

11.7 CONDENSATE FILTER-DEMINERALIZER SYSTEM

11.7.1 Power Generation Objective

The objective of the Condensate Filter-Demineralizer System is to treat the flow of condensate from the condenser hotwell to remove dissolved and suspended solids which result from corrosion in the condenser and associated piping systems and from leakage of cooling water into the condenser.

11.7.2 Power Generation Design Basis

1. The system will be capable of processing the full flow of condensate under normal operating conditions.
2. The system will be capable of handling, at less than full flow, the high concentrations of dissolved and particulate material present in the condensate during startup and restart operations.
3. The system will be capable of handling some inleakage of condenser cooling water with only a minimal increase in effluent conductivity.

11.7.3 System Description

The Condensate Filter-Demineralizer System for each reactor unit consists of ten filter-demineralizer units, a backwash system, a precoat system, and a bodycoat system (Figures 11.7-1, 11.7-2, and 11.7-3).

Nine filter-demineralizer units are located in individual concrete cells. No valves or other equipment with moving parts are located within the cells. Holding pumps, which serve to keep the precoat in place while their associated units are out of service, are located in a pump and valve room adjacent to the demineralizer units.

The tenth filter-demineralizer unit is located in an area adjacent to the nine filter-demineralizers. It is enclosed by a radiological shield. There are no valves or other equipment with moving parts located within the shield.

The filter-demineralizer units, arranged in parallel, are supplied by the condensate pumps via an inlet header. An outlet header collects the effluent from the individual filter demineralizer. When the unit is shut down for refueling, one or more filter-demineralizer units may be used to polish condensate for filling the reactor well and dryer-separator pit. The fill water is normally supplied from condensate storage to the reactor via the condenser hotwell and the condensate and feedwater lines or via the Core Spray System. At the end of the refueling period, filter-demineralizer units may be used to treat water drained from the reactor well and dryer-separator pit before it is returned to condensate storage.

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The filter-demineralizer system effluent water should meet the following minimum expected quality criteria during power operation:

Loading	Effluent
Specific conductivity	Less than 0.1 micromho/cm
Total iron	Less than 10 ppb
Total copper	Less than 2 ppb

The filter-demineralizer vessels are vertical cylinders with dished heads. They are 6 feet in diameter by 6 feet 6 inches straight side height or as described in the vendor manual. The tenth filter-demineralizer vessel is a segmented vertical cylinder with a flat head. It is 6 feet in diameter by 8 feet 8 inches high. Each vessel contains 302 filter elements which are removable for inspection or replacement. The system is designed for a total flow of 26,800 gpm (pre-uprated). The normal (extended uprated) flow rate is approximately 33,250 gpm. Flow rates are approximately equal through each filter-demineralizer unit.

The filter-demineralizer filter elements are coated with a mixture of cation and anion exchange resins in hydrogen and hydroxyl forms, respectively. The coating is applied to the filter elements in thicknesses of up to about 1/4 inch. This coating serves the dual functions of filtration and ion exchange.

A filter-demineralizer unit may be removed from service when its pressure drop exceeds operational requirements or when the effluent conductivity increases above water chemistry specification. The exhausted unit is backwashed to remove the spent resin, which is flushed to a backwash receiver tank. Fresh resin slurry is prepared as required and pumped to the unit, where the resin particles are deposited on the filter elements. Backwash and precoating operations are normally performed automatically but may be performed manually. After precoating is completed, flow produced by the holding pump keeps the resin coating in place on the filter elements until the unit is placed in service. Backwash receiver tank contents are pumped to one of the condensate phase separator tanks in the Radwaste Building.

A strainer which serves as a resin trap is located in the effluent line from each filter-demineralizer unit. The resin trap is designed to stop particulates that might leak through in the event of a failure of one or more filter support elements.

Instrumentation and controls are provided to perform the following functions:

- a. Measure electrical conductivity of water in the influent header, effluent line of each filter-demineralizer, and effluent header. Alarms are provided for each of the effluent points.

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- b. Measure pressure drop across each filter-demineralizer, and alarm on high differential pressure.
- c. Measure pressure differential between influent and effluent headers, and open the system bypass valve on system high-differential signal.
- d. Measure flow rates.
- e. Start holding pump when flow rate through any filter-demineralizer unit decreases to a preset setpoint.
- f. Alarm high-pressure drop across resin traps.

Controls and local instrumentation for the system are mounted on a panel located near the precoat system. Recorders [Unit 1 only] / Monitors [Units 2 and 3] and alarms are on this panel for Unit 2 only. For Units 1 and 3, alarms and monitors are provided on the panel. In the Main Control Room, an alarm indicates trouble in the condensate demineralizer system. A hand switch which operates the system bypass valve is also located in the Main Control Room. Recorders and alarms for conductivity are also located in the analytical laboratory.

Decontamination of filter-demineralizer units can be performed using the precoat system to make up and circulate decontaminating solutions.

11.7.4 Power Generation Evaluation

In the event of a complete power failure, the condensate pumps stop, and flow through the filter-demineralizers ceases. The holding pumps are not supplied with emergency power, so that they are unable to maintain a minimum flow. Under no-flow conditions, the coating on the filter elements tends to fall to the bottom of the vessel. Before the filter-demineralizers are returned to service, after power is restored, they should be backwashed and precoated.

11.7.5 Inspection and Testing

The filter-demineralizer system is used extensively during preoperational testing and during startup operations. This use provides thorough testing of the system.

Filter-demineralizer elements are replaced by high differential pressure across a filter demineralizer unit or due to resin leakage. Other equipment in the system receives routine maintenance.