

2.6 Reactor Auxiliary Systems

2.6.1 Reactor Water Cleanup System

Design Description

The Reactor Water Cleanup (CUW) System removes particulate and dissolved impurities from the reactor coolant by circulating a portion of the reactor coolant through a filter-demineralizer.

The CUW System removes excess coolant from the reactor system during startup, shutdown and hot standby. The excess water is directed to the radwaste or main condenser. The CUW System also provides processed water to the reactor head spray nozzle for Reactor Pressure Vessel (RPV) cooldown.

The CUW System reduces RPV temperature gradients by maintaining circulation in the bottom head of the RPV during periods when the reactor internal pumps are unavailable.

Figure 2.6.1 shows the basic CUW System configuration and scope. Except for the primary containment penetration and isolation valves, and the portions belonging to the reactor coolant pressure boundary, the CUW System is classified as non-safety-related. The major portion of the system is located outside of the primary containment in the Reactor Building.

CUW System piping and components from the RPV, out to and including the outboard isolation valves, are part of the reactor coolant pressure boundary and are classified as Seismic Category I. The remainder of the piping system is classified as non-Seismic Category I. Figure 2.6.1 shows the ASME Code class for the CUW system components

The inboard containment isolation valve is powered from Class 1E Division II, and the outboard containment isolation valves are powered from Class 1E Division I. In the CUW System, independence is provided between the Class 1E divisions, and between the Class 1E divisions and non-Class 1E equipment.

The main control room has control and open/close status indication for the containment isolation valves.

The safety-related electrical equipment, located in the primary containment and Reactor Building is qualified for a harsh environment.

The motor-operated valves (MOVs) for containment isolation shown in Figure 2.6.1 have active safety-related functions to close and perform this function under differential pressure, fluid flow and temperature conditions.

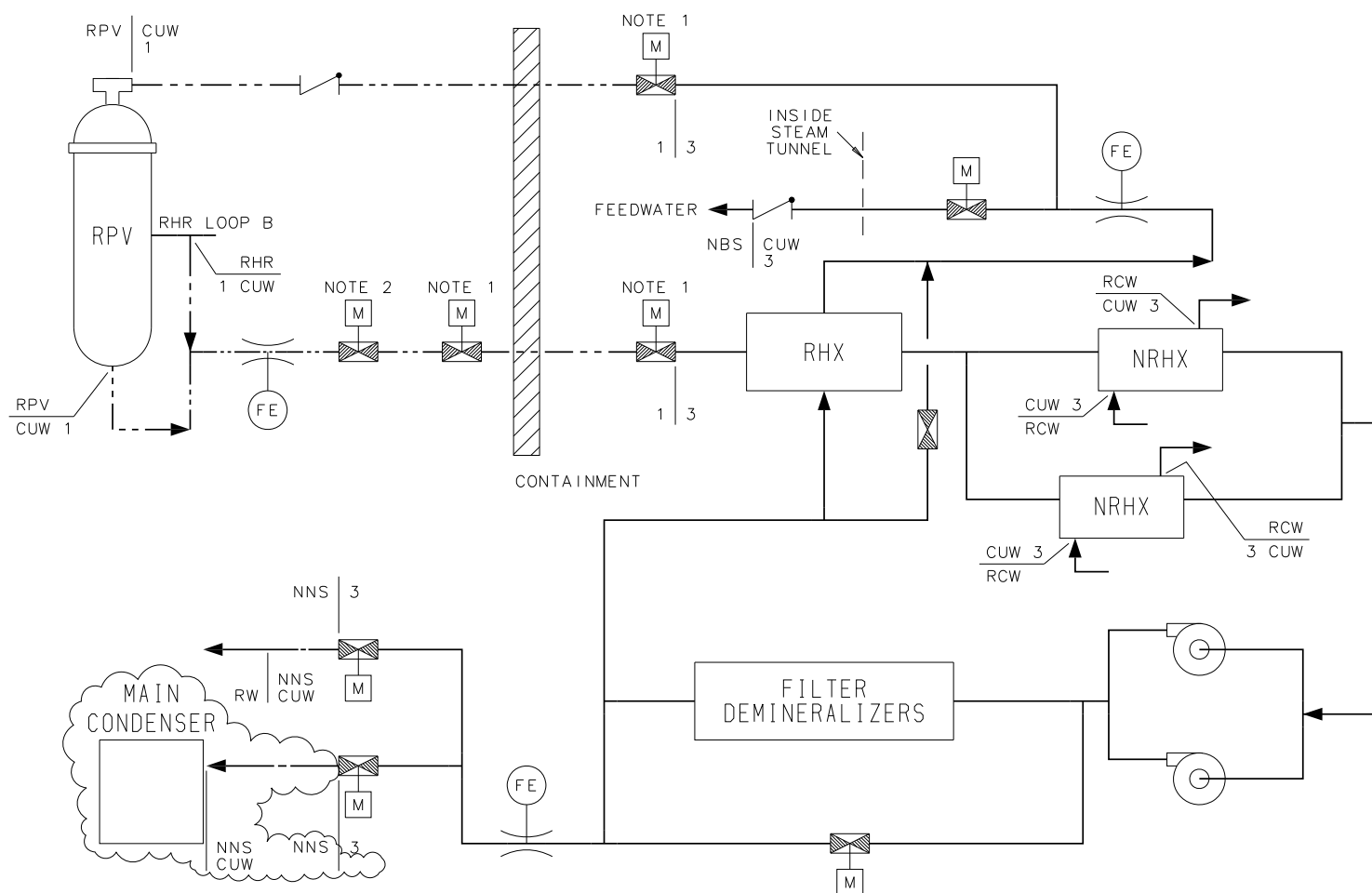
The check valves (CVs) shown on Figure 2.6.1, have active safety-related function to close under system pressure, fluid flow, and temperature conditions.

The CUW suction line is provided with a flow restrictor which provides flow restricting and flow monitoring functions. Maximum throat diameter is 135 mm.

The CUW piping and components downstream of the blowdown valve leading towards the Radwaste System shown on Figure 2.6.1 have a design pressure of 2.82 MPaG for intersystem loss-of-coolant accident (ISLOCA) conditions.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.6.1 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria, which will be undertaken for the CUW System.



NOTES:

1. THE INBOARD CONTAINMENT ISOLATION VALVE IS POWERED FROM CLASS 1E DIVISION II AND THE OUTBOARD ISOLATION VALVES ARE POWERED FROM CLASS 1E DIVISION I.
2. NOT CONSIDERED A CONTAINMENT ISOLATION VALVE; CLASSIFIED AS NON-SAFETY-RELATED.

Figure 2.6.1 Reactor Water Cleanup System

Table 2.6.1 Reactor Water Cleanup System

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitments	Inspections, Tests, Analyses	Acceptance Criteria
1. The basic configuration for the CUW System is as shown in Figure 2.6.1.	1. Inspection of the as-built system will be conducted.	1. The as-built CUW System conforms with the basic configuration shown in Figure 2.6.1.
2. The ASME Code components of the CUW System retain their pressure boundary integrity under internal pressures that will be experienced during service.	2. A hydrostatic test will be conducted on those Code components of the CUW System required to be hydrostatically tested by the ASME Code.	2. The results of the hydrostatic test of the ASME Code components of the CUW System conform with the requirements in the ASME Code, Section III.
3. The inboard containment isolation valve is powered from Class 1E Division II, and the outboard containment isolation valves are powered from Class 1E Division I. In the CUW System, independence is provided between Class 1E divisions, and between Class 1E divisions and non-Class 1E equipment.	3. <ul style="list-style-type: none"> a. Tests will be performed on the CUW System by providing a test signal in only one Class 1E division at a time. b. Inspections of the as-installed Class 1E divisions in the CUW System will be performed. 	3. <ul style="list-style-type: none"> a. The test signal exists only in the Class 1E division under test in the CUW System. b. In the CUW System, physical separation or electrical isolation exists between Class 1E divisions. Physical separation or electrical isolation exists between Class 1E divisions and non-Class 1E equipment.
4. Main control room displays and controls provided for CUW System are as defined in Section 2.6.1.	4. Inspections will be performed on the main control room displays and controls for the CUW System.	4. Displays and controls exist or can be retrieved in main control room as defined in Section 2.6.1.

Table 2.6.1 Reactor Water Cleanup System (Continued)

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitments	Inspections, Tests, Analyses	Acceptance Criteria
5. a. MOVs designated in Section 2.6.1 as having an active safety- related function close under differential pressure and fluid flow and temperature conditions.	5. a. Tests of installed valves for closing will be conducted under preoperational differential pressure, fluid flow, and temperature conditions.	5. a. Upon receipt of the actuation signal each MOV closes. The following valves close in the following time limits: <div> <div>Valve</div> <div>Time (s)</div> <div>Suction line inboard containment isolation valve</div> <div>≤30 Close</div> <div>Suction line outboard containment isolation valve</div> <div>≤30 Close</div> </div>
b. CVs designated in Section 2.6.1 as having an active safety-related function close under system pressure, fluid flow, and temperature conditions.	b. Tests of installed valves for closing will be conducted under system pre-operational pressure, fluid flow, and temperature conditions.	b. Each CV closes.
6. Maximum throat diameter of the CUW suction line flow restrictor is 135 mm.	6. Inspections will be performed on the CUW suction line flow restrictor throat diameter.	6. Maximum throat diameter of the CUW suction line flow restrictor is 135 mm.

2.6.2 Fuel Pool Cooling and Cleanup System

Design Description

The Fuel Pool Cooling and Cleanup (FPC) System (Figure 2.6.2) removes decay heat generated by the spent fuel assemblies in the spent fuel storage pool. The system also maintains the water quality and monitors and maintains the water level above the spent fuel in the spent fuel storage pool. Figure 2.6.2 shows the basic FPC System configuration and scope.

The FPC System is classified non-safety-related, except for piping connections and valves for safety-related fuel pool makeup and supplemental cooling by the Residual Heat Removal (RHR) System.

The safety-related makeup water source for the spent fuel storage pool is provided by the RHR System, which pumps suppression pool water to the FPC System.

The spent fuel storage pool has no piping connections (inlet, outlet, drains or other piping) located below a point 3m above the top of active fuel located in the spent fuel storage racks.

The FPC System components, with the exception of the filter/demineralizer unit, are classified as Seismic Category I. Figure 2.6.2 shows the ASME Code class for the FPC System piping and components.

The FPC System is located in the Reactor Building.

The FPC System has parameter displays in the main control room for instruments shown on Figure 2.6.2.

The check valves (CVs) shown on Figure 2.6.2 have active safety-related functions to open, close, or both open and close under system pressure, fluid flow, and temperature conditions.

The piping and components of the FPC System at the suction side of the RHR System from the upstream isolation valve have a design pressure of 2.82 MPaG for intersystem LOCA (ISLOCA) conditions.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.6.2 provides a definition of the inspections, tests and/or analyses, together with associated acceptance criteria, which will be undertaken for the FPC System.

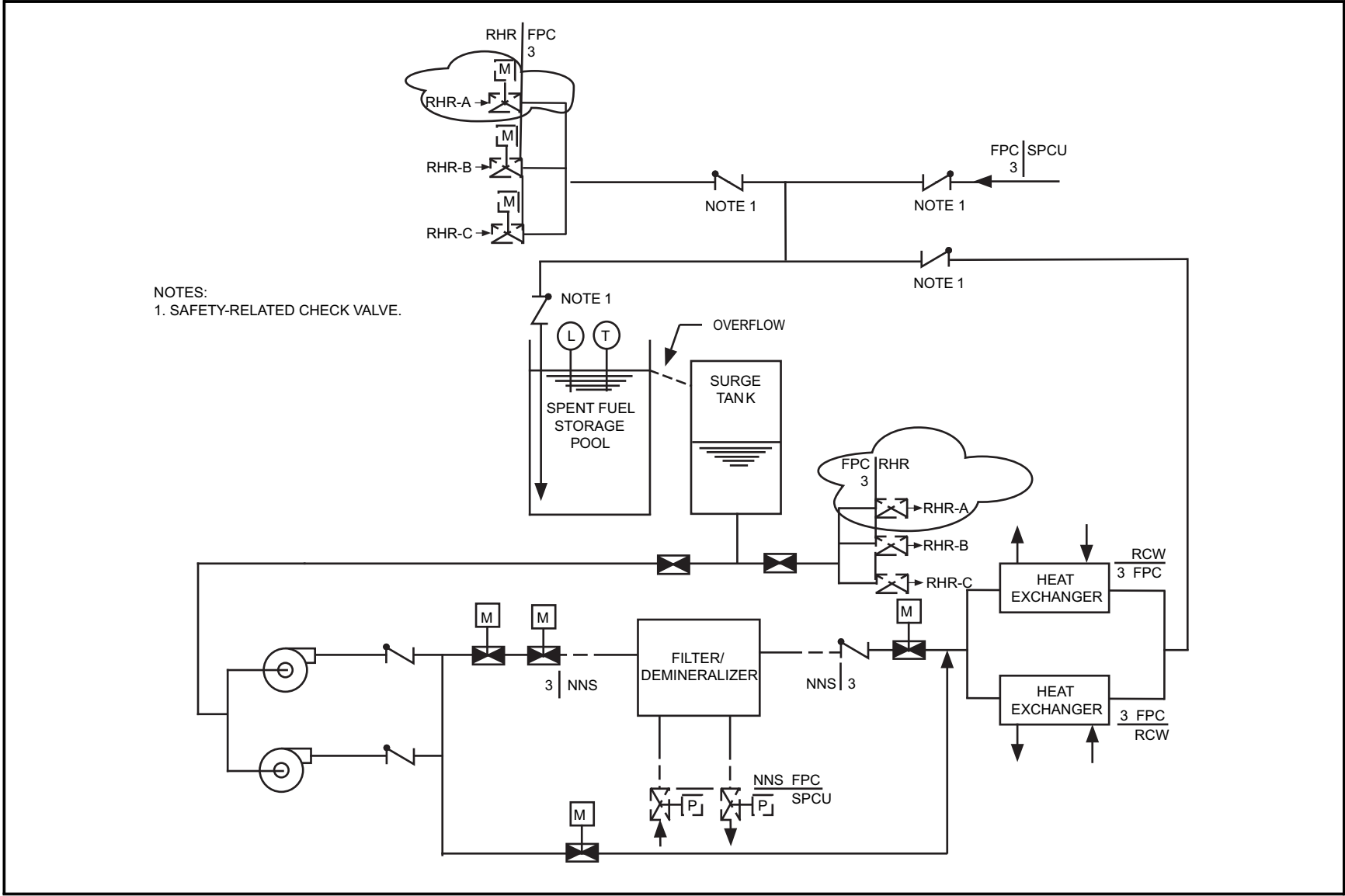


Figure 2.6.2 Fuel Pool Cooling and Cleanup System

Table 2.6.2 Fuel Pool Cooling and Cleanup System

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The basic configuration of the FPC System is as shown on Figure 2.6.2.	1. Inspection of the as-built system will be conducted.	1. The as-built FPC System conforms with the basic configuration shown on Figure 2.6.2.
2. The ASME Code components of the FPC System retain their pressure boundary integrity under internal pressures that will be experienced during service.	2. A hydrostatic test will be conducted on those Code components of the FPC System required to be hydrostatically tested by the ASME Code.	2. The results of the hydrostatic test of the ASME Code components of the FPC System conform with requirements in the ASME Code, Section III.
3. The safety-related makeup water source for the spent fuel storage pool is provided by the RHR System, which pumps suppression pool water to the FPC System.	3. Tests will be conducted on the as-built FPC and RHR Systems by aligning the systems so that the RHR System draws water from the suppression pool and discharges into the spent fuel storage pool.	3. The combined RHR System and FPC System operation transfers water from suppression pool to the spent fuel storage pool.
4. The spent fuel storage pool has no piping connections (inlet, outlet, drains or other piping) located below a point 3m above the top of active fuel located in the spent fuel storage racks.	4. Inspections of the as-built spent fuel storage pool will be conducted.	4. The spent fuel storage pool has no piping connections (inlet, outlet, drains or other piping) located below a point 3m above the top of active fuel located in the spent fuel storage racks.
5. Main control room displays provided for the FPC System are as defined in Section 2.6.2.	5. Inspections will be performed on the main control room displays for the FPC System.	5. Displays exist or can be retrieved in the main control room as defined in Section 2.6.2.
6. CVs designated in Section 2.6.2 as having an active safety-related function open, close, or open and close, under system pressure, fluid flow, and temperature conditions.	6. Tests of installed valves for opening, closing, or both opening and closing, will be conducted under system preoperational pressure, fluid flow, and temperature conditions.	6. Based on the direction of the differential pressure across the valve, each CV opens, close, or both opens and closes depending upon the valve's safety functions.

2.6.3 Suppression Pool Cleanup System

Design Description

The Suppression Pool Cleanup (SPCU) System removes particulates and dissolved impurities from the suppression pool by circulating suppression pool water through the Fuel Pool Cooling (FPC) System water treatment equipment. The SPCU System also provides a source of makeup water to the spent fuel storage pool and the Reactor Building Cooling Water (RCW) System surge tanks using either the suppression pool or condensate storage tank (CST) water via the High Pressure Core Flooder (HPCF) System supply piping. Figure 2.6.3 shows the basic system configuration and scope.

Except for the primary containment penetration and isolation valves, the SPCU System is classified as non-safety-related.

The SPCU System piping and components, as shown on Figure 2.6.3, are classified as Seismic Category I. Figure 2.6.3 shows ASME Code class for the SPCU System piping and components.

The SPCU System is located outside the primary containment in the Reactor Building.

The inboard containment isolation valves are powered from Class 1E Division II, and the outboard containment isolation valve is powered from Class 1E Division I. In the SPCU System, independence is provided between the Class 1E divisions, and also between Class 1E divisions and non-Class 1E equipment.

The main control room has control and open/close status indication for the containment isolation valves.

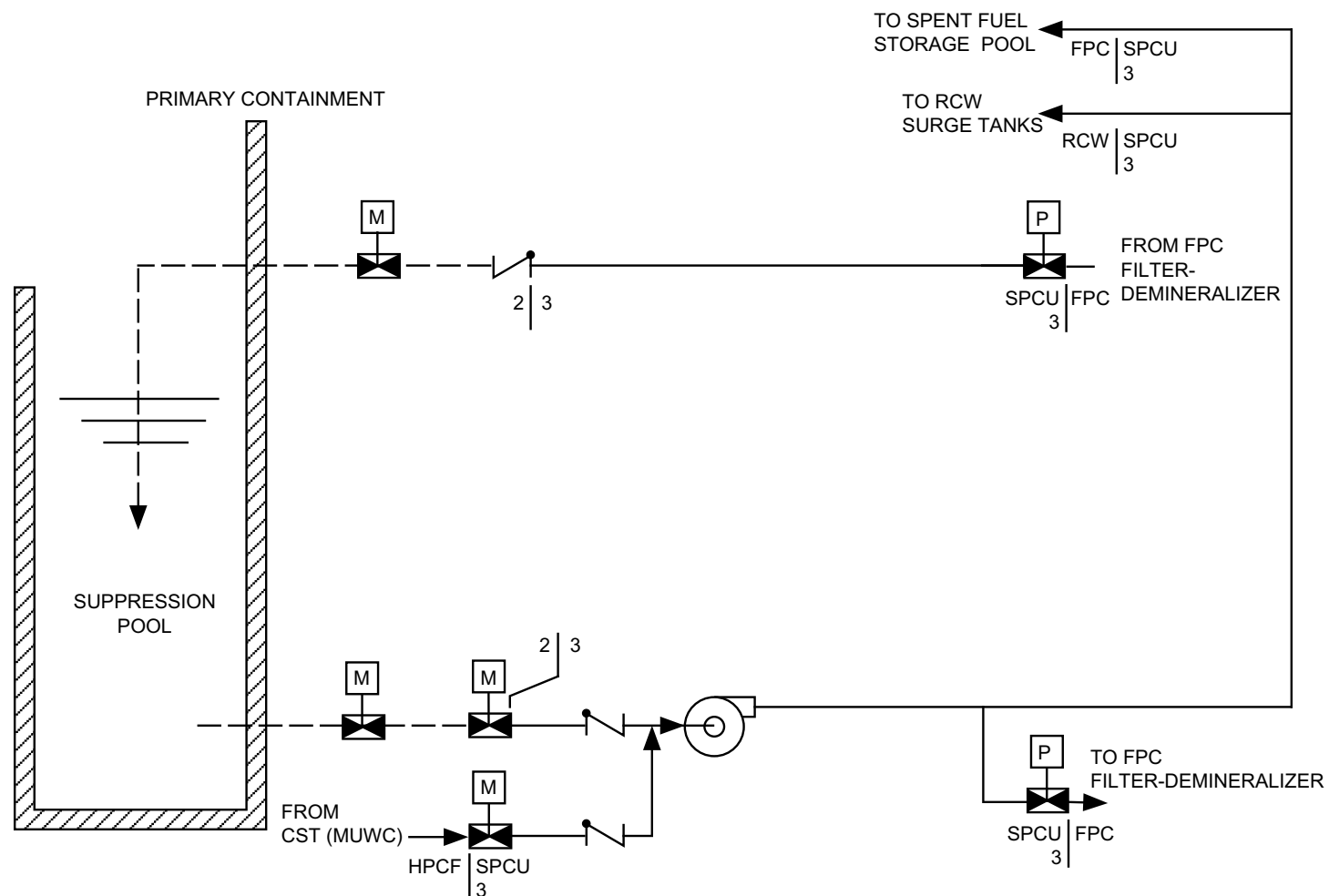
The safety-related electrical equipment located outside the primary containment in the Reactor Building is qualified for a harsh environment.

The motor-operated valves (MOV) for containment isolation, shown on Figure 2.6.3 have active safety-related function to close and perform this function under differential pressure, fluid flow, and temperature conditions.

The check valve (CV) for containment isolation shown on Figure 2.6.3, has active safety-related function to close under system pressure, fluid flow, and temperature conditions.

Inspections, Tests, Analyses and Acceptance Criteria

Table 2.6.3 provides definition of inspections, tests, and/or analyses, together with associated acceptance criteria, which will be undertaken for the SPCU System.



NOTES:

1. THE INBOARD CONTAINMENT ISOLATION VALVES ARE POWERED FROM CLASS 1E DIVISION II AND THE OUTBOARD CONTAINMENT ISOLATION VALVE IS POWERED FROM CLASS 1E DIVISION I.

Figure 2.6.3 Suppression Pool Cleanup System

Table 2.6.3 Suppression Pool Cleanup System

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The basic configuration of the SPCU System is as shown on Figure 2.6.3.	1. Inspections of the as-built system will be conducted.	1. The as-built SPCU System conforms with the basic configuration shown on Figure 2.6.3.
2. The ASME Code components of the SPCU System retain their pressure boundary integrity under internal pressures that will be experienced during service.	2. A hydrostatic test will be conducted on those Code components of the SPCU System required to be hydrostatically tested by the ASME Code.	2. The results of the hydrostatic test of the ASME Code components of the SPCU System conform with the requirements in the ASME Code Section III.
3. The inboard containment isolation valves are powered from Class 1E Division II, and the outboard containment isolation valve is powered from Class 1E Division I. In the SPCU System, independence is provided between Class 1E divisions, and between Class 1E divisions and non-Class 1E equipment.	3. <ul style="list-style-type: none"> a. Tests will be conducted in the SPCU System by providing a test signal in only one Class 1E division at a time. b. Inspections of the as-built Class 1E divisions in the SPCU System will be performed. 	3. <ul style="list-style-type: none"> a. The test signal exists only in the Class 1E division under test in the SPCU System. b. In the SPCU System, physical separation or electrical isolation exists between Class 1E divisions. Physical separation or electrical isolation exists between these Class 1E divisions and non-Class 1E equipment.
4. Main control room displays and controls provided for the SPCU System are as defined in Section 2.6.3.	4. Inspections will be conducted on the main control room displays and controls for the SPCU System.	4. Displays and controls exist or can be retrieved in the main control room as defined in Section 2.6.3.
5. <ul style="list-style-type: none"> a. MOVs designated in Section 2.6.3 as having an active safety-related function close under differential pressure, fluid flow, and temperature conditions. 	5. <ul style="list-style-type: none"> a. Tests of installed valves for closing will be conducted under preoperational differential pressure, fluid flow, and temperature conditions. 	5. <ul style="list-style-type: none"> a. Upon receipt of the actuating signal, each MOV closes.

Table 2.6.3 Suppression Pool Cleanup System (Continued)

Inspections, Tests, Analyses and Acceptance Criteria		
Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
b. The CV designated in Section 2.6.3 as having an active safety-related function closes under system pressure, fluid flow, and temperature conditions.	b. Tests of the installed valve for closing will be conducted under system preoperational pressure, fluid flow, and temperature conditions.	b. The CV closes.