

## **21 (6.2.L) Emergency Power Supply Building**

### **21.1 Functions, Basic Configuration, and Interfaces**

#### **21.1.1 Functions**

The main functions of the emergency power supply (EPS) building are the following:

- 1) House and support the systems, and provide space.
- 2) Provide a suitable environment for the system and workers inside.

##### **21.1.1.1 House and Support the Systems, and Provide Space**

The EPS building provides space for the systems located within the building, and has enough strength to support the systems. The EPS building resists external hazards, including seismic events, extreme weather (hurricanes, tornadoes, rainfall, snow, etc. as specified in the PDS) in order to prevent failure of the systems. The emergency power supply system is self sufficient. Only the power supply cable and control cable are connected to the site infrastructure.

##### **21.1.1.2 Provide a Suitable Environment**

For a suitable working environment, the building provides the following:

- Lighting, service power
- Fire detection, alarm, and mitigation
- Service fluid distribution
- Drainage
- Grounding
- Heating, ventilation, and air conditioning (HVAC)
- Access control and personnel escape
- Communications

Many of these systems are commonly found in large industrial buildings, but there are some special features of the plant that generate some uncommon requirements:

- a very robust adequate grounding system
- an access control system

#### **21.1.2 Basic Configuration**

The EPS building is a four-level, reinforced concrete structure. The diesel electric generators are located in the basement with isolated foundation due to their vibration. Stacks and cooling towers are located on the roof. The major systems to be installed in the EPS building are shown in Table 21 (6.2.L) -1.

**Table 21 (6.2.L) -1 Major Systems installed in the EPS Building**

Emergency Power Supply System	Diesel Generators
	Switchgear
	Control Panels

### 21.1.3 Interfaces

The building has interfaces with the following WBS elements:

WBS	Title
4.3.B	Emergency power supply
4.5	CODAC
4.6	Interlocks system
6.1.A	Site general layout
6.2.S	Utility tunnels & site improvements
6.5	Liquid distribution
6.6	Gas distribution and compressors

## 21.2 Design Requirements

### 21.2.1 General

The requirements for the EPS building are derived from DRG1 and section 21.1.1, and identify the overall configuration and general conceptual design of the building. They are however, not complete as some equipment is still being designed.

#### 21.2.1.1 Systems, Components and Connections

The EPS building shall provide space for all systems, components and connections, as shown in Table 21(6.2.L) -2.

**Table 21 (6.2.L) -2 Systems, Components and Connections**

System	Remarks
Diesel generators	With necessary pipes and cables to supply emergency power to the site. Intake and exhaust systems, and water-to-air heat rejection system for the generators shall be located outdoors or on the roof. The additional oil tank should be located outdoors.
Transformers, converters, switchgears, control panels and batteries	To distribute the power supply.

#### 21.2.1.2 Seismic

The EPS building is not safety importance class (SIC), but shall withstand SL-2 seismic conditions with peak horizontal and vertical accelerations as specified in the PDS and shall meet functional requirements for seismic classification.

### 21.2.1.3 Structural

#### 21.2.1.3.1 Dead Loads and Equipment Load

The building shall support its own weight as well as the weight of all installed equipment.

#### 21.2.1.3.2 Live Loads

The building shall support the weight and forces of all movable and active components, systems, and structures located on the slabs or walls of the building.

#### 21.2.1.3.3 Internal Hazard Loads

The structure shall resist the explosion of hydrogen and combustible fuels.

#### 21.2.1.3.4 External Hazard Loads

The structure shall resist the force exerted by seismic activity, wind, snow and soil and ground water pressure, as defined in the PDS.

### 21.2.1.4 Testing

The EPS building shall be constructed to appropriate codes and standards, which shall include requirements for construction and commissioning testing of materials, welding, piping systems, electrical systems, and other active building components. In addition to construction-related inspection and testing, the EPS building shall be designed to accommodate functional testing of building support systems such as fire detection, alarm, and mitigation systems.

### 21.2.1.5 Electrical

#### 21.2.1.5.1 Lighting

The building shall be provided with appropriate permanently installed electrical lighting which shall include an emergency lighting circuit.

#### 21.2.1.5.2 Electrical Service

The buildings shall distribute low voltage power for services and welding to points within the buildings.

#### 21.2.1.5.3 Grounding

The building shall have an electrical grounding grid with connections to the plant-wide grounding grid network, and shall have robust grounding terminals at specified locations inside the building.

#### 21.2.1.5.4 Lightning Protection

The building shall have lightning protection systems with connection to specified grounding grid terminals.

#### 21.2.1.6 Potable Water and Drainage

The building shall provide potable water and drainage systems for lavatories and drinking fountains. The building shall have roof drains that connect to the yard drain system.

#### 21.2.1.7 HVAC

The building HVAC systems shall provide air quality (temperature, humidity, purity, freshness) sufficient to meet the requirements of the equipment and workers located in the building. Any rooms containing electric batteries will be equipped as necessary with dedicated systems to prevent the buildup of hydrogen or other flammable gases.

#### 21.2.1.8 Fire Protection

The EPS building shall provide fire detection, alarm, and mitigation systems commensurate with the occupancy and fire risk loading of the building.

#### 21.2.1.9 Internal Communication

The building shall provide an internal communication system, including distribution of telephone connections, a public address system, and appropriate warning systems (plant emergency, crane movement, fire, etc.). Telephone access points will be provided with noise shields where necessary.

#### 21.2.1.10 Access Control

The EPS building will not contain any radiological exposure hazards. However, it shall be provided with access control to prevent unauthorised entry to control centres and equipment halls, to prevent worker exposure to electrical and other hazards. Access control will be accomplished through the use of badges or other identification which must be inserted into readers to allow doors to be opened. The system will provide for automatic tracking of the individuals and total number of workers within each controlled space.

#### 21.2.1.11 Materials

##### 21.2.1.11.1 Structural

The building shall be constructed with structural steel and reinforced concrete as required in the codes specified in section 21.3.

##### 21.2.1.11.2 Electrical

All cables will be made with copper and should have appropriate insulation level according to the nominal voltage of equipment to be supplied. 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-332-3

**Table 21 (6.2.L) -3 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

#### 21.2.1.12 Cranes, Lifts and Material Handling

The building shall provide overhead bridge cranes in equipment halls where diesel generators are located. Cranes will be sized according to the largest objects to be moved during normal maintenance activities of the diesel systems.

#### 21.2.1.13 Instrumentation and Control

Building support systems which have actively controlled components shall comply with ITER plant standards for control and communication protocols, and shall provide appropriate interfaces to the CODAC system.

### 21.2.2 **Operation and Maintenance**

The operations and maintenance (O&M) requirements for the EPS building are derived from DRG1 and the functions of the building (as given in section 21.1.1).

#### 21.2.2.1 Operation and Control of Building Services

Building services shall incorporate appropriate instrumentation and control subsystems to manage system operation. Manual control over lighting, power distribution, and fluid supply is expected to be adequate. Manual control with safety interlocks will be provided for the crane. Building support systems with no safety or radiation control function (compressed air distribution, industrial drainage, grounding, etc.) will be equipped with appropriate instrumentation and control to operate in a stand-alone mode. Operation and control of these building support systems will be centralised in building control panels located within the building. Status of these building support systems will be provided to the CODAC system. However, the EPS building support systems will not be directly controlled from the main

control room.

Fire protection systems in the EPS building will be equipped with automatic controls with manual override capability. These systems will initiate alarms and signals, and will report status to the CODAC system, but these systems will not be controlled directly from the main control room.

#### 21.2.2.2 Maintenance of Building Services

There are no specific building system maintenance requirements apart from periodic inspection and repair or system correction during or after these inspection periods. Operation of most systems may be interrupted for maintenance activities. However, HVAC systems will include sufficient installed redundancy that at least 50% of normal service can be maintained while one unit is removed from service for maintenance.

#### 21.2.2.3 Maintenance of Structures

The buildings materials which may be degraded by corrosion shall have prevention and control measures which may be maintained over the life of the project including decommissioning and dismantling.

### 21.2.3 **Surveillance and In-Service Inspection**

There are no surveillance and in-service inspection requirements for the building apart from usual, annual, visual inspections of the building for noting the status of the overall condition, and for monitoring for any deterioration. In addition, there may be legal inspections for some of the building service equipment such as lifts, and the fire detection, alarm, and suppression systems.

### 21.2.4 **Quality Assurance (QA)**

The EPS building will meet all applicable QA requirements specified in the ITER QA manuals and procedures. The building shall be designed and constructed in accordance with American concrete institute (ACI) - 349 (or equivalent) and all the QA and inspections contained therein, plus any additional requirements specified by the ITER QA program.

### 21.2.5 **Reliability Assurance**

There are no special reliability assurance requirements for the EPS building structures. Building support systems shall be designed to meet all functional requirements with the lowest overall lifetime cost, including effects of unavailability and cost of maintenance and repair.

## 21.3 **Codes and Standards**

The EPS building will be built in accordance with the American concrete institute (ACI) - 349 code (or equivalent).