21 (6.2.K) Control Building

21.1 Functions, Basic Configuration, and Interfaces

21.1.1 Functions

The main functions of the control building are the following:
1) House and support the systems, and provide space
2) Provide a suitable environment for the system and personnel inside

21.1.1.1 House and Support the Systems, and Provide Space

The control building provides space for the systems located within the building. The control 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.

21.1.1.2 Provide a Suitable Environment

For a suitable environment for the systems, equipment, and workers, the following services are provided;
- 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 buildings, but there are some special features of the plant that generate some uncommon requirements:
- a very robust grounding system.
- an access control system

The other systems are as usually found in large industrial buildings.

21.1.2 Basic Configuration

The control building is a two-level structure including a basement. Systems that need large rooms are located on the grade level, the rest are located in the basement. The number of internal columns should be reduced to the minimum possible to create the useful space for operation. The main systems accommodated in the control building are the CODAC system, and the interlocks system, including all their constituent processors, monitors, etc.

Each system requires services, such as power supply (transformers, switchgear), cooling water, etc. Thus, cables have to be installed in the control building, to be connected to the site infrastructure.

The major systems to be installed in the control building are shown in the following table:

Table 21 (6.2.K) -1 Major Systems installed in the Control Building

CODAC system	Computer, Network, Operator Consoles, Annunciator Panels
Interlocks system	Computer, Network, Annunciator Panels
Electrical Equipment	Transformer, Switchgear,
	Class II Power Supplies, Cables

21.1.3 Interfaces

The buildings have interfaces with the following WBS elements:

WBS	Title
2.6.P	Chilled Water Systems
4.5	CODAC
4.6	Interlocks System
6.1.A	Site General Layout
6.2.S	Utility Tunnels & Site Improvements
6.5	Liquid Distribution, Including Water
6.6	Gas Distribution and Compressors

21.2 Specific System – Internal Requirements

21.2.1 Design

The requirements for the control building are derived from the section 21.1.1. The requirements are not complete as some equipment is still being designed and specified. However, this section identifies the major requirements for determining the overall configuration and general conceptual design of the building.

21.2.1.1 General

21.2.1.1.1 CODAC System

The building shall accommodate the CODAC system, including computer network, operator consoles, power supplies (including UPS capability).

21.2.1.1.2 Interlocks System

The building shall accommodate the interlocks system including its separate computer network, annunciator panels, and power supplies (including UPS capability).

21.2.1.1.3 Electrical Equipment

The building shall accommodate electrical equipment including transformers, switchgear, class II power supplies and cables.

21.2.1.1.4 Working Space

The building shall provide office space, meeting rooms, library, entrance lobby and so on.

21.2.1.2 Seismic

The control 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.

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 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 control building shall be constructed to appropriate codes and standards, which will include requirements for construction and commissioning testing of materials, welding, piping systems, electrical systems, and other building components. In addition to construction-related inspection and testing, the control building must be designed to accommodate functional testing of building support systems such as the lifts, and the 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 Services

The buildings shall distribute low voltage power for services to points within the buildings. This will include the class II power supplies to vital instrumentation and control equipment in the building.

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, kitchen facilities, 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 workers and equipment located in the building.

21.2.1.8 Fire Protection

The control 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 Communications

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

21.2.1.10 Access Control

The control building will not contain any radiological exposure hazards. However, it shall provide access control to prevent unauthorised entry to control rooms and equipment areas, 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.K) -2 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 Lifts and Materials Handling

One central lift shall be provided to accommodate 10-12 personnel, and to be used for carrying office and miscellaneous supplies and components from one floor to another.

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 control building are derived from the functions of the building (see 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 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 stand-alone mode. Operation and control of these building systems will be centralised in building control panels located within the building. Status of these building systems will be provided to the CODAC system. However, the control of building systems will not be directly controlled from the main control room.

The fire protection system in the control building will be equipped with automatic controls with manual override capability. These systems will initiate alarms and signals and will report the status to the CODAC system. However, 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.

21.2.2.3 Specific Maintenance for 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 mitigation systems.

21.2.4 Quality Assurance (QA)

The control building will meet all applicable QA requirements specified in the ITER QA manual and procedures. The building shall be designed and constructed in accordance with American concrete institute ACI - 349 (or equivalent) and all the QA, quality control, 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 control 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 control building will be built in accordance with the American concrete institute (ACI) - 349 code (or equivalent).