21 (6.2.H) Laboratory Office Building

21.1 Functions, Basic Configuration, and Interfaces

21.1.1 Functions

The primary functions performed by the building are to house, support, protect, provide a suitable environment, to provide and control access to the materials, equipment and processes which are located inside the building, and to provide working space and environment for ITER scientists, engineers, administrators and support personnel. There are no experimental laboratories in the building. The building provides some general services such as lighting, power, and fluids and is linked to other parts of the ITER site through communications computer networks.

21.1.2 Basic Configuration

The laboratory office building is a five-level structure with an appendage to house an auditorium which provides the space for conferences and symposia. Ground floor building amenities include a lobby and display area at the building entrance, cafeteria and kitchen facilities, locker and exercise area, computer room, library, conference rooms, an auditorium and various areas to house building support personnel and equipment. Floors 2 though 4 provide staff offices, workstations (cubicles), and conference rooms. HVAC and elevator equipment are located on the roof. The building provides some general services such as lighting, power, HVAC, fluids and linked to other parts of the ITER site through communications networks.

The below-grade structure, which is built from cast-in-place reinforced concrete, extends from -1 m (top of auditorium slab) to grade. The above-grade structures use structural steel framing. The building has floor levels at grade, + 3.60 m, + 7.20 m, + 10.80 m, + 14.40 m, and a roof level at + 18.00 m. Two roof-top structures are provided to house HVAC and elevator equipment. The foundation of the building is set below grade so that the finished grade floor level matches the paved grade level at the entrances to the building.

The laboratory office building will be located outside of the ITER high security fence.

21.1.3 Interfaces

The laboratory office building has interfaces with the following WBS elements:

WBS	Title
4.3.C	Steady State Electrical Power Distribution
4.5	CODAC
6.1.A	Site General Layout
6.2.S	Utility Tunnels & Site Improvements
6.5.C	Potable & Fire Water
6.5.D	Sewage (Sanitary & Industrial)

21.2 Requirements

21.2.1 General

The requirements for the laboratory office building are derived from the functions of the building. The requirements identified below are not a complete list because equipment designers continue to provide new interface information. However, the following requirements control the overall configuration and general design concept of the building.

21.2.1.1 Accommodate Personnel, Equipment and Materials

The building shall provide support and space for the laboratory office facilities. It also provides space for maintenance and access. The building bears the loads caused by laboratory office facilities such as dead-weight loads. The building also shall bear the loads caused by installing and transporting components.

21.2.1.2 Protect Materials, Equipment, and Personnel from External Hazards

The building shall provide resistance for anticipated wind, snow, and other environmental loads. The building also shall resist seismic loads, consistent with protection of health and safety of workers (UBC requirements - see 21.2.1.8, below).

21.2.1.3 Provide Required Building Services

The building shall provide building services such as lighting, HVAC, potable water, drainage, communications networks, low voltage electrical service and fire protection. It shall also provide systems including access control, and communications. Requirements for each of these are described below.

21.2.1.4 Provide Heating, Ventilation, and Air Conditioning

The building shall provide air quality sufficient to meet the requirements set by the systems and functions located within the building. All of these systems and functions are non-safety importance class (non-SIC), therefore these requirements can be met by using conventional HVAC system equipment. The building must provide space for an HVAC system and other building services.

21.2.1.5 Working Space and Amenities

The building shall consist of office space, entrance lobby, computer network room, meeting rooms, library, auditorium and amenities for an occupancy of 300 people.

21.2.1.6 Access, Maintenance and Parts Storage Space

The building shall provide space for normal maintenance, materials handling equipment and storage appropriate for a technical office building. The building shall provide good access to all equipment within the building and large aisles and doors for the transport of large objects.

21.2.1.7 Landscaping

The building shall be provided with appropriate landscaping for erosion control and a pleasant environment.

21.2.1.8 Seismic

The lab office building shall be non-SIC and shall withstand SL-0 seismic conditions with peak horizontal and vertical accelerations as specified in the PDS, or UBC and industrial health and safety requirements, which provide for a minimum of 0.05 g horizontal seismic force.

21.2.1.9 Structural

21.2.1.9.1 Components supported by the Building Structure

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

21.2.1.9.2 Live Loads supported by the Slabs

The structure shall support the weight and forces of all movable and active equipment, systems, and structures located on the slabs.

21.2.1.9.3 Wind Loads

The building shall withstand horizontal wind conditions of up to 140 km/h defined at 10 m above grade.

21.2.1.9.4 Snow Loads

The building shall withstand snow loading conditions of up to 300 kg/m^2.

21.2.1.10 Electrical

21.2.1.10.1 Building Lighting Service

The building shall provide appropriate permanently installed normal and emergency electrical lighting.

21.2.1.10.2 Building Electrical Service

The building shall provide low-voltage (~ 100 - 230 V and ~ 400 V welding power) electrical service to all areas of the building where needs for this service are anticipated.

21.2.1.10.3 Grounding/Insulation/Lightning Protection

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

21.2.1.10.4 Lightning Protection System

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

21.2.1.11 Potable Water and Drainage

The building shall provide potable water and sanitary drainage systems for lavatories, shower, drinking fountains and kitchen facilities.

21.2.1.12 HVAC Systems

The building HVAC system shall consist of two redundant air handling trains with distribution ducts to partitioned offices and other rooms. The system will recirculate air within the building to provide two to three air changes per hour. The recirculated air will be heated or cooled to maintain an appropriate temperature. Fresh air taken through a roof level inlet will be added to the building at a flow rate, which is about 30% of the total air recirculation rate. Fresh air will be filtered to remove particulate, and heated or cooled to match the building temperature. The HVAC system will keep the building generally at a positive relative pressure. The redundant system allows for partial operation during maintenance activities.

21.2.1.13 Fire Protection

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

21.2.1.14 Internal Communication

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

21.2.1.15 Access Control

There is no special provisions for access control for the laboratory office building. The building lobby will be freely accessible to persons, once they have passed the host site access control point, but a reception desk at the lobby will provide a level of access control. The laboratory office building will not contain any safety-related systems or equipment, or any radiological exposure hazards.

21.2.1.16 Materials

21.2.1.16.1 Structural

There are no special requirements for construction materials. The building foundation will be a cast-in-place reinforced concrete mat, locally thickened to provide stiffness and point load bearing, and the superstructure will be prefabricated structural steel. Siding and roofing will be metallic, with integral insulation where appropriate.

21.2.1.16.2 Electrical

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-332-3

Table 21 (6.2.H) -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

21.2.1.17 Cranes, Lifts and Transportation

The building shall provide two elevator shafts for passengers and office equipment.

21.2.1.18 Instrumentation and Control

Building support systems, including HVAC and any other subsystems 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 (O&M)

The O&M requirements for the laboratory office building are derived from the systems which occupy the building, and from the functions of the building.

21.2.2.1 Operation and Control of Building Services

Building service systems shall incorporate instrumentation and control to manage system operation. Manual control over lighting, power distribution, large doors, and fluid supply is expected to be adequate. Automatic controls with manual override capability will be installed for the operation of HVAC and fire detection, alarm, and suppression systems. Operation and control of building systems will be centralised in building control panels located within the building. Status of building systems will be provided to the CODAC system. However, no building system will be directly controlled from the ITER main control room.

21.2.2.2 Maintenance of Building Services

The building system maintenance requirements are those usual for a large office building. Operation of most systems will 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.

21.2.3 Surveillance and In-Service Inspection

21.2.3.1 General

There are no surveillance and in-service inspection requirements for the laboratory office 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.

21.2.3.2 Corrosion Protection and Control

The laboratory office building will be painted and provided with passive corrosion protection features (galvanising) where appropriate to assure that the design life of the structure is at least 30 years, the expected combination of ITER construction and operating periods.

21.2.4 Quality Assurance (QA)

There are no quality assurance requirements for the laboratory office building beyond those established by the uniform building code (or equivalent).

21.2.5 Reliability Assurance

There are no special reliability assurance requirements for the laboratory office building structure. 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. HVAC components and equipment shall be designed, procured, and installed in accordance with industrial codes and standards. No additional reliability assurance requirements are applied.

21.3 Codes and Standards

The laboratory office building shall be designed in accordance with the 1994 uniform building code (or equivalent). Good engineering practice, as expressed in the "Ninth Edition of the American Institute of Steel Construction (AISC) Manual of Steel Construction", shall also be employed.