ABB
ASEA BROWN BOVERI

March 5, 1993
LD-93-038

Docket No. 52-002

Attn: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject: System 80+™ Prototype Design Descriptions and ITAAC

Reference: NRC Letter, D. Crutchfield to R. Matzie, dated 2/10/93

Dear Sirs:

Attached are eleven prototype system Design Descriptions and associated ITAAC (Inspections, Tests, Analyses and Acceptance Criteria) which are submitted for review and approval. These descriptions and ITAAC are submitted in response to the reference letter which proposed that the experience gained in the two week industry review of System 80+ ITAAC be factored into the ITAAC before the NRC staff conducts its acceptance review. ABB-CE concurs completely with this process as a means of avoiding unnecessary iterations.

Ten of the system descriptions and ITAAC were the subject of the intensive industry review which was conducted by representatives of nine nuclear utilities, four architect-engineering (A/E) organizations, INPO, EPRI, NUMARC, and ABB-CE's legal counsel. At least eight of the participants had extensive personal experience in the September and/or January reviews of the lead ITAAC application. All eleven ITAAC were subsequently reviewed by ABB-CE management with assistance from NUMARC, two A/E firms, one nuclear utility and legal counsel. Guidance from NRC staff reviews was also applied.

We are also in the process of preparing an electrical distribution system ITAAC and a structural building ITAAC. We will withhold submittal of these prototypes until after the lessons learned from the structural and electrical ITAAC reviews (to be held the week of March 8, 1993) can be factored into them. We hope the System 80+ review team will review these as well as the attached prototype ITAAC.

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We believe that these design descriptions and ITAAC fairly represent the consensus guidance obtained through the multiple and valuable inputs described above. We look forward to coming to final agreement on these system descriptions and ITAAC so that we may proceed in a straightforward fashion to complete and submit the remaining ITAAC patterned after the approved prototypes.

Please feel free to query us as the review team evaluates this submittal. You may contact me or Mr. John Rec (203-285-2861) for assistance in this matter.

Very truly yours,

COMBUSTION ENGINEERING, INC.

C B Brinkman

C. B. Brinkman
Acting Director
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Basic Configuration (for a system) -- The functional arrangement of structures, Divisions and components specified in the Design Description. Additionally, Basic Configuration includes and is limited to pressure-boundary welds for ASME Code Class 1, 2, and 3 components, dynamic qualification of Seismic Category I mechanical and electrical equipment, qualification of Class 1E electrical equipment for the environmental conditions that would exist during and following a design basis accident, and qualification of active safety related Motor Operated Valves. Inspections for basic configuration include and are limited to inspection of the system functional arrangement and the following inspections, tests, and analyses:

(1) Inspections, including non-destructive examination (NDE), of the as-built, pressure boundary welds for ASME Code Class 1, 2, or 3 components identified in the design description to demonstrate that the requirements of ASME Code Section III for the quality of pressure boundary welds are met. The Code-approved inspector(s) finding of compliance with Code requirements shall be conclusive.

(2) Tests and/or analyses of the Seismic Category I mechanical and electrical equipment (including connected instrumentation and controls) identified in the Design Description, including associated anchorage, to demonstrate that the as-built equipment is qualified to withstand design basis dynamic loads without loss of its Safety Function.

(3) Tests and/or analyses of the as-built Class 1E electrical equipment identified in the Design Description to demonstrate that it is qualified to withstand the environmental conditions that would exist during and following a design basis accident without loss of its Safety Function for the time needed to be functional. These environmental conditions, as applicable to the bounding design basis accident(s), are as follows: expected time-dependent temperature and pressure profiles, humidity, chemical effects, radiation, aging, submergence, and their synergistic effects which have a significant effect on equipment performance. As used in this paragraph, the term "Class 1E electrical equipment" includes the equipment itself, connected instrumentation and controls, connected electrical components, (such as cabling, wiring, and terminations), and the lubricants necessary to support performance of the Safety Functions of the Class 1E electrical components identified in the Design Description, to the extent that such equipment is not in a mild environment.

Electrical equipment environmental qualification may be demonstrated through:

(a) Testing of an identical item of equipment under identical or similar conditions with a supporting analysis to show that the

equipment is qualified; or

(b) testing of a similar item of equipment under identical or similar conditions with a supporting analysis to show that the equipment is qualified; or

(c) experience with identical or similar equipment under identical or similar conditions with supporting analysis to show that the equipment is qualified; or

(d) analysis in combination with partial type test data that supports the analytical assumptions and conclusions to show that the equipment is qualified.

(4) Tests or type tests of active safety related Motor-Operated Valves (MOVs) identified in the design description to demonstrate that the MOVs are qualified to perform their Safety Functions under design basis differential pressure, system pressure, fluid temperature, ambient temperature, minimum voltage, and minimum and/or maximum stroke times.

1.3.6 REACTOR VESSEL INTERNALS

Design Description

The Reactor Vessel Internals consist of a Core Support Barrel Assembly and an Upper Guide Structure Assembly.

The Core Support Barrel (CSB) assembly is suspended from the reactor vessel flange. The CSB assembly provides support and location positioning for the fuel assembly lower end fittings. The CSB assembly contains structures that provide an instrumentation guide path from the lower vessel, and hydraulic flow paths through the vessel from the inlet nozzles, to the upper end of the fuel assemblies.

The Upper Guide Structure (UGS) assembly is supported by the CSB upper flange and extends into the CSB assembly to engage the top of the fuel assemblies. The UGS assembly provides an insertion path for the control element assemblies (CEA). The UGS assembly contains structures which provide both a guide path and lateral support for the upper portion of the control element assemblies and extension shafts in the reactor vessel upper plenum region. The UGS assembly also provides guide paths for heated junction thermocouple (HJTC) assemblies.

The Basic Configuration of the CSB and UGS are as shown in Figures 1.3.6-1 and 1.3.6-2,respectively.

The Core Support Barrel and Upper Guide Structure assemblies are designed and fabricated in accordance with ASME Code Section III Class NG requirements and are qualified Seismic Category I.

The Reactor Vessel Internals withstand the effects of flow induced vibration caused by the operation of the reactor coolant pumps.

Inspections, Tests, Analyses and Acceptance Criteria

Table 1.3.6-1 specifies the inspections, tests, analyses and associated acceptance criteria for the Reactor Vessel Internals.

TABLE 1.3.6-1

REACTOR VESSEL INTERNALS
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The Basic Configuration of the Reactor Vessel Internals is as shown in Figures 1.3.6-1 and 1.3.6-2.	1. Inspection of the as-built Reactor Vessel Internals will be conducted.	1. For the components and equipment shown on Figures 1.3.6-1 and 1.3.6-2, the as-built Reactor Vessel Internals conform with the Basic Configuration.
2. The Reactor Vessel Internals withstand the effects of flow induced vibration caused by operation of the reactor coolant pumps.	2. Tests will be performed to subject the Reactor Vessel Internals to flow induced vibration. Pre and post-test visual inspection will be performed on the Reactor Vessel Internals.	2. Tests and inspections results demonstrate that the Reactor Vessel Internals retain their integrity.

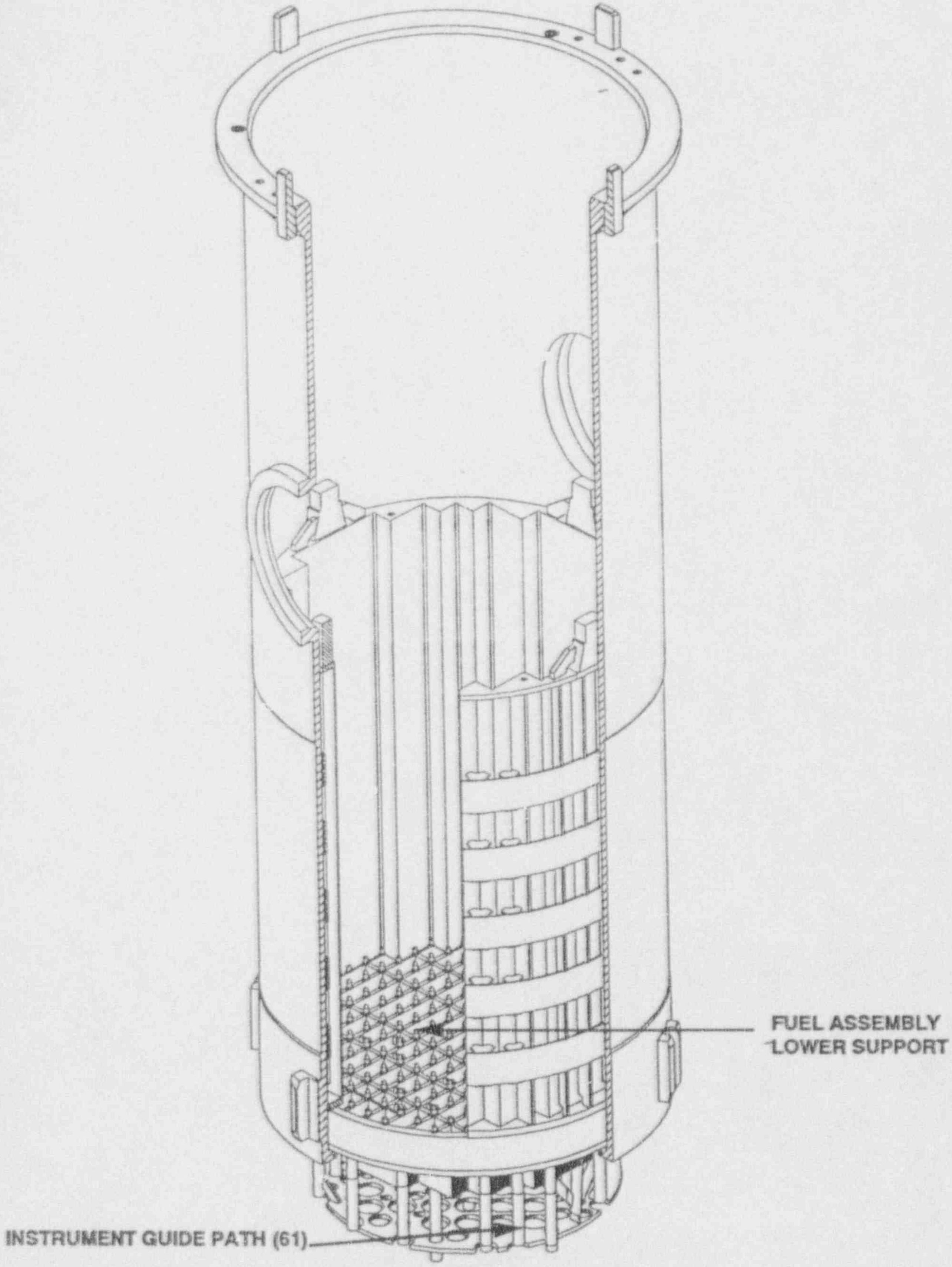


FIGURE 1.3.6-1
CORE SUPPORT BARREL ASSEMBLY

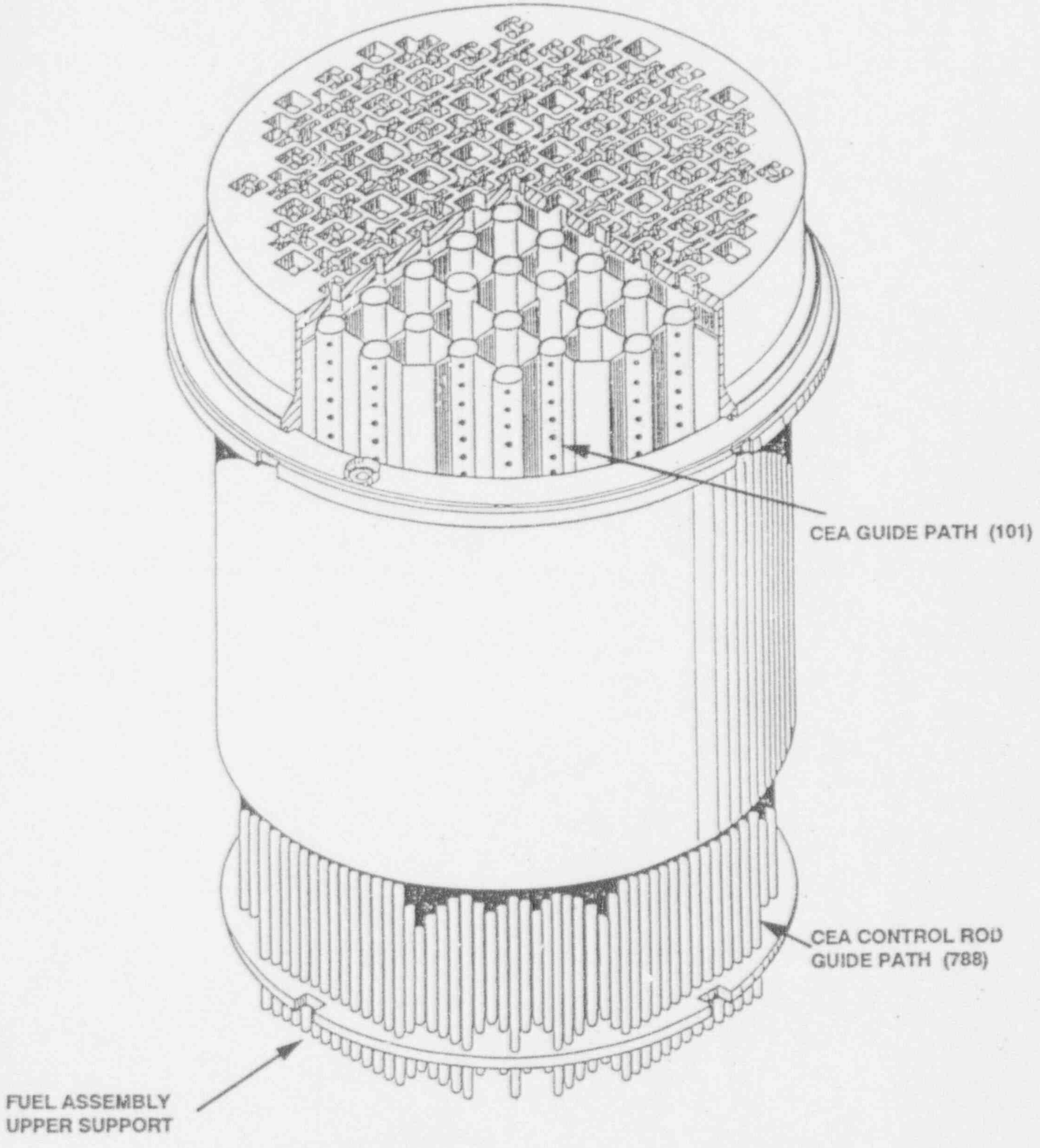


FIGURE 1.3.6-2
UPPER GUIDE STRUCTURE ASSEMBLY

1.5.1 REACTOR COOLANT SYSTEM

Design Description

The reactor coolant system (RCS) removes heat generated in the reactor core and transfers the heat to the steam generators. The reactor coolant system forms part of the pressure boundary between the reactor coolant and the containment atmosphere.

The RCS is located in the containment and has a reactor vessel (RV), two steam generators (SGs), four reactor coolant pumps (RCPs), one pressurizer (PZR), four pressurizer safety valves, piping, heaters, controls, instrumentation and valves.

The Reactor Coolant Pumps (RCPs) circulate reactor coolant water in loops through the RV to the SG's and back to the RCPs. The PZR provides a surge volume and pressurizes the RCS.

The pressurizer safety valves provide overpressure protection for reactor coolant pressure boundary components in the RCS. Low temperature overpressure protection for the RCS is provided by the Shutdown Cooling System (SCS).

The pressure retaining components of the reactor coolant pressure boundary that are made of ferritic materials meet the fracture toughness requirements of the ASME Code Section III. Reactor vessel beltline materials have Charpy upper shelf energy of no less than 75 ft.-lb. initially. The RV beltline materials are SA-508 Class 2 or 3 (forgings) and austenitic stainless steel or Ni-Cr-Fe alloy equivalent to SB-166 (cladding).

The RV is equipped with holders for accommodating material surveillance capsules. Specimens taken from materials actually used in fabrication of the belt line region are inserted in the holders. The capsules contain Charpy V-notch specimens of base metal, weld metal and heat-affected zone material, and tensile specimens from base metal and weld metal.

Each RCP motor has a flywheel which retains its integrity at a design overspeed condition of 125 percent of normal operating speed.

Each SG steam outlet nozzle has an integral flow-limiting venturi.

The basic configuration of the RCS is as shown on Figure 1.5.1-1.

The ASME Code Section III Class for the RCS pressure retaining components shown on Figure 1.5.1-1 is as depicted on the figure.

The safety related equipment shown on Figure 1.5.1-1 is qualified Seismic Category I.

Two pressurizer backup heater banks are powered from separate Class 1E Divisions; all other PZR heaters are not powered from Class 1E buses. Instrumentation shown on Figure 1.5.1-1 is powered from its respective Class 1E bus except for the ultrasonic instruments and temperature instruments in the Pressurizer Safety Valve discharge lines, the temperature and level instruments shown connected directly to the reactor vessel, and the refueling water level instruments between the SCS suction lines and safety injection system lines and between the SCS suction lines and PZR RCGVS lines.

RCS instrumentation indications shown on Figure 1.5.1-1 exist in the control room or can be retrieved there. Controls exist in the control room to start and stop the RCPs, open and close the pressurizer spray control valves, and energize or de-energize the pressurizer heaters.

Inspections, Tests, Analyses and Acceptance Criteria

Table 1.5.1-1 specifies the inspections, tests, analyses, and associated acceptance criteria for the RCS.

TABLE 1.5.1-1

REACTOR COOLANT SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The Pressurizer Safety Valves provide overpressure protection for reactor coolant pressure boundary components in the RCS.	1. Tests and analysis in accordance with ASME Code Section III will be performed to determine set pressure and flow capacity of each pressurizer safety valve.	1. Pressurizer Safety Valve setpressure equals 2500 psia ± 25psi and the minimum capacity of each valve is 525,000 lb/hr.
2. RV beltline materials have Charpy upper-shelf energy of no less than 75 ft-lb initially.	2. Charpy V-notch specimens of RCS beltline materials will be tested.	2. The initial RV beltline Charpy upper shelf energy is no less than 75 ft-lb.
3. The RV beltline materials are SA-508 Class 2 or 3 (forgings) and austenitic stainless steel or Ni-Cr-Fe alloy equivalent to SB-166 (cladding).	3. Inspection of the RV beltline material test reports will be conducted.	3. The RV beltline materials are SA-508 Class 2 or 3 (forgings) and austenitic stainless steel or Ni-Cr-Fe alloy equivalent to SB-166 (cladding).
4. The RV is equipped with holders for accommodating material surveillance specimens.	4. Inspection of the RV for presence of capsule holders will be performed.	4. Capsule holders are in place.
5. RV material specimens are made from the actual material from which the vessel was fabricated.	5. Inspections of RV material specimens will be performed.	5. RV material specimens are made from material used in RV fabrication.
6. Each RCP motor has a flywheel which retains its integrity at 125% of normal operating speed.	6. Overspeed tests of each RCP flywheel will be performed.	6. Each RCP flywheel was tested and passed an overspeed test no less than 125% of normal operating speed.

TABLE 1.5.1-1 (Continued)

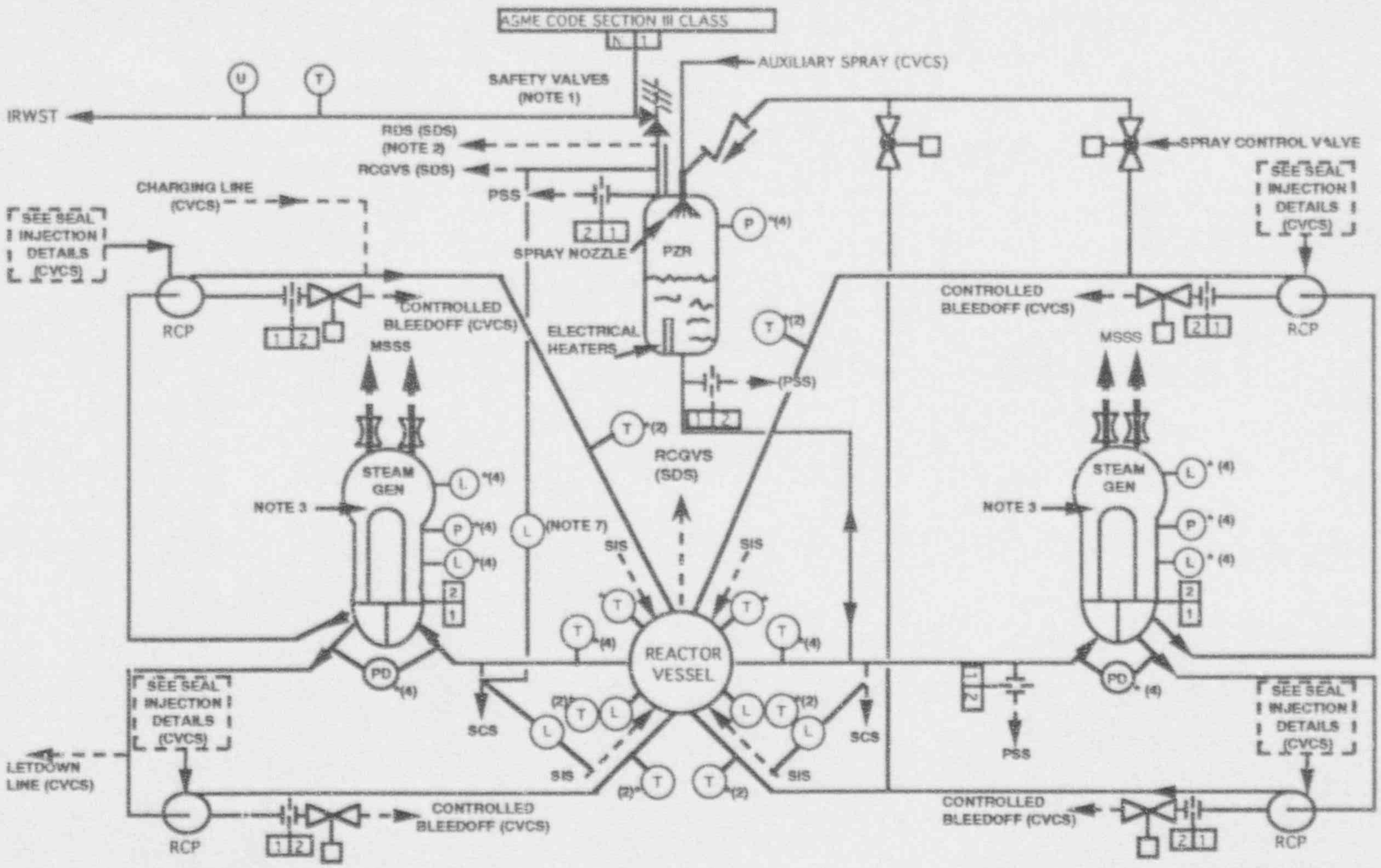
REACTOR COOLANT SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. Each steam generator steam outlet nozzle has an integral flow-limiting venturi.	7. The as-built SG steam outlet nozzles will be inspected.	7. Each SG steam outlet nozzle has an integral venturi with a throat area no greater than 1.283 square feet.
8. The Basic Configuration of the RCS is as shown on Figure 1.5.1-1.	8. Inspections of the as-built RCS configuration will be conducted.	8. For the components and equipment shown on Figure 1.5.1-1, the as-built RCS conforms with the Basic Configuration.
9. The ASME Code Section III RCS components shown on Figure 1.5.1-1 retain their pressure boundary integrity under internal pressures that will be experienced during service.	9. A pressure test will be conducted on those components of the RCS required to be pressure tested by ASME Code Section III.	9. The results of the pressure test of ASME Code Section III components of the RCS conform with the pressure testing criteria in the ASME Code Section III.
10. Two PZR backup heater banks are powered from separate Class 1E Divisions.	10. Tests will be performed on the PZR heaters by providing a test signal in only one Class 1E Division at a time.	10. Within the RCS, a test signal exists only at the equipment powered from the Class 1E Division or bus under test.
Class 1E instrumentation shown on Figure 1.5.1-1 is powered from its respective Class 1E bus.	Tests will be performed on the Class 1E instrumentation shown on Figure 1.5.1-1 by providing a test signal in only one Class 1E bus at a time.	

TABLE 1.5.1-1 (Continued)

REACTOR COOLANT SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
11. RCS instrumentation indications shown on Figure 1.5.1-1 exist in the Control Room or can be retrieved there.	11. Inspection for the existence or retrievability in the Control Room of instrumentation indications will be performed.	11. The instrumentation indications shown on Figure 1.5.1-1 exist in the Control Room or can be retrieved there.
Controls exist in the Control Room to start and stop the RCPs, open and close the pressurizer spray valves, and energize or de-energize the pressurizer heaters.	Tests will be performed using the RCS controls in the Control Room.	RCS controls in the Control Room operate to start and stop the RCPs, open and close the pressurizer spray valves, and energize or de-energize the pressurizer heaters.



NOTES:

1. ONE OF FOUR SAFETY VALVES IS SHOWN.
2. ONE OF TWO RDS LINES IS SHOWN.
3. SG TUBES ARE ASME CODE SECTION III CLASS 1.
4. TUBE SIDE IS CLASS 1 AND SHELL SIDE IS NON-ASME SECTION III.
5. * : EQUIPMENT FOR WHICH PARAGRAPH NUMBER 3 OF THE BASIC CONFIGURATION DEFINITION APPLIES.
6. FOR INSTRUMENTS, THE NUMBER OF REDUNDANT DETECTORS AND CHANNELS IS LISTED IN PARATHESES.
7. ANOTHER LEVEL INSTRUMENT (NOT SHOWN) IS PROVIDED BETWEEN THE OTHER SCS SUCTION LINE AND THE OTHER RCGVS LINE FROM A DIFFERENT SAFETY VALVE (NOT SHOWN).

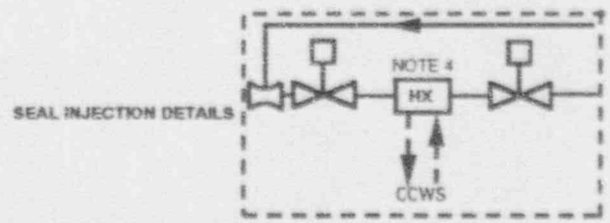


FIGURE 1.5.1-1
SYSTEM 80⁺ REACTOR COOLANT SYSTEM

1.5.2 SHUTDOWN COOLING SYSTEM

Design Description

The Shutdown Cooling System (SCS) removes heat from the reactor coolant and transfers the heat to the component cooling water system during reduced RCS pressure and temperature conditions. The SCS provides low temperature overpressure protection (LTOP) for the Reactor Coolant System (RCS).

The SCS consists of two Divisions. Each SCS Division has a SCS pump, a SCS heat exchanger, valves, piping, controls and instrumentation.

Each SCS Division has the heat removal capacity to cool the reactor coolant from SCS entry conditions to refueling conditions.

Each SCS division contains a relief valve that provides LTOP for the RCS when the RCS is connected to the SCS.

The SCS pump and the Containment Spray System (CSS) pump in the same division are connected by piping and valves such that the CSS pump in a division can perform the function of the SCS pump in the division. The piping and valves in the cross-connect line between the SCS pump suction and the CSS pump suction permit flow in either direction.

In each Division, a flow-limiting device is installed downstream from the SCS pump discharge between the cross-connect line from the CSS pump discharge and the containment isolation valves to limit runout flow.

The SCS discharge valves are capable of opening with the SCS pump operating.

The piping from the RCS to the SCS pump suction is self venting and contains no loop seals.

The SCS pumps can be flow tested during plant operation.

The Basic Configuration of the SCS is as shown in Figure 1.5.2-1.

The ASME Code Section III Class for the SCS pressure retaining components shown on Figure 1.5.2-1 is as depicted on the figure.

The safety related equipment shown on Figure 1.5.2-1 is qualified Seismic Category I. Pressure retaining components shown on Figure 1.5.2-1 have a design pressure of at least 900 psig and design temperature of at least 400 °F.

Water is supplied to each SCS pump at a net positive suction heat (NPSH) greater than the pump's required NPSH during operation at redu' :d RCS pressure and temperature.

The Class 1E loads shown on Figure 1.5.2-1 are powered from their respective Class 1E bus.

Outside containment, the two mechanical divisions of the SCS are physically separated.

SCS instrumentation indications shown on Figure 1.5.2-1 exist in the Control Room or can be retrieved there. The SCS is controlled manually from the control room. Controls exist in the Control Room to start and stop the SCS pumps, and to open and close those power operated valves shown on Figure 1.5.2-1.

The valves in the piping from the RCS to the suction side of the SCS pumps are interlocked so the valves cannot be opened if reactor coolant pressure exceeds SCS design pressure.

Inspections, Tests, Analyses and Acceptance Criteria

Table 1.5.2-1 specifies the inspections, tests, analyses and associated acceptance criteria for the SCS.

TABLE 1.5.2-1

SHUTDOWN COOLING SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. Each shutdown cooling system Division has the heat removal capacity to cool the reactor coolant from SCS entry conditions to refueling conditions.	1. Tests of as-built SCS configuration to measure the shutdown cooling flow at the combined discharge of the SCS heat exchanger and heat exchanger bypass line will be performed. Test and analysis will be performed to determine the heat removal capability of the SCS heat exchanger.	1. Flow through the SCS heat exchanger and heat exchanger bypass line can be adjusted while maintaining a flow of no less than 5000 gpm per Division. One SCS heat exchanger can remove a minimum of 30 million Btu/hr. of heat from the RCS during refueling conditions. Two SCS heat exchangers can cool the RCS from SCS entry conditions (350°F) to 120°F within 96 hours.
2. Each SCS division contains a relief valve that provides LTOP for the RCS when the RCS is connected to the SCS.	2. Tests and analyses of the LTOP relief valves will be conducted.	2. LTOP relief valve set pressure is not greater than 600 psia and each valve has a capacity of no less than 4000 gpm.
3. The Basic Configuration for the SCS is as shown in Figure 1.5.2-1.	3. Inspections of the as-built SCS configuration will be conducted.	3. For the components and equipment shown on Figure 1.5.2-1, the as-built SCS conforms with the Basic Configuration.
4. The CSS pump in a division can perform the function of the SCS pump in the Division.	4. Testing to measure the flowrate produced by the CSS pump, when its suction is cross-connected to the SCS pump suction and its discharge to the SCS pump discharge, will be performed.	4. CSS pump pumps at least 5000 gpm to the SCS heat exchanger inlet piping.

TABLE 1.5.2-1 (Continued)

SHUTDOWN COOLING SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
5. In each Division, a flow limiting device is installed downstream from the SCS pump discharge between the cross-connect line from the CSS pump discharge and the containment isolation valves to limit runout flow.	5. Inspections of the as-built SCS will be conducted.	5. In each Division, a flow limiting device is installed downstream from the SCS pump discharge between the cross-connect line from the CSS pump discharge and the containment isolation valves.
6. The piping from the RCS to the SCS pump suction is self-venting and contains no loop seals.	6. An inspection of the as-built piping will be conducted.	6. The piping from the RCS to the SCS pump suction is oriented downward or horizontal except for an upward section connecting to the pump suction flange and has no loop seals.
7. The SCS pumps can be flow tested during plant operation.	7. Tests of the as-installed SCS will be performed by manually aligning suction and discharge valves to the IRWST and starting the SCS pumps manually.	7. The SCS pumps pump at least 5000 gpm each through the test loop.
8. The ASME Code Section III SCS components shown on Figure 1.5.2-1 retain their pressure boundary integrity under internal pressures that will be experienced during service.	8. A pressure test will be conducted on those components of the SCS required to be pressure tested by ASME Code Section III.	8. The results of the pressure test of ASME Code Section III components of the SCS conform with the pressure testing criteria in ASME Code Section III.

TABLE 1.5.2-1 (Continued)

SHUTDOWN COOLING SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
9. Water is supplied to each SCS pump at a net positive suction head (NPSH) greater than the pump's required NPSH.	9. Tests to measure SCS pump suction pressure will be performed. Inspections and analyses to determine NPSH available to each pump will be prepared based on test data and as-built data.	9. The available NPSH exceeds each SCS pump's required NPSH.
10.a) Class 1E loads shown on Figure 1.5.2-1 are powered from their respective Class 1E bus.	10.a) Tests will be performed on the SCS by providing a test signal in only one Class 1E bus at a time.	10.a) Within the SCS, a test signal exists only at the equipment powered from the Class 1E bus under test.
b) The SCS pump motor in each Division is powered from one of the two Class 1E buses for that Division. Each SCS pump derives its control power from the same Class 1E bus that provides motive power to the pump motor. The SCS pump motor in each Division is not powered from the same Class 1E bus as the CSS pump motor in that Division.	b) Tests on the SCS will be conducted with a test signal applied to one class 1E bus at a time.	b) The SCS pump motor in each Division is powered from one of the two Class 1E buses for that Division. Each SCS pump derives its control power from the same Class 1E bus that provides motive power to the pump motor. The SCS pump motor in each Division is not powered from the same Class 1E bus as the CSS pump motor in that Division.
11. Outside containment, the two mechanical Divisions of the SCS are physically separated.	11. Inspections of the as-built SCS will be performed.	11. Outside containment, a Divisional wall separates the two SCS mechanical Divisions.

TABLE 1.5.2-1 (Continued)

SHUTDOWN COOLING SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
12. SCS instrumentation indications shown on Figure 1.5.2-1 exist in the Control Room or can be retrieved there.	12. Inspection for the existence or retrieveability in the Control Room of instrumentation indications will be performed.	12. The instrumentation indications shown on Figure 1.5.2-1 exist in the Control Room or can be retrieved there.
Controls exist in the Control Room to start and stop the SCS pumps and to open and close those power operated valves shown on Figure 1.5.2-1.	Tests will be performed using the SCS controls in the Control Room.	SCS controls in the Control Room operate to start and stop the SCS pumps, and to open and close those power operated valves shown in Figure 1.5.2-1.
13. Remotely-operated SCS suction line isolation valves have independent interlocks to prevent opening if RCS pressure exceeds SCS design pressure.	12. Tests using a RCS pressure simulated signal greater than the SCS design pressure will be performed by attempting to open the valves from the control room. Each valve will be tested independently.	13. The SCS suction isolation valves do not open.
14. Motor-Operated Valves (MOVs) having an active Safety Function will open and/or close under differential pressure or fluid flow and temperature conditions.	14. Opening and/or closing of designated MOVs will be conducted under preoperational differential pressure or fluid flow and temperature conditions.	14. Each MOV having an active Safety Function opens and/or closes.

NOTE:

1. TUBESIDE IS ASME CODE SECTION III CLASS 2 AND SHELLSIDE IS ASME CODE SECTION III CLASS 3.
2. ALL ELECTRICAL LOADS SHOWN ON THE FIGURE ARE CLASS 1E.
3. * : EQUIPMENT FOR WHICH PARAGRAPH NUMBER 3 OF THE BASIC CONFIGURATION DEFINITION APPLIES .

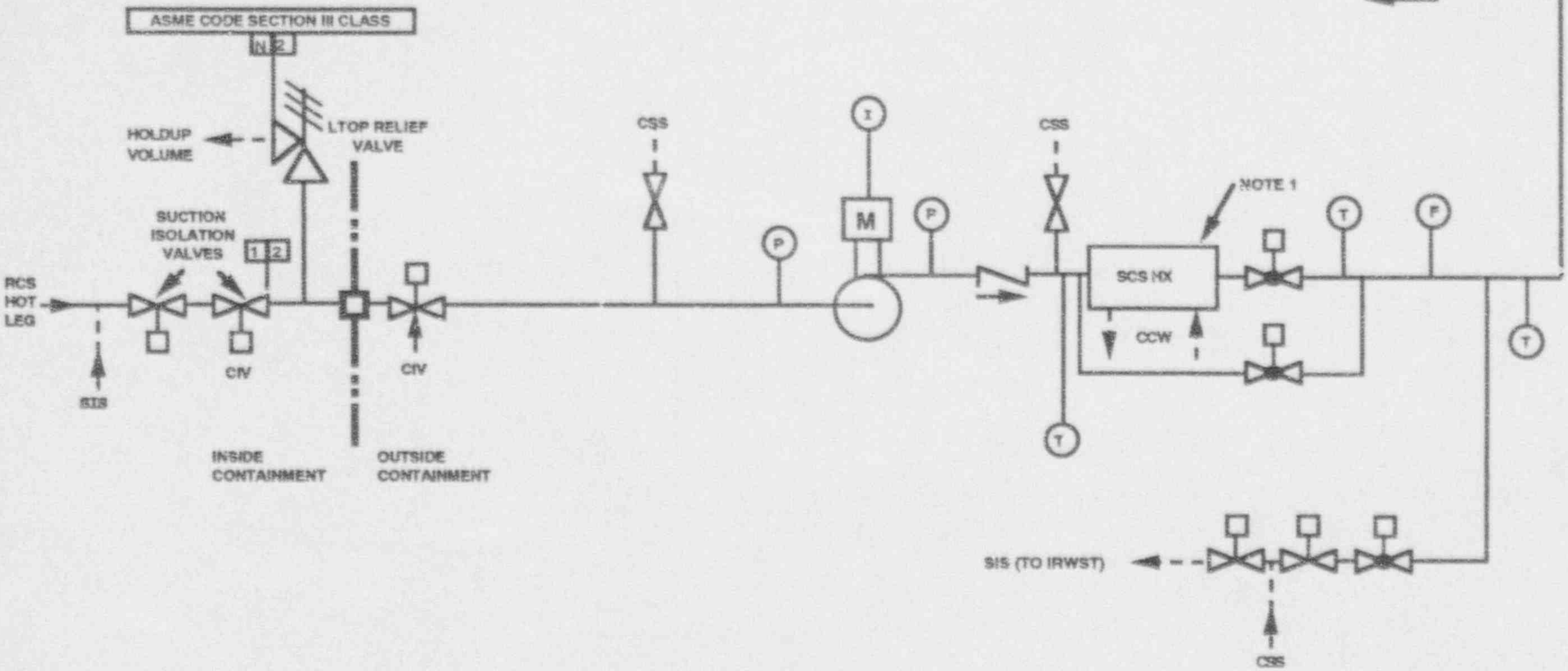


FIGURE 1.5.2-1
SHUTDOWN COOLING SYSTEM
(ONE OF TWO DIVISIONS)

1.6.6 CONTAINMENT ISOLATION SYSTEM

Design Description

The Containment Isolation System (CIS) provides a means to close valves in fluid system piping that passes through Containment penetrations.

The CIS provides a double pressure barrier at each containment penetration.

The Basic Configuration of the Containment isolation valves for piping which penetrates containment is as shown on Figure 1.6.6-1: each Containment isolation valve arrangement is as shown in one of the configurations on this Figure.

The ASME Code Section III Class for the CIS pressure retaining components is as shown on Figure 1.6.6-1.

The Containment isolation valves and connecting piping shown on Figure 1.6.6-1 are qualified Seismic Category I.

Redundant Containment isolation valves which require electrical power are powered from different Class 1E Divisions. Each electrically powered Containment isolation valve and its electrically powered valve controls are powered from the same Class 1E bus.

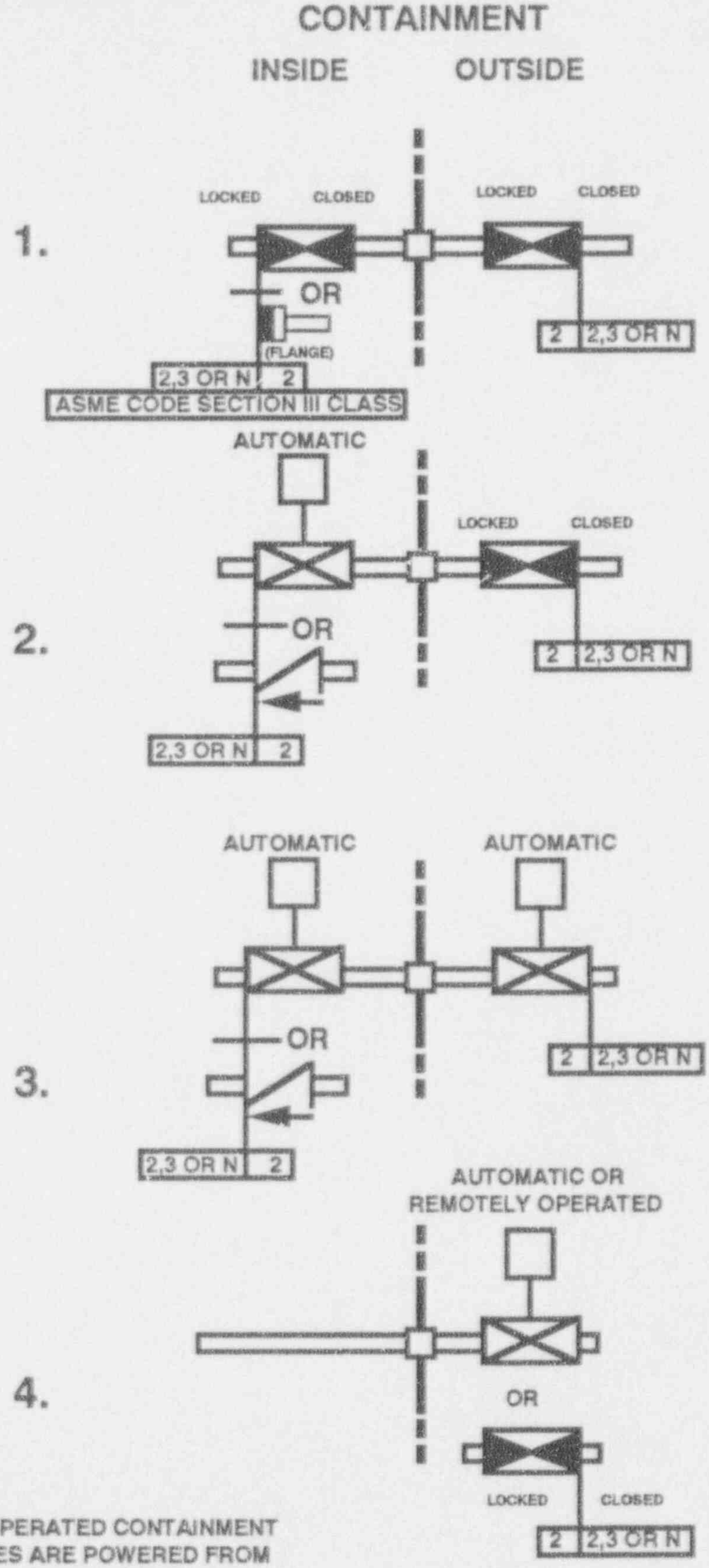
CIS valve position indications exist in the Main Control Room (MCR) or can be retrieved there. Controls exist in the MCR to open and close CIS power operated valves.

Only those valves required to close for containment isolation are closed automatically by a Containment Isolation Actuation Signal (CIAS). Valves that receive a CIAS close within the time allocated to the function performed. Fluid system lines whose Containment isolation valves are not automatically closed by a CIAS or are not locked closed have a minimum of one manual remotely operated isolation valve outside containment.

Pneumatic Containment isolation valves close upon loss of motive power to the valve.

Inspections, Tests, Analyses and Acceptance Criteria

Table 1.6.6-1 specifies the inspections, tests, and associated acceptance criteria for the CIS.



NOTE:
ELECTRICALLY OPERATED CONTAINMENT ISOLATION VALVES ARE POWERED FROM THEIR RESPECTIVE CLASS 1E BUSES.

FIGURE 1.6.6-1
CONTAINMENT ISOLATION VALVE CONFIGURATION

TABLE 1.6.6-1

CONTAINMENT ISOLATION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The Basic Configuration of the Containment isolation valves for piping which penetrates containment is as shown on Figure 1.6.6-1.	1. Inspections of the as-built CIS configuration will be conducted.	1. For the components and equipment shown on Figure 1.6.6-1, the as-built CIS conforms with the Basic Configuration.
2. The ASME Code Section III Containment Isolation System valves shown on Figure 1.6.6-1 retain their pressure boundary integrity under internal pressures that will be experienced during service.	2. A pressure test will be performed on those components of the CIS required to be pressure tested by ASME Code Section III.	2. The results of the pressure test of ASME Code Section III components of the CIS conform with the pressure testing criteria in ASME Code Section III.
3. Redundant Containment isolation valves which require electrical power are powered from different Class 1E Divisions. Each electrically powered Containment isolation valve and its electrically powered valve controls is powered from the same Class 1E bus.	3. Tests will be performed on the containment isolation valves by providing a test signal in only one Class 1E bus at a time.	3. Within the CIS, a test signal exists only at the equipment powered from the Class 1E bus under test.
4. CIS valve position indications for remotely operated and automatic Containment isolation valves exist in the Main Control Room (MCR) or can be retrieved there.	4. Inspection for the existence or retrievability in the MCR of Containment isolation valve position indication will be performed.	4. Valve position indications for remotely operated Containment isolation valves exist in the MCR or can be retrieved there.
Controls exist in the MCR to open and close CIS power operated valves.	Tests will be performed using the Containment isolation valve controls in the MCR.	Controls exist in the MCR to open and close power operated Containment isolation valves.

TABLE 1.6.6-1 (Continued)

CONTAINMENT ISOLATION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
5.a) Only those valves required to close for Containment isolation are closed automatically by a CIAS.	5.a) A test of the isolation function will be performed using a simulated CIAS.	5.a) Containment isolation valves respond to a CIAS as specified in Table 1.6.6-2.
b) Valves that receive a CIAS close within the time allocated to the function performed.	b) Testing of the closure times of automatically actuated Containment isolation valves will be performed using a simulated CIAS.	b) Containment Isolation Valves close upon receipt of a CIAS, in less than or equal to the time specified in Table 1.6.6-2.
6. Fluid system lines whose Containment isolation valves are not automatically closed by a CIAS or are not locked closed have a minimum of one remotely operated Containment isolation valve outside Containment.	6. An inspection of as-built Containment isolation valves will be performed.	6. Fluid system lines whose Containment isolation valves are not automatically closed by a CIAS or are not locked closed have a minimum of one remotely operated Containment isolation valve outside Containment.
7. Pneumatic Containment isolation valves close upon loss of motive power to the valve.	7. Testing will be conducted on each pneumatic Containment isolation valve to simulate loss of pneumatic conditions.	7. Pneumatic Containment isolation valves respond to loss of pneumatic conditions as specified in Table 1.6.6-2.
8. Motor Operated Valves (MOVs) closed by a CIAS will close under differential pressure or fluid flow conditions, and under temperature conditions.	8. Closing of designated MOVs will be conducted under preoperational differential pressure or fluid flow conditions, and under temperature conditions.	8. Each MOV closed by a CIAS closes.

TABLE 1.6.6-2

Item No.	Service	(Note 1) Valve Arrangement	Valve Closes Upon Loss of Motive Power (Fail Safe)	(Note 2) Closes On CIAS (Yes, No)	(Note 3) Valve Closure Time
1	Main Steam Line #1 from Steam Generator #1	4	Yes	No	
	Remotely Operated				–
	Safety Valve				–
	Safety Valve				–
	Safety Valve				–
	Safety Valve				–
	Safety Valve				–
	Remotely Operated				–
	Remotely Operated				–
	Manual Valve				–
	Manual Valve				–
2	Main Steam Line #2 from Steam Generator #1	4	Yes	No	
	Remotely Operated				–
	Safety Valve				–
	Safety Valve				–
	Safety Valve				–
	Safety Valve				–
	Safety Valve				–
	Remotely Operated				–
	Remotely Operated				–
	Manual Valve				–
	Remotely Operated				–
3	Main Steam Line #1 from Steam Generator #2	4	Yes	No	
	Remotely Operated				–
	Safety Valve				–
	Safety Valve				–
	Safety Valve				–
	Safety Valve				–
	Safety Valve				–
	Remotely Operated				–
	Remotely Operated				–
	Remotely Operated				–
	Manual Valve				–

TABLE 1.6.6-2 (Continued)

Item No.	Service	(Note 1) Valve Arrangement	Valve Closes Upon Loss of Motive Power (Fail Safe)	(Note 2) Closes On CIAS (Yes, No)	(Note 3) Valve Closure Time
4	Main Steam Line #2 from Steam Generator #2	4	Yes	No	
	Remotely Operated				–
	Safety Valve				–
	Safety Valve				–
	Safety Valve				–
	Safety Valve				–
	Safety Valve				–
	Remotely Operated				–
	Remotely Operated				–
	Manual Valve				–
	Manual Valve				–
5	Main Feedwater to Downcomer Nozzle Steam Generator #1	4	Yes	No	
	Remotely Operated				–
	Remotely Operated				–
	Check Valve				–
	Check Valve				–
	Manual Valve				–
	Manual Valve				–
6	Main Feedwater to Downcomer Nozzle Steam Generator #2	4	Yes	No	
	Remotely Operated				–
	Remotely Operated				–
	Check Valve				–
	Check Valve				–
	Manual Valve				–
	Manual Valve				–
7	Main Feedwater to Economizer Nozzles for Steam Generator #1	4	Yes	No	
	Remotely Operated				–
	Remotely Operated				–
	Check Valve				–
	Manual Valve				–

TABLE 1.6.6-2 (Continued)

Item No.	Service	(Note 1) Valve Arrangement	Valve Closes Upon Loss of Motive Power (Fail Safe)	(Note 2) Closes On CIAS (Yes, No)	(Note 3) Valve Closure Time
8	Main Feedwater to Economizer Nozzles for Steam Generator #2	4	Yes	No	
	Remotely Operated				–
	Remotely Operated				–
	Check Valve				–
	Manual Valve				–
9	Motor-Driven EFW Pump #1 Discharge	4	No	No	
	Remotely Operated				–
	Check Valve				–
10	Motor-Driven EFW Pump #2 Discharge	4	No	No	
	Remotely Operated				–
	Check Valve				–
11	Steam-Driven EFW Pump #1 Discharge	4	No	No	
	Remotely Operated				–
	Check Valve				–
12	Steam-Driven EFW Pump #2 Discharge	4	No	No	
	Remotely Operated				–
	Check Valve				–
13	Safety Injection Pump #4 Discharge	3	No	No	
	Remotely Operated				–
	Check Valve				–
14	Safety Injection Pump #2 Discharge	3	No	No	
	Remotely Operated				–
	Remotely Operated				–
	Check Valve				–
	Remotely Operated				–
	Check Valve				–

TABLE 1.6.6-2 (Continued)

Item No.	Service	(Note 1) Valve Arrangement	Valve Closes Upon Loss of Motive Power (Fail Safe)	(Note 2) Closes On CIAS (Yes, No)	(Note 3) Valve Closure Time
15	Safety Injection Pump #3 Discharge	3	No	No	
	Remotely Operated				–
	Check Valve				–
16	Safety Injection Pump #1 Discharge	3	No	No	
	Remotely Operated				–
	Remotely Operated				–
	Check Valve				–
	Remotely Operated				–
	Check Valve				–
17	SCS Pump #2 Suction	3	No	No	
	Remotely Operated				–
	Relief Valve				–
	Remotely Operated				–
	Remotely Operated				–
18	SCS Pump #1 Suction	3	No	No	
	Remotely Operated				–
	Relief Valve				–
	Remotely Operated				–
	Remotely Operated				–
19	Hot Leg Injection Loop #2	3	No	No	
	Remotely Operated				–
	Check Valve				–
20	Hot Leg Injection Loop #1	3	No	No	
	Remotely Operated				–
	Check Valve				–
21	Containment Spray Pump #2 Discharge	3	No	No	
	Remotely Operated				–
	Check Valve				–
	Manual Valve				–

TABLE 1.6.6-2 (Continued)

Item No.	Service	(Note 1) Valve Arrangement	Valve Closes Upon Loss of Motive Power (Fail Safe)	(Note 2) Closes On CIAS (Yes, No)	(Note 3) Valve Closure Time
22	Containment Spray Pump #1 Discharge	3	No	No	
	Remotely Operated				–
	Check Valve				–
	Manual Valve				–
23	Safety Injection Pump #3 and Containment Spray Pump #1 Suction Line	4	No	No	
	Remotely Operated				–
24	Safety Injection Pump #4 and Containment Spray Pump #2 Suction Line	4	No	No	
	Remotely Operated				–
25	Safety Injection Pump #1 Suction	4	No	No	
	Remotely Operated				–
26	Safety Injection Pump #2 Suction	4	No	No	
	Remotely Operated				–
27	SIS Division 1 Miniflow Return to IRWST	3	No	No	
	Remotely Operated				–
	Check Valve				–
	Remotely Operated				–
28	SIS Division 2 Miniflow Return to IRWST	3	No	No	
	Remotely Operated				–
	Check Valve				–
	Remotely Operated				–
29	Return Header from SI Tanks	2	Yes	No	
	Remotely Operated				–
	Remotely Operated				–
	Manual Valve				–
	Relief Valve				–

TABLE 1.6.6-2 (Continued)

Item No.	Service	(Note 1) Valve Arrangement	Valve Closes Upon Loss of Motive Power (Fail Safe)	(Note 2) Closes On CIAS (Yes, No)	(Note 3) Valve Closure Time
30	CCW Supply to Letdown Heat Exchanger	4	No	Yes	
	Remotely Operated				60 sec
	Remotely Operated				60 sec
	Check Valve				–
31	CCW Return from Letdown Heat Exchanger	4	No	Yes	
	Remotely Operated				60 sec
	Remotely Operated				60 sec
	Check Valve				–
32	CCW Supply to RCP Heat Exchangers 1A and 1B	4	No	No	
	Remotely Operated				–
	Remotely Operated				–
	Check Valve				–
33	CCW Return from RCP Heat Exchangers 1A and 1B	4	No	No	
	Remotely Operated				–
	Remotely Operated				–
	Check Valve				–
34	CCW Supply to RCP Heat Exchangers 2A and 2B	4	No	No	
	Remotely Operated				–
	Remotely Operated				–
	Check Valve				–
35	CCW Return from RCP Heat Exchangers 2A and 2B	4	No	No	
	Remotely Operated				–
	Remotely Operated				–
	Check Valve				–
36	Shutdown Purification Line to Letdown Heat Exchanger	2	No	No	
	Manual Valve				–
	Check Valve				–

TABLE 1.6.6-2 (Continued)

Item No.	Service	(Note 1) Valve Arrangement	Valve Closes Upon Loss of Motive Power (Fail Safe)	(Note 2) Closes On CIAS (Yes, No)	(Note 3) Valve Closure Time
37	Letdown to Purification System	3	Yes		
	Remotely Operated			Yes	15 sec
	Remotely Operated			No	15 sec
	Remotely Operated			Yes	15 sec
38	CVCS Charging Line	3	No	No	
	Remotely Operated				–
	Check Valve				–
39	RCP Seal Injection	3	No	No	
	Remotely Operated				–
	Check Valve				–
40	RCP Seal Return Flow	3	Yes	No	
	Remotely Operated				–
	Remotely Operated				–
41	RDT Flow to RDPs	4	Yes	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
42	Resin Sluice Supply to Reactor Drain Tank	4	Yes	Yes	
	Remotely Operated				15 sec
	Check Valve				–
43	Breathing Air Supply	3	No	Yes	
	Remotely Operated				15 sec
	Check Valve				–
44	Station Air Supply	3	No	Yes	
	Remotely Operated				15 sec
	Check Valve				–

TABLE 1.6.6-2 (Continued)

Item No.	Service	(Note 1) Valve Arrangement	Valve Closes Upon Loss of Motive Power (Fail Safe)	(Note 2) Closes On CIAS (Yes, No)	(Note 3) Valve Closure Time
45	Instrument Air Supply	3	No	Yes	
	Remotely Operated				15 sec
	Check Valve				–
46	Refueling Cavity Cleanup Suction Line	1	No	No	
	Manual Valve				–
	Manual Valve				–
47	Refueling Cavity Cleanup Return Header	1	No	No	
	Manual Valve				–
	Manual Valve				–
48	Pressurizer Liquid Sample Line	3	Yes	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
49	Pressurizer Steam Space Sample Line	3	Yes	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
50	Hot Leg Sample Line	3	Yes	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
51	Holdup Volume Tank Sample Line	3	Yes	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
	Remotely Operated				15 sec
52	Steam Generator #1 Cold Leg Sample	4	Yes	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec

TABLE 1.6.6-2 (Continued)

Item No.	Service	(Note 1) Valve Arrangement	Valve Closes Upon Loss of Motive Power (Fail Safe)	(Note 2) Closes On CIAS (Yes, No)	(Note 3) Valve Closure Time
53	Steam Generator #1 Hot Leg Sample	4	Yes	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
54	Steam Generator #1 Downcomer Sample	4	Yes	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
55	Steam Generator #2 Cold Leg Sample	4	Yes	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
56	Steam Generator #2 Hot Leg Sample	4	Yes	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
57	Steam Generator #2 Downcomer Sample	4	Yes	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
58	High Volume Containment Purge System Supply #1	3	Yes	Yes	
	Remotely Operated				60 sec
	Remotely Operated				60 sec
59	High Volume Containment Purge System Supply #2	3	Yes	Yes	
	Remotely Operated				60 sec
	Remotely Operated				60 sec
60	High Volume Containment Purge System Exhaust #1	3	Yes	Yes	
	Remotely Operated				60 sec
	Remotely Operated				60 sec

TABLE 1.6.6-2 (Continued)

Item No.	Service	(Note 1) Valve Arrangement	Valve Closes Upon Loss of Motive Power (Fail Safe)	(Note 2) Closes On CIAS (Yes, No)	(Note 3) Valve Closure Time
61	High Volume Containment Purge System Exhaust #2	3	Yes	Yes	
	Remotely Operated				60 sec
	Remotely Operated				60 sec
62	Low Volume Containment Purge System Supply	3	Yes	Yes	
	Remotely Operated				30 sec
	Check Valve				–
63	Low Volume Containment Purge System Exhaust	3	Yes	Yes	
	Remotely Operated				30 sec
	Remotely Operated				30 sec
64	Steam Generator #1 Combined Blowdown	4	No	Yes	
	Remotely Operated				10 sec
	Remotely Operated				10 sec
	Check Valve				
65	Steam Generator #2 Combined Blowdown	4	No	Yes	
	Remotely Operated				10 sec
	Remotely Operated				10 sec
	Manual Valve				
66	Fire Protection Water Supply to Containment	4	No	Yes	
	Remotely Operated				20 sec
	Check Valve				
67	NCWS Supply to Containment Ventilation Units and CEDM Units	4	No	No	
	Remotely Operated				–
	Check Valve				–
68	NCWS Return From Containment Ventilation Units and CEDM Units	4	No	No	
	Remotely Operated				–
	Remotely Operated				–
	Check Valve				–

TABLE 1.6.6-2 (Continued)

Item No.	Service	(Note 1) Valve Arrangement	Valve Closes Upon Loss of Motive Power (Fail Safe)	(Note 2) Closes On CIAS (Yes, No)	(Note 3) Valve Closure Time
69	Containment Radiation Monitor (Inlet)	3	Yes	Yes	
	Remotely Operated				15 sec
	Remotely Operated				5 sec
70	Containment Radiation Monitor (Outlet)	3	Yes	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
71	ILRT Pressure Sensing Line	1		No	
	Manual Valve				–
	Manual Valve				–
72	Demineralized Water	4	No	Yes	
	Remotely Operated				15 sec
	Check Valve				–
73	Nitrogen Supply to Safety Injection Tanks and RDT	3	No	Yes	
	Remotely Operated				15 sec
	Check Valve				–
74	ILRT Pressurization Line	1	No	No	
	Manual Valve				–
	Flange				–
75	RCP Oil Fill Line	4	No	Yes	
	Remotely Operated				15 sec
	Remotely Operated				–
76	Containment Sump Pump Discharge Line	3	No	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
	Check Valve				–

TABLE 1.6.6-2 (Continued)

Item No.	Service	(Note 1) Valve Arrangement	Valve Closes Upon Loss of Motive Power (Fail Safe)	(Note 2) Closes On CIAS (Yes, No)	(Note 3) Valve Closure Time
77	Containment Ventilation Units' Condensate Drain Header	3	No	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
	Check Valve				
78	Reactor Drain Tank Gas Space to GWMS	4	No	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
79	Decontamination Line	4	No	No	
	Manual Valve				–
	Manual Valve				–
80	Division 1 Hydrogen Recombiner Suction from Containment	3	No	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
81	Division 2 Hydrogen Recombiner Suction from Containment	3	No	Yes	
	Remotely Operated				15 sec
	Remotely Operated				15 sec
82	Division 1 Hydrogen Recombiner Discharge to Containment	3	No	Yes	
	Remotely Operated				15 sec
	Check Valve				–
83	Division 2 Hydrogen Recombiner Discharge to Containment	3	No	Yes	
	Remotely Operated				15 sec
	Check Valve				–
84	Steam Generator Wet Layup Recirculation Return to Steam Generator #1	4	No	No	
	Manual Valve				–
	Check Valve				–

Item No.	Service	(Note 1) Valve Arrangement	Valve Closes Upon Loss of Motive Power (Fail Safe)	(Note 2) Closes On CIAS (Yes, No)	(Note 3) Valve Closure Time
85	Steam Generator Wet Layup Recirculation Return to Steam Generator #2	4	No	No	
	Manual Valve				–
	Check Valve				–

NOTES:

1. Valve arrangements are in accordance with the Containment isolation valve configurations shown on Figure 1.6.6-1.

2. Paragraph Number 3 of the Basic Configuration definition applies to Containment isolation valves which receive a CIAS.

3. A dash (–) denotes NOT APPLICABLE

1.7.1 PLANT PROTECTION SYSTEM

Design Description

The Plant Protection System (PPS) is a safety related system which supports reactor trip, and actuation of engineered safety features. The PPS monitors information provided by the process instrumentation. Initiation signals from the PPS logic are provided to the reactor trip switchgear and to the Engineered Safety Features - Component Control System (ESF-CCS) to actuate protective functions.

PPS safety related software is designed, tested, installed and maintained using a process which defines the organization, responsibilities, and activities for the software engineering life cycle and which specifies requirements for software quality assurance, verification and validation, configuration management, and operations and maintenance.

Setpoints for initiation of PPS safety-related functions are determined, documented, installed and maintained according to methodologies which specify requirements for documenting the bases for selection of trip setpoints, accounting for instrument uncertainties and drift, testing of instrumentation setpoint response and replacement of setpoint related instrumentation.

Reactor Trip Initiation Function

Process instrumentation, the Plant Protection Calculators (PPCs), the Core Protection Calculators (CPCs) and the reactor trip switchgear function to initiate an automatic reactor trip. The process instrumentation provides sensor data input to the PPS which monitors the following plant conditions to provide a reactor trip:

Reactor Power - High
Reactor Coolant System Pressure - Low or High
Steam Generator Water Level - Low or High
Steam Generator Pressure - Low
Containment Pressure - High
Reactor Coolant Flow - Low
Departure from Nucleate Boiling Ratio - Low
Linear Heat Generation Rate - High

Setpoints for initiation of a reactor trip are installed for each monitored condition to provide for initiation of a reactor trip prior to exceeding reactor fuel thermal limits and the Reactor Coolant System pressure boundary limits for anticipated operational occurrences. If a monitored condition exceeds its setpoint, the PPS automatically actuates the reactor trip switchgear.

Engineered Safety Features Initiation Function

Process instrumentation, the PPCs, the ESF-CCS, motor starters and other actuated devices function to initiate the engineered safety feature systems. The process instrumentation provides sensor data input to the PPCs, which monitor the following plant conditions to initiate the engineered safety features systems.

Pressurizer Pressure - Low
Steam Generator Water Level - Low or High
Steam Generator Pressure - Low
Containment Pressure - High

If a monitored condition exceeds its setpoint, the PPCs automatically generate one or more of the following Engineered Safety Feature Actuation Signals (ESFAS).

Safety Injection Actuation Signal
Containment Isolation Signal
Containment Spray Actuation Signal
Main Steam Isolation Signal
Emergency Feedwater Actuation Signals

These initiating signals are provided to the ESF-CCS, which responds by actuating the engineered safety feature systems.

Elements Of The PPS

The PPS is located in the Nuclear Island.

The Basic Configuration of the PPS is as shown on Figure 1.7.1-1.

The PPS and the electrical equipment that initiate reactor trip or engineered safety feature actuation are qualified Seismic Category I.

The PPS is divided into four redundant channels. The following elements, depicted in Figures 1.7.1-2 and 1.7.1-3, are included in each channel of the PPS:

Limit Logic (PPC Bistables and CPCs)
Local Coincidence Logic
Initiation Logic
Interface and Test Processor

Limit logic for process-value to setpoint comparison is implemented in bistable processors in each channel. The bistable processors generate trip signals based on the channel digitized value exceeding a digital setpoint. Limit logic for calculated departure from nucleate boiling ratio and high linear heat generation rate are

implemented in each channel in a section of the PPS referred to as the Core Protection Calculator (CPC).

The trip output signals of the bistable processors and the CPC in each channel are sent to the local coincidence logic processors in all four PPS channels. Therefore, for each trip condition, the local coincidence logic processor in each channel receives four trip signals, one from its associated bistable processors or CPC from within the channel, and one from the equivalent bistable processors or CPC located in each of the other three redundant channels. The coincidence processors evaluate the local coincidence logic based on the state of the four like trip signals and their respective bypasses. A coincidence of any two like trip signals is required to generate a reactor trip or ESF initiation signal.

Upon coincidence of two like signals indicating one of the conditions for reactor trip, the PPS logic initiates actuation of a channel of the reactor trip switchgear. As shown on Figure 1.7.1-2, actuation of a single channel of the reactor trip switchgear will not cause a reactor trip. The reactor trip switchgear breakers interrupt power to the Control Element Drive Mechanism (CEDM) coils, allowing all Control Element Assemblies to drop into the core by gravity. The reactor trip switchgear can be tripped manually from the Main Control Room or the Remote Shutdown Room, independent of the PPS bistable and coincidence processors. The manual reactor trip uses hardwired circuits. Once a reactor trip has been initiated, the breakers in the reactor trip switchgear latch open.

Upon coincidence of two like signals indicating a condition for generating an ESFAS, the ESF initiation logic transmits the respective initiation signal to the ESF-CCS.

The PPS interfaces at the Main Control Room allow for manual initiation of ESF actuation signals. Manual initiation of all ESF actuation signals can be performed independent of the bistable and coincidence processors from the Main Control Room. Manual initiation of the Main Steam Isolation Signal can also be performed independent of the bistable and coincidence processors from the Remote Shutdown Room.

The equipment allows operators to enter trip channel bypasses, operating bypasses, and variable setpoint resets at the PPS operator's module at the Main Control Room or at the maintenance and test panel. These provide indication of bypass status and bistable trip and pre-trip status. Only one channel can be bypassed at a time. Manual testing of PPS functions and hardware can be performed at the maintenance and test panel.

Loss of power to, or disconnection of a reactor trip path component in a PPC or CPC will cause a trip initiating state to be detected in a downstream component in that channel.

The Interface and Test Processor (ITP) performs automatic testing of PPS logic.

PPS Channel Separation and Isolation

Figure 1.7.1-3 shows the PPS channels and the signal flow from the process instrumentation to the individual channels for initiation of protection system functions. Four measurement channels with electrical independence are provided for each parameter used in the direct generation of these initiation signals, with the exception of the Control Element Assembly position which is a two channel measurement.

The four PPS channels are physically separated and electrically isolated.

Each PPS channel is powered from a separate Class 1E bus.

System Characteristics:

Number of independent channels of equipment	4
Minimum number of sensors per trip variable (at least one per channel except as identified above for the Control Element Assembly position))	4
Coincidence logic used for plant sensor inputs	2-out-of-4
Reactor Manual/Automatic actuation trip logic	Selective 2-out-of-4
ESF Manual/Automatic Actuation Logic	Selective 2-out-of-4

Electrical isolation and electrical independence are provided between the PPS and the process control system. Where the PPS and the process control system interface with the same component (e.g., with sensors, signal conditioners, or actuated devices), electrical isolation devices are provided between the process control system and the shared component. Electrical isolation devices are provided at PPS interfaces with the Power Control System, Discrete Indication and Alarm System and Data Processing System.

Operator interfaces from the main control panel and the remote shutdown panel to the PPS have electrical isolation devices. Switches for manual initiation of reactor trip interface the reactor trip switchgear such that a reactor trip can be initiated from either the Main Control Room or the Remote Shutdown Room at any time.

Administrative controls exist to limit access to locations which provide PPS trip setpoint controls, calibration controls and test points.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 1.7.1-1 specifies the inspections, tests, analyses, and associated acceptance criteria for the PPS.

TABLE 1.7.1-1

PLANT PROTECTION SYSTEM
Inspections, Tests, Analyses and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. PPS safety related software is designed, tested, installed and maintained using a process which defines the organization, responsibilities, and activities for the software engineering life cycle and which specifies requirements for software quality assurance, verification and validation, configuration management, and operations and maintenance.	1. Inspection will be performed of the process used to design, test, install, and maintain the PPS safety related software.	1.a) The organization, responsibilities and activities are defined for the following phases of the software engineering life cycle: • Establishment of plans and methodologies for all software to be developed. • Specification of functional, system and software requirements and identification of safety critical requirements. • Design of the software architecture, program structure and definition of the software modules. • Development of the software code and testing of the software modules. • Interpretation of software and hardware and performance of unit and system tests. • Software installation and checkout testing. • Reporting and correction of software defects during operation.

TABLE 1.7.1-1 (Continued)

PLANT PROTECTION SYSTEM
Inspections, Tests, Analyses and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
		1.b) Requirements are specified for the following software development functions: • Software management, which defines organization responsibilities, documentation requirements, standards for software coding and testing, review requirements, and procedures for problem reporting and corrective actions. • Software configuration management, which establishes methods for maintaining historical records of software as it is developed, controlling software changes and for recording and reporting software changes. • Verification and validation, which specifies the requirements for the verification review process, the validation testing process, review and test activity documentation and reviewer independence.

TABLE 1.7.1-1 (Continued)

PLANT PROTECTION SYSTEM
Inspections, Tests, Analyses and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
2. Setpoints for initiation of PPS safety related functions are determined, documented, installed and maintained according to methodologies which specify requirements for documenting the bases for selection of trip setpoints, accounting for instrument uncertainties and drift, testing of instrumentation setpoint response and replacement of setpoint related instrumentation.	2. Inspection will be performed of the methodologies used to determine, document, install and maintain the PPS safety related software.	2. Requirements are specified for: • Documentation of data, assumptions, and methods used in the bases for selection of trip setpoints. • Consideration of instrument calibration uncertainties and uncertainties due to environmental conditions, instrument drift, power supply variation and the effect of design basis event transients is included in determining the margin between the trip setpoint and the safety limit. • The methods used for combining uncertainties. • Use of written procedures for preoperational testing and tests performed to satisfy Technical Specifications. • Documentated evaluation for equivalent or better performance of replacement instrumentation which is not identical to the original equipment.

TABLE 1.7.1-1 (Continued)

PLANT PROTECTION SYSTEM
Inspections, Tests, Analyses and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
3. The Basic Configuration of the PPS is as shown on Figure 1.7.1-1.	3. Inspections of the as-built PPS configuration will be conducted.	3. For the components and equipment shown on Figure 1.7.1-1, the as-built PPS conforms with the Basic Configuration.
4. The four PPS channels are physically separated and electrically isolated.	4. Inspection for separation and isolation of the four as-built PPS channels will be conducted.	4. Physical separation exists between the 4 PPS channels. Electrical isolation devices are provided at interfaces between the 4 PPS channels.
5. Each PPS channel is powered from a separate Class 1E bus.	5. Tests will be performed on the PPS by providing a test signal in only one Class 1E bus at a time.	5. Within the PPS, a test signal exists only at the equipment powered from the Class 1E bus under test.
6. Where the PPS and the process control system interface to the same component, isolation devices are provided between the process control system and the shared component.	6. Inspection of the as-built PPS configuration will be conducted.	6. Electrical isolation devices are provided between the process control system and sensors, signal conditioners and actuated devices which interface to the PPS.
7. Electrical isolation devices are provided at PPS interfaces with the Power Control System, Discrete Indication and Alarm System and the Data Processing System.	7. Inspection of the as-built configuration will be conducted.	7. Electrical isolation devices are provided at PPS interfaces with the Power Control System, Discrete Indication and Alarm System and the Data Processing System.

TABLE 1.7.1-1 (Continued)

PLANT PROTECTION SYSTEM
Inspections, Tests, Analyses and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
8. Loss of power to, or disconnection of a reactor trip path component in a PPC or CPC will cause a trip initiating state to be detected in a downstream component in that channel.	8. Loss of power and disconnect tests will be conducted.	8. Test results confirm that loss of power to, or disconnection of a reactor trip path component in a PPC or CPC will cause a trip initiating state to occur in a downstream component in that trip path.
9. The PPS initiates a reactor trip for the following conditions: Reactor Power - High Reactor Coolant System Pressure - Low or High Steam Generator Level - Low or High Steam Generator Pressure - Low Containment Pressure - High Reactor Coolant Flow - Low Departure from Nucleate Boiling Ratio - Low Linear Heat Generation Rate - High	9. Tests will be performed using simulated initiating signals to the PPS.	9. The PPS generates reactor trip switchgear actuation signals.
10. The PPS generates ESFAS signals for the following conditions: Pressurizer Pressure - Low Steam Generator Water Level - Low or High Steam Generator Pressure - Low Containment Pressure - High	10. Tests will be performed using simulated initiating signals to the PPS.	10. The PPS generates ESFAS signals related to the initiating conditions for each condition listed in the Design Commitment.

TABLE 1.7.1-1 (Continued)

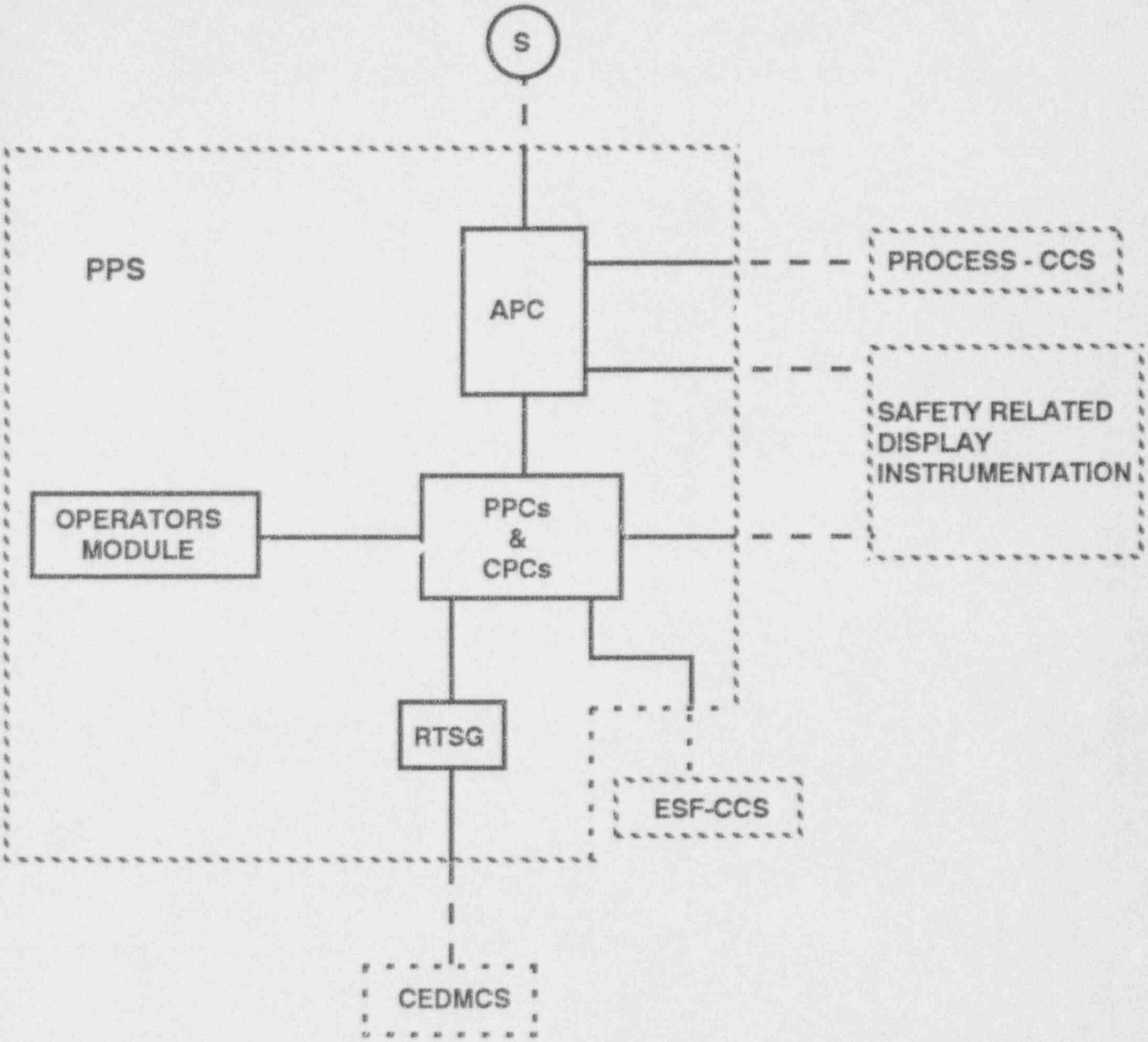
PLANT PROTECTION SYSTEM
Inspections, Tests, Analyses and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
11. A reactor trip initiation signal from a PPS channel results in actuation of the correct reactor trip switchgear breaker.	11. A test of the as-built reactor trip switchgear actuation circuits will be conducted.	11. The reactor trip initiation signal from each PPS channel actuates the correct single reactor trip switchgear breaker.
12. The RTSG can be tripped manually from the Main Control Room or the Remote Shutdown Room.	12. Manual reactor trip from Main Control Room and Remote Shutdown Room will be tested.	12. Actuation of either pair of reactor trip switches at the Main Control Room or the pair of trip switches at the Remote Shutdown Room interrupts power to the CEDMs.
13.a) The following ESFAS signals can be manually actuated at the Main Control Room. Safety Injection Actuation Signal Containment Spray Actuation Signal Containment Isolation Signal Main Steam Isolation Signal Emergency Feedwater Actuation Signal	13.a) Manual ESF actuation from Main Control Room will be tested.	13.a) Actuation of either pair of ESFAS actuation switches for an ESF function at the Main Control Room initiates the associated ESFAS signal input to the ESF-CCS.
b) A Main Steam Isolation Signal can be manually actuated at the Remote Shutdown Room.	b) Manual MSIS actuation from the Remote Shutdown Room will be tested.	b) Actuation of the pair of MSIS actuation switches at the Remote Shutdown Room initiates a MSIS input to the ESF-CCS.

TABLE 1.7.1-1 (Continued)

PLANT PROTECTION SYSTEM
Inspections, Tests, Analyses and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
14. A bistable trip channel bypass can be activated in only one channel at a time.	14. PPS Trip Channel Bypasses will be tested.	14. With one trip channel in bypass, attempts to actuate a second like parameter bypass in a second channel are rejected.
15. The PPS initiates reactor trip and ESF system actuations within allocated response times.	15. Tests and analysis will be performed to measure PPS equipment response times.	15. Measured response times are less than or equal to the response time values required for reactor trip and ESF actuations.



NOTES:

1. PPS EQUIPMENT SHOWN ON THE FIGURE IS QUALIFIED SEISMIC CATEGORY 1.
2. PPS EQUIPMENT IS POWERED FROM CLASS 1E SUPPLIES.
3. EACH PPS CHANNEL (4 IN NUMBER) IS POWERED FROM A SEPARATE CLASS 1E BUS.

FIGURE 1.7.1-1
PPS CONFIGURATION

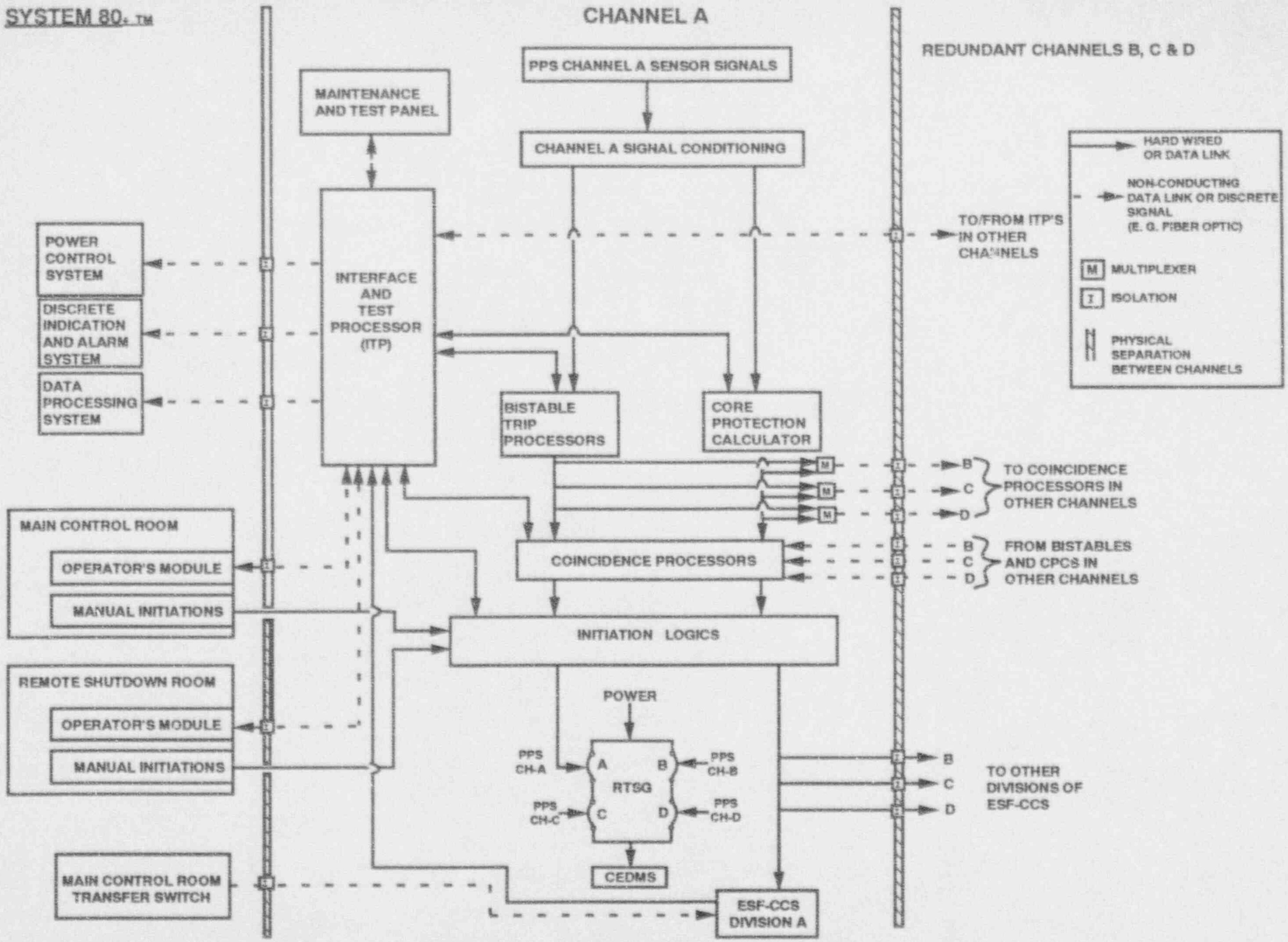


FIGURE 1.7.1-2
PLANT PROTECTION SYSTEM INTERFACES

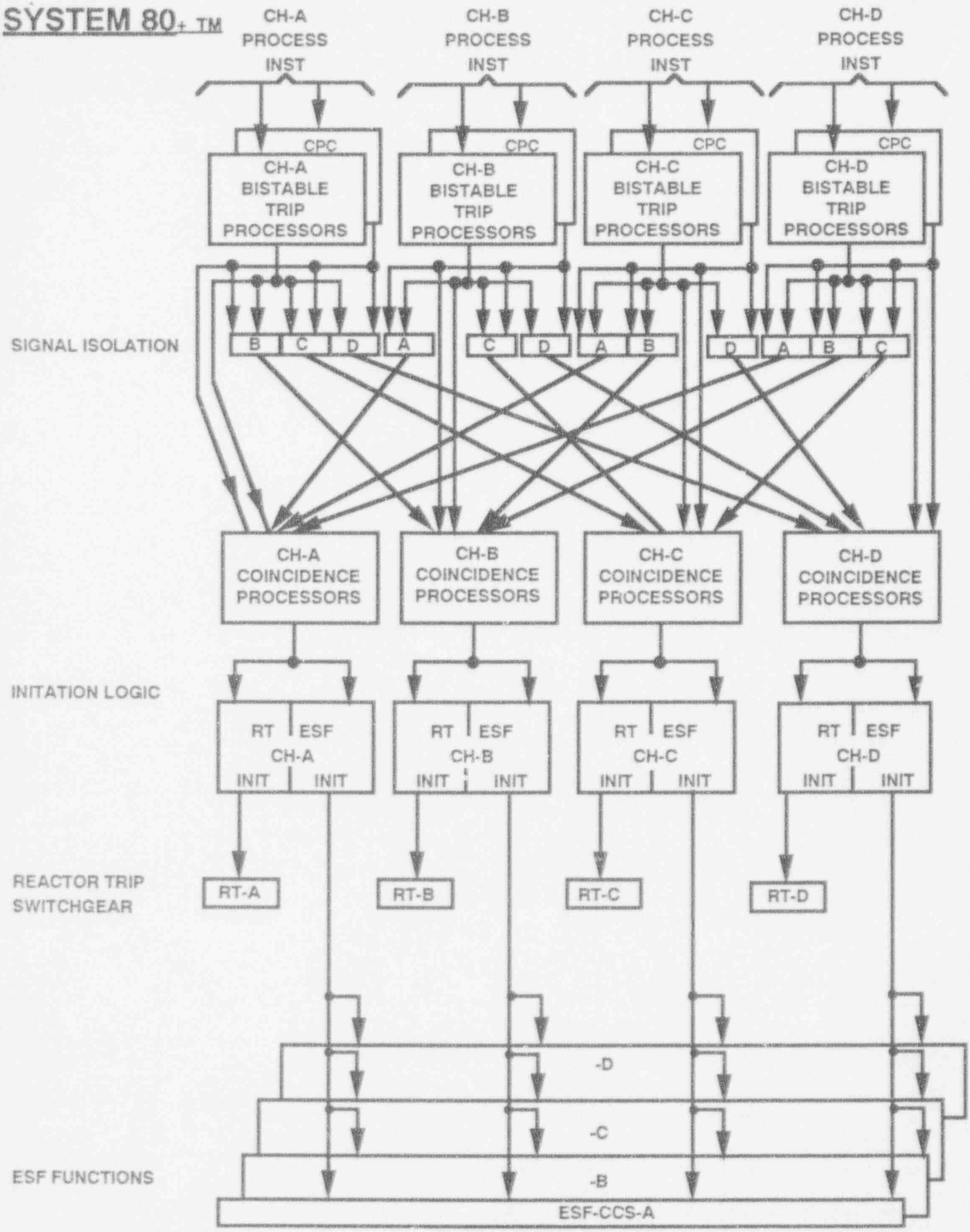


FIGURE 1.7.1-3
PPS BASIC BLOCK DIAGRAM

1.9.2.1 STATION SERVICE WATER SYSTEM

Design Description

The Station Service Water System (SSWS), in conjunction with the Ultimate Heat Sink (UHS), provides cooling water to remove heat from the Component Cooling Water System (CCWS).

The SSWS pumps and strainers are located in the SSWS Pump Structure(s). Interconnecting piping runs between the SSWS Pump Structure(s) and the Component Cooling Water Heat Exchanger Structure.

The SSWS consists of two Divisions. Each SSWS Division is connected to its corresponding CCWS Division through the component cooling water heat exchangers.

The SSWS has the capacity to remove heat from the CCWS during operation, shutdown, refueling, and design basis accident conditions. Each Division has the heat dissipation capacity to achieve and maintain cold shutdown.

Each Division of the SSWS includes two station service water pumps, two station service water strainers, piping, valves, controls, and instrumentation.

The Basic Configuration of the SSWS is as shown on Figure 1.9.2.1-1.

The ASME Code Section III Class for the SSWS pressure retaining components shown on Figure 1.9.2.1-1 is as depicted on the Figure.

The safety related equipment shown on Figure 1.9.2.1-1 is qualified Seismic Category I.

The Class 1E loads shown on Figure 1.9.2.1-1 are powered from their respective Class 1E bus.

The two mechanical Divisions of the SSWS are physically separated.

SSWS instrumentation indications shown on Figure 1.9.2.1-1 exist in the Control Room or can be retrieved there. Controls exist in the Control Room to start and stop the station service water pumps, and to open and close those power operated valves shown on Figure 1.9.2.1-1.

Interface Requirements

The Ultimate Heat Sink (UHS) transfers heat from the SSWS to the environment during operation, shutdown, refueling, and design basis accident conditions. The UHS is sized so that makeup water is not required for at least 30 days following a design

basis accident. During this period of 30 days, design basis temperature is not exceeded.

Water is supplied to each SSWS pump at a net positive suction head (NPSH) greater than the pump's required NPSH.

The Station Service Water Pump Structure is qualified Seismic Category I and provides physical barriers to maintain separation of SSWS mechanical Divisions.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 1.9.2.1-1 specifies the inspections, tests, analyses and associated acceptance criteria for the SSWS.

TABLE 1.9.2.1-1

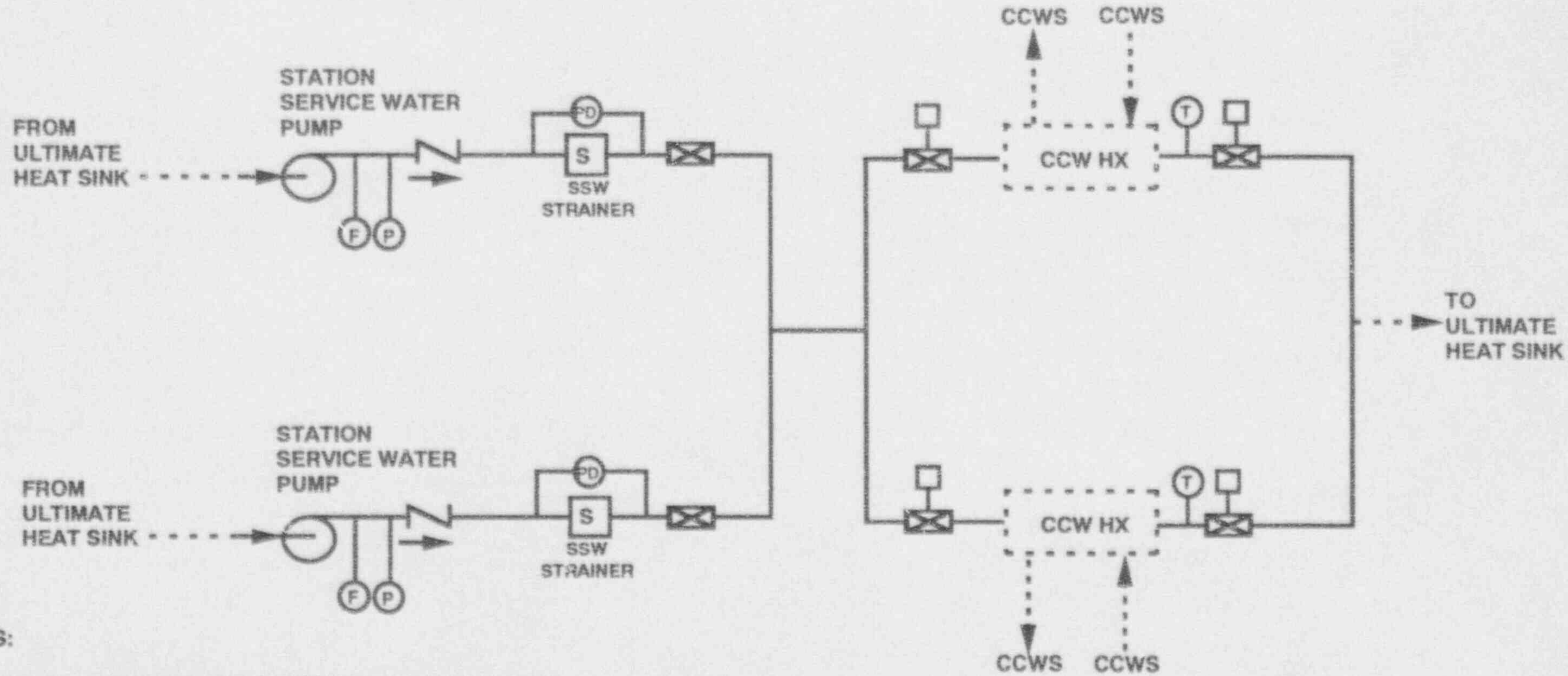
STATION SERVICE WATER SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The SSWS has the capacity to remove heat from the CCWS during operation, shutdown, refueling, and design basis accident conditions.	1. Flow tests will be performed, as-built inspections will be conducted, and analyses will be performed to determine the heat removal capacities of the as-built SSWS.	1. The SSWS heat transfer capacity is greater than or equal to 143.0 million BTU/hr.
2. The Basic Configuration of the SSWS is as shown on Figure 1.9.2.1-1.	2. Inspections of the as-built SSWS configuration will be conducted.	2. For the components and equipment shown on Figure 1.9.2.1-1, the as-built SSWS conforms with the Basic Configuration.
3. The ASME Code Section III SSWS components shown on Figure 1.9.2.1-1 retain their pressure boundary integrity under internal pressures that will be experienced during service.	3. A pressure test will be conducted on those components of the SSWS required to be pressure tested by ASME Code Section III.	3. The results of the pressure test of ASME Code Section III components of the SSWS conform with the pressure testing criteria in ASME Code Section III.
4. The Class 1E loads shown on Figure 1.9.2.1-1 are powered from their respective Class 1E bus.	4. Tests will be performed on the CCWS by providing a test signal in only one Class 1E bus at a time.	4. Within the SSWS, a test signal exists only at the equipment powered from the Class 1E bus under test.
5. The two mechanical Divisions of the SSWS are physically separated.	5. Inspections of the as-built SSWS will be performed.	5. A Divisional wall or physical barriers separate the two SSWS mechanical Divisions.

TABLE 1.9.2.1-1 (Continued)

STATION SERVICE WATER SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
6. SSWS instrumentation indications shown on Figure 1.9.2.1-1 exist in the Control Room or can be retrieved there.	6. Inspection for the existence or retrieveability in the Control Room of instrumentation indications will be performed.	6. The instrumentation indications shown on Figure 1.9.2.1-1 exist in the Control Room or can be retrieved there.
Controls exist in the Control Room to start and stop the station service water pumps, and to open and close those power operated valves shown on Figure 1.9.2.1-1.	Tests will be performed using the SSWS controls in the Control Room.	SSWS controls in the Control Room operate to start and stop station service water pumps, and to open and close those power operated valves shown on Figure 1.9.2.1-1.
7. Motor-Operated Valves (MOVs) having an active Safety Function will open and/or close under differential pressure or fluid flow conditions and under temperature conditions.	7. Opening and/or closing of designated MOVs will be conducted under pre-operational differential pressure or fluid flow conditions and under temperature conditions.	7. Each MOV having an active Safety Function opens and/or closes.



NOTES:

A. SSWS COMPONENTS AND EQUIPMENT SHOWN ON THE FIGURE ARE ASME CODE SECTION III CLASS 3.

B. ALL ASME CODE SECTION III CLASS 3 COMPONENTS SHOWN ON THE FIGURE ARE SAFETY RELATED.

C. SAFETY RELATED COMPONENTS AND EQUIPMENT SHOWN ON THE FIGURE ARE POWERED FROM THEIR RESPECTIVE CLASS 1E BUS.

FIGURE 1.9.2.1 - 1
STATION SERVICE WATER SYSTEM
(ONE OF TWO DIVISIONS)

1.9.2.2 COMPONENT COOLING WATER SYSTEM

Design Description

The Component Cooling Water System (CCWS) is a closed loop cooling water system that, in conjunction with the Station Service Water System (SSWS) and the Ultimate Heat Sink (UHS), removes heat generated from the plant's safety related and non-safety related components connected to the CCWS.

The CCWS heat exchangers are located in the CCWS Heat Exchanger Structure. The remainder of the CCWS components and equipment is located within the Nuclear Island structure except for piping that connects the CCWS heat exchangers to the components and equipment in the Nuclear Island structure.

The CCWS consists of two Divisions. Each CCWS Division is connected to its corresponding SSWS Division through the component cooling water heat exchangers.

The CCWS has the capacity to dissipate the heat loads of connected components during operation, shutdown, refueling, and design basis accident conditions. Each Division has the heat dissipation capacity to achieve and maintain cold shutdown.

Each Division of the CCWS includes two component cooling water heat exchangers, a component cooling water surge tank, two component cooling water pumps, piping, valves, controls, and instrumentation.

The Basic Configuration of the CCWS is as shown on Figure 1.9.2.2-1. Equipment listed in Table 1.9.2.2-1 can receive cooling water flow during the plant modes indicated.

The ASME Code Section III Class for the CCWS pressure retaining components shown on Figure 1.9.2.2-1 is as depicted on the Figure.

The safety related equipment shown on Figure 1.9.2.2-1 is qualified Seismic Category I.

Water is supplied to each CCWS pump at a net positive suction head (NPSH) greater than the pump's required NPSH.

The Class 1E loads shown on Figure 1.9.2.2-1 are powered from their respective Class 1E bus.

Outside containment, the two mechanical Divisions of the CCWS are physically separated.

CCWS instrumentation indications shown on Figure 1.9.2.2-1 exist in the Control Room or can be retrieved there. Controls exist in the Control Room to start and stop the component cooling water pumps and to open and close those power operated valves shown on Figure 1.9.2.2-1.

The ASME Code Section III Class 3 valves that separate ASME Code Section III Class 3 component cooling water piping and non-ASME Code Section III component cooling water piping close automatically upon receipt of a Safety Injection Actuation Signal (SIAS). Upon loss of motive power to those valves, the valves close.

Automatic initiation or termination of component cooling water flow is provided in the following instances:

1) Component cooling water to cooling loops composed of non-ASME Code Section III piping is terminated upon receipt of a component cooling water low-low surge tank level signal.

2) Component cooling water flow to each containment spray heat exchanger is initiated automatically upon receipt of a Containment Spray Actuation Signal (CSAS).

3) Component cooling water flow to each spent fuel pool cooling heat exchanger is terminated by a Safety Injection Actuation Signal (SIAS).

Makeup water to the CCWS is supplied by the Demineralized Water Makeup System (DWMS). A safety related Seismic Category I makeup line is provided to each Division from the SSWS via a spool piece which can be connected.

Interface Requirements

The CCWS pipe channels from the Nuclear Island structure to the component cooling water heat exchanger structure are qualified Seismic Category I and provide physical barriers between CCWS mechanical Divisions.

Inspections, Tests, Analyses, and Acceptance Criteria

Table 1.9.2.2-2 specifies the inspections, tests, analyses and associated acceptance criteria for the CCWS.

TABLE 1.9.2.2-1

Plant Mode/ Components	Normal Operation	Shutdown Cooling (Note b)	Refueling	Design Basis Accident
SAFETY RELATED		(Note a)		
Shutdown cooling heat exchanger	-	X	X	-
Containment spray heat exchanger	-	-	-	X
Spent fuel pool cooling heat exchanger	X	X	X	X (Note b)
Diesel Generator	X	X	X	X
Pump Motor Coolers, Miniflow Heat Exchangers, and Essential Chilled Water Condensers	X	X	X	X

TABLE 1.9.2.2-1 (Continued)

Plant Mode/ Components	No:mal Operation	Shutdown Cooling	Refueling	Design Basis Accident
NON-SAFETY RELATED		(Note a)		
Reactor coolant pumps and pump motors	X	X	X	X
Charging pump motor coolers	X	X	X	X
Charging pump miniflow heat exchanger	X	X	X	X
Normal Chilled Water Condensers, Instrument Air Compressors.	X	X	X	-
Letdown Heat Exchanger, Sample Heat Exchangers, Gas Stripper, and Boric Acid Concentrator (Note c)	X	X	X	-

NOTES FOR TABLES 1.9.2.2-1

a. (X) = Equipment can receive component cooling water flow in this mode.

(-) = Equipment does not receive component cooling water flow in this mode.

b. Will require operator action to restore.

c. Assignment of the non-safety related CCWS heat removal loads to the respective CCWS Division is dependent upon the location of the components associated with those loads.

TABLE 1.9.2.2-2

COMPONENT COOLING WATER SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The CCWS has the capacity to dissipate the heat loads of connected components during operation, shutdown, refueling and design basis accident conditions.	1. Flow tests will be performed, as-built inspections will be conducted, and analyses will be performed to determine the heat removal capacities of the as-built component cooling water heat exchangers.	1. The CCWS pump discharge flow rate is greater than or equal to 15,200 gpm per CCW pump and CCW heat exchanger capacity is greater than or equal to 143.0 million BTU/hr per heat exchanger.
2. The Basic Configuration of the CCWS is as shown on Figure 1.9.2.2-1.	2. Inspections of the as-built CCWS configuration will be conducted.	2. For the components and equipment shown on Figure 1.9.2.2-1, the as-built CCWS conforms with the Basic Configuration.
3. The ASME Code Section III CCWS components shown on Figure 1.9.2.2-1 retain their pressure boundary integrity under internal pressures that will be experienced during service.	3. A pressure test will be conducted on those components of the CCWS required to be pressure tested by ASME Code Section III.	3. The results of the pressure test of ASME Code Section III components of the CCWS conform with the pressure testing criteria in ASME Code Section III.
4. Water is supplied to each CCWS pump at a net positive suction head (NPSH) greater than the pump's required NPSH.	4. Tests to measure CCWS pump suction pressure will be performed. Inspections and analyses to determine NPSH available to each pump will be prepared based on test data and as-built data.	4. Water is supplied to each CCWS pump at a net positive suction head (NPSH) greater than the pump's required NPSH.

TABLE 1.9.2.2-2 (Continued)

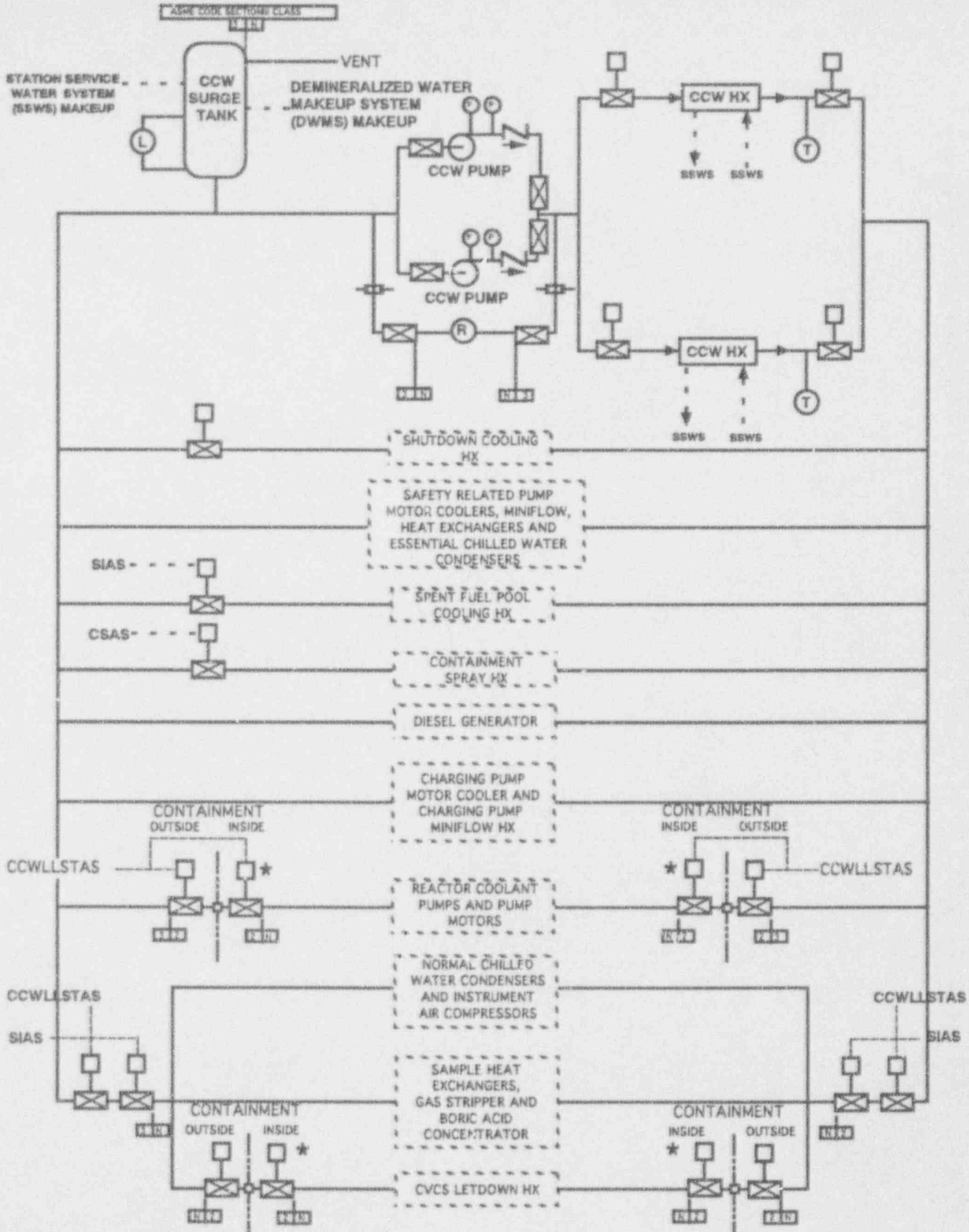
COMPONENT COOLING WATER SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
5. The Class 1E loads shown on Figure 1.9.2.2-1 are powered from their respective Class 1E bus.	5. Tests will be performed on the CCWS by providing a test signal in only one Class 1E bus at a time.	5. Within the CCWS, a test signal exists only at the equipment powered from the Class 1E bus under test.
6. Outside containment, the two mechanical Divisions of the CCWS are physically separated.	6. Inspections of the as-built CCWS will be performed.	6. Outside containment, a Divisional wall or a physical barrier separates the two CCWS mechanical Divisions.
7. CCWS instrumentation indications shown on Figure 1.9.2.2-1 exist in the Control Room or can be retrieved there.	7. Inspection for the existence or retrieveability in the Control Room of instrumentation indications will be performed.	7. The instrumentation indications shown on Figure 1.9.2.2-1 exist in the Control Room or can be retrieved there.
Controls exist in the Control Room to start and stop the component cooling water pumps, and to open and close those power operated valves shown on Figure 1.9.2.2-1.	Tests will be performed using the CCWS controls in the Control Room.	CCWS controls in the Control Room operate to start and stop component cooling water pumps, and to open and close those power operated valves shown on Figure 1.9.2.2-1.
8.a) The ASME Code Section III Class 3 valves that separate the ASME Code Section III Class 3 component cooling water piping and non-ASME Code Section III component cooling water piping close automatically upon receipt of a Safety Injection Actuation Signal (SIAS).	8.a) A test will be performed using a simulated SIAS.	8.a) The valves close upon receipt of a simulated SIAS.
b) Upon loss of motive power to these valves, the valves close.	b) A test of loss of motive power to the valves will be performed.	b) The valves close on loss of motive power.

TABLE 1.9.2.2-2 (Continued)

COMPONENT COOLING WATER SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
9. Automatic initiation or termination of component cooling water flow is as specified below:	9. Tests will be performed using simulated component cooling water surge tank low-low level, CSAS, and SIAS signals.	9. Automatic initiation or termination of component cooling water flow occurs as specified below:
a) Component cooling water flow to cooling loops composed of non-ASME Code piping is terminated automatically upon the receipt of a component cooling water surge tank low-low level signal.		a) Component cooling water flow to cooling loops composed of non-ASME Code piping is terminated automatically upon the receipt of a component cooling water surge tank low-low level signal.
b) Component cooling water flow to each containment spray heat exchanger is initiated automatically upon receipt of a Containment Spray Actuation Signal (CSAS).		b) Component cooling water flow to each containment spray heat exchanger is initiated automatically upon receipt of a Containment Spray Actuation Signal (CSAS).
c) Component cooling water flow to each spent fuel pool cooling heat exchanger is terminated automatically by a Safety Injection Actuation Signal (SIAS).		c) Component cooling water flow to each spent fuel pool cooling heat exchanger is terminated automatically by a Safety Injection Actuation Signal (SIAS).
10. Motor-Operated Valves (MOVs) having an active Safety Function will open and/or close under differentia' pressure or fluid flow conditions and under temperature conditions.	10. Opening and/or closing of designated MOVs will be conducted under preoperational differential pressure or fluid flow conditions and under temperature conditions.	10. Each MOV having an active Safety Function opens and/or closes.



NOTES:

A. ALL ASME CODE CLASS 2 AND 3 COMPONENTS SHOWN ON THE FIGURE ARE SAFETY RELATED.

B. ASSIGNMENT OF THE NON-SAFETY RELATED CCWS HEAT REMOVAL LOADS TO THEIR RESPECTIVE CCWS DIVISION IS DEPENDENT UPON THE LOCATION OF COMPONENTS ASSOCIATED WITH THOSE LOADS.

C. SAFETY RELATED COMPONENTS AND EQUIPMENT SHOWN ON THE FIGURE ARE POWERED FROM THEIR RESPECTIVE CLASS 1E BUS.

* EQUIPMENT FOR WHICH PARAGRAPH NUMBER 3 OF THE BASIC CONFIGURATION DEFINITION APPLIES.

FIGURE 1.9.2.2-1
COMPONENT COOLING WATER SYSTEM
(ONE OF TWO DIVISIONS)

1.9.6 INSTRUMENT AIR SYSTEM

Design Description

The Instrument Air System (IAS) is a non-safety related system which supplies compressed air to air-operated instrumentation, air-operated controls, and air-operated valves.

The Basic Configuration of the IAS is as shown on Figure 1.9.6-1.

Each IAS air compressor shown on Figure 1.9.6-1 is powered from a Permanent Non-safety Bus.

IAS instrumentation indication shown on Figure 1.9.6-1 exists in the Control Room or can be retrieved there.

Inspections, Tests, Analyses and Acceptance Criteria

Table 1.9.6-1 specifies the inspections, tests, analyses and associated acceptance criteria for the IAS.

TABLE 1.9.6-1

INSTRUMENT AIR SYSTEMS
Inspections, Tests, Analyses and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The Basic Configuration of the IAS is as shown on Figure 1.9.6-1.	1. Inspections of the as-built IAS configuration will be conducted.	1. For the components and equipment shown on Figure 1.9.6-1, the as-built IAS conforms with the Basic Configuration.
2. IAS instrumentation indication shown on Figure 1.9.6-1 exists in the Control Room or can be retrieved there.	2. Inspection for the existence or retrieveability in the Control Room of instrumentation indication will be performed.	2. The instrumentation indication shown on Figure 1.9.6-1 exists in the Control Room or can be retrieved there.
3. Each IAS air compressor shown on Figure 1.9.6-1 is powered from a Permanent Non-safety Bus.	3. Tests will be performed on the IAS by providing a test signal in both Permanent Non-safety Buses.	3. Within the IAS, a test signal exists at the equipment.

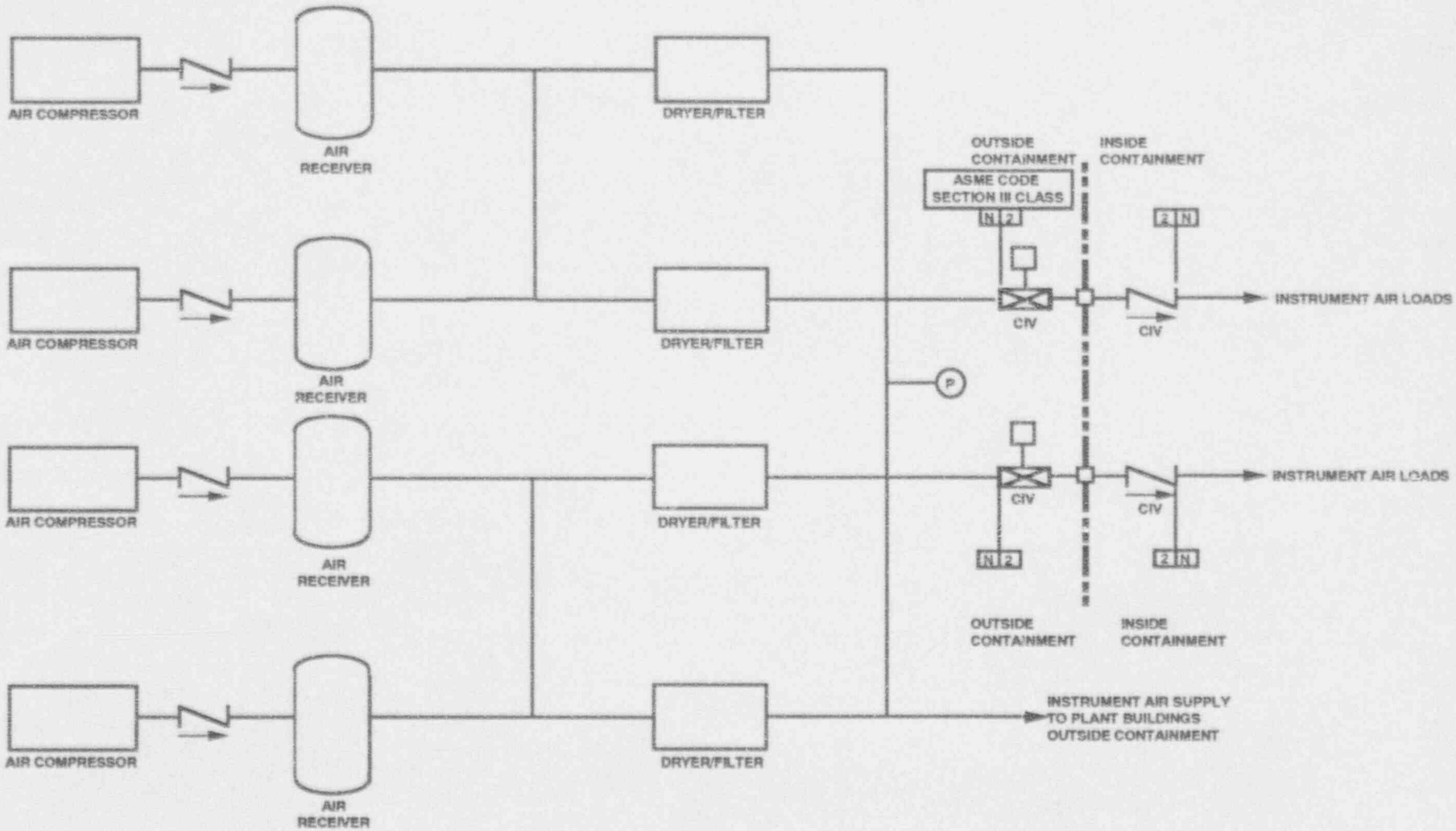


FIGURE 1.9.6-1
INSTRUMENT AIR SYSTEM

1.9.12 CONTROL COMPLEX VENTILATION SYSTEM

Design Description

The Control Complex Ventilation System (CCVS) maintains the environment in the control complex.

The Control Complex Ventilation System is located in the Control Complex area in the Nuclear Island.

The CCVS consists of (a) the Main Control Room (MCR) Air Conditioning System and the Technical Support Center (TSC) Air Conditioning System, and (b) the balance of control complex air conditioning systems.

a) The MCR Air Conditioning System consists of two Divisions. The TSC has one filtration train and one air conditioning unit. The MCR is continuously pressurized. MCR pressurization is maintained slightly positive with respect to the outside atmosphere.

   The TSC can be pressurized with respect to the outside atmosphere.

   Each outside air intake for the MCR and TSC Air Conditioning Systems contains the following:

   A minimum of two redundant isolation dampers.

   At least one detector to detect the products of combustion.

   At least one radiation detector to detect radiation.

   A tornado damper.

   Each MCR Filtration Unit and the TSC filtration train have filters to remove particulate matter and iodine.

   The isolation dampers close upon receipt of a signal indicating the detection of smoke.

   The MCR Filtration Units start automatically on a Safety Injection Actuation Signal (SIAS). In addition, the dampers in the MCR circulation lines and the bypass lines reposition to establish the flow path through the MCR Filtration Units.

   The Basic Configuration of the MCR and the TSC Air Conditioning Systems is as shown on Figure 1.9.12-1.

b) The balance of the CCVS serves:

The safety-related electrical equipment rooms and vital instrumentation rooms, and the Remote Shutdown Panel Area.

The non-safety related areas consisting of the Operation Support Center, Men's Change Area, Women's Change Area, Break Room, Shift Assembly and Offices, Radiation Access Control, Non-safety Related Electrical Rooms, Computer Rooms and Battery Rooms.

The Basic Configuration of the balance of the CCVS is as shown on Figure 1.9.12-2.

Each battery room has an exhaust fan. Hydrogen detection devices are installed in the battery rooms. The battery room exhaust ducts are maintained at a negative pressure relative to the outside atmosphere by a building roof mounted fan.

The safety related equipment shown on Figures 1.9.12-1 and 1.9.12-2 is qualified Seismic Category I.

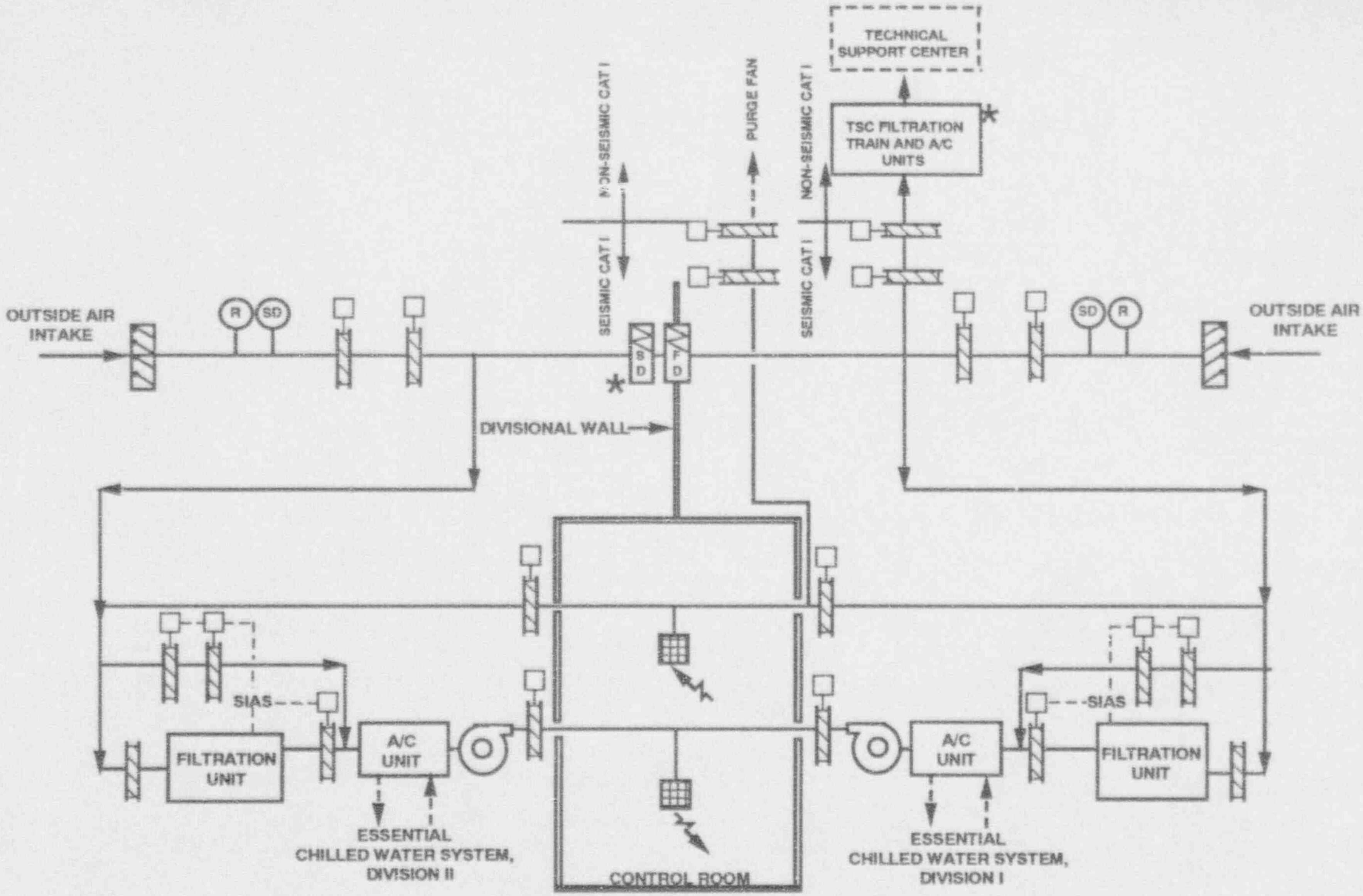
The Class 1E loads shown on Figure 1.9.12-1 and Figure 1.9.12-2 are powered from their respective Class 1E buses.

Outside containment, the active components of the two mechanical Divisions of the CCVS are physically separated.

The CCVS instrumentation indications shown on Figures 1.9.12-1 and 1.9.12-2 exist in the MCR or can be retrieved there. Controls exist in the MCR to start and stop the MCR Filtration Units and the TSC filtration train, and to open and close the isolation dampers shown on Figure 1.9.12-1.

Inspections, Tests, Analyses and Acceptance Criteria:

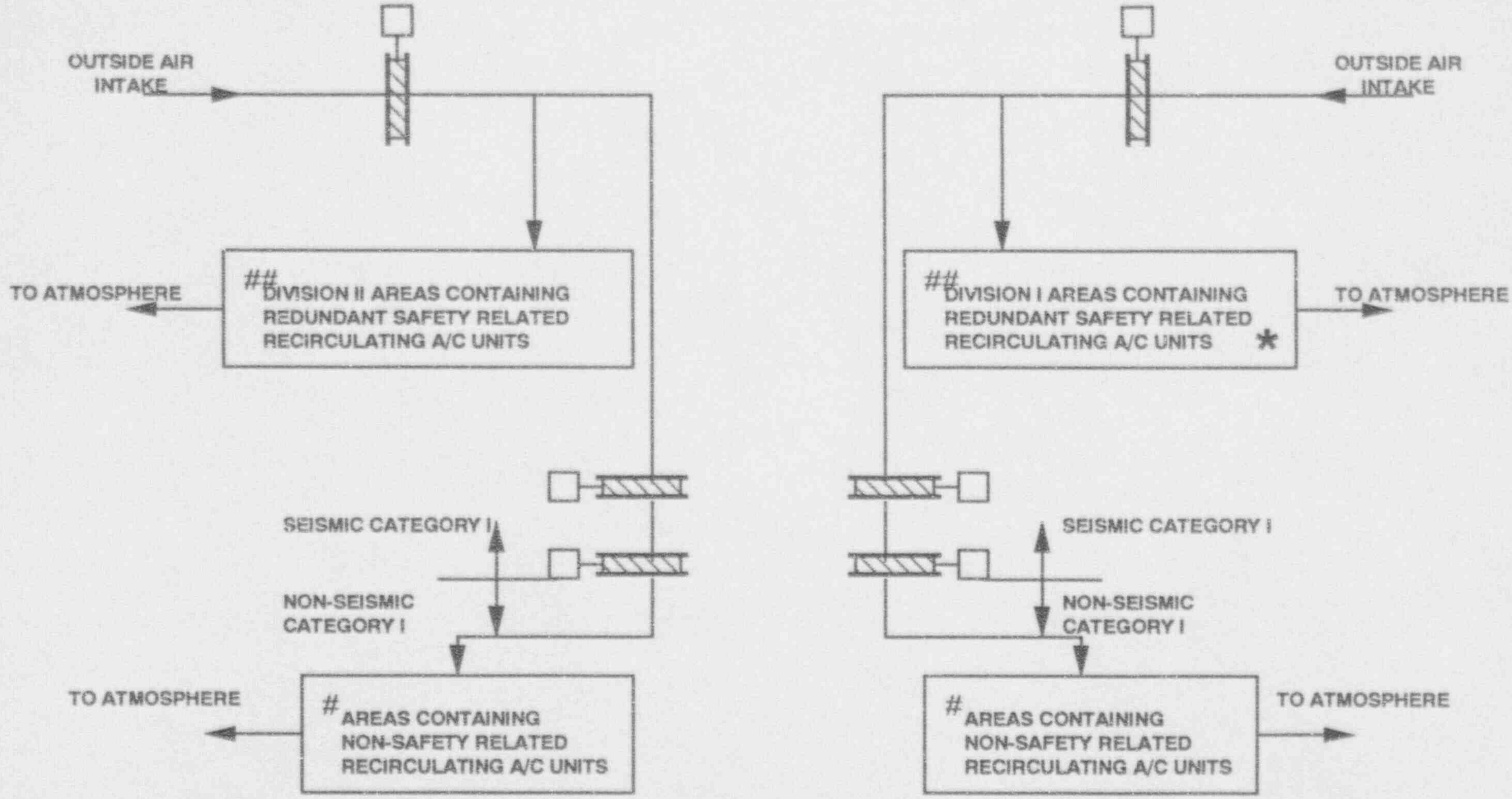
Table 1.9.12-1 specifies the inspections, tests, analyses and associated acceptance criteria for the Control Complex Ventilation System.



NOTES:

1. SYSTEM IS SEISMIC CATEGORY I UNLESS OTHERWISE NOTED.
2. ELECTRICAL LOADS ARE CLASS 1E UNLESS OTHERWISE NOTED.
3. * DENOTES NON-CLASS 1E COMPONENTS.

FIGURE 1.9.12-1
CONTROL COMPLEX VENTILATION SYSTEM



NOTES:

1. * DENOTES REMOTE SHUTDOWN ROOM ALSO HAS A REDUNDANT COOLING UNIT RECEIVING CHILLED WATER AND CLASS 1E POWER FROM DIVISION II.
2. ## DENOTES CLASS 1E LOADS.
3. # DENOTES NON CLASS 1E LOADS.

FIGURE 1.9.12-2 BALANCE OF CONTROL COMPLEX VENTILLATION SYSTEM

TABLE 1.9.12-1

CONTROL COMPLEX VENTILATION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The CCVS maintains the environment in the control complex.	1. Tests will be performed on the CCVS to measure room temperatures and analyses will be performed to relate test data to limit temperatures.	1. The CCVS controls the temperature a) between 73°F and 78°F in the MCR. b) between 60°F and 90°F in the battery room. c) less than or equal to 104°F in mechanical equipment rooms. d) less than or equal to 85°F in other areas of the control complex.
2. The MCR is pressurized with respect to the outside atmosphere.	2. Tests and analysis will be performed on the MCR Air Conditioning System.	2. The MCR is pressurized to at least 0.125 inches of water gauge relative to the outside atmosphere with outside air supply no more than 2000 CFM.
3. The TSC is pressurized with respect to the outside atmosphere.	3. Tests will be performed on the TSC.	3. The TSC can be maintained at a positive pressure with respect to the outside atmosphere.
4. The Basic Configuration of the MCR and TSC Air Conditioning Systems are as shown on Figure 1.9.12-1.	4. Inspection of the as-built MCR and TSC Air Conditioning Systems configurations will be conducted.	4. For the components and equipment shown on Figures 1.9.12-1, the as-built MCR and TSC Air Conditioning Systems conform with the Basic Configuration.

TABLE 1.9.12-1 (Continued)

CONTROL COMPLEX VENTILATION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
5. Each MCR Filtration Unit and the TSC filtration train have filters to remove particulate matter and iodine.	5. Tests and analysis will be performed on each MCR Filtration Unit and the TSC Filtration Train to determine filter efficiency.	5. The MCR and TSC filter efficiencies are: $\geq$95% for elemental and organic iodine. $\geq$99% for particulate matter greater than 0.3 micron.
6. The isolation dampers close upon receipt of a signal indicating the detection of smoke.	6. Tests will be conducted for isolation of outside air intake upon receiving a simulated signal indicating the detection of smoke concentration at the associated air intake.	6. The isolation dampers close upon receipt of the simulated signal.
7. The MCR Filtration Units start automatically on receipt of a Safety Injection Actuation Signal (SIAS). In addition, the dampers in the MCR circulation lines and the bypass lines reposition to establish the flow path through the MCR Filtration Units.	7. Tests will be performed on the MCR Filtration Unit and dampers using a simulated Safety Injection Actuation Signal (SIAS).	7. The MCR Filtration Units start on receipt of a simulated Safety Injection Actuation Signal (SIAS) and dampers reposition.
8. The Basic Configuration of the balance of the CCVS is as shown on Figure 1.9.12-2.	8. Inspection of the balance of the as-built CCVS will be performed.	8. For the components and equipment shown on Figure 1.9.12-2, the balance of the as-built CCVS conforms with the Basic Configuration.

TABLE 1.9.12-1 (Continued)

CONTROL COMPLEX VENTILATION SYSTEM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
9.a) Each battery room has an exhaust fan.	9.a) Inspection of the battery rooms will be performed.	9.a) An exhaust fan is installed in each battery room.
b) Hydrogen detection devices are installed in the battery rooms.	b) Inspection for hydrogen detection devices in the battery rooms will be performed.	b) Hydrogen detection devices are installed.
c) The battery room exhaust ducts are maintained at a negative pressure relative to the outside atmosphere.	c) Tests will be performed to measure the pressure in the battery room ducting upstream of the roof exhaust fan.	c) A negative pressure is maintained in the battery room exhaust duct with the roof fan operating.
10. The Class 1E loads shown on Figures 1.9.12-1 and 1.9.12-2 are powered from their respective Class 1E buses.	10. Tests will be performed on the CCVS system by providing a test signal in only one Class 1E bus at a time.	10. Within the CCVS, a test signal exists only at the equipment powered from the Class 1E bus under test.
11. Outside containment, the active components of the two mechanical divisions of the CCVS are physically separated.	11. Inspections of as-built mechanical separations will be conducted.	11. Outside containment, a divisional wall separates the active components of the two CCVS divisions.
12. The CCVS instrumentation indications shown in Figures 1.9.12-1 and 1.9.12-2 exist in the control room or can be retrieved there.	12. Inspection for the existence or retrieveability in the Control Room of instrumentation indications will be conducted.	12. The instrumentation indications shown in Figures 1.9.12-1 and 1.9.12-2 exist in the Control Room or can be retrieved there.
Controls exist in the MCR to start and stop the MCR Filtration Units and the TSC filtration train, and to open and close the isolation dampers shown on Figure 1.9.12-1.	Tests will be performed using the CCVS controls in the MCR.	CCVS controls in the MCR operate to start and stop the MCR Filtration Units and the TSC filtration train and to open and close the isolation dampers shown on Figure 1.9.12-1.

1.10.5 CONDENSER CIRCULATING WATER SYSTEM

Design Description

The Condenser Circulating Water System is a non-safety interface system that provides cooling water for the turbine condensers and transfers heat to the normal heat sink.

1.18.1 MAIN CONTROL ROOM

Design Description

The Main Control Room (MCR) provides suitable workspace and facilities for continuous occupancy and use by MCR operators. The MCR makes available the alarms, displays, and controls to operate the plant and maintain plant safety including at least those alarms, displays and controls identified in Table 1.18.1-1. (Ventilation, fire protection, communications, lighting, radiation protection and control panels are covered in Sections 1.9.12, 1.9.19, 1.9.20, 1.9.21, 1.12 and 1.18.3, respectively.)

The MCR is located in the Nuclear Annex.

The Basic Configuration of the MCR is as shown in Figure 1.18.1-1. The MCR contains the Master Control Console, the Auxiliary Console, the Safety Console, the Integrated Process Status Overview (IPSO), the Control Room Supervisor (CRS) Console and administrative support facilities.

MCR consoles are organized functionally according to the following:

Master Control Console	Auxiliary and Safety Consoles
Reactor Coolant System	Heating, Ventilation & Air Conditioning
Chemical & Volume Control System	Cooling Water Systems
Plant Monitoring & Control	Engineered Safety Features
Feedwater & Condensate Systems	Safety Monitoring
Turbine Control	Secondary Cycle Auxiliaries
	Switchyard
	Electrical Distribution

The CRS console provides a workstation from which the CRS coordinates control room operations. Administrative support facilities provide office workspace. The IPSO provides safety parameter display information at a fixed location that can be viewed from the MCR consoles and administrative support facilities.

The MCR permits execution of MCR tasks to operate the plant and maintain plant safety.

Inspection, Test, Analyses, and Acceptance Criteria

Table 1.18.1-2 specifies the inspections, tests, analyses, and acceptance criteria for the MCR.

TABLE 1.18.1-1

[LATER]

TABLE 1.18.1-2

MAIN CONTROL ROOM
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The Basic Configuration for the Main Control Room is as shown in Figure 1.18.1-1.	1. Inspections of the as-built MCR configuration will be conducted.	1. For the components and equipment shown in Figure 1.18.1-1, the as-built Main Control Room conforms with the Basic Configuration.
2. The MCR makes available the alarms, displays and controls identified in Table 1.18.1-1.	2. HFE availability verification inspection of the as-built MCR will be performed.	2. The MCR makes available the alarms, displays and controls identified in Table 1.18.1-1.
3. The MCR provides suitable work space for continuous occupancy and use by MCR operators.	3. HFE suitability inspection against verification criteria will be performed.	3. Inspections demonstrate HFE suitability of the MCR workspace.
4. The MCR permits execution of MCR tasks to operate the plant and maintain plant safety.	4. Tests and analyses against the validation criteria using a fullsize dynamic mockup of the MCR consoles that simulates plant operational responses will be performed.	4. The test and analysis results demonstrate validation of MCR task execution.

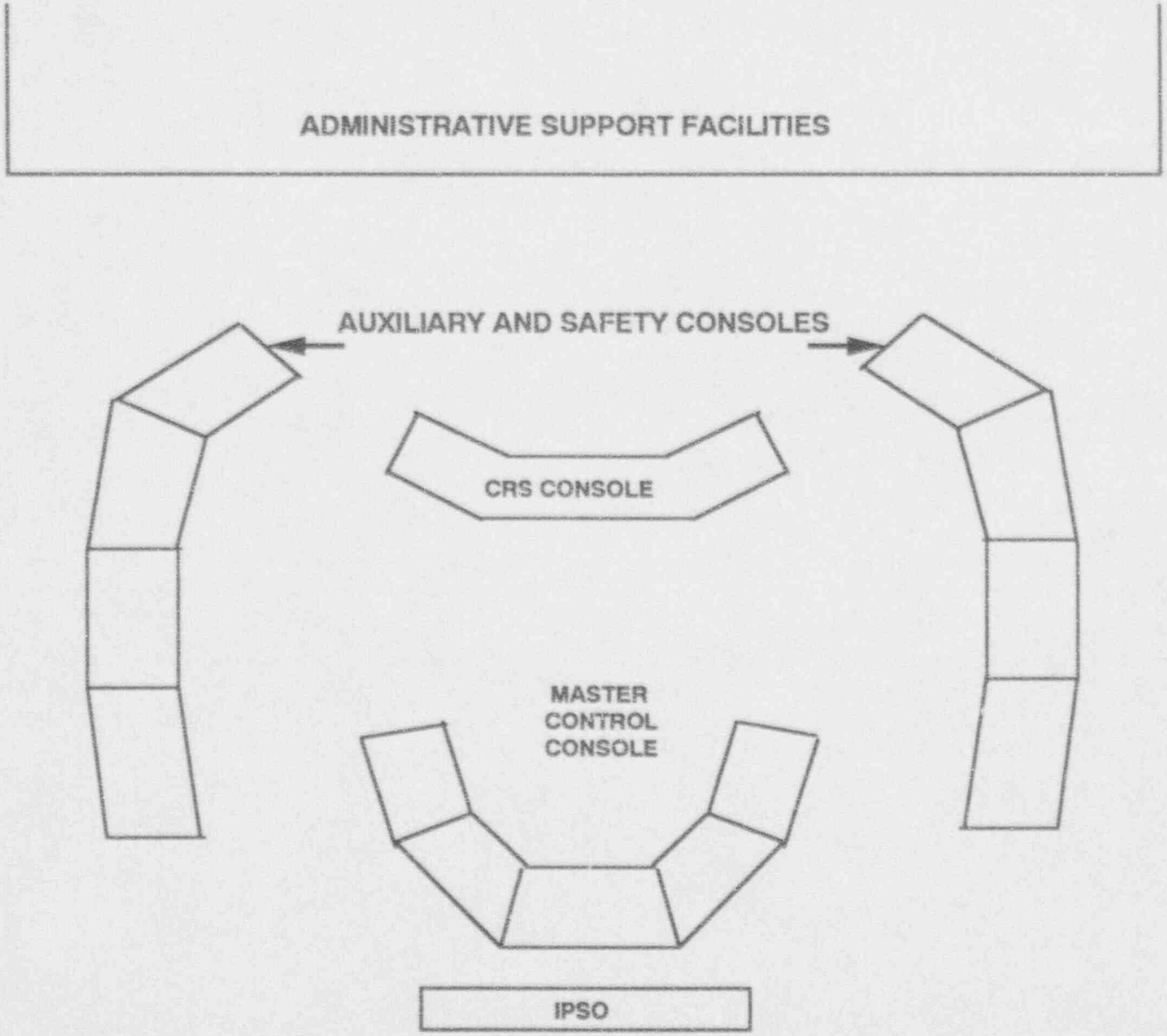


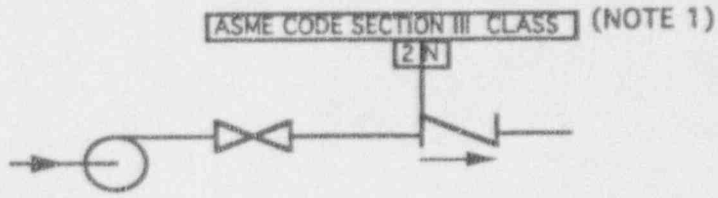
FIGURE 1.18.1-1 MAIN CONTROL ROOM

FIGURE INFORMATION

Simplified figures are included for a number of ITAAC. The figures use the following conventions.

ASME Code Class Break

An ASME Code class break is identified by a single horizontal or vertical dashed line perpendicular to the designated location for the class break. As shown in the example.



Instrumentation

Flow Instrument	(F)
Temperature Instrument	(T)
Radiation Instrument	(R)
Differential Pressure Instrument	(PD)
Pressure Instrument	(P)
Level Instrument	(L)
Current Instrument	(I)
Ultrasonic Instrument	(U)
Annunciator	◇A
Annunciator Symbols For:	
High High	HH
High	H
Low	L
Low Low	LL

Valves

Gate Valve

Globe Valve

Check Valve

Butterfly Valve

Ball Valve

Relief Valve

Three Way Valve

Valve Type Not Specified

Valve operators

Operator Of Unspecified Type

Motor Operator

Solenoid Operator

Pneumatic Operator

Hydraulic Operator

Mechanical Equipment

Positive Displacement Pump

Centrifugal Pump

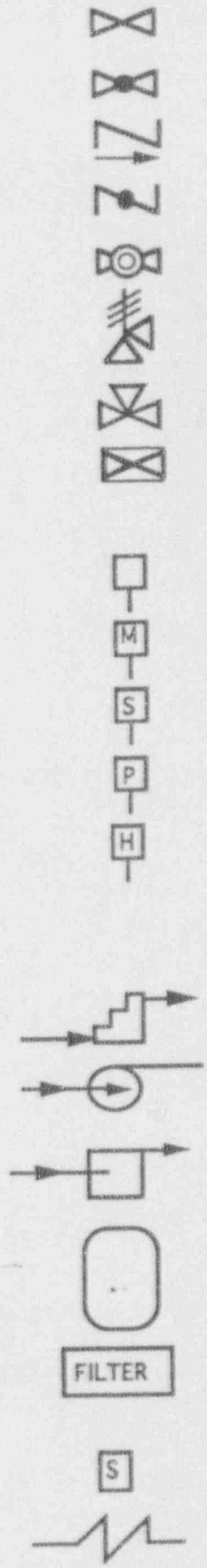
Pump Type Not Specified

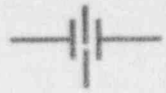
Tank

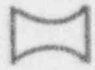
Filter

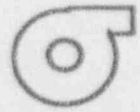
Strainer

Flexible Connection



Orifice 

Venturi 

Compressor 

Air Distribution Device 

Dampers

Pressure Operated Damper 

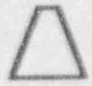
Remotely Operated Damper 

Fire Damper 

Smoke Damper 

Back Draft Damper 

Pump Drivers

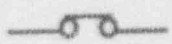
Turbine Drive 

Motor Drive 

Electrical Equipment

Circuit Breaker 

Motor Operated Circuit Breaker 

Disconnect Link 

Multiplexer 

Isolation 

Detectors

Radiation Detectors	Ⓡ
Humidity Detectors	Ⓗ
Smoke Detector	(SD)

Abbreviations

Abb.	Meaning
IRWST	In-containment Refueling Water Storage Tank
CVCS	Chemical And Volume Control System
RDS	Rapid Depressurization System
SDS	Safety Depressurization System
RCGVS	Reactor Coolant Gas Vent System
RCP	Reactor Coolant Pump
MSSS	Main Steam Supply System
PZR	Pressurizer
PSS	Process Sampling System
SG	Steam Generator
SCS	Shutdown Cooling System
SIS	Safety Injection System
CCWS	Component Cooling Water System
LTOP	Low Temperature Overpressure Protection
RCS	Reactor Coolant System
CIV	Containment Isolation Valve
CSS	Containment Spray System
HX	Heat Exchanger
CCW	Component Cooling Water
DVI	Direct Vessel Injection

PPS	Plant Protection System
APC	Auxiliary Process Cabinet
CCS	Component Control System
CPC	Core Protection Calculator
RTSG	Reactor Trip Switchgear
ESF	Engineered Safety Features
CEDMCS	Control Element Drive Mechanism Control System
CEDMs	Control Element Drive Mechanisms
ITP	Interface And Test Processor
RT	Reactor Trip
INIT	Initiation
CH	Channel
INST	Instrumentation
SSW	Station Service Water
SSWS	Station Service Water System
DWMS	Demineralized Water Makeup System
SIAS	Safety Injection Actuation Signal
CSAS	Containment Spray Actuation Signal
CCWLLSTAS	Component Cooling Water Low Level Surge Tank Actuation Signal
TSC	Technical Support Center
A/C	Air Conditioning
CRS	Control Room Supervisor
IPSO	Integrated Process Status Overview

NOTE

1. The header, "ASME Code Section III Class", must appear at least once on each figure on which class breaks are shown, but need not appear at every class break shown on a figure.

[N] Indicates Non ASME Code Section III.