

23 (6.5C) Potable and Fire Water

23.1 Functions, Basic Configuration and Interfaces

23.1.1 Functions and Basic Configuration

The function of the potable water system (PWS) is to distribute water suitable for human ingestion throughout the ITER site. Such water will be used in kitchens, lavatories, and drinking fountains. The PWS also provides makeup water to the fire protection water system (FPWS) and the demineralized water system. The quality of potable water meets biological standards for safe drinking water. Water delivered to potable water use points will be collected by the sanitary and industrial sewage system (WBS 6.5.D) The PWS maintains an inventory of potable water suitable to accommodate an outage of the potable water treatment equipment for up to 5 days.

The scope of the PWS includes piping networks from the intake pipe connection to each building which requires potable water, and the potable water receiver/storage tank. Potable water is assumed to be supplied by the host country at the site boundary at sufficient pressure for site distribution.

The function of the FPWS is to supply and distribute water for the purpose of fire fighting. The system maintains a pressurized, plant-wide distribution system which can supply fire water on demand to installed site-wide hydrants and/or sprinkler mains and buildings. It is also capable of filling and delivering water through a separate piping network which is normally dry. The dry standby-pipe system shall serve as a backup distribution network, and will not normally be connected to installed sprinkler mains. The system maintains an inventory of fire fighting water on-site suitable for 20 minutes of continuous fire fighting operation at a flow of 0.4 m³/s at a pressure of 1 MPa from the fire water storage tanks. The system shall be capable of drawing water from other sources, such as the cooling tower basin, after the fire fighting inventory is exhausted. The FPWS is part of an overall ITER fire protection design which will include fire detection, local installed dry chemical and acceptable halon-substitute or CO₂ fire fighting systems, and portable fire extinguishers located throughout the plant. Local installed systems will be used where it is inadvisable to install automatic sprinkler system or to use water to fight fires. These local sub-systems will be identified and described later.

23.1.2 Interfaces

- 2.6.M Cooling Tower System
- 6.1.A Site General Layout
- 6.2.A Tokamak Buildings
- 6.2.B Hot Cell Building
- 6.2.E Auxiliary Buildings
- 6.2.G Radwaste and Personnel Building
- 6.2.H Laboratory Office Building
- 6.2.J Cryoplant Buildings
- 6.2.K Control Building
- 6.2.L Emergency Power Supply Building
- 6.2.M Site Services Building
- 6.2.S Utility Tunnels & Site Improvements

23.2 Design Requirements

23.2.1 General

23.2.1.1 Reliability

The FPWS shall be designed to operate during all modes of ITER plant operation. The system shall be designed so that the failure to supply water is less than 10^{-3} per demand.

23.2.1.2 Site Elevation

The PWS and FPWS must be designed to operate at elevations up to 500 m above sea level.

23.2.1.3 Temperature Range

Portions of the PWS and FPWS which are outdoors must be designed to operate from -25°C to 35°C (for one hour) and -15°C to 30°C (for 24 hours).

23.2.1.4 Maximum Humidity

Portions of the PWS and FPWS which are outdoors must be designed to operate at up to 95% relative humidity (24 hour average) and up to 90% for a 30 day average period.

23.2.1.5 Thermohydraulic Requirements - Capacity

The PWS shall be able to supply water sufficient for consumption by 1000 persons, or 400 m^3 per day. This includes water for cleaning purposes as well as the water makeup to the demineralization plant. The FPWS shall be designed to provide a maximum flow rate of $0.4\text{ m}^3/\text{s}$ at a pressure of 1 MPa for 20 minutes from the fire water storage tanks, but can draw water from alternate sources such as the PWS and the cooling tower basins. The pressurized subsystem and the dry system shall each be designed so that these delivery conditions can be met by the total of 10 delivery points (hydrants and sprinkler mains) on either piping network but not exceed $0.4\text{ m}^3/\text{s}$ as a total.

23.2.1.6 Mechanical - Hydrant and Hosepipe Connection Design

Hydrants and hosepipe connections shall be selected to be compatible with the standards used by the local civic authorities in the host party.

23.2.1.7 Electrical

All electrical components shall operate at standard IEC nominal voltages. In order to limit the number of step-down transformers, preference shall be given to 11 kV for large equipment ($< 1,000\text{ kW}$) and to 3.3 kV for ($100\text{-}1,000\text{ kW}$).

23.2.1.8 Seismic

All outdoor parts of the FPWS shall be designed to resist forces associated with an SL-2 design basis earthquake or as the local regulation requires (even though the FPWS is not a safety importance class (SIC) system). Portions of the FPWS shall be equipped with manual

isolation valves so that the failure of a non-SIC structure will not compromise the integrity of the fire water distribution system. The PWS shall be designed to withstand an SL-0 earthquake.

23.2.1.9 Construction

23.2.1.9.1 Potable Water Configuration

The PWS shall be configured to meet the needs of the ITER project at the lowest overall cost. The design shall be evaluated to determine compliance with this requirement. Centralized water treatment, storage, and pressurization equipment (provided by the ITER site host) shall be used unless compelling cost or operational requirements dictate otherwise.

23.2.1.9.2 Fire Water Configuration

The pressurized FPWS shall be configured as ring headers, so that water can be supplied to any delivery point by at least two routes. Manual valves shall be incorporated in the design to enable fire fighters to isolate and close a locally failed part of the distribution system.

23.2.1.9.3 Operational Capability During Construction

The PWS shall be designed to support operation of the PF coil fabrication building and other ITER systems and buildings which will be placed in operation during construction. It shall not be required to support construction workers who will use temporary or portable facilities.

23.2.1.10 Instrumentation and Control Requirements

23.2.1.10.1 General Instrumentation and Control

The PWS and FPWS shall be designed to include all necessary instrumentation and controls. The operation of either system shall be independent of any other signal generation and processing system.

23.2.1.10.2 CODAC Interface

The PWS and FPWS shall provide status reporting signals to CODAC. Therefore, they shall conform to all signal and command protocol standards established by CODAC.

23.2.1.11 Materials

23.2.1.11.1 Mechanical

Parts of the FPWS which are maintained in a filled, wet condition shall be designed with a suitable corrosion allowance. In addition, the system design shall specify periodic testing and flushing to monitor the condition of the system.

23.2.1.11.2 Electrical Insulation

All cables will be made with copper and should have the 15 kV, 6 kV and 0.6 kV rated insulation voltage for 11 kV. Cable insulation should meet the following requirements:

- insulation material XLPE preferred, PVC not accepted;
- max. permissible temperature of conductor:
 - continuous 90°C,
 - under short circuit conditions 250°C;
- acid gas content zero halogen, according to IEC-754;
- fire retardancy according to IEC-332

Table 23 (6.5.C) -1 IEC Relevant Material

IEC #	Technical Committee	Title
332-1 to 3	SC 20C	Test on electric cables under fire conditions
728	SC 12G	Cable distribution systems
754	SC 20C	Tests on gases involved during combustion of electric cables
840	SC 20A	Test on electric cables 30 kV to 150 kV

23.2.2 Operation and Maintenance

23.2.2.1 Built-in Redundancy

The FPWS shall be designed with sufficient built-in redundancy to allow the maintenance of all active components (particularly pumps and flow control valves) without removal of the entire system from service.

23.2.2.2 Duty Cycle

The PWS and FPWS shall be designed to be available 100% of the time. Sections of the system may be isolated and unavailable for limited periods of time for maintenance and testing.

23.2.3 Surveillance and Inspection

Regular inspection shall be necessary for the FPWS. The inspection procedures will be described in their respective operational and maintenance manuals and will include visual and electromechanical inspections.

23.2.4 Quality Assurance

These requirements shall be determined by the local law and/or regulations after site selection.

23.2.5 Reliability Assurance

All components must be inspected according to the maintenance manual based on utility power plant standards. Applicable standards will be selected during detailed design after site selection.

23.3 Codes and Standards

23.3.1 Mechanical

The PWS shall be designed to local building codes. The FPWS shall be designed in detail to local codes and standards, with the local regulators after the site selection.

23.3.2 Electrical

All electrical components shall be designed to IEC standards. Other applicable electrical standards and codes will be determined after the site selection.