
REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.: 269-8319
SRP Section: 09.02.02 - Reactor Auxiliary Cooling Water Systems
Application Section: Section 9.2.7
Date of RAI Issue: 10/22/2015

Question No. 09.02.02-14

RG 1.206, Section C.I.9.2.2.5, "Instrumentation Requirements," states "[t]he applicant should describe the system alarms, instrumentation, and controls. Include a description of the adequacy of instrumentation to support required testing, as well as the adequacy of alarms to notify operators of degraded conditions."

DCD Tier 2, Section 9.2.7.5, "Instrumentation Requirements," provides a high-level description of the essential chilled water system (ECWS) instrumentation as well as indication and alarms. However, the staff finds that DCD Tier 2, Section 9.2.7.5, and associated figures are incomplete. For example:

- a) DCD Tier 2, Section 9.2.7.5 states "local temperature and pressure indicators are provided at selected points in the system;" however, it is unclear to the staff if this information is included on Figure 9.2.7-1.
- b) DCD Tier 2, Section 9.2.7.5 specifies that inlet and outlet pressure of the evaporators are provided; however, this is not shown on Figure 9.2.7-1.
- c) DCD Tier 2, Section 9.2.7.5 provides a list of main control room (MCR) and remote shutdown room (RSR) indication and alarms; however, it is not clear to the staff what control instrumentation is available to the operators and which instruments provide the input to specific indication or alarms.
- d) DCD Tier 2, Section 9.2.7.5 or Figure 9.2.7-1 do not include instrumentation, controls, or alarms for protection against freezing, high/low refrigerant pressure, refrigerant leak detection, flow, and temperature.

The applicant is requested to address the above items regarding instrumentation and controls for the ECWS. DCD Tier 2, Section 9.2.7, Figure 9.2.7-1, and DCD Tier 1, including Table 2.7.2.3-3, should be revised accordingly.

Response - (Rev. 1)

- a) Local temperature, flow, and pressure indicators will be added to the figure 9.2.7-1.
- b) Inlet and outlet pressure indicators of the evaporators will be added to the figure 9.2.7-1.
- c) An essential chiller and ECW pump combination can be manually or automatically started or stopped either in the Main Control Room (MCR) and Remote Shutdown Room (RSR) or on the Local Control Panel (LCP). The ECW makeup pump can be manually or automatically started or stopped either in the Main Control Room (MCR) and Remote Shutdown Room (RSR). The level signal of ECW compression tank interlocks the automatic operation of the ECW makeup pump. To start/stop the components, the operator uses control switches installed on the operator console, safety console, or local control panel. The component status such as start/stop and trouble/disable is indicated on the component symbols shown on the information flat panel displays (IFPD), which are installed on the operator console. The component status is also indicated on the control switches on the safety console and local control panel. Alarms such as component trouble/disable are indicated on the IFPD, large display panel (LDP), or Qualified indication and alarm system – non-safety (QIAS-N) display. ECW compression tank level HI-HI and LO-LO are alarmed on the LCP. The operator console, safety console, IFPD, LDP, and QIAS-N have been described in DCD Tier 2, Chapter 7 and Chapter 18.
- d) The reset cutout function and annunciator function for **essential** chiller protection **against** condenser refrigerant high pressure, evaporator refrigerant low pressure, evaporator refrigerant low temperature, chilled water high/low temperature, chilled water low flow, **and chiller trouble** is provided on the local control panel (LCP) by the chiller vendor. **DCD Tier 2, Section 9.2.7.5 will be revised to add alarms for essential chiller protection provided on the LCP. Any vibration monitor for essential chillers is not provided. However, vibration levels of essential chillers are measured to check that the vibration levels of essential chillers are within design limits by conducting the mechanical run tests at the manufacturer's shop in accordance with ASME AG-1, Article RA-5214.1(c) and performing the in-service test every 3 months at the plant in accordance with ASME N511, Table 6, Refrigeration Equipment In-Service Tests.** And as described in the Section 9.2.7.2.1.2, the refrigerant leak detectors are provided in the chiller room to actuate an alarm in the chiller room, MCR, and RSR and start the chiller room supply fan and exhaust fan to remove refrigerant when the chiller room refrigerant concentration rises.

Impact on DCD

APR1400 DCD Tier 2, **Section 9.2.7.5 and** Figure 9.2.7-1 will be revised as indicated in the Attachment.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environment Report.

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The chillers, chilled water pumps, and system piping are hydrostatically tested in accordance with ASME Section III.

Preoperational testing of the ECWS is performed as described in Section 14.2 to demonstrate that systems and components operate in accordance with applicable test programs and specifications.

Test and inspection programs and inservice test programs for safety-related portions of the system components are addressed in Subsection 3.9.6 and Section 6.6.

9.2.7.4.2 Plant Chilled Water System

Equipment is factory inspected and tested in accordance with the applicable equipment specifications and codes. System piping and equipment installation is inspected during various construction stages. Construction tests are performed on mechanical components, and the system is balanced for the design water flows and system operating pressures.

Controls, interlocks, and safety devices on each system are checked, adjusted, and tested to provide reasonable assurance of the proper sequence of operation. A final integrated acceptance test is conducted with equipment and controls in operation to verify system performance.

The chillers, chilled water pumps, and system piping are hydrostatically tested in accordance with ASME Section VIII and ASME B31.1.

Preoperational testing of the PCWS is performed as described in Section 14.2 to demonstrate that systems and components operate in accordance with applicable test programs and specifications.

The testing of containment isolation valves to verify operability and the ability to meet closing requirements is described in Subsection 6.2.4. The inservice inspection of Class 2 components is described in Section 6.6.

9.2.7.5 Instrumentation Requirements

Local temperature and pressure indicators are provided at the selected points in the system. The discharge pressures of both ECWS and PCWS are locally indicated at the discharge of



, flow,

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the pumps in addition to the inlet and outlet of the evaporators. Makeup water flow to the compression tank is initiated automatically by a compression tank water low-level signal and continues until the normal level is re-established.

9.2.7.5.1 Essential Chilled Water System

The following instrumentation is provided in the MCR and RSR:

- a. Indication - Chiller status
- b. Indication - ECW pump status
- c. Indication - ECW makeup pump status
- d. Alarm - Chiller trouble
- e. Alarm - ECW pump trouble
- f. Alarm - ECW makeup pump trouble
- g. Alarm - Compression tank water level low-low

The following instrumentation is provided on the LCP :

- a. Alarm - Condenser refrigerant high pressure
- b. Alarm - Evaporator refrigerant low pressure
- c. Alarm - Evaporator refrigerant low temperature
- d. Alarm - Chilled water high/low temperature
- e. Alarm - Chilled water low flow
- f. Alarm - Chiller trouble

9.2.7.5.2 Plant Chilled Water System

The following instrumentation is provided in the MCR and RSR:

- a. Indication - Central chiller status
- b. Indication - Central chilled water pump status
- c. Indication - CIV position status (open/close)
- d. Alarm - CIV trouble

NOTES

1. ALL COMPONENTS AND PIPING SHOWN ON THIS DRAWING ARE SAFETY-RELATED AND SEISMIC CATEGORY I UNLESS OTHERWISE NOTED.
2. DESIGN PRESSURE OF THIS SYSTEM IS 12.66 KG/CM² (180 PSIG) AND DESIGN TEMPERATURE OF THIS SYSTEM IS 65.6°C (150°F).

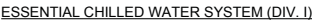


Figure 9.2.7-1 Essential Chilled Water System Flow Diagram (Sheet 1 of 4)

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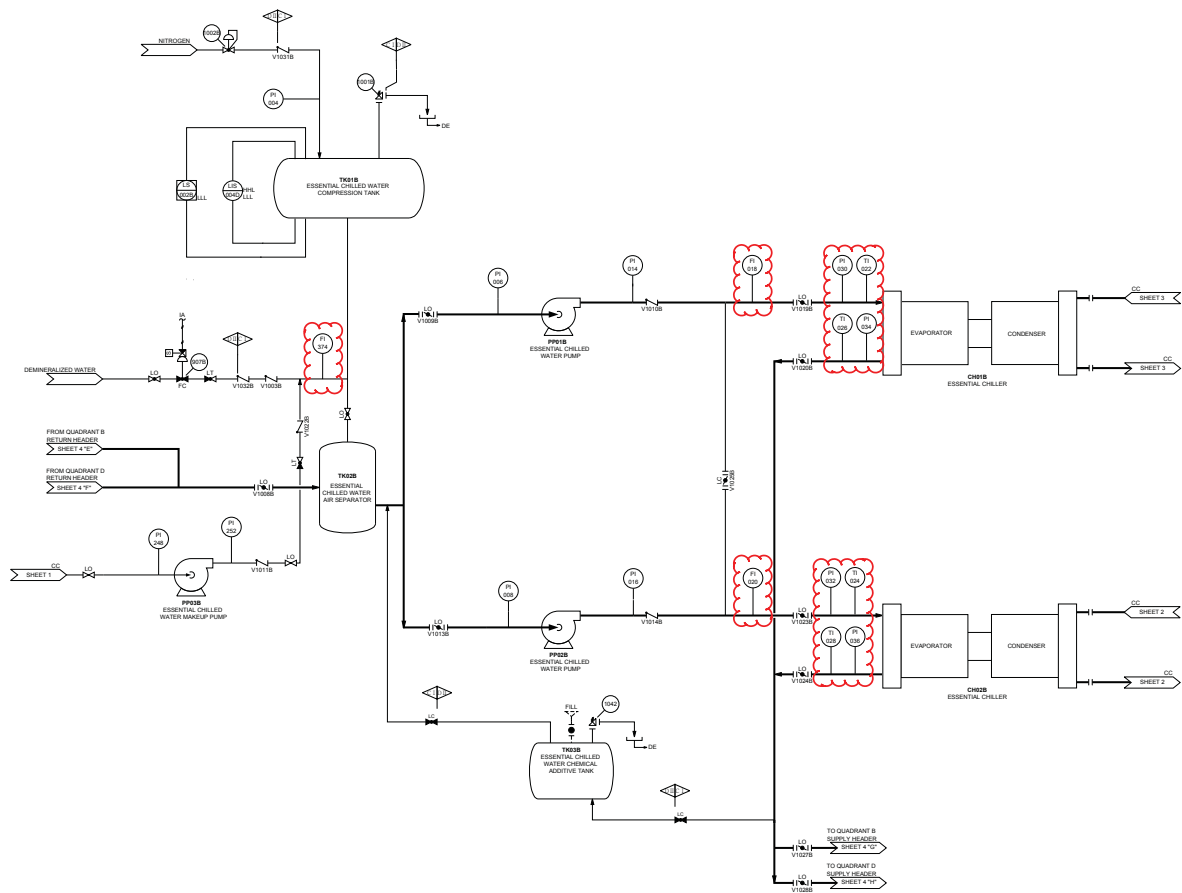


Figure 9.2.7-1 Essential Chilled Water System Flow Diagram (Sheet 3 of 4)