other than the MFWFLIVs, fails as-is on loss of electric power to the valve actuator.
6.1	Components in Table 2.8.6-2, that are designated as harsh environment, will perform the function listed in Table 2.8.6-1 in the environments that exist during and following design basis events.	a. Type tests or type tests and analysis will be performed to demonstrate the ability of the components listed as harsh environment in Table 2.8.6-2 to perform the function listed in Table 2.8.6-1 for the environmental conditions that could occur during and following design basis events. b. Components listed as harsh environment in Table 2.8.6-2 will be inspected to verify installation in accordance with the construction drawings including the associated wiring, cables and terminations. Deviations to the construction drawings will be reconciled to the EQDP.	a. Environmental Qualification Data Packages (EQDP) exist and conclude that the components listed as harsh environment in Table 2.8.6-2 can perform the function listed in Table 2.8.6-1 during and following design basis events including the time required to perform the listed function. b. Inspection reports exists and conclude that the components listed in Table 2.8.6-2 as harsh environment has been installed per the construction drawings and any deviations have been reconciled to the EQDP.
7.1	Class 1E valves listed in Table 2.8.6-2 perform the function listed in Table 2.8.6-1 under system operating conditions.	Tests and analyses or a combination of tests and analyses will be performed to demonstrate the ability of the valves listed in Table 2.8.6-2 to change position as listed in Table 2.8.6-1 under system operating conditions.	The valve changes position as listed Table 2.8.6-1 under system operating conditions.

Next File