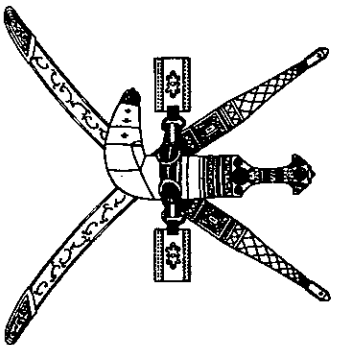


SULTANATE OF OMAN
MINISTRY OF ELECTRICITY AND WATER



STANDARD - OES 30
3MVA/6MVA 33/11KV OUTDOOR SUBSTATION

FIRST EDITION - MAY 1991

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD OES-30
3MVVA/6MVVA 33/11KV OUTDOOR SUBSTATION

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SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER
STANDARD OES-30
3MV/6MV/11KV OUTDOOR SUBSTATION

1.0 GENERAL

The 3/6MV/11KV Outdoor substation shall generally be as per the layout Drawing No. MEW/OH-GA/32.

All equipment installed shall conform to General Requirements for all Electrical Materials and Equipment OES-11 and to the specifications given below.

2.0 STEEL STRUCTURES

All steel structures for gantry supporting isolators, insulators, lightning arrestors, busbars and other equipment and fittings generally shall conform to sizes mentioned in the drawing.

Structures shall be rigid and self bracing against all dead, wind, pull-off and other applied loads whenever such an arrangement can be adopted; structures shall be braced by horizontal beams at intermediate or high level to provide an integrated frame work such that all bending moments shall be distributed in the structures with zero over turning moments at ground level. Structures shall be provided with generously designed base plate footings for securing with holding bolts to the foundation base.

The whole of the rolled steel sections, tubes, flats, plates, bolts, nuts and bars shall employ weldable structural steel of an approved quality to BS 4360 grades 43-A and 50-C or equivalent.

Steel sections forming structures shall be galvanized to BS 729 in accordance with Clause 0.04d OES-11 minimum thickness 127 microns.

Bolts and nuts shall be galvanized and fitted with galvanized springer washers. Taper washers are to be added where necessary. Threads of bolts shall be spun galvanized and the threads of nuts shall be oiled. No bolt shall be of less diameter than 7 mm.

Bolt holes shall not be more than 1.5 mm larger in diameter than the corresponding bolt diameter.

All members of structures shall be cut of Jig and holes shall be drilled or punched to jig. Parts shall be carefully cut and holes accurately aligned before being bolted up. Drifting of holes will not be permitted.

3.0 FOUNDATION

Foundation of all steel structures and transformer base shall be concrete. Foundation for structures shall be provided with foundation bolts.

The foundation bolts shall conform to the approved standard.

The projecting part of foundation bolts and the length within 300mm of concrete shall be protected from corrosion by hot-dip galvanizing or by painting accordingly to the General Mechanical Requirement.

The tolerance for foundation bolt group and plinth spacing must be inserted on the construction drawings to fit holes in base plates for supporting structures.

4.0 INSULATORS

Insulators used for supporting bus bars and isolators shall be of porcelain and station post type in accordance with IEC 273/BS 3297.

Porcelain shall be sound, free from defects and thoroughly vitrified.

Glaze shall be smooth, hard of a uniform shade of brown chocolate and shall completely cover all exposed parts of the insulators. Insulator fitting shall remain unaffected by atmospheric conditions producing weathering, acids, alkalis, dust and rapid changes in temperature that may be experienced under working conditions.

Insulators shall be secured in an approved manner; preferably by means of bolts or metal clamping plates.

The creepage distance shall not be less than 40mm/KV or system voltage.

The sheds of insulators shall be self cleaning aerodynamic open profile type.

The minimum cantilever strength shall be : 12.5 KN The height shall be :

5.0 BUS BARS AND BUSBAR CONNECTIONS

The busbar shall be of tubular type and made of tinned copper of high conductivity, 50mm dia and thickness 8SWG suitable for 400A continuous rating at Oman conditions and conform to BS 159. Design calculations shall be submitted for approval to confirm the following:

- a) Short circuit withstand capacity
- b) Continuous current carrying capability
- c) Bending stress withstand capability under normal and under short circuit conditions
- d) Deflection of the busbar at the longest span
- e) Frequency of vibrations
- f) Wind oscillations

Busbars shall have indelible phase marking, Red, Yellow and Blue.

All joints and connections from busbars shall be designed to withstand a short circuit on the busbars. All joints and connections from the busbars shall be suitable for rated continuous and short time current.

Busbar assemblies shall be suitable to withstand the combined effects of electromagnetic and mechanical forces, thermal loadings, structural and vibrational stresses brought out by any realistic combinations of seismic, climatic, short circuit and normal electrical loadings.

Adequate provision shall be made for thermal expansion and contraction of the busbars and all associated components.

The design of connectors from busbars and circuit connections shall permit easy dismantling for maintenance purpose.

Where dis-similar metals are connected, approved bimetallic joints shall be provided. Joint surfaces of copper or copper alloy shall be tinned.

6.0 LIGHTNING ARRESTORS

Lightning arrestors shall be station type and generally in accordance with OES-9 and 10. They shall be mounted generally as shown in layout drawing.

7.0 33KV/11KV, 3MVA/6MVA TRANSFORMERS

33KV/11KV, 3MVA/6MVA transformers shall generally conform to OES-6. Specification for 33/11KV transformers.

8.0 CAPACITOR BANKS (2 X 1MVAR OR 4 X 1MVAR)

Each unit in capacitor bank shall be 1MVar outdoor type and shall be suitable for site conditions as mentioned in OES-11 General Requirement of Electrical Materials and Equipment. Each bank is built from 1MVar capacitor units connected in parallel to give rating of 2MVar for 3MVA or 4MV Ar for 6MVA substation respectively.

The capacitors shall be designed to BS 165 – or IEC 70 and shall be suitable for outdoor installation under climatic condition and system characteristics mentioned in OES-11.

The capacitors shall be housed in steel casings which shall be suitably treated and protected against corrosion. The degree of protection shall be not less than IP55.

The creepage of all outdoor bushing and insulators shall be 40mm/KV of system voltage.

The equipment shall be complete with all necessary galvanized steel supporting structures with minimum ground clearance of 3.6 meters from live metal parts and all necessary earthing.

The shunt capacitor shall be rated for normal supply voltage of 11.5KV at 33/11KV substation.

The capacitors shall be protected by suitable line HRC fuses and shall have built-in reactors to protect the units from inrush currents during switching.

Each capacitor element shall have internal fuse and built in discharge resistor.

9.0 AUTO REclosERS

11KV auto reclosers shall be provided as shown in the layout drawing. They shall generally conform to OES-20.

10.0 ISOLATORS (33KV AND 11KV)

The equipment shall in general comply with MEFW Standard OES-11.

33KV and 11KV triple pole spring opening, on-load disconnect outdoor type shall be complete with galvanized steel support structure.

The equipment shall comprise the following:

a) Three phase outdoor, horizontal, rotating disconnect with technical feature as follows:

	33KV	11KV
– Current rating	400 A (site)	400 A
– Impulse withstand	170 KV	75 KV
– Creepage of Insulators	1320 mm	440
– Phase centers	1200 mm	1050
– Load breaking capacity with interrupter head wiring	400 A at 0.7 P.F.	
– Contacts tipped with copper/lungsten:		
– Long life, fire resistant, horn fibre, borne lining:		
– Arc extinguishing contact follower:		
– Large volume exhaust muffler		
– On load switching	400 Amps 0.7 P.F.	
– Off load switching	30 Amps 0.15 P.F.	
– Short circuit rating	25 KA for 3 Secs.	18.4 KA for 3 Secs.
– For use on system with highest voltage of 36/12.5 KV continuously.		
– Operating rod to include well treated wood insulator inserted at 2.8 meters from ground level.		
– Insulators shall have open aerofoil profile, sheds, spring opening and manual closing operating mechanism housed in galvanized weather proof cabinet to include		
– Handle for manual closing the disconnect with provision for pad locking		

b) Galvanized steel structure for mounting the disconnect and operating mechanism cabinet.

- Mounting height of disconnect : 3.5 meters above foundation level
- Mounting height of operating mechanism cabinet : 1.2 meters above foundation level

11.0 EARTHING

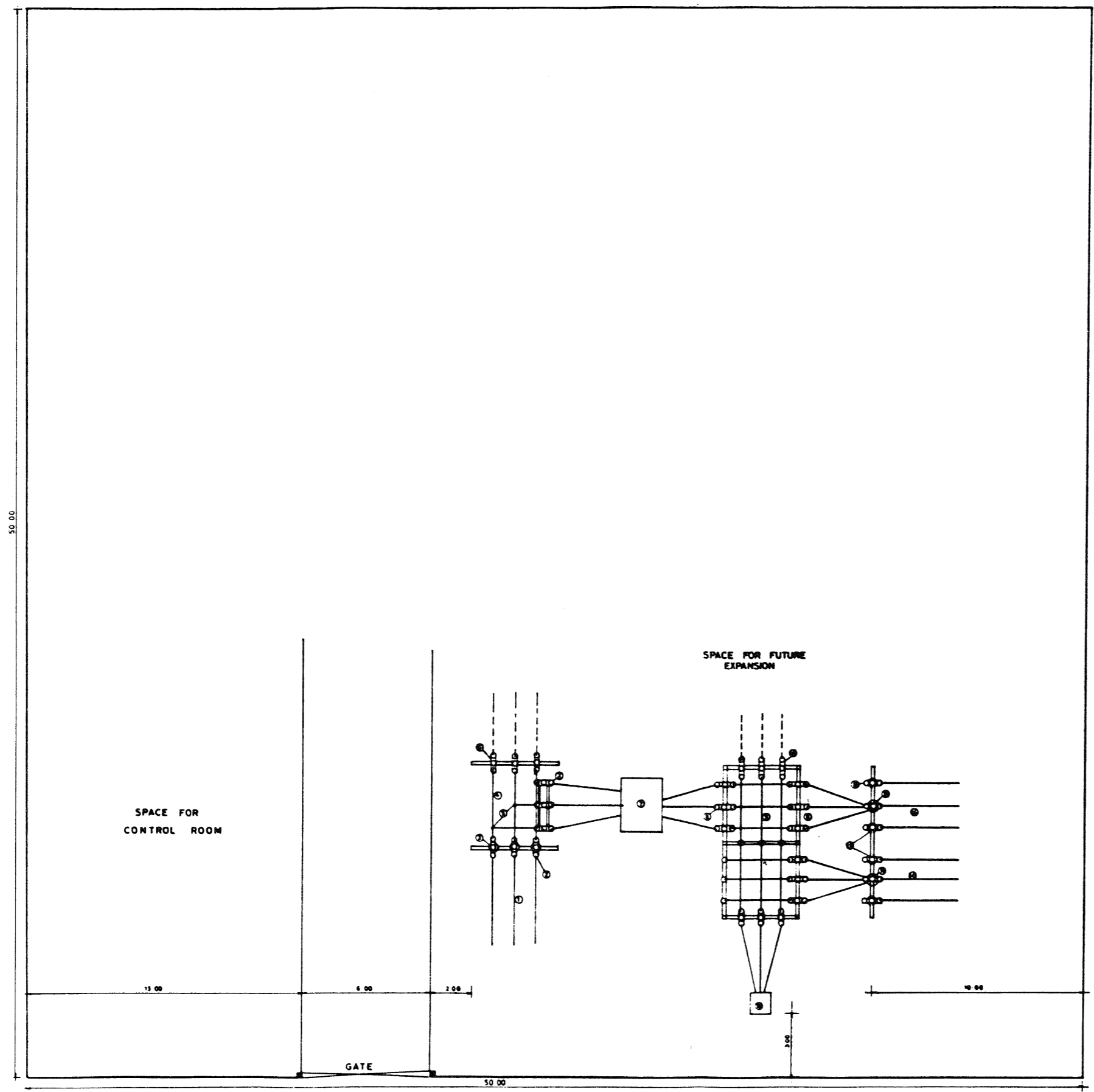
Earthing of equipment, steel structures shall be carried out as per earthing layout Drawing No. MEW/OH-GA/31.

The structure and equipment earthing shall comprise four earth pits with copper earth rod sets 16 sq.mm at the four corners of the switchyard inter-connected with tinned copper straps (200 sq.mm) to form a ring and 150 sq.mm copper strap branch connections to the structure and equipment earthing points.

Lightning arrestors to be connected to separate pit and bonded to main station earth.

Inspection pits with covers shall be provided for the earth rod sets.

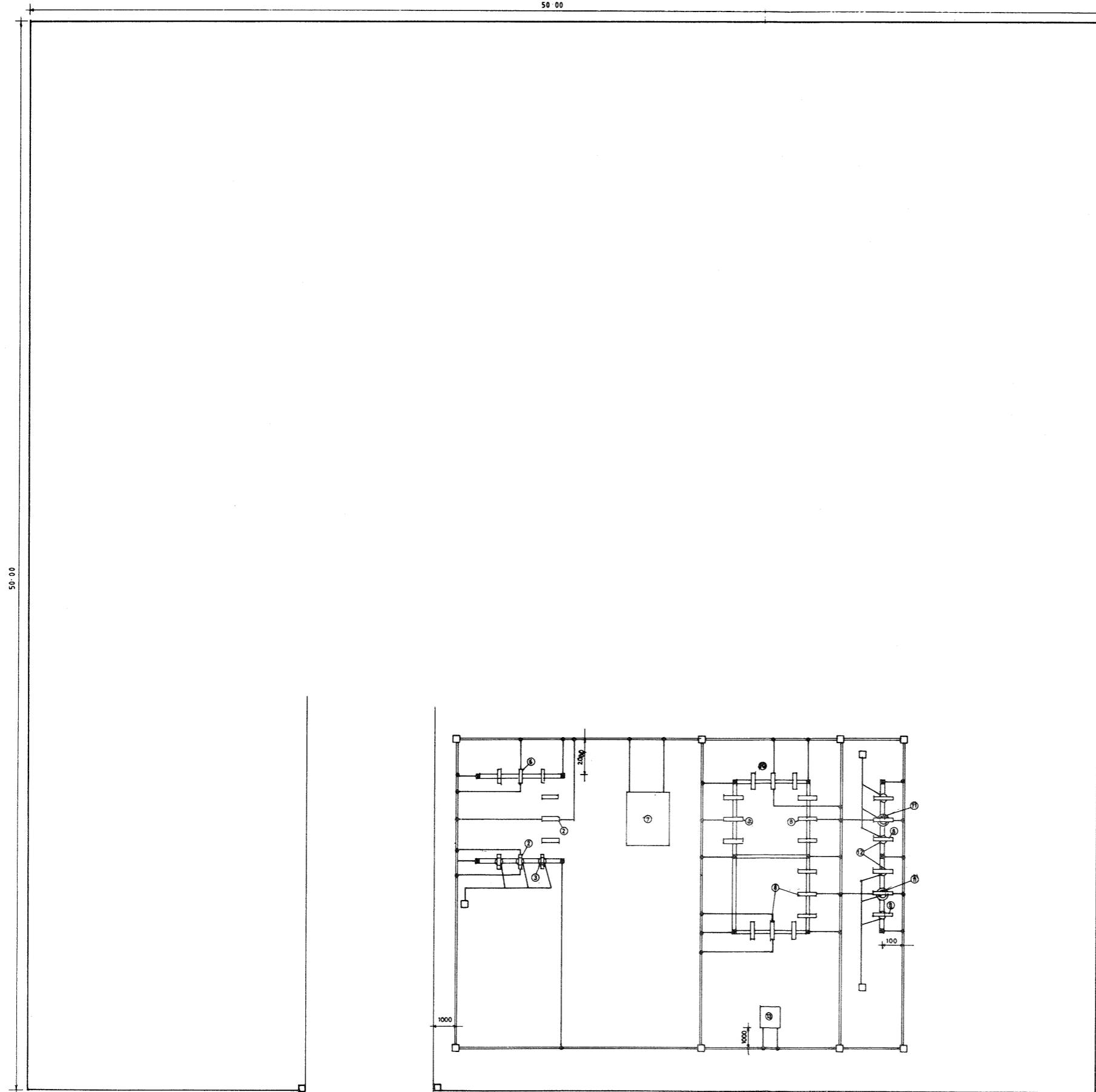
The station earth value shall not exceed one Ohm.



LEGEND

- 1 33 KV INCOMING FEEDER
- 2 33 KV ISOLATOR
- 3 33 KV LIGHTNING ARRESTOR
- 4 33 KV BUS BAR
- 5 33 KV BUS SUPPORTING INSULATOR
- 6 33 KV BUS COUPLER
- 7 33/11 KV TRANSFORMER
- 8 11 KV ISOLATOR
- 9 11 KV BUS BAR
- 10 11 KV BUS COUPLER
- 11 11 KV AUTO RECLOSER
- 12 11 KV LIGHTNING ARRESTOR
- 13 11 KV CAPACITOR BANK
- 14 11 KV OUT GOING FEEDER

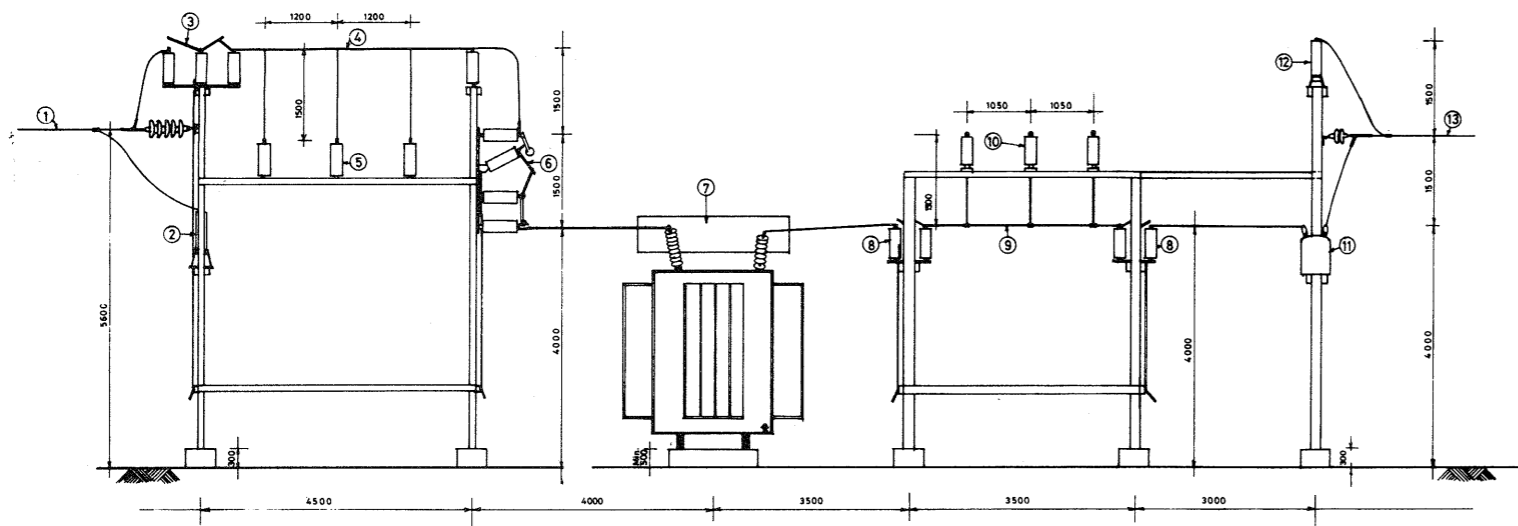
SULTANATE OF OMAN MINISTRY OF ELECTRICITY AND WATER		
33/11KV, 3/6 MVA OUT DOOR SUBSTATION		
GENERAL LAYOUT PLAN		
DRAWN FRANCIS	CHECKED	APPROVED
DRAWING NO: MEW / OM.GA / 29-		
SCALE : 1 : 100	DATE 08-07-1989	



- 1 33 KV INCOMING FEEDER
- 2 33 KV ISOLATOR
- 3 33 KV LIGHTNING ARRESTOR
- 4 33 KV BUSBAR
- 5 33 KV BUS SUPPORT INSULATOR
- 6 33 KV BUS COUPLER
- 7 33 / 11 KV TRANSFORMER
- 8 11 KV ISOLATOR
- 9 11 KV BUS BAR
- 10 11 KV BUS COUPLER
- 11 11 KV AUTO RECLOSER
- 12 11 KV LIGHTNING ARRESTOR

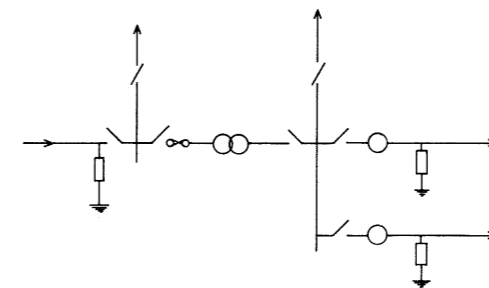
- EARTH PIT
- COPPER STRIP 50x6mm
- INSULATED COPPER WIRE 70mm²

SULTANATE OF OMAN MINISTRY OF ELECTRICITY AND WATER		
33 / 11 KV 3 / 6 MVA OUT DOOR SUBSTATION		
EARTHING LAYOUT		
DRAWN FRANCIS.	CHECKED	APPROVED
DRAWING NO: MEW / OH- GA / 31		
SCALE : 1 : 100	DATE : 09 - 07 - 1989	

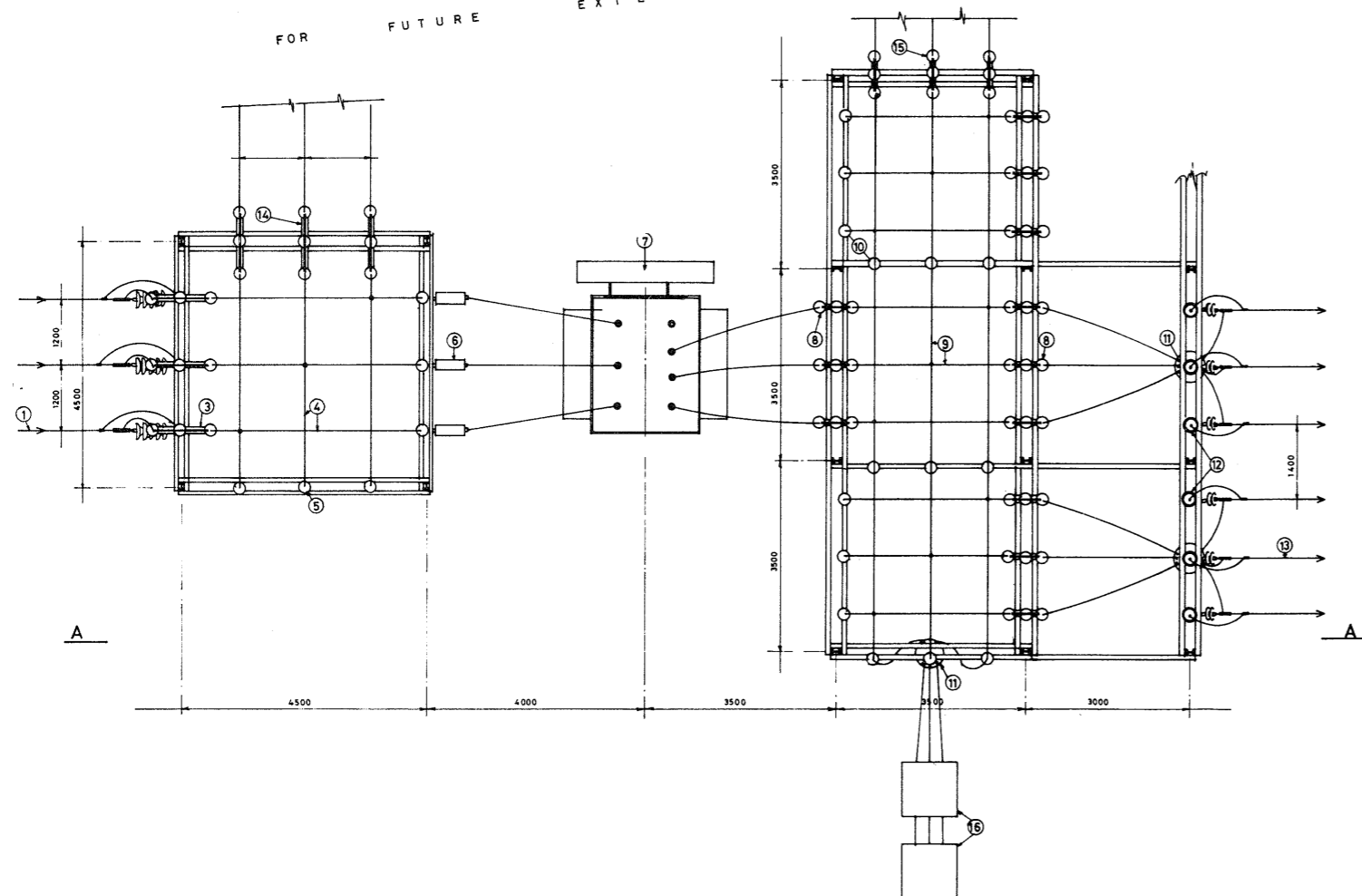


VIEW - AA

SINGLE LINE DIAGRAM



FOR FUTURE EXTENSION



LEGEND

- ① 33 Kv INCOMING LINE
- ② 33 Kv LIGHTNING ARRESTOR
- ③ 33 Kv ISOLATOR
- ④ 33 Kv TUBULAR COPPER BUS BAR
- ⑤ 33 Kv BUS SUPPORTING INSULATOR
- ⑥ 33 Kv ISOLATOR WITH FUSE
- ⑦ 33 Kv / 11 Kv TRANSFORMER
- ⑧ 11 Kv ISOLATOR
- ⑨ 11 Kv TUBULAR COPPER BUS BAR
- ⑩ 11 Kv BUS SUPPORTING INSULATOR
- ⑪ 11 Kv AUTO RECLOSER
- ⑫ 11 Kv LIGHTNING ARRESTOR
- ⑬ 11 Kv OUT GOING LINE
- ⑭ 33 Kv BUS COUPLER
- ⑮ 11 Kv BUS COUPLER
- ⑯ CAPACITORS

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY AND WATER

33 / 11 KV 3 mva, 6 mva TX
OUT DOOR SUBSTATION

DETAILED LAYOUT

DRAWN	FRANCIS	CHECKED	APPROVED
DRAWING NO:	MEW/OH-GA/32	SCALE	1 : 50
		DATE	08-10-1989