

# DESIGN CRITERIA AND STANDARDS

Civil DCS  
Electrical Rooms

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## 1 Introduction

- a) This document is the Design Criteria and Standard for the design and construction of Electrical Rooms.
- b) The requirements in the Particular Design Criteria and Standards overrule the general requirements of the Design Criteria and Standards, in case of discrepancies.

## 2 Definitions

The following words and expressions shall have the meanings hereby assigned to them:

Term	Explanation
Contractor	Means the entity named as contractor or Seller in the main contract.
Employer	Means the entity named as employer or Buyer in the main contract.
DCS	Or “ <b>Design Criteria and Standards</b> ” means the documents as referred to in Annex 5 or the Employer requirements hereof, and including any specifications and other Employer requirements in respect of the Works to be carried out by the Contractor, if any, and any Variation to such document.
PDCS	Or “ <b>Particular Design Criteria and Standards</b> ” means the documents as referred to in Annex 4 or the Employer requirements hereof, and including any specifications and other Employer requirements in respect of the Works to be carried out by the Contractor, if any, and any Variation to such document.
Site	Means the location as identified in the main contract where the Permanent Works are to be delivered or executed.
Works	Means all the work and design to be performed by the Contractor including temporary work and any Variation as specified in the Contract and the Employers Requirements.

**Table 1: Definitions**

## 3 Codes and Standards

- a) The design, manufacturing, provisions, installation and construction of all works, shall conform to the local Codes and Standards of the country of the works and shall conform to the Codes and Standards mentioned in the DCS.
- b) The design and construction of the Works shall be carried out in accordance with the regulations and requirements of all relevant legal authorities.

- c) If there is any specification in this document which is against local or European Codes and Standards, the Contractor shall provide to the Employer for approval a similar solution which is in line with local and Standards.

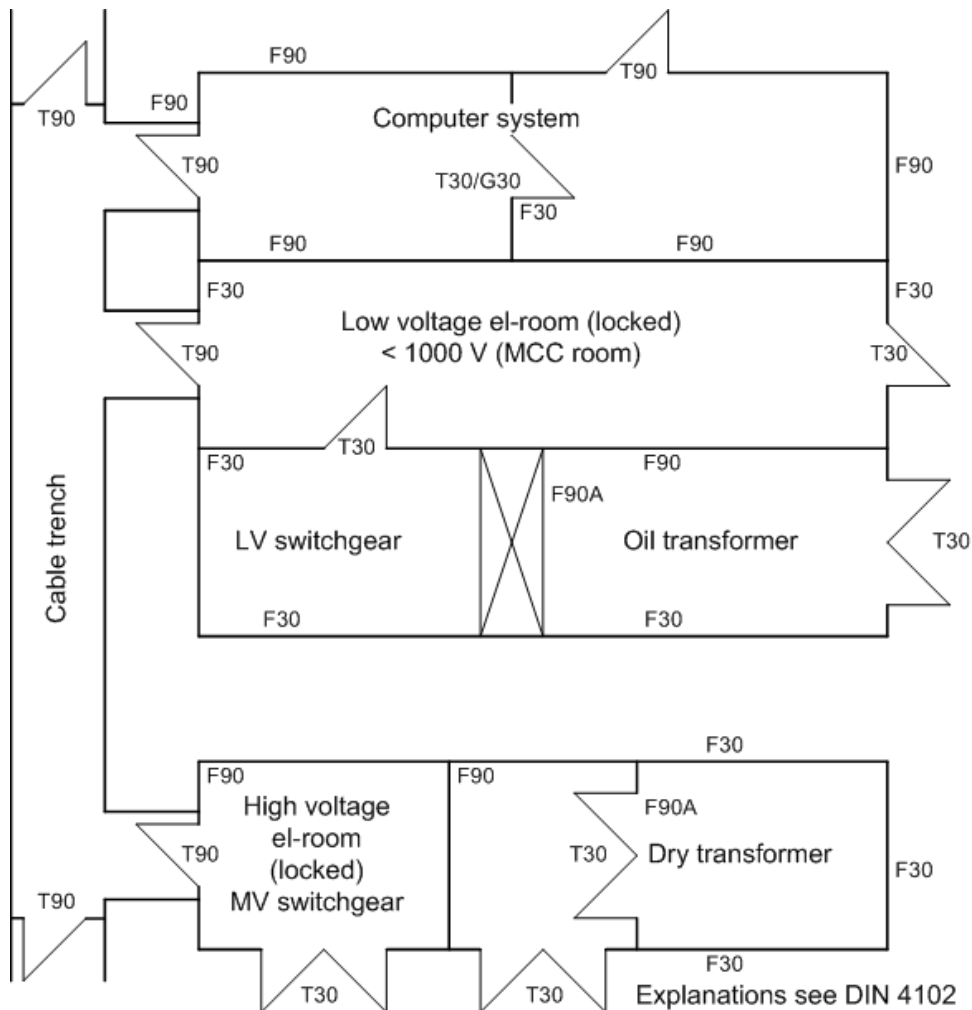
## **4 Basic Requirements**

- a) The electrical rooms shall be as close as possible to the corresponding consumers.
- b) The room shall be dust proof.
- c) The doors shall provide sealing against dust. All cable entrance to the room shall be sealed against dust.
- d) The temperature inside the room has to be maintained between 5 and 30 °C in all conditions.
- e) Rooms shall be equipped with over pressure ventilation with long life filter devices and air-conditioned. It is recommended to directly vent waste heat air from large frequency converters. For this application, the ventilation system must be powerful enough to keep the positive pressure in the room.
- f) All inside walls shall be painted with white coating to gain maximum reflection of lighting.
- g) All electrical rooms within the plant shall be clearly marked according to the general tag-name specification.
- h) All electric rooms shall be sized for 25% reserve space. The room layout must be approved by the Employer.
- i) Double floors shall be used in all electric rooms.
- j) The floor shall be of not conductive material or rubber mats must be laid around all electrical cabinets.
- k) The floor shall be built to carry the weight of all equipment plus any other miscellaneous loadings and provide enough space for bending of all trays and conduits entering or exiting the electric room.
- l) Cable connections to the cabinets shall be generally come up from the bottom.
- m) A concrete type floor may be used together with the cable room underneath with the approval of the Employer. In this case the cable room shall be at least 2 m high.
- n) There shall be a sufficient number of fire protection detectors in each e-room. All entry and exit points in the electric room shall be fire proof. The fire detection device of the Contractor must be connected to the fire detection system of the plant.
- o) All safety equipment as there are voltage testers, earthing lines, warning plates etc. must be supplied by the Contractor according to the national Codes and Standards.

## **5 Specific Requirements**

### **5.1 Fire Protection**

- a) Electrical rooms shall be equipped with automatic early-warning fire-detection systems, which have to be connected to a central alarm unit. The fire risk has to be reduced to a minimum.
- a) The degree of fire protection of walls and access doors to electrical rooms is shown in the figure 1.



**Figure 1**

## 5.2 Doors

- a) Doors for all electrical rooms must be fireproof for 90 minutes and will be provided with a panic door-opening system for escape from inside to outside.
- b) Doors for all electrical rooms must be dustproof.
- c) The electrical room shall be provided with two escape doors. The doors must be equipped with panic exit push bar.
- d) The following features must apply to access doors leading to "locked electrical rooms":
  1. They have to open outwards
  2. Door locks have both to prevent unauthorized persons from entering the rooms
  3. Allow persons inside the room to leave it quickly in an emergency.

- e) These requirements are met if the access doors can only be opened from the outside using a special key for cylinder or single-tumbler locks and can be easily opened from inside using a door handle or a similar simple device without a key (panic lock).
- f) Doors between separate rooms within a “locked electrical room” do not have to be equipped with a lock.
- g) Exits are to be laid out in such a way that the escape route length within the room does not exceed 25 m.
- h) Plaster in-fill is to be used for the door frames (do not fill with foam!)

### **5.3 Walls and Ceilings**

- a) Construction materials for separation walls, paneling and housings have to meet the requirements of construction category B1 according to DIN 4102 (combustion characteristics) at least.
- b) When placing sealant into wall and ceiling openings, fire protective mortar or special fire protection materials shall be used. As an exception, fiber silicate, mineral fibers, or sand can be applied as well.
- c) The hollow spaces between the separate cables and / or wires shall be closed off. This can be done by loosening up the bundle or by installing the cables and wires separately. The sealant has to be placed in such a way as to allow an easy extension at later date without damaging the cables and wires that are already installed.
- d) If conductor rail systems are led through wall and ceiling breakthroughs, the openings have to be closed in such a way that the required duration of fire resistance of the walls and ceilings is not reduced.

### **5.4 Cable Channel and Sealing**

Cable channels that run below fireproof walls or complex partitioning walls are to be sealed in such a way that the required duration of fire resistance of the walls is not reduced.

### **5.5 Double Floors**

- a) The electric room floor, including trenches, conduits, etc. is to be formed in accordance with the positions and detail drawings and specifications.
- b) The floor is to be designed to be capable of carrying the loads of the substation equipment.
- c) The floor must have a level steel troweled finish.
- d) If the floor is laid on natural or filled ground an appropriate waterproofing membrane is to be placed between the underside of the substation floor and the ground.
- e) Provision is to be incorporated in the floor slab if required for eyes/anchors.
- f) The transformer loading area is to be constructed of reinforced concrete and must have the same load bearing characteristics as the substation floor. The landing area must have a slight slope such that water flows away from the doors and it must be at the same relative level as the substation floor to allow equipment to be rolled into the substation directly from the landing area.
- g) Double floor design and frame sizes shall be:

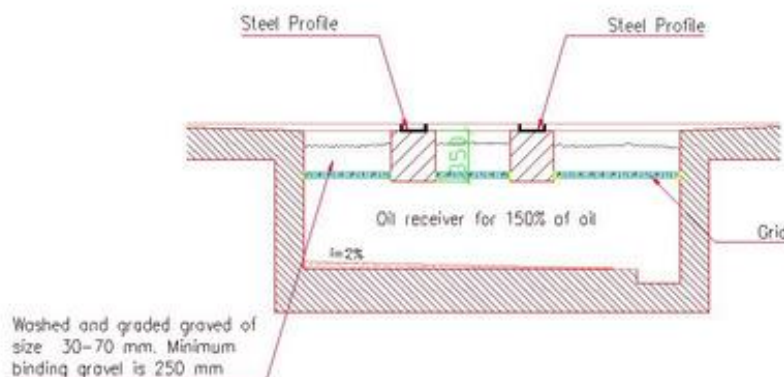
1. construction height min 500 mm
2. grid for cabinets 1200 x 600 mm<sup>2</sup>
3. load capacity minimum 15 kN/m<sup>2</sup>
4. conductive connection of the grid

h) Cover plates based on DIN 4102 shall be:

1. bottom side is covered by Alumina plates
2. top side is antistatic and non-slip
3. Plate size 600 x 600 mm<sup>2</sup>
4. Plate thickness 40 mm
5. Lifting tool

## 5.6 Oil Containment

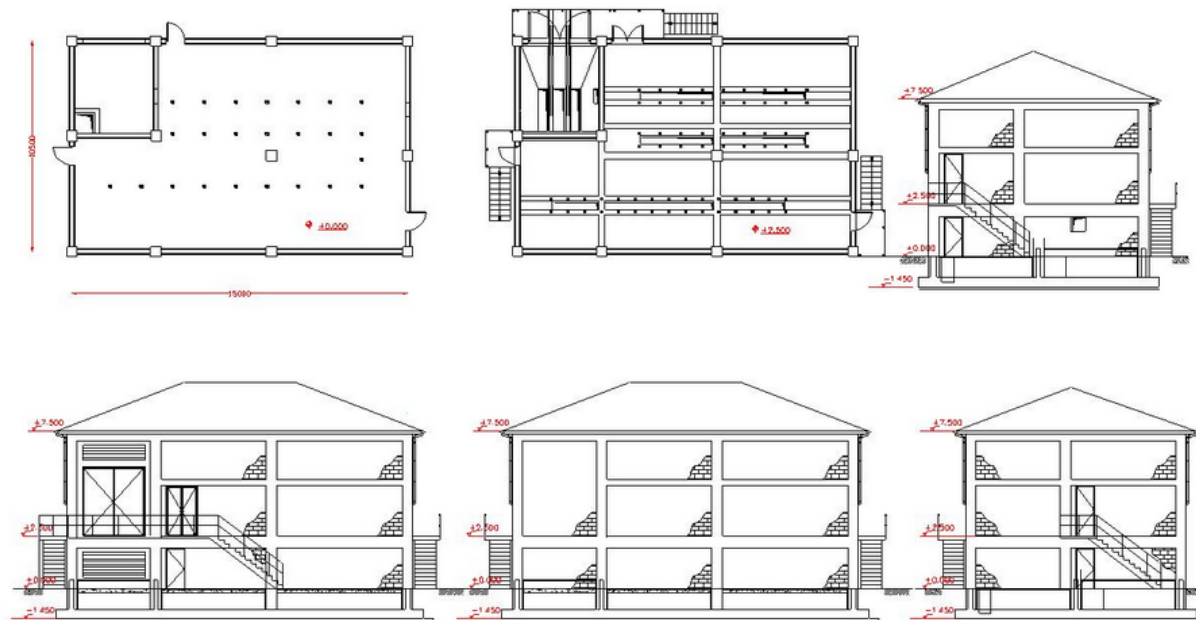
- a) For rooms equipped with oil filled transformers, provision shall be made within the electrical room to contain any oil spillage (in the unlikely event of a transformer tank failure) and slope to a sump pit. Spillage from transformers needs to be contained within the substation and be 150% of oil volume.
- b) This is usually achieved by draining any oil spillage into the trench. In order to prevent any flow out through the conduits and into the surrounding storm water system the lower edge of the conduits shall be a minimum of 100 mm above the trench floor.
- c) This is the minimum requirement. In some regions, due to local regulations, precautions such as an oil trap may be required.
- d) Oil receiver for transformers shall have the following requirements:
  1. Design, sealing, steel girders and aggregate filling shall be according to Local Requirements.
  2. The concrete shall be coated oil proof. No cable trough shall be provided within the pit.
  3. Natural venting shall be provided; grates shall prevent birds of entering.
  4. A typical design is shown in drawing below.



**Figure 2: Oil containment example**

## 6 Typical Building

- a) Transformer and power distribution panels are installed on the ground floor. Motor control cabinets are located in the second floor. Access doors, openings for cabinets and lifting facilities have to be foreseen.
- b) The following figure shows a typical electrical building.



**Figure 3**

- c) The internal minimum height is 2800mm from the top of the false floor to the bottom of the ceiling.
- d) Windows are not allowed in Electrical Rooms