

23 (6.5.D) Sewage (Sanitary and Industrial)

23.1 Functions, Basic Configuration and Interfaces

23.1.1 Functions and Basic Configuration

The function performed by the sanitary and industrial sewage systems is to collect, pre-treat and release the sanitary and industrial drainage from the ITER plant to the host's off-site sewage systems. Sanitary drainage includes fluids drained from lavatories, drinking fountains, kitchens, showers, laundry facilities and floors in rooms where these services are located. Industrial drainage includes floor and equipment drains where there is no expectation of biological waste. Industrial drainage may include contamination with oils, dirt, chemicals, or metals. Cooling tower blowdown may also flow to the industrial sewage system if it has a high mineral content. Activities within the ITER plant are designed to provide a high level of assurance that sanitary drains are not contaminated with oils, chemicals, metals, or saline water, and industrial drains are not contaminated with biological waste. Both the sanitary subsystem and the industrial subsystem will use off-site waste treatment facilities provided by the host. Note that water from nuclear areas is screened for release into these systems prior to acceptance, so no radioactive water is released.

23.1.2 Interfaces

The sanitary and industrial sewage systems interface with the following:

- 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 Specific

23.2.1.1 Site Elevation

The sewage system must be designed to operate at elevations up to 500 m above sea level, as per DRG1.

23.2.1.2 Temperature Range

Portions of the sewage system 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).

23.2.1.3 Maximum Humidity

Portions of the sewage system which are outdoors must be designed to operate at up to 90% relative humidity (24 hour average).

23.2.1.4 Sanitary Sewage Pretreatment of Solid Material

The sanitary sewer system shall remove or reduce in size, all solid materials to a size that can be pumped by system lift pumps and be accepted by the sewer service provided by the ITER site host.

23.2.1.5 Industrial Sewage Pretreatment of Solid Material

The ITER industrial sewer system shall remove or reduce in size, all solid materials to a size that can be pumped by system lift pumps and be accepted by the sewer service provided by the ITER site host.

23.2.1.6 Thermohydraulic

23.2.1.6.1 Sanitary Sewer Capacity

The sanitary sewer subsystem shall be able to receive a total drainage flow equal to the water consumption for 1000 persons, or 150 m³ per day. The sanitary sewer system shall be able to continue to receive waste despite an interruption in site discharge operations for at least 15 days.

23.2.1.6.2 Industrial Sewer Capacity

The industrial sewer subsystem shall be designed to receive a maximum flow rate of 200 m³/day. The industrial sewer system shall be able to continue to receive waste despite an interruption in site discharge operations for at least 10 days.

23.2.1.6.3 Gravity Flow

Both the sanitary and industrial sewage subsystems shall flow by gravity at the design flow rate. The drainage direction shall be to the low point at the southeast corner of the site. However, lift pumps shall be installed at building collection tanks if necessary.

23.2.2 **General**

23.2.2.1 Mechanical Requirements

All components shall be of standard quality for these types of systems.

23.2.2.2 Electrical

23.2.2.2.1 Equipment Voltage

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 (>

500 kW) and to 3.3 kV for (100-500 kW).

23.2.2.3 Construction

23.2.2.3.1 Operational Capability During Construction

The sewage system shall be designed to support operation of the PF coil fabrication activity and other ITER systems (including HVAC) which will be placed in operation during construction. It shall not be required to support construction workers (who will use temporary or portable facilities).

23.2.2.3.2 Configuration

The sewage systems 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 waste discharge and treatment provided by the host shall be used unless compelling cost or operational requirements dictate otherwise.

23.2.2.3.3 Excavation Protocol

Both the sanitary and industrial sewage pipe shall have the lowest excavation protocol consistent with the gravity drain requirement. The sewage pipe will be located below all other utility structures including buried supply pipe, penstocks and electrical tunnels. Drainage water from electrical tunnels and conduits shall gravity flow to the industrial sewage system.

23.2.2.4 Instrumentation and Control

23.2.2.4.1 General Instrumentation and Control

The sewage systems shall be designed to include all necessary instrumentation and controls. The operation of the system shall be independent of any other signal generation and processing system.

23.2.2.4.2 CODAC Interface

The sewage systems shall be designed to provide status information to CODAC, and shall conform to all signal and command protocol standards established by CODAC.

23.2.2.5 Grounding, Insulation

Sanitary and industrial sewage electrically operated equipment shall be firmly grounded to the site grounding grid.

23.2.2.6 Materials

23.2.2.6.1 Corrosion Allowance

The sewage systems shall be designed with a suitable corrosion allowance, selected to serve the life of the ITER project.

23.2.2.6.2 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.D) -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

23.2.3 Operations and Maintenance

Operation shall be continuous and automatic.

23.2.4 Surveillance and Inspection

23.2.4.1 Surveillance

The water quality such as oil concentration and concentration of radioactive materials shall be surveyed periodically at least once a day before transfer to the site sewage facility.

23.2.4.2 Inspection

Regular inspection (annually) shall be necessary for this system during the long term maintenance state. The inspection procedures, including visual inspection and periodic inspections, will be described in their respective operational and maintenance manuals.

23.2.5 Quality Assurance (QA)

All system components are non-safety importance class (non-SIC). Therefore, only industrial level QA is required from the vendors and constructors.

23.3 Codes and Standards

23.3.1 Mechanical

All components and parts should be designed based on the general industrial standard in the site.

23.3.2 Electrical

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