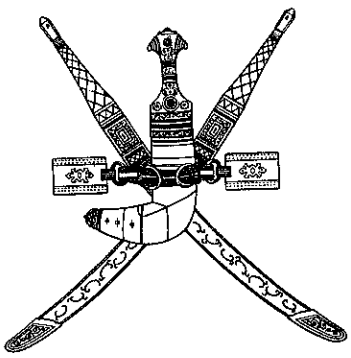
SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER



OVERHEAD LINE MATERIALS AND EQUIPMENTS

STANDARDS – OES 8, 9, 10, 16A and B, 17, 18 20, 25A, B, C and D, 26A, B, C and D, 29 and 33

BRIEF SPECIFICATIONS
and
STANDARD DRAWINGS

Second Edition : January 1995

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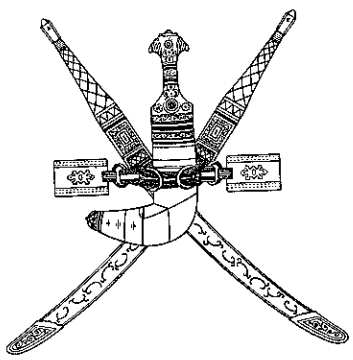
MINISTRY OF ELECTRICITY & WATER



11KV DROP OUT FUSE UNIT

STANDARD – OES 8

BRIEF SPECIFICATIONS
and
STANDARD DRAWINGS

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MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 8
11KV DROP OUT FUSE UNIT

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MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 8
SPECIFICATION FOR 11KV DROPOUT FUSE UNIT

01 RATINGS

Normal voltage	:	11KV
Maximum voltage	:	12.5 KV
BIL	:	95 KV
Continuous current	:	100 amps
Interrupting current symmetrical R.M.S.	:	4.5 KA
Leakage distance		440 mm

02 CONSTRUCTION

The dropout fuse unit shall be of the single vented type, venting through bottom of fuse tube, the tope being closed with substantial screw cap; no rain-water shall collect in the cap. It shall comprise two insulators mounted on channel base. The assembly shall be of strong construction to sustain forces resulting from short circuits, interruptions and mechanical opening and closing. Live parts shall be fixed to the insulators by cementing : clamping is not permitted.

03 LIVE PARTS

The live part contacts shall be of silver plated copper, backed up by stainless steel springs to give trouble free service in dusty, saline and humid conditions.

04 FERROUS PARTS

All ferrous parts shall be either stainless steel or hot dip galvanised.

05 FUSE TUBE

The fuse tube shall be made of epoxy fibre glass lined with horn fibre. The outer surface shall be protected with an ultra-violet resistant finish. The fuse tube shall be fire resistant. The fuse tube shall be complete with easy access lifting ring for handling with a hood stick.

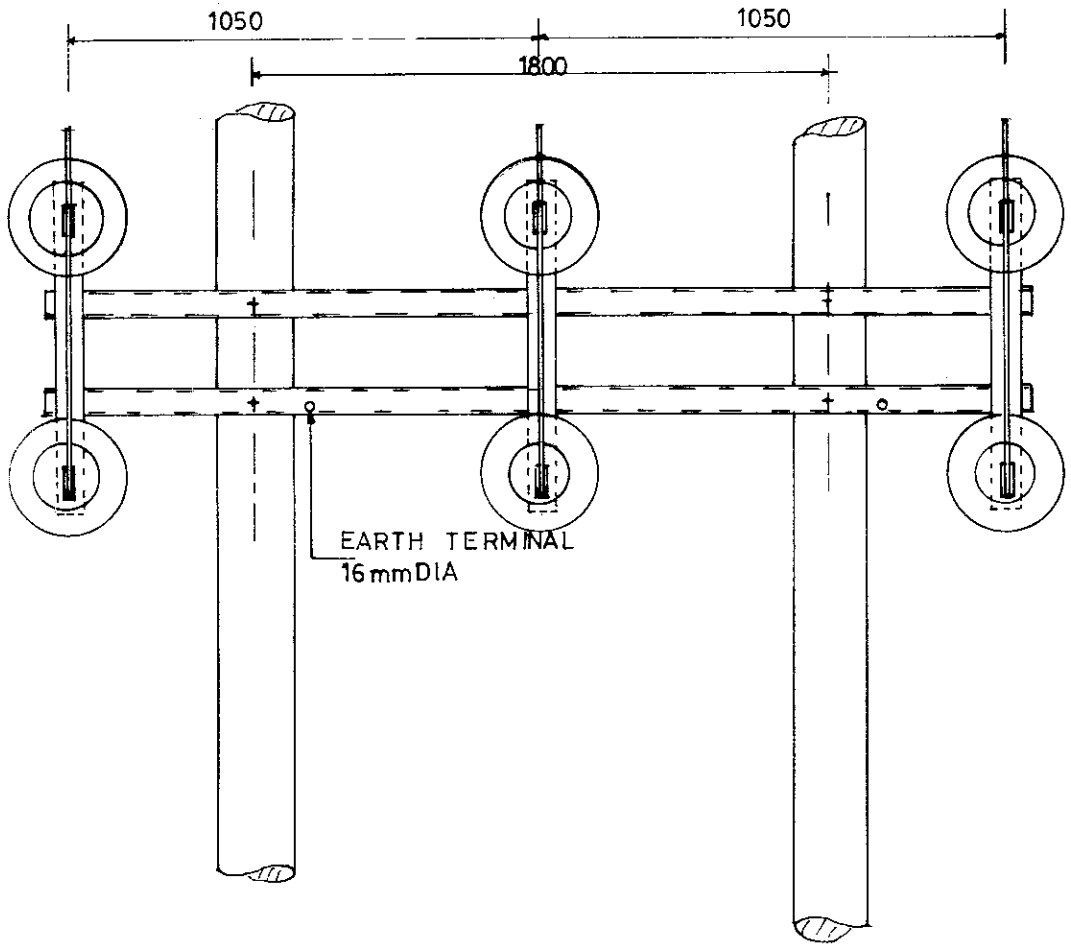
The construction shall be such that the fuse tube can be engaged in the hinge with ease and without interference. The dis-engagement and and dropout upon melting of fuse link shall be easy and without interference. When closing the fuse tube into the upper contact, the fuse tube shall be properly guided into the contact even when closed with the hook stick under an adverse angle. The latching mechanism must be such that no additional tension is applied to the fuse link upon closing of the fuse tube into the upper contact.

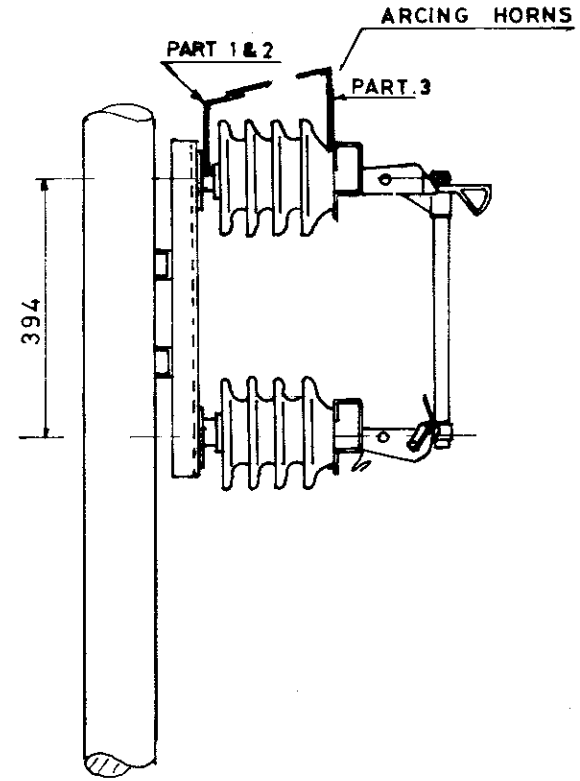
06 ARCING HORN

The insulator on the line side of the dropout fuse shall be provided with Arcing Horns. The arcing horns shall be made of galvanised malleable iron adjustable 5 cm to 8 cm and giving a clearance of 6 cm from insulator sheds. Arcing horns shall generally conform to Drawing No. MEW/OH/050.

07 DRAWING

The unit shall generally be in accordance with drawing MEW/OH/030 Rev. "A".





NOTE.

1. ALL DIMENSIONS IN MM
2. ALL STEEL WORK 30 TON QUALITY TO B.S 4848
3. GALVANISED TO B.S 729 WITH MINIMUM THICKNESS OF 127 MICRONS
4. INSULATOR CREEPAGE 440 mm MIN
5. ARCING HORNS ADJUSTABLE 5cm TO 8cm AND CLEARANCE OF 6cm FROM INSULATOR SHED AS PER DRG No: MEW / OH / 050

REV.	DATE	DESCRIPTION	DRAWN
A	03-05-89	Arcing horns added	francis

MINISTRY OF ELECTRICITY & WATER

TITLE

11KV DROP-OUT FUSE UNIT

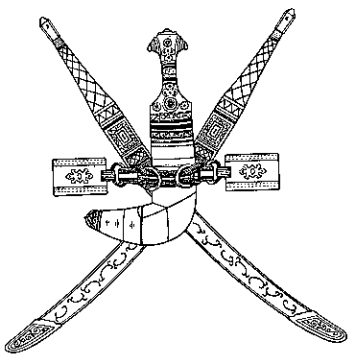
DRAWN BY	CHECKED BY	APPROVED BY
FRANCIS		

DRG.NO. MEW / OH / 030 DATE. 21 / 09 / 1985

SCALE N. T. S

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER



33KV LIGHTNING ARRESTORS

STANDARD – OES 9

BRIEF SPECIFICATIONS
and
STANDARD DRAWINGS

Second Edition : January 1995

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MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 9
33KV LIGHTNING ARRESTORS

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MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 9
33KV LIGHTNING ARRESTORS

01 GENERAL

33KV lightning arrestors shall be suitable for operation in Oman conditions and MEW 33KV system, the characteristics of which are as follows :

02 SITE CONDITIONS

Mean annual rain fall		100 mm
Maximum 24 hours rain fall	:	80 mm
Maximum ambient temperature	:	50 Deg.C
Minimum ambient temperature	:	5 Deg.C
Mean daily temperature	:	30 Deg.C
Maximum temperature of metal		
Surface in direct sun light	:	80 Deg.C
Relative humidity maximum	:	100 %
Annual average	:	40 %
Height above sea level	:	0 - 2000 m
Maximum wind pressure		100 kg/m^2
Daily average wind speed	:	4-5 m/sec

03 33KV SYSTEM CHARACTERISTICS

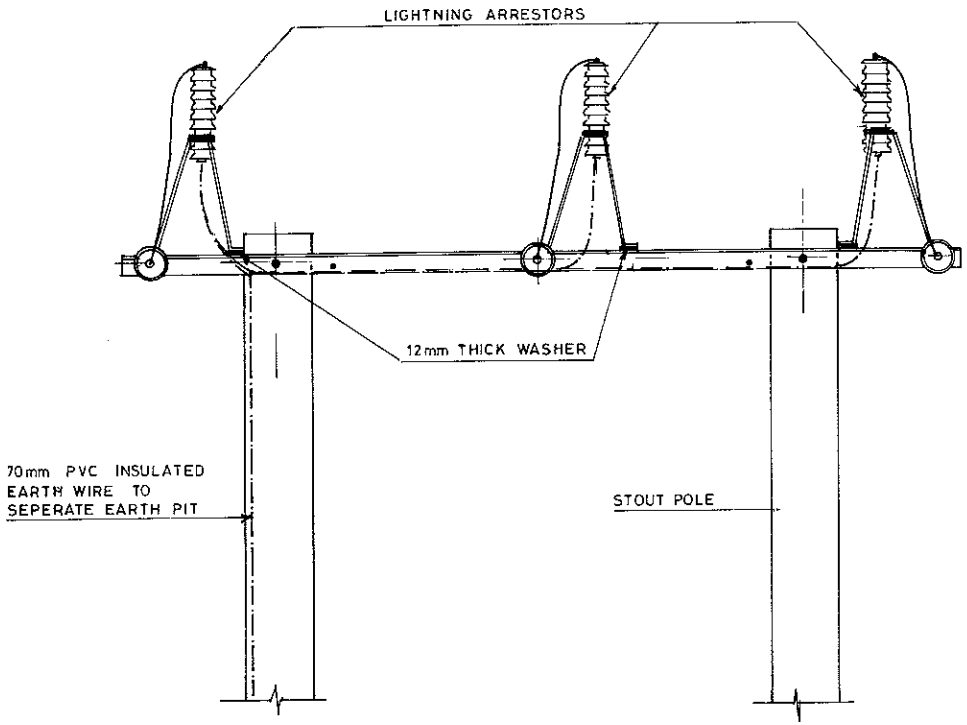
System voltage	:	33KV
Highest system voltage		36KV
Frequency	:	50Hz
No. of phases	:	3
Symmetrical short circuit current	:	25KA
at rated voltage		
Impulse level	:	170KV
Neutral earthing	:	Earthed through 12.5 ohms resistance limiting earth fault current to 1500 amps maximum

04 TYPE

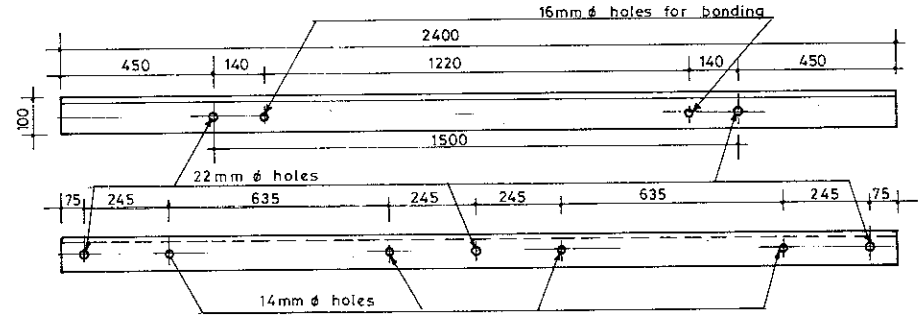
Lightning arrestor shall be of heavy duty station type (10KA discharge) with shell having minimum creepage of 1320mm and open profile. It shall conform to BS. 2914.

05 CONSTRUCTION

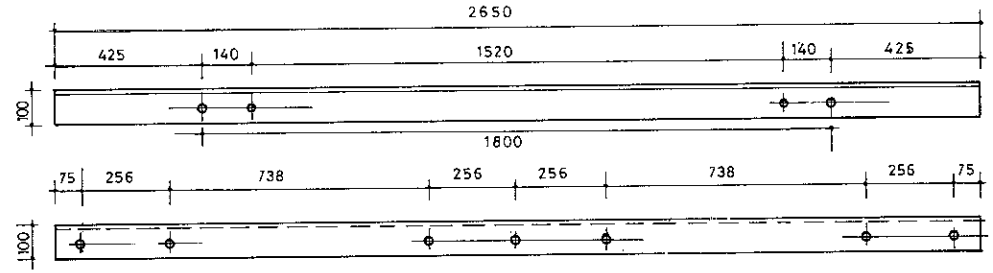
It shall be complete with earth lead and bimetallic clamps suitable for ACSR conductor 200 sq.mm and galvanised steel tripoid for mounting on cross arms of Mild steel galvanised angle 100 x 100 x 10mm as shown in Drawing No. MEW/OH GA/30.

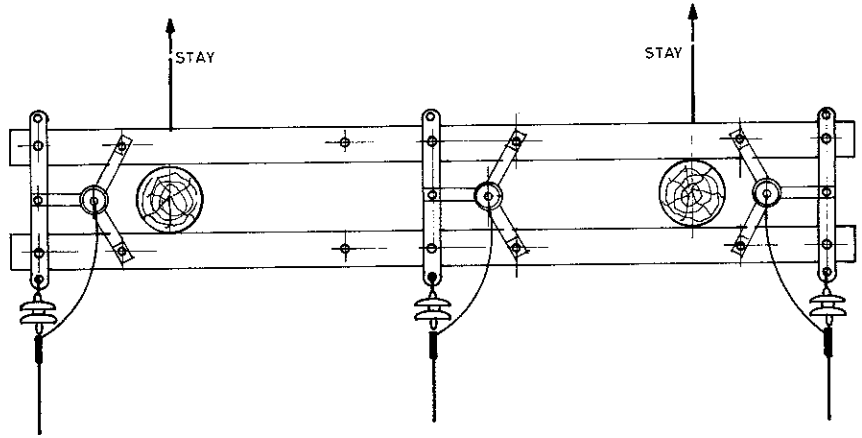


11 KV. TERMINAL CROSS ARM



33 KV TERMINAL CROSS ARM





NOTE

1 Lightning arrestors to be connected to seperate earth pit Earth resistance should be below 10 Ohms

2 In addition to above earth of lightning arrestor to be connected to station earth by bonding to armour of the cable connected to the equipment

3 Cross arms used shall be terminal cross arm as per drawing no MEW/OH/007 and MEW/OH/008 by providing additional holes

4 All metal parts galvanised to B S. 729 in accordance with the O E S 11 with minimum thickness of 127 microns

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY AND WATER

GENERAL ARRANGEMENTS OF 33 KV AND 11 KV LIGHTNING ARRESTORS ON 'H' TERMINAL POLES

DRAWN	CHECKED	APPROVED
FRANCIS		

DRAWING No. MEW / OH-GA / 30

SCALE : N.T.S. DATE 15 _ 05 _ 1989.

TECHNICAL GUARANTEED PARTICULARS

Sr. No.	Description		Particulars
1	Type		
2	Model Number		
3	Make		
4	Maximum line to ground voltage	KV (RMS)	
5	Residual voltage while discharge 10/20 microsecond wave		
	a) 10KA peak	KV	
	b) 20KA peak	KV	
6	Maximum discharge capacity	KA	
7	Maximum 50 cycle phase voltage for discharge	KV (RMS)	

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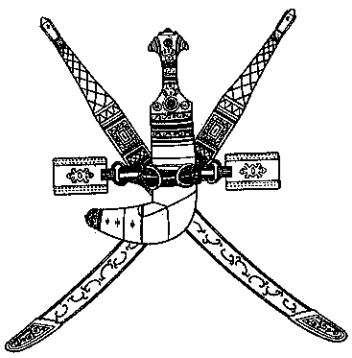
MINISTRY OF ELECTRICITY & WATER



11KV LIGHTNING ARRESTORS

STANDARD – OES 10

BRIEF SPECIFICATIONS
and
STANDARD DRAWINGS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 10
11KV LIGHTNING ARRESTORS

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MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 10
11KV LIGHTNING ARRESTORS

01 GENERAL

11KV lightning arrestors shall be suitable for operation in Oman conditions and MEW 11KV system, the characteristics of which are as follows :

02 SITE CONDITIONS

Mean annual rain fall	:	100 mm
Maximum 24 hours rain fall	:	80 mm
Maximum ambient temperature	:	50 Deg.C
Minimum ambient temperature	:	5 Deg.C
Mean daily temperature	:	30 Deg.C
Maximum temperature of metal		
Surface in direct sun light	:	80 Deg.C
Relative humidity maximum	:	100 %
Annual average	:	40 %
Height above sea level	:	0 - 2000 m
Maximum wind pressure	:	100 kg/sq.m
Daily average wind speed	:	4-5 m/sec

03 11KV SYSTEM

System voltage	:	11KV
Highest system voltage	:	12.5KV
Frequency	:	50Hz
No. of phases	:	3
Symmetrical short circuit current	:	18.4KA
at rated voltage		
Impulse level	:	75KV
Neutral earthing	:	Solidly earthed

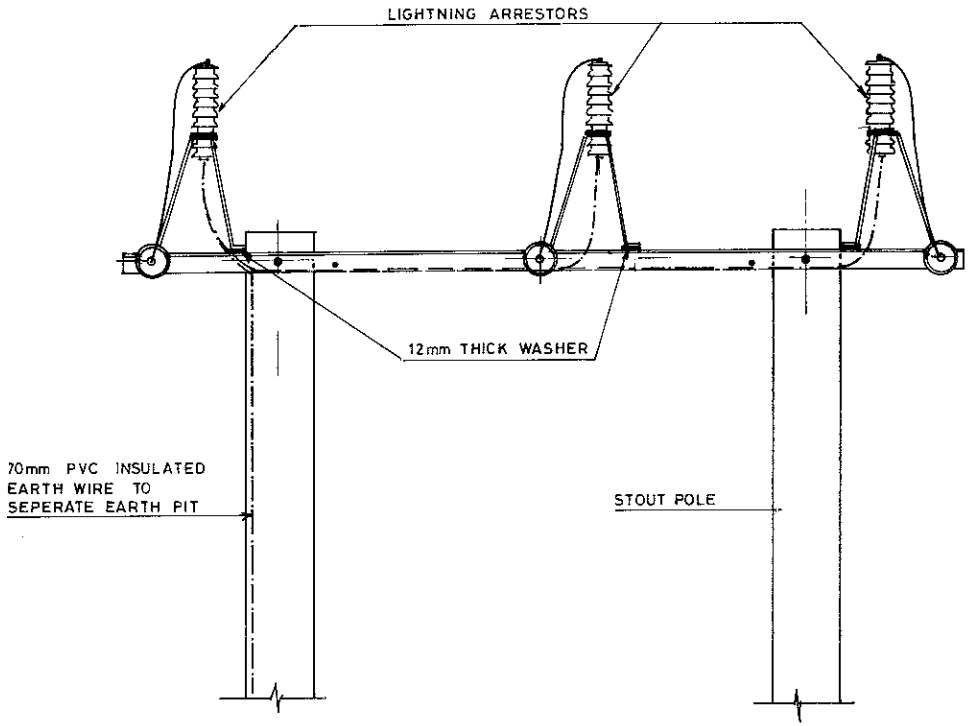
04 TYPE

11KV lightning arrestor shall be of heavy duty station type (10KA discharge) with shell having minimum creepage of 440mm and open profile sheds.

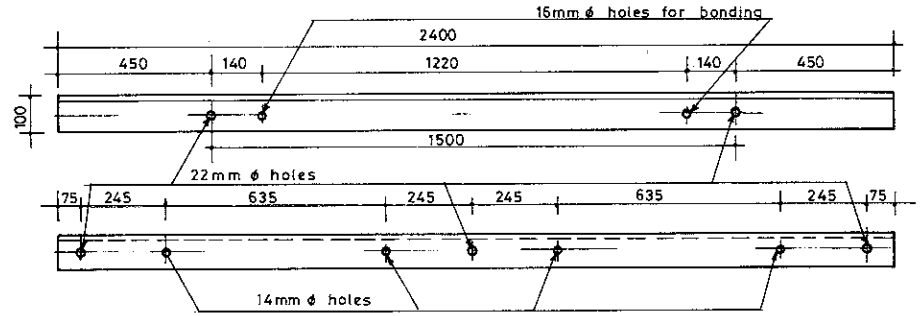
It shall conform to BS. 2914

05 CONSTRUCTION

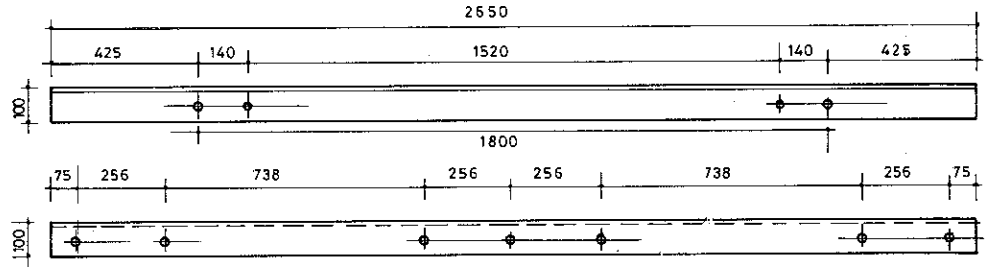
It shall be complete with earth lead and bimetallic clamps suitable for ACSR conductor 150 sq.mm (WOLF) and galvanised steel tripoid for mounting on cross arms of Mild steel galvanised angle 100 x 100 x 10mm as shown in Drawing No. MEW/OH GA/30.

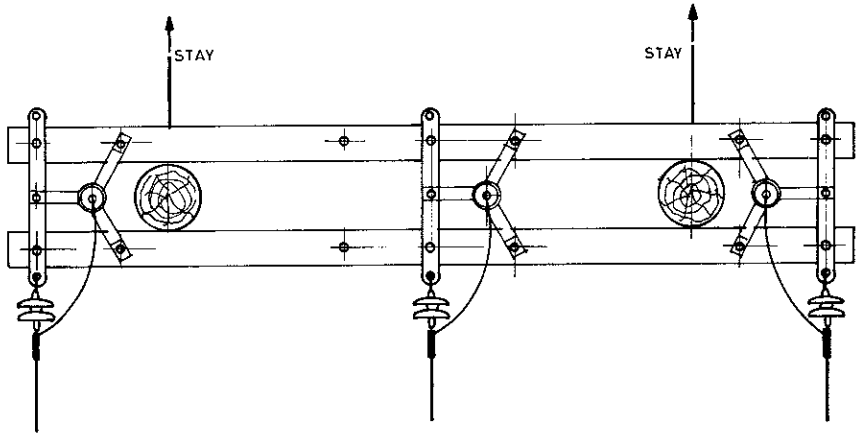


11 KV. TERMINAL CROSS ARM



33 KV TERMINAL CROSS ARM





NOTE

1 Lightning arrestors to be connected to seperate earth pit Earth resistance should be below 10 Ohms

2 In addition to above earth of lightning arrestor to be connected to station earth by bonding to armour of the cable connected to the equipment

3 Cross arms used shall be terminal cross arm as per drawing no MEW/OH/007 and MEW/OH/008 by providing additional holes

4 All metal parts galvanised to B.S. 729 in accordance with the O.E.S 11 with minimum thickness of 127 microns

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY AND WATER

GENERAL ARRANGEMENTS OF 33 KV AND 11 KV LIGHTNING ARRESTORS ON 'H' TERMINAL POLES

DRAWN	CHECKED	APPROVED
FRANCIS		

DRAWING No: MEW/OH-GA/30

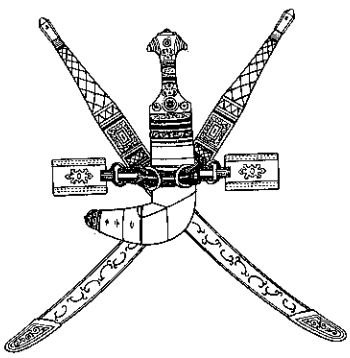
SCALE: N.T.S. DATE 15-05-1989.

TECHNICAL PARTICULARS AND GUARANTEES

Sr. No.	Description		Particulars
1	Type		
2	Model Number		
3	Make		
4	Maximum line to ground voltage	KV (RMS)	
5	Residual voltage while discharge 10/20 microsecond wave		
	a) 10KA peak	KV	
	b) 20KA peak	KV	
6	Maximum discharge capacity	KA	
7	Maximum 50 cycle phase voltage for discharge	KV (RMS)	

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER



33KV FAULT THROW SWITCH

STANDARD – OES 16A

BRIEF SPECIFICATIONS

Second Edition : January 1995

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MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 16A
33KV FAULT THROW SWITCH

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MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 16A
33KV FAULT THROW SWITCH

01 GENERAL

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

02 PARTICULAR SPECIFICATION

33KV single phase fault throw switch, outdoor type, for protection of 33/11KV transformer, shall comprise the following :

1) Centre post insulator, horizontal rotating type, with earthing blade, double make operated by spring closing and manual opening operating mechanism.

   The insulators shall have a minimum creepage of 1320mm with open aerofoil profile sheds.

2) Two fixed post insulators, one on each side of centre post insulator complete with contact jaws for the earthing blade and terminal clamps one clamp bimetallic type for connection to the line conductor (ACSR 200 sq.mm) and the other to high voltage single core XLPE insulated PVC sheathed 300 sq.mm copper cable.

3) Switch operating mechanism housed in galvanised weather proof cabinet with provision for pad locking.

   The operating mechanism shall include a robust closing spring and a manual handle. The mechanism shall be so arranged that manual opening of the switch charges the spring and latches it in. 30 volt DC trip coil shall be provided for releasing the spring to close the switch and "throw" the live line phase conductor into direct low resistance earth fault for tripping out the sending end circuit breaker. The mechanism shall include 2 "NO" and 2 "NC" auxiliary switches.

   The cabinet shall include 240 volt AC heater with thermostat control, and two earthing terminals for connection from outside.

4) 30 Volt DC auxiliary relay handset (electro mechanical type) with 4 "NO" contacts, mounted inside the operating mechanism cabinet.

   Power transformer internal fault sensed by the transformer protection relays (differential/restricted earth fault/buchholz) would energise the auxiliary relay and one of the "NO" contacts on the relay shall be arranged to close the trip coil (release coil) of the closing spring of the fault throw switch.

   The remaining three "NO" contacts of the relay shall be wired to terminal block in the cabinet.

5) All necessary wiring and terminal blocks for DC auxiliary and 240 volt AC supply.

6) Galvanised steel structure of substantial steel sections for mounting the fault throw switch and operating mechanism cabinet.

The fault throw switch shall be mounted on the support structure at 3.5 meters above foundation level; the operating mechanism cabinet shall be mounted at 1.2 meters above foundation level.

The structure shall be complete with 2 earthing terminals and foundation bolts.

7) All steel work shall be galvanised as per Clause 0.04 (d) of OES 11.

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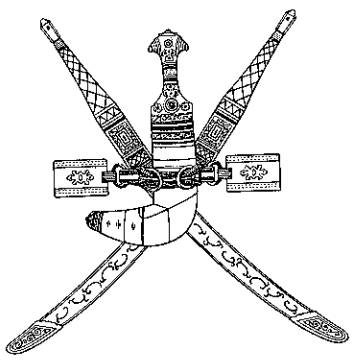
MINISTRY OF ELECTRICITY & WATER



33KV SPRING OPENING DISCONNECT

STANDARD – OES 16B

BRIEF SPECIFICATIONS

Second Edition : January 1995

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STANDARD : OES - 16B
33KV SPRING OPENING DISCONNECT

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MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 16B
33KV SPRING OPENING DISCONNECT

01 GENERAL

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

33KV tripple pole spring opening, load-break disconnect, outdoor type, complete with galvanised steel support structure, is required for use in conjunction with 33KV fault throw switch described in MEW Standard OES 16-A.

02 PARTICULAR SPECIFICATION

1) The equipment shall comprise the following :

i) 33KV three phase outdoor, horizontal, rotating disconnect with technical features as follows :

–	Current rating	400 Amps (site)
–	Impulse withstand	170KV
–	Creepage of insulators	1320mm
–	Phase centres	1200mm
–	Load breaking capacity with interrupter head wiring	400 Amps at 0.7 pf
–	Contacts tipped with copper tungsten; long life arc resistant horn fibre bore lining; arc extinguishing contact follower; large volume exhaust muffler;	
	On-load switching	400 Amps 0.7 pf
	Off-load switching	30 Amps 0.15 pf
–	Short circuit rating	25KA for 3 secs
–	For use on system with highest voltage of 36 KV continuously	
–	Operating rod to include well treated wood insulator inserted at 2.8 metres from ground level	
–	Insulators shall have open aerofoil profile	

ii) Spring opening and manual closing mechanism housed in galvanised weather proof cabinet to include :

–	Handle for manual closing the disconnect, with provision for pad-locking	
–	Release coil	: 30 volt DC
–	Auxiliary switches	: 2 NO and 2 NC
–	Time delay relay	: 30 volt DC, range 2 to 60 sec.
–	240 volt heater with thermostat control and fuse protection	
–	Two earthing terminals	

iii) Galvanised steel structure for mounting the disconnect and the operating mechanism cabinet :

–	Mounting height of disconnect	3.5 metres above foundations level
–	Mounting height of operating mechanism cabinet	: 1.2 metres above foundation level

The structure shall be of substantial steel section, complete with foundation bolts and two earthing terminals.

iv) All steel work shall be galvanised as per Clause 0.04 (d) of OES 11.

In order to ensure that the fault throw switch and the spring opening disconnect operate in a proper sequence, the 30 volt DC time delay relay operating coil of the spring opening disconnect will be arranged to be wired at site in series with a "NO" contact of the fault throw auxiliary relay and a "NO" auxiliary switch of the fault throw switch operating mechanism (OES 16-A). The auxiliary switch is open when the fault throw switch is open - time delay relay gets energised only when both the auxiliary relay contact and mechanism auxiliary switch close.

2) The sequence of operating shall be as follows :

- Transformer internal fault sensed by the transformer protection relays (differential/restricted earth fault/buchholz) would energise the auxiliary relay of the 33KV fault throw switch (OES 16-A) and cause the fault throw switch to operate and as a sequence of a direct earth fault, trip out the sending end circuit breaker.

- Once the fault throw switch has operated, the 30 volt DC time delay relay operating coil of the 33KV spring opening disconnect is energised to actuate the mechanism and isolate the faulty power transformer after a preset time delay so that the sending end circuit breaker may be reclosed after required time lapse as a sequential operation.

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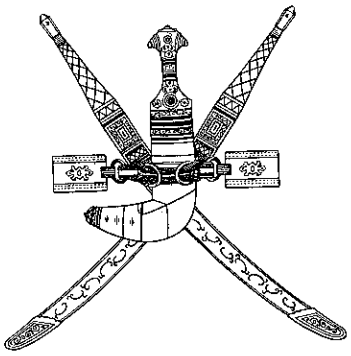

11KV OUTDOOR SWITCHGEAR
AIR BREAK SWITCHES

STANDARD – OES 17

BRIEF SPECIFICATIONS
and
STANDARD DRAWINGS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 17
11KV OUTDOOR SWITCHGEAR
(AIR BREAK SWITCHES)

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MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 17
11KV OUTDOOR SWITCHGEAR
(AIR BREAK SWITCHES)

01 GENERAL

The switchgear shall be outdoor type for mounting on "H" type wood pole construction.

The equipment shall in general conform to MEW Standard OES-11.

02 PARTICULAR SPECIFICATION

The switchgear shall comply with BSS 5253 and shall have the following technical features :

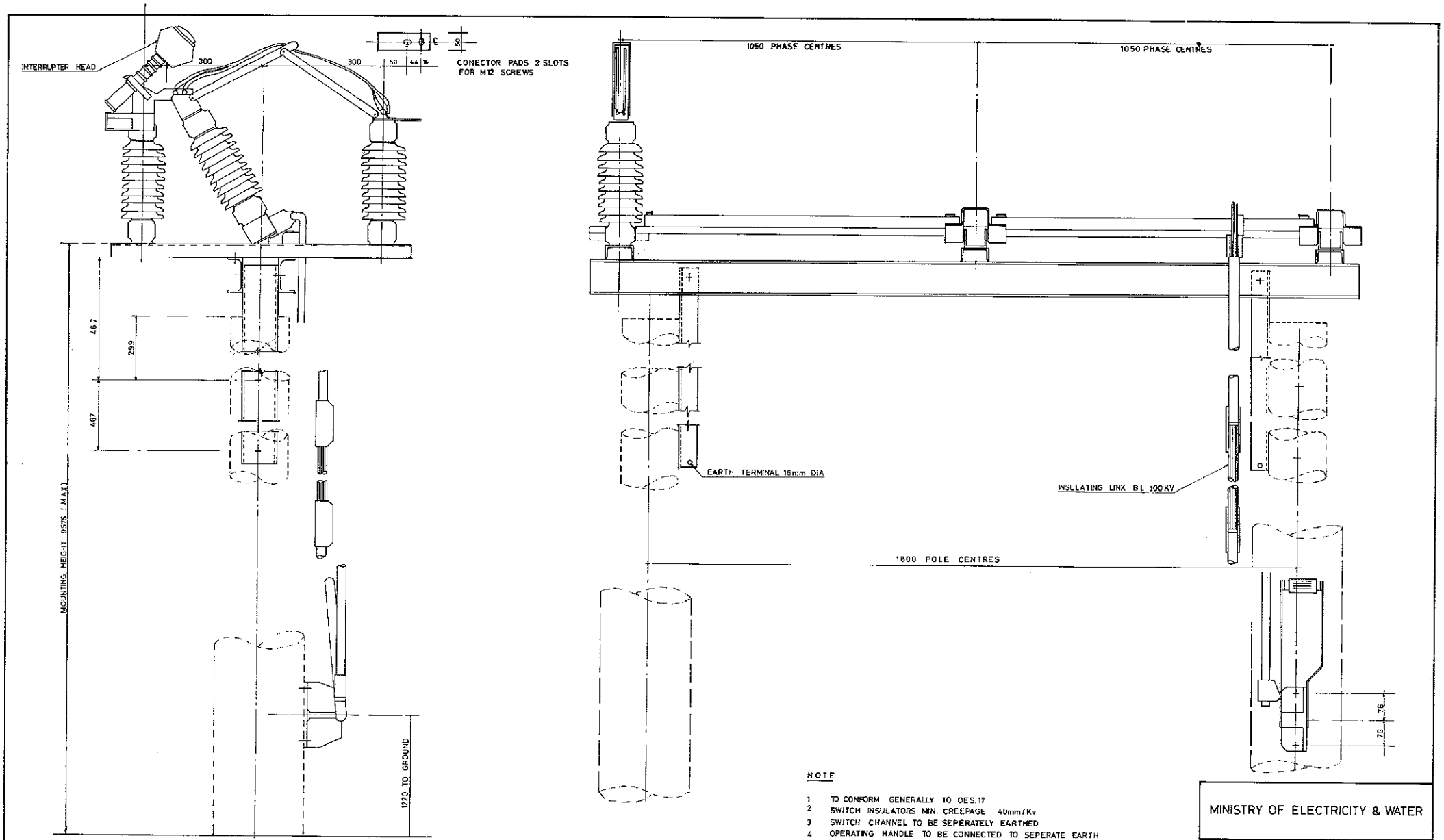
1. 11KV MAST HEAD SWITCH WITH LOAD INTERRUPTERS

- Mounting height for switch : 9000 mm
- Phase centres : 1050 mm
- Wood pole centres ('H' type construction) : 1800 mm
- Mounting height for operating handle 1200 mm
- Switch shall be complete with load interrupters, phase coupling rod, operating rod with well treated wood insulator inserted at 4500 mm from ground level, rod guides, galvanised supporting steel work, bolts, nuts and washers.

The operating handle to include earthing terminals, cable lugs for stranded copper conductor 70 sq.mm, "OFF" and "ON" indicators and pad-locking facilities.

- Creepage of insulators 440mm (40mm/KV)
- Load breaking capacity : 400 Amp at 0.7 pf
- With interrupter head contacts tipped with copper tungsten, long life arc resistance horn fibre bore lining; arc extinguishing contact follower; large volume exhaust muffler:
  - On-load switching : 400 Amps at 0.7 pf
  - Off-load switching : 30 Amps at 0.15 pf
- Short circuit rating : 18.4 KA for 3 secs
- For use on system with highest voltage of 12.5KV continuously.
- Current rating 400 Amps (site)
- Insulators shall have open aerofoil profile sheds
- All steel work shall be galvanised as per Clause 0.04 (d) of OES-11.

The equipment shall generally be in accordance with Drawing No. MEW/OH/027.



NOTE

1. TO CONFORM GENERALLY TO DES.17
2. SWITCH INSULATORS MIN. CREEPAGE 40mm/Kv
3. SWITCH CHANNEL TO BE SEPERATELY EARTHED
4. OPERATING HANDLE TO BE CONNECTED TO SEPERATE EARTH
5. ALL STEEL WORK 30 TON QUALITY TO BS.4848
6. GALVANISED TO B.S 729 MINIMUM THICKNESS 127 MICRONS
7. ALL DIMENSIONS IN MM.

REV	DATE	DESCRIPTION	CKD	APD
A	19 05 90	Notes added		

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER

TITLE

11KV MAST HEAD SWITCH GEAR WITH LOAD INTERRUPTER

DRAWN	CHECKED	APPROVED
FRANCIS		

DRG.NO. MEW/OH/027

DATE 16 10 1985

2 11KV VERTICAL MOUNTING SWITCH UNIT WITH LOAD INTERRUPTER

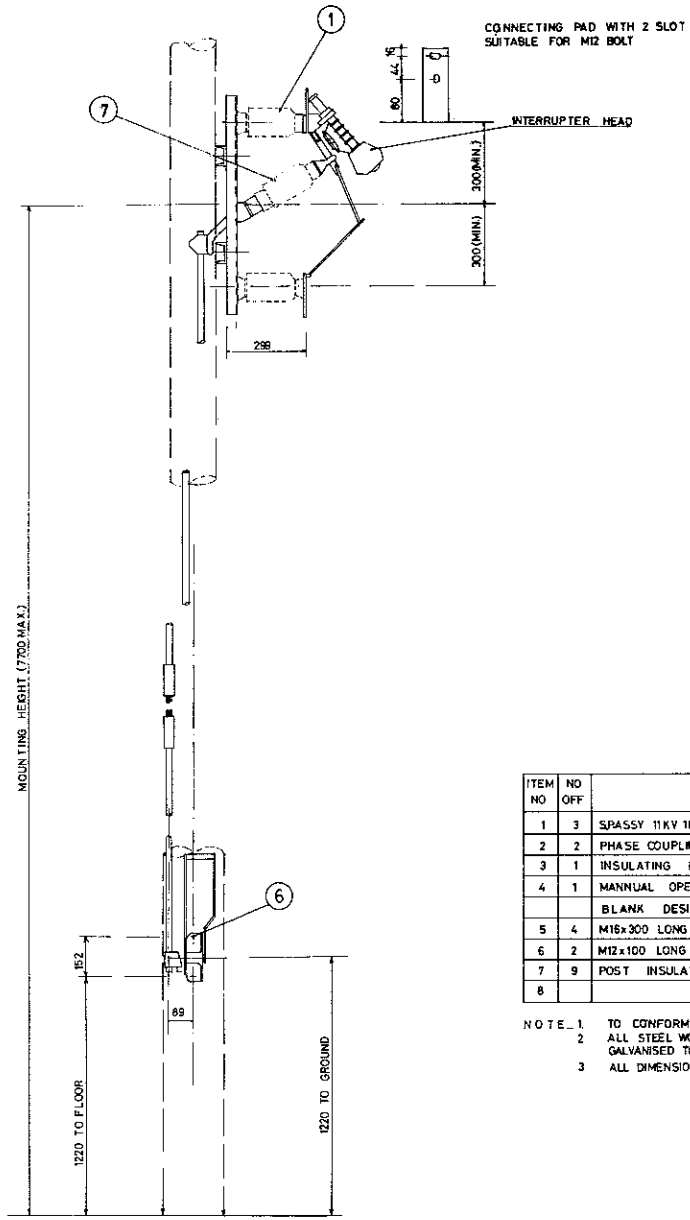
- Mounting height for switch : 7700 mm
- Phase centres : 1050 mm
- Wood pole centres ('H' type construction) : 1800 mm
- Mounting height of the operating handle above ground : 1220 mm
- Switch shall be complete with load interrupters, phase coupling rod, operating rod with well treated wood insulator inserted, at 4500mm from ground level, rod guides, galvanised supporting steel work, bolts, nuts and washers.

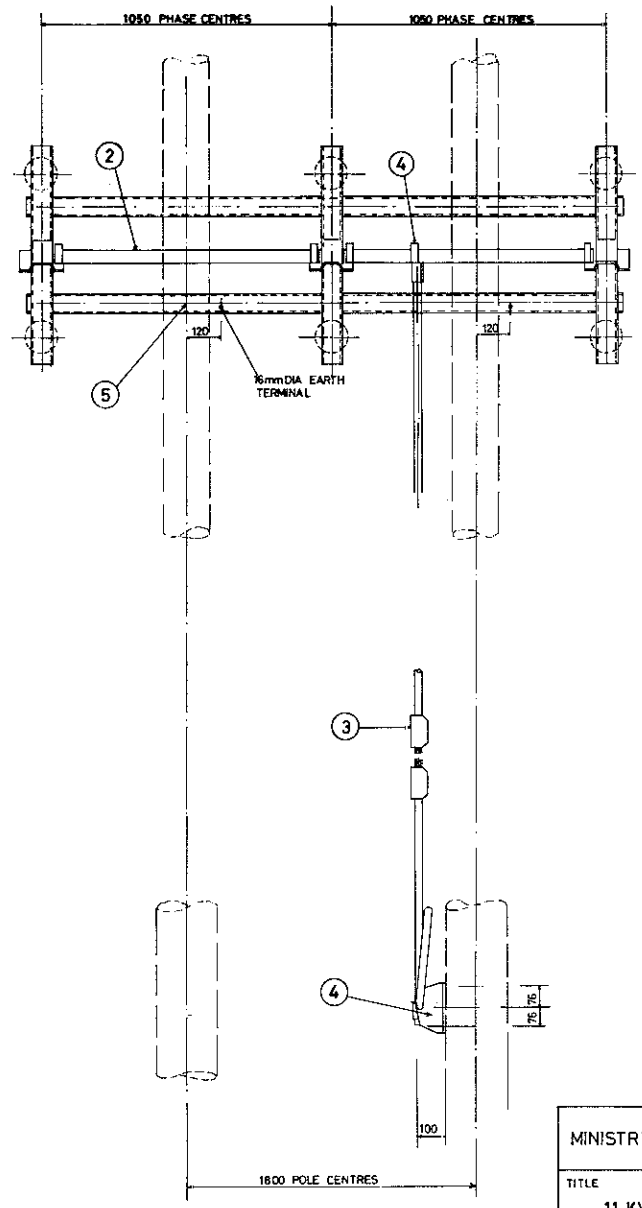
The operating handle to include earthing terminals, cable lugs for stranded copper conductor 70 sq.mm, "OFF" and "ON" indicators and pad-locking facilities.

Creepage insulators : 440 mm (40mm/KV with open aerofoil profile sheds

- Load breaking capacity : 400 Amps at 0.7 pf
- With interrupter head having contacts tipped with copper tungsten longlife arc resistant horn fibre bore lining; arc extinguishing contact follower :
  long volume exhaust muffler :
  - On-load switching : 400 Amps at 0.7 pf
  - Off-load switching : 300 Amps at 0.15 pf
- Short circuit rating : 18.4 KA for 3 secs
- For use on system with highest voltage of 12.5KV continuously.
- All steel work shall be galvanised as per Clause 0.04 (d) of OES-11
- Current rating : 400 Amps (site)

The equipment shall generally be in accordance with Drawing No. MEW/OH/029.





ITEM NO	NO OFF	DESCRIPTION
1	3	SPASSY 11KV 18KA 400A ROCKING DISCONNECTOR
2	2	PHASE COUPLING TUBE SQUARE HOLLOW SECTION
3	1	INSULATING LINK ASSEMLY 100KV BIL
4	1	MANNUAL OPERATING MECHANISM WITH EARTH LUG AND BLANK DESIGNATION LABEL
5	4	M16x300 LONG BOLT NUT SPRING AND PLAIN WASHER
6	2	M12x100 LONG COACH SCREWS
7	9	POST INSULATOR CREEPAGE 440 mm
8		

NOTE 1. TO CONFORM GENERALLY TO OES 17
2 ALL STEEL WORK 30 TON QUALITY TO B.S.S. 4848 AND GALVANISED TO B.S.729
3 ALL DIMENSIONS IN MM

REV	DATE	DESCRIPTION	CKD	APD
A.	19 05 90	Notes added		

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER

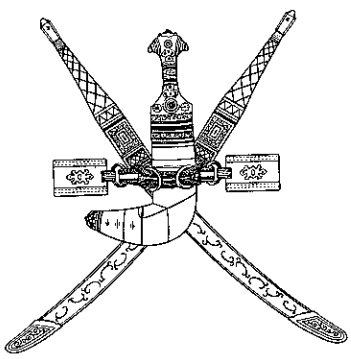
TITLE
11 KV VERTICAL MOUNTING SWITCH UNIT

DRAWN BY	CHECKED BY	APPROVED BY
R A QURESHI		

DRG.NO. MEW/O H/029
DATE 03-07.1985
SCALE

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER



33KV OUTDOOR SWITCHGEAR
(AIR BREAK SWITCHES)

STANDARD – OES 18

BRIEF SPECIFICATIONS
and
STANDARD DRAWINGS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 18
33KV OUTDOOR SWITCHGEAR
(AIR BREAK SWITCHES)

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MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 18
33KV OUTDOOR SWITCHGEAR
(AIR BREAK SWITCHES)

01 GENERAL

The switchgear shall be outdoor type for mounting on "H" type wood pole construction.

The equipment shall in general conform to MEW Standard OES-11.

02 PARTICULAR SPECIFICATION

The switchgear shall comply with BSS 5253 and shall have the following technical features :

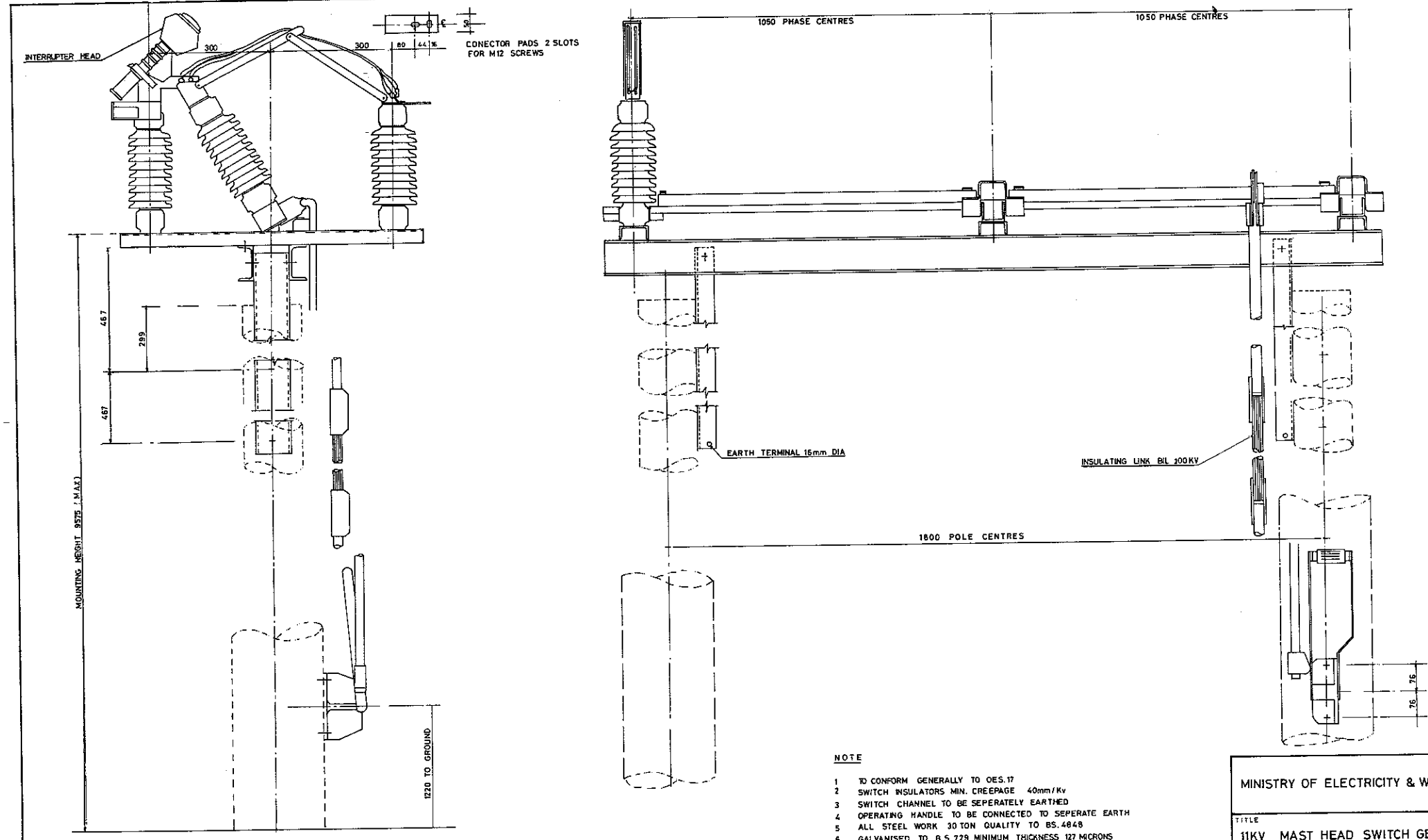
1. 33KV MAST HEAD SWITCH WITH LOAD INTERRUPTERS

- Mounting height for switch : 9000 mm
- Phase centres : 1200 mm
- Wood pole centres ('H' type construction) : 1800 mm
- Mounting height for operating handle : 1200 mm
- Switch shall be complete with load interrupters, phase coupling rod, operating rod with well treated wood insulator inserted at 4500 mm from ground level, rod guides, galvanised supporting steel work, bolts, nuts and washers.

The operating handle to include earthing terminals, cable lugs for stranded copper conductor 70 sq.mm, "OFF" and "ON" indicators and pad-locking facilities.

- Creepage of insulators : 440mm (40mm/KV)
- Load breaking capacity 400 Amp at 0.7 pf
- With interrupter head contacts tipped with copper tungsten, long life arc resistance horn fibre bore lining; arc extinguishing contact follower; large volume exhaust muffler:
  - On-load switching : 400 Amps at 0.7 pf
  - Off-load switching : 30 Amps at 0.15 pf
- Short circuit rating : 18.4 KA for 3 secs
- For use on system with highest voltage of 12.5KV continuously.
- Current rating : 400 Amps (site)
- Insulators shall have open aerofoil profile sheds
- All steel work shall be galvanised as per Clause 0.04 (d) of OES-11.

The equipment shall generally be in accordance with Drawing No. MEW/OH/027.



NOTE

1. TO CONFORM GENERALLY TO OES.17
2. SWITCH INSULATORS MIN. CREEPAGE 40mm/Kv
3. SWITCH CHANNEL TO BE SEPERATELY EARTHED
4. OPERATING HANDLE TO BE CONNECTED TO SEPERATE EARTH
5. ALL STEEL WORK 30 TON QUALITY TO BS.4848
6. GALVANISED TO B.S 729 MINIMUM THICKNESS 127 MICRONS
7. ALL DIMENSIONS IN MM.

REV	DATE	DESCRIPTION	CKD	APD
A	19 05 90	Notes added		

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER

TITLE

11KV MAST HEAD SWITCH GEAR WITH LOAD INTERRUPTER

DRAWN	CHECKED	APPROVED
FRANCIS		

DRG.NO. MEW/OH/027 DATE 16 10 1985

2 33KV VERTICAL MOUNTING SWITCH UNIT WITH LOAD INTERRUPTERS

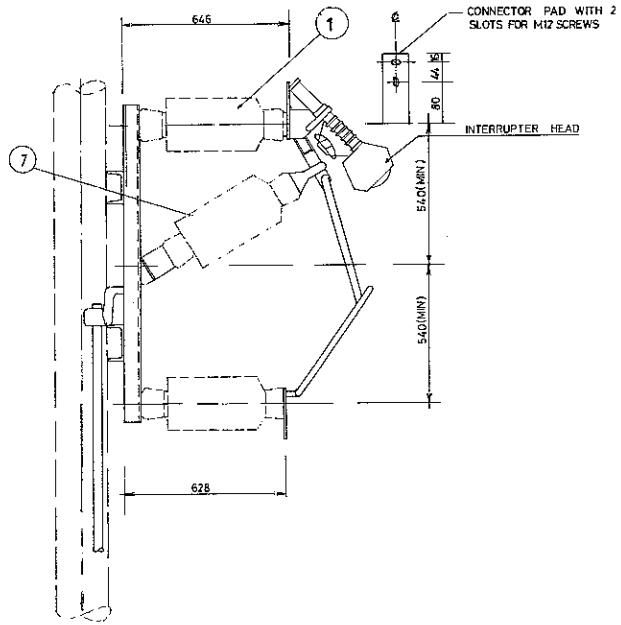
- Mounting height for switch : 7700 mm
- Phase centres : 1200 mm
- Wood pole centres ('H' type construction) : 1800 mm
- Switch shall be complete with load interrupters, phase coupling rod, operating rod with well treated wood insulator inserted, at 4500mm from ground level, rod guides, galvanised supporting steel work, bolts, nuts and washers.

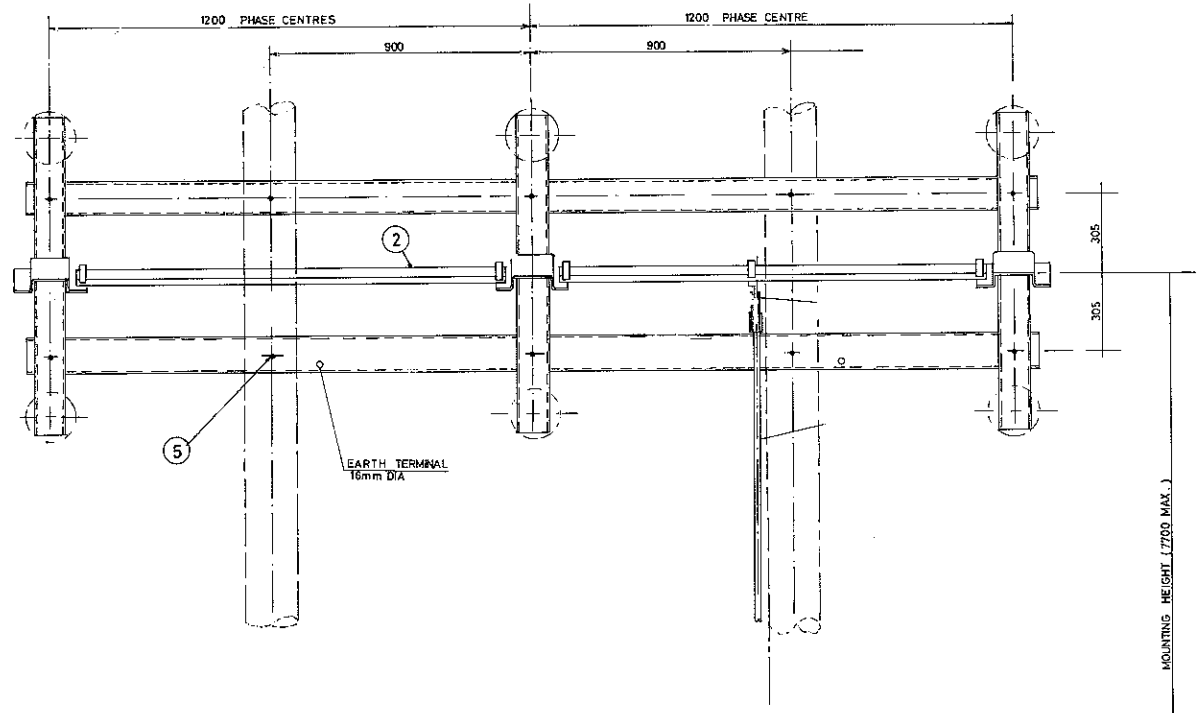
The operating handle to include earthing terminals, cable lugs for stranded copper conductor 70 sq.mm, "OFF" and "ON" indicators and pad-locking facilities.

Creepage of insulators : 1320 mm (40mm/KV with open aerofoil profile sheds

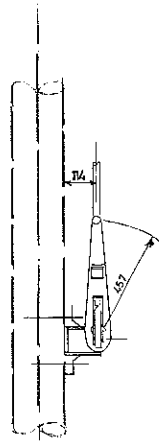
- Load breaking capacity : 400 Amps at 0.7 pf
- With interrupter head having contacts tipped with copper tungsten longlife arc resistant horn fibre bore lining; arc extinguishing contact follower :
  long volume exhaust muffler :
  - On-load switching : 400 Amps at 0.7 pf
  - Off-load switching : 30 Amps at 0.15 pf
- Short circuit rating : 25 KA for 3 secs
- For use on system with highest voltage of 36 KV continuously.
- All steel work shall be galvanised as per Clause 0.04 (d) of OES-11

The equipment shall generally be in accordance with Drawing No. MEW/OH/028.



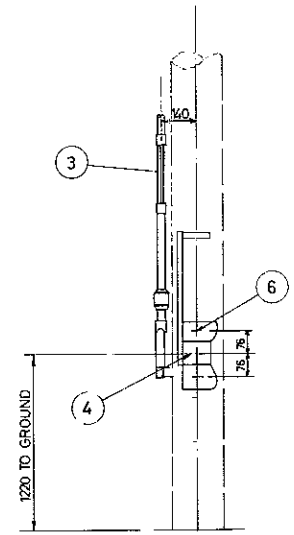


ITEM	NO.OFF	DESCRIPTION
1	3	S.P ASSY 33 KV 25 KA 400A ROCKING DISCONNECTOR
2	2	PHASE COUPLING TUBE SQUARE HOLLOW SECTION
3	1	INSULATING LINK ASSEMBLY
4	1	MANUAL OPERATING MECHANISM WITH EARTH LUG AND BLANK DESIGNATION LABEL
5	4	M16x300 LONG BOLT NUT SPRING AND PLAIN WASHER
6	2	M12x100 LONG COACH SCREWS
7	9	POST INSULATOR CREEPAGE 40 mm/KV



NOTE

1 TO CONFORM GENERALLY TO O.E.S. 18
2 ALL DIMENSIONS IN MM.
3 ALL STEEL WORK 30TON QUALITY TO B.S 4848
4 GALVANISED TO B.S 729 MINIMUM THICKNESS 127 MICRONS



REV	DATE	DESCRIPTION	CKD	APD
A	19 05 90	Notes added		

MINISTRY OF ELECTRICITY & WATER

TITLE 33KV ON LOAD VERTICAL MOUNTING DISCONNECTOR

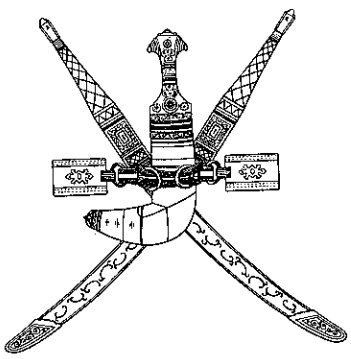
DRAWN BY	CHECKED BY	APPROVED BY
R.A.QURESHI		

DRG NO. MEW/OH/028 DATE 11.6.1996

SCALE

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER



33KV & 11KV AUTO RECLOSERS

STANDARD – OES 20

BRIEF SPECIFICATIONS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 20
33KV & 11KV AUTO RECLOSERS

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MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 20
33KV & 11KV AUTO RECLOSERS

01 ELECTRICAL SYSTEM AND SITE CONDITIONS

The equipment shall be fully tropicalised and must be suitable in all respects for use and operation on MEW system and site conditions mentioned below :

Electrical System	**33KV**	**11KV**
Rated service voltage	33	11
Highest system voltage	36	12.5
Number of phases	3	3
Frequency	50 Hz	50 Hz

Site conditions

Climatic condition are very severe in the Sultanate of Oman. Dust storms are prevalent and the atmosphere is saline, humid and corrosive. Humidity is high and periods of high humidity are long and continuous.

Maximum Ambient temperature	:	50^0C
Minimum Ambient temperature	:	5^0C
Maximum temperature of metal surface in direct sunlight	:	80^0C
Daily average with speed	:	4 - 5m/sec
Maximum rainfall	:	100mm
Relative humidity maximum	:	100%
minimum	:	40%
Height above sea level	:	0 - 2000M

02 REQUIREMENTS

Auto reclosers shall be wood pole mounting SF6 or vacuum type with oil insulating medium for service on 11KV and 33KV over head line networks. Oil immersed type are not acceptable. They should meet following minimum requirements.

Service voltage	:	11KV	33KV
Highest system voltage	:	12.5KV	36KV
Normal current rating	:	400amps	400 amps
Breaking capacity	:	6KA	13KA
Impulse withstand		110KV	170KV
Short circuit tests	:	To IEC 56-BS 5311	
Operating duty	:	440mm for 11KV	
Creepage of bushing	:	1320mm for 33KV	

	11KV	33KV
Power frequency withstand		
dry for 60 sec.	50KV	70KV
wet for 10 sec.	45KV	60KV

03 PROTECTION

Overcurrent setting	25% - 200% in steps of 25%
Overcurrent time multiplier	0.1 - 1.5 in steps of 0.1
Earth fault setting	1 - 10% in steps of 1%
Earth fault instantaneous (selective)	80 - 120 ms
Earth fault time delay	0.2 - 25 secs
Reclose time selectable	1 - 60 secs
Reclaim time selectable	1 - 180 secs
Local control	local control operated manually with hood stick comprising a) manual close b) close and lock in c) trip and lockout d) Auto/Non-auto e) Earth fault In/Out

Reclosers shall be supplied complete in every respect including mounting brackets.

04 PAINTING AND FINISH

It is to be borne in mind that the atmosphere in Oman is highly corrosive. Therefore, special attention should be given to protection of all iron-work. The methods proposed and means adopted for rust proofing should be full described in the tender.

All surfaces should be thoroughly cleaned and free from rust, scale, grease, dirt and other foreign matter. Sharp points, weld spatter, flux or other imperfections shall be removed. The whole of the tank and fittings shall be sand blasted inside and outside to remove all scale and rust before painting.

Immediately after cleaning, a primary coat of red or other approved primer shall be applied. After the application of the first primary coat all rough surfaces shall be rubbed down and filed and a second coat of red lead or other approved primer applied. This shall be followed by the application of two coats of an approved finishing paint.

Damage to paint work incurred during transport and delivery to MEW stores shall be made good by thoroughly cleaning the damage portion and applying the full number of coats that has applied before the damage was caused.

A matching finish shall be obtained tot eh satisfaction of the purchaser.

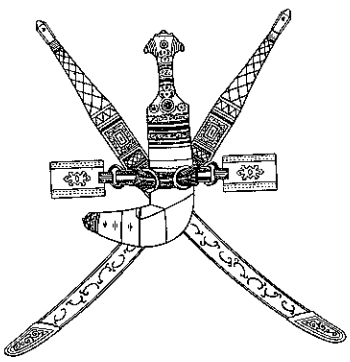
05 TECHNICAL GUARANTEED PARTICULARS

33KV & 11KV Auto Reclosers

Sr. No.	Description	11KV	33KV
1	Make and Type		
2	Rated Voltage KV		
3	Highest system voltage KV		
4	Impulse Test voltage 1/50 wave KV		
5	Power frequency test voltage dry/wet		
6	Rated Normal current		
7	Rated Breaking capacity KA		
8	Rated making capacity		
9	Short circuit test duties as per IEC 56/BSS 5311 with durations of fault clearance times		
10	Details of closing arrangement		
11	Typical duty cycle Tripping and clearance intervals and tripping times		
12	Details of Protection a) Overcurrent b) Earth Fault		
13	Overall weight – Kgs		
14	Overall Dimensions		

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER



ALUMINIUM CONDUCTORS STEEL REINFORCED

STANDARD – OES 25A

BRIEF SPECIFICATIONS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 25A
ALUMINIUM CONDUCTORS STEEL REINFORCED

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MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 25A
ALUMINIUM CONDUCTORS STEEL REINFORCED

01 GENERAL

Aluminium conductors steel reinforced shall conform to BS 215 : Part 2 : 1970/IEC 209 and shall be suitable for operation under service conditions stated in OES-11.

The conductor sizes covered by this specification are shown in table below :

CODE	AREA	STRANDING ALUMINIUM NO/DIA	STRANDING STEEL NO/DIA	OVERALL DIA MM	WEIGHT PER KM KG	ULTIMATE STRENGTH KG
Panther	261.2	30/3.00	7/3.00	21	976	9095
Wolf	195.	30/2.59	7/2.59	18.13	727	6875
Dog	118.8	6/4.72	7/1.57	14.5	394	3310

The aluminium wires used in the construction of conductor shall be as per BS 2627. The purity of aluminium used shall not be less than 99.5%.

The galvanised steel wire shall be as per BS. 4565.

All wires used in the manufacture of the conductors shall be free from protrusions, sharp edges, abrasions and any other imperfections.

2 CONSTRUCTION

2.1 The aluminium and steel wires shall have diameters according to tables 2 and 3 of BS 215 Part 2.

2.2 JOINS IN WIRE

Joints in aluminium strands are not permitted in the outer most layers of the conductors. No joints even in the inner layers shall be less than 15m apart in the complete stranded conductor.

The joints shall be made by resistance butt welding and shall be annealed after welding over a distance of at least 25cm on each side of the joint. During drawing operation, no joints shall be permitted. Joints shall fullfil the mechanical and electrical requirements for unjoined wires. The joining shall be done in a neat manner with good workmanship.

The joints are not permitted in galvanised steel wires either in the base rod before drawing or in the wire during or after drawing.

The galvanising of steel wires shall be in accordance with OES 11 and BSS 443.

Minimum thickness of coating shall be as follows :

CONDUCTOR	SIZE OF STEEL WIRE - MM	MINIMUM THICKNESS OF ZINC COATING MICRONS (PTM)
PANTHER	3.00	37 (260 gm/m^2)
WOLF	2.59	34 (240 gm/m^2)
DOG	1.57	31 (215 gm/m^2)

Stranding and lay ratios shall be in accordance with BS 215 Part 2 : 1970. For all constructions, successive layer shall have opposite directions of lay, the outer most layer being right hand.

Finished conductors shall not show any noticeable looseness and the strands shall remain intact and shall not untwist when conductor is cut.

Twisting of conductors shall be as small as possible when unrolling and stringing.

3 GREASING OF CONDUCTORS

The inner layers of ACSR conductors shall be covered with an approved anti-corrosive grease having a high melting point not less than 250 Deg.C. The minimum drop point of grease shall be 100 Deg. C and it shall not migrate towards and bottom of the conductor when the conductor is maintained continuously at a temperature of 90 Deg.C.

The grease shall completely fill the interstices between the strands. There shall be no excess grease remaining on the outside surface of the conductor which may cause sand and dust particles to adhere during pulling out and stringing of conductors.

The specified characteristics of grease shall not be affected after heating to 15 Deg. C above its drop point of 150 hours.

The grease shall protect the conductor from corrosion in severe atmospheric condition including saline coastal areas or industrial pollution.

The grease shall have adequate resistance of oxidisation and shall chemically be stable at all service temperature between 50 Deg.C to 90 Deg.C.

4 COMPLETED CONDUCTOR

The completed conductor shall be free from dirt, grit, excessive amounts of drawing oil and other foreign deposits.

5 TESTS

The following tests shall be made at the manufacturer's works in accordance with BS 2627 in case of aluminium wires and BS 4565 for steel wires.

ALUMINIUM WIRES

- Tensile test
- Wrapping test
- Resistivity test

STEEL WIRES

1. Determination of stress at 1% elongation
2. Tensile test
3. Wrapping test
4. Galvanising test

The following tests shall be carried out on completed conductor :

- Lay ratio of each layer (to be measured)
- Tensile strength in accordance with IEC 209/BS215 Part 2
- Measurement of weight (with and without grease)
- Resistance test

6 MARKING AND PACKING

The conductors shall be supplied in 2000 meter lengths on impregnated drums of approved material so constructed to enable the conductor to run smoothly without damage to the conductor in transport, handling or installation.

The following information in Arabic and English shall be clearly marked indelible paint on both flanges of every conductor drum.

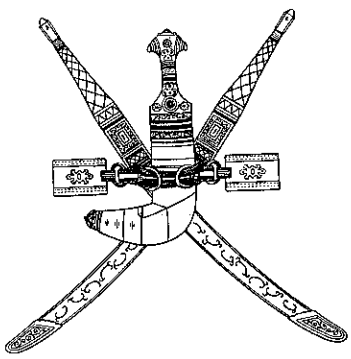
- Conductor and drum particulars
  - Conductor type and name
  - Conductor size and stranding
  - Exact length (m)
  - Nett and gross weights (kg)
  - Year of manufacture
- Arrow showing correct direction of rolling which is opposite to the direction of unwinding wit instruction "ROLL THIS WAY"
- Instructions "DO NOT LAY FLAT"
- Manufacturer's name and country of origin
- MEW order number and address
- MEW's material code number
- Stores destination
- Drum serial number

ALUMINIUM CONDUCTOR STEEL REINFORCED
TECHNICAL GUARANTEED PARTICULARS

Sl. No.	Description	Particulars
1	Standard to which conductor conform	
2	Sectional area of conductor	
	a) Area	Sq.mm
	b) Nominal aluminium area	Sq.mm
	c) No. of strands	
	Dia of strands	
	– steel	mm
	– aluminium	mm
	d) Overall diameter of conductor	mm
3	Lay ratio max/mm	
	Inner layer	
	Middle layer	
	Outer layer	
4	Maximum resistance oat 20%	Ohms
5	Weight of conductor per km	Kg
6	Weight of conductor including grease/km	Kg
7	Type of grease	
8	Drum length	
9	Gross weight of drum when full	

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER



ALUMINIUM ALLOY STRANDED CONDUCTOR

STANDARD – OES 25B

BRIEF SPECIFICATIONS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 25B
ALUMINIUM ALLOY STRANDED CONDUCTORS

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MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 25B
ALUMINIUM ALLOY STRANDED CONDUCTORS

1.0 GENERAL

Aluminium Alloy Stranded Conductor for use on overhead lines network of Ministry of Electricity and Water shall conform to BS 3242/IEC 208 and shall be suitable for service under the site conditions stated in OES-11.

The conductor sizes covered by this specification are as follows :

TYPE	NOMI-NAL AREA SQ.MM	SECTI-ONAL AREA SQ.MM	STRAND-ING NO/DIA MM	OVER-ALL DIA MM	WEIGHT Kg/Km	ULTI-MATE STEN-GTH KG	D.C. RESIS TANCE AT 20^0C OHMS/ KM	VOL-TAGE LEVEL AT WHICH TO BE USED
AAAC 19/2.89	105	124.6	19/2.89	14.45	343	3836	0.265411	11KV
AAAC 19/3.94	195	231.7	19/3.94	19.70	637	6932	0.142798	33/
AAAC 37/3.15	240	288.3	37/3.15	11KV 22.05	794	8629	0.114972	33KV
YEW	400	478.76	27/4.06	28.42	1320	13600	.06921	132KV

The aluminium alloy conductor shall be made of heat treated aluminium magnesium silicon allow wires conforming to IEC 208.

All wire used in manufacture of the conductors shall be free from protrusions, sharp edges, abrasions or any other blemishes/imperfections. Wires shall be free from metal particles and dirt.

2.0 STRANDING, LAY RATIOS AND LAYERS

Stranding and lay ratios shall be in accordance with BS 3242 for all constructions, successive layers shall be have opposite directions of lay, the outer most layer being right hand.

3.0 JOINTS

Joints in individual wires are not permitted in the outer most layer; no two joints shall be less than 15 metres apart in the finished stranded conductor. Such joints shall be made by resistance butt welding and shall be annealed after welding over a distance of atleast 25cm on each side of the joint.

The joints to fulfill the mechanical and electrical requirements for unjointed wires.

4.0 GREASING OF CONDUCTOR

Each conductor inner layer shall be covered with an approved grease such as Shell Ensis 358, having a minimum drop point of 100^0C, which shall completely fill the interstrices between the strands of the outer layer.

The mass of grease shall represent a minimum of 0.7% of total conductor weight.

There shall be no excess grease remaining on the outside surface of the conductor which may cause sand and dust particles to adhere during pulling out and erection of conductors.

The grease shall have a high melting point not less than 250^0C and shall not migrate towards the bottom of the conductor when the conductor is maintained continuously at a temperature of 90^0C.

The specified characteristics of grease shall not be affected after heating to 15^0C above its drop point for 150 hours.

The grease shall protect the conductor from corrosion in severe atmospheric conditions including coastal areas or industrial pollution.

The grease shall have adequate resistance to oxidisation and shall be chemically stable at all service temperatures between 5^0 to 90^0C.

5.0 COMPLETED CONDUCTOR

The completed conductor shall be free dirt, girt, excessive amounts of drawing oil and other foreign deposits.

6.0 TESTS

The following test shall be carried out on aluminium allow sires in accordance with IEC 208.

- Tensile test
- Elongation test
- Resistance test
- Diameter measurement

The following tests shall be carried out on completed conductor in accordance with IEC 208/BS 3242.

- lay ratio of each layer (to be measured)
- Tensile strength
- Measurement of weight (with and without grease)
- Resistance test

7.0 MARKING AND PACKING

The conductors shall be supplied in 2000 meter lengths on impregnated drum of approved material so constructed to enable the conductor to run smoothly without damage to the conductor in transport, handling or installation.

The following information in Arabic and English shall be clearly marked in indelible paint on both flanges of every conductor drum.

- Conductor and rum particulars
  - Conductor type and name
  - Conductor size and stranding
  - Exact length (m)
  - Nett and gross weights (kg)
  - Year of manufacture
- Arrow showing correct direction of rolling which is opposite to the direction of unwinding with instruction "ROLL THIS WAY:"
- Instruction "DO NOT LAY FLAT"
- Manufacturer's name and country of origin
- MEW order number and address
- MEW's material code number
- Stores destination
- Drum serial number

TECHNICAL GUARANTEED PARTICULARS

Sl. No.	Description		Particulars
1	Standard to which conductor conform		
2	Sectional area of conductor		
	a) Area	Sq.mm	
	b) Nominal aluminium area	Sq.mm	
	c) No. of strands		
	Dia of strands	mm	
	d) Overall diameter of		
	conductor	mm	
3	Lay ratio maximum/minimum		
	– Inner layer		
	– Middle layer		
	– Outer layer		
4	Maximum resistance at 20^0C	Ohms	
5	Weight of conductor per km	Kg	
6	Weight of conductor including		
	grease/KM	Kg	
7	Type of grease		
8	Drum length	m	
9	Gross weight of drum when full	Kg	

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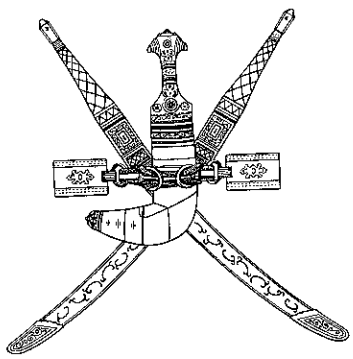

ALUMINIUM STRANDED CONDUCTOR FOR L.T. OVERHEAD LINE

STANDARD – OES 25C

BRIEF SPECIFICATIONS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 25C
ALUMINIUM STRANDED CONDUCTOR FOR L.T. OVERHEAD LINES

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SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 25C
ALUMINIUM STRANDED CONDUCTOR FOR LT OVERHEAD LINES

1.0 GENERAL

All aluminium stranded conductor shall conform to BS 215 Part I and shall be suitable for operation under service conditions stated in OES-11.

The conductor sizes covered by this specification shall be as follows :

NOMINAL AREA Sq.mm	SECTION AREA Sq.mm	STRANDING/ DIA mm	OVERALL DIA mm	WEIGHT/KM Kg	UTS Kg
200	213.2	19/3.78	18.9	587.00	3240
120	119.51	19/2.83	14.21	329.39	1991.8
70	73.65	7/3.66	10.97	202.77	1216.0
35	37.16	7/2.6	7.8	101.5	576

The aluminium wires used in the construction of the conductor shall be as specified in BS 2627. The purity of aluminium used shall not be less than 99.5%.

2.0 DIMENSIONS AND CONSTRUCTION

Aluminium wires for stranded construction covered by this specification shall have diameters specified in the above table.

The weight and resistance shall be as per BS 215 Pt.I table 3.

3.0 JOINTS IN WIRES

Joints in wires of stranded conductors containing seven wires is not permitted, except those made in the base rod before final drawing based on guarantee that the joint will develop at least 90% of the tensile strength of the unjoined rod.

Joints in the wires of stranded conductor containing more than seven strands shall be resistance butt welded.

4.0 MARKING AND PACKING

The conductors shall be supplied in 2000 meter lengths on impregnated drum of approved material so constructed to enable the conductor to run smoothly without damage to the conductor in transport, handling or installation.

The following information in Arabic and English shall be clearly marked in indelible paint on both flanges of every conductor drum.

- Conductor and rum particulars
  - Conductor type and name
  - Conductor size and stranding
  - Exact length (m)
  - Nett and gross weights (kg)
  - Year of manufacture
- Arrow showing correct direction of rolling which is opposite to the direction of unwinding with instruction "ROLL THIS WAY:"
- Instruction "DO NOT LAY FLAT"
- Manufacturer's name and country of origin
- MEW order number and address
- MEW's material code number
- Stores destination
- Drum serial number

TECHNICAL GUARANTEED PARTICULARS

Sl. No.	Description		Particulars
1	Standard to which conductor conform		
2	Sectional area of conductor		
	a) Area	Sq.mm	
	b) Nominal aluminium area	Sq.mm	
	c) No. of strands		
	Dia of strands	mm	
	d) Overall diameter of		
	conductor	mm	
3	Lay ratio maximum/minimum		
	– Inner layer		
	– Middle layer		
	– Outer layer		
4	Maximum resistance at 20^0C	Ohms	
5	Weight of conductor per km	Kg	
6	Weight of conductor including		
	grease/KM	Kg	
7	Type of grease		
8	Drum length	m	
9	Gross weight of drum when full	Kg	

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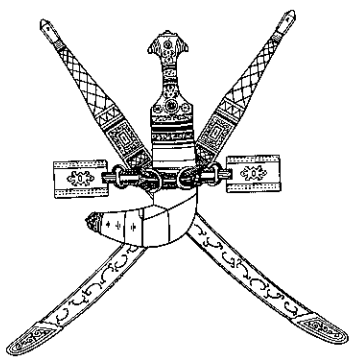
MINISTRY OF ELECTRICITY & WATER



XLPE COVERED ALUMINIUM CONDUCTOR FOR L.T. OVERHEAD LINE

STANDARD – OES 25D

BRIEF SPECIFICATIONS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 25D
XLPE COVERED ALUMINIUM CONDUCTOR FOR L.T. OVERHEAD LINES

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MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 25D
XLPE COVERED ALUMINIUM CONDUCTOR FOR LT OVERHEAD LINES

1.0 GENERAL

XLPE covered aluminium conductors for LT overhead lines shall generally be in accordance with BS 6485 except the XLPE covering and compaction of conductors.

They shall be suitable for operation under service conditions stated in OES 11.

The conductor sizes covered by this specification shall be as follows :

NOMINAL AREA Sq.mm	SECTION AREA Sq.mm	STRANDING/ DIA mm	OVERALL DIA mm	WEIGHT/KM KM Kg	UTS Kg
200	213.2	19/3.78	18.9	587.00	3240
120	119.51	19/2.83	14.21	329.39	1991.8
70	73.65	7/3.66	10.97	202.77	1216.0
35	37.16	7/2.6	7.8	101.5	576

2.0 CONSTRUCTION

The construction of conductor shall be as follows :

2.1 CONDUCTOR

The conductor shall consist of compacted circular aluminium conductor in accordance with BS 215 Part I.

2.2 COVERING

The covering shall consist of an extruded black cross linked polyethylene compound complying with IEC 502.

The minimum average thickness of covering shall be not less than values give below :

SIZE – SQ.MM	THICKNESS – MM
35	1.2
70	1.4
120	1.6
200	1.8

The thickness at nay point may however be less than the nominal value provided that difference does not exceed 0.1 mm + 1.0% of nominal value.

3.0 DIMENSIONS AND CHARACTERISTICS

The voltage grade shall be 600/1000 volt. The dimensions and characteristics of the conductor shall conform to BS 215 Pt. I except for covering.

MARKING

The following shall be marked on the XLPE covering of the conductor at an interval of 50 metres.

a) Size of conductor
b) Voltage grade
c) Property of Ministry of Electricity and Water
d) Manufacturer's name
e) Country of origin
f) Year of manufacture

4.0 TESTS

The following tests shall be carried out in accordance with BS 6485 and IEC 502.

- Spark test (AC 6 KV)
- Measurement of thickness of covering
- Conductor resistance
- Insulation resistance test on sample
- High voltage test

MARKING AND PACKING

The conductor shall be supplied in 2000 meter lengths on impregnated drums of approved material so constructed to enable the conductor to run smoothly without damage to the conductor in transport, handing or installation.

The following information in Arabic and English shall be clearly marked in indelible paint on both flanges of every conductor drum.

- Conductor and rum particulars
  - Conductor type and name
  - Conductor size and stranding
  - Exact length (m)
  - Nett and gross weights (kg)
  - Year of manufacture
- Arrow showing correct direction of rolling which is opposite to the direction of unwinding with instruction "ROLL THIS WAY:"
- Instruction "DO NOT LAY FLAT"
- Manufacturer's name and country of origin
- MEW order number and address
- MEW's material code number
- Stores destination
- Drum serial number

TECHNICAL GUARANTEED PARTICULARS

Sl. No.	Description	Details
1	Rated voltage	V
2	Conductor : 2.1 Nominal cross sectional area	mm^2
	2.2 No. of strands	
	2.3 Outer diameter approx.	mm
3	Minimum thickness of covering	mm
4	Overall diameter approx.	mm
5	Net weight of cably approx.	Kg/Km
6	Nominal dc conductor resistance at 20 << C	Ohm/Km
7	Breaking load approx.	Kn

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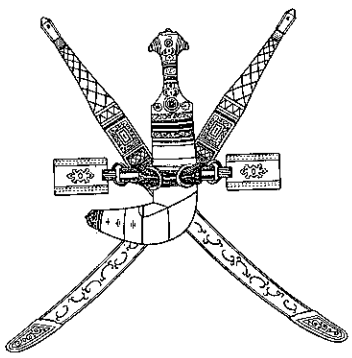
MINISTRY OF ELECTRICITY & WATER



DISC INSULATORS

STANDARD – OES 26A

BRIEF SPECIFICATIONS
AND
STANDARD DRAWINGS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 26A
DISC INSULATORS

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SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 26A
DISC INSULATORS

1 GENERAL

Glazed porcelain disc insulators for use on 33KV and 11KV over head line network shall conform to BS 137 type A and generally to MEW Drawing No. MEW/OH/003 and be suitable in all respects for operation under service conditions stated in OES-11.

2 PROFILE

The insulators shall be aerofoil open profile self cleaning type.

3 CREEPAGE

The minimum creepage distance shall be 280mm.

4 MINIMUM MECHANICAL FAILING LOAD

Minimum mechanical failing load shall be 80KN.

5 ELECTRICAL VALUES

Minimum Electrical characteristics of the disc insulators shall be as follows :

		KV
Power frequency flashover	dry	68
	wet	50
Impulse flashover voltage	positive	100
	negative	100
Power frequency withstand	dry	64
Voltage (one minute)	wet	45
Impulse withstand voltage		90
Power frequency puncture voltage		120

6 CONSTRUCTION

The porcelain shall be sound, thoroughly vitrified and free from defects, blemishes, undulations and pittings which might adversely affect the life of the insulator.

The porcelain used shall be produced by the wet process method and shall be non-porous with high fusion point. The surface of the porcelain shall be free of irregularities and rough particles. The exposed parts of the porcelain shall be smoothly glazed and shall be brown/chocolate in colour.

The cement used in the manufacture of insulators shall not cause fracture by expansion or loosening by contraction and proper care shall be taken to locate the individual parts correctly during cementing. The cement shall not chemically react with metal fittings and its thickness shall be uniform.

The caps of insulator shall be of malleable iron having necessary strength to enable the complete unit to satisfy the requirements of this standard. Metal part surfaces shall be smooth with no projecting points or irregularities.

The security clips for use with bass and socket insulator unit shall comply with the requirements of BS 3288.

Ball and socket couplings of insulator unit shall be in accordance with BSS 3288 : Part 2.

PROTECTION OF FERROUS METAL PARTS AGAINST CORROSION

All ferrous metal parts shall be hot dip galvanised in accordance with OES-11 as per BS 729 with minimum zinc thickness 127 microns.

7 MARKING

Every insulator unit shall be legibly and permanently marked with the following information in English in accordance with BS 137.

- Manufacturer's name and trade mark
- Year of manufacture
- Mechanical failing load

8 TESTS

8.1 TYPE TESTS

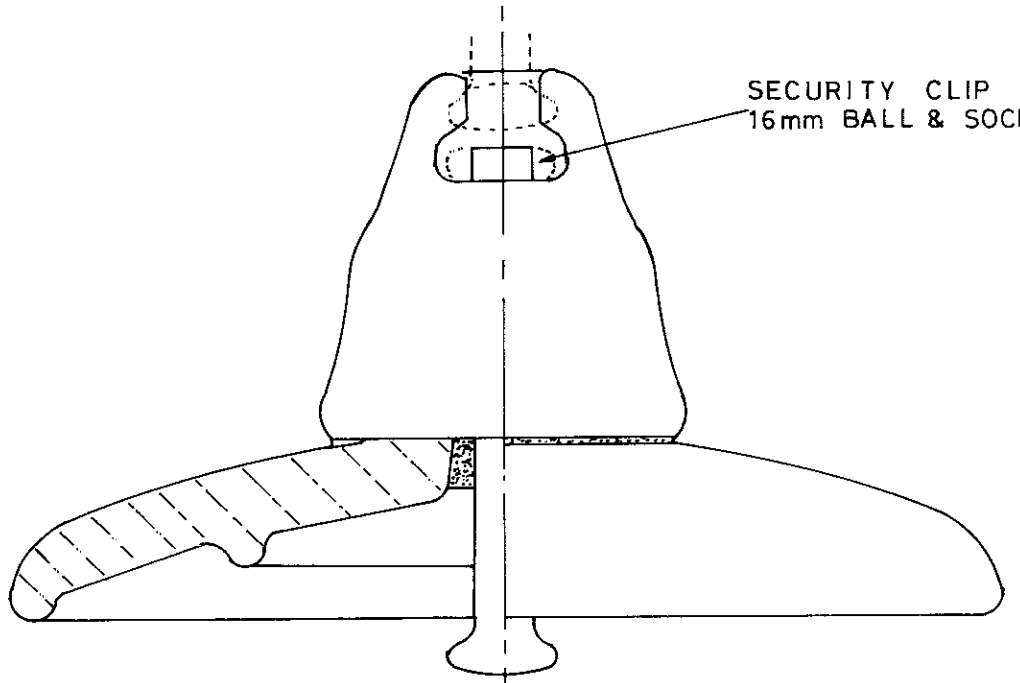
- Dry lightning impulse withstand
- Wet power frequency withstand
- Performance test
- Radio interference test

8.2 SAMPLE TESTS

- Verification of dimensions
- Temperature cycle test
- Mechanical failing load test
- Porosity test
- Galvanising test

8.3 ROUTINE TESTS

- Visual examination
- Mechanical routine test



DISC INSULATOR
AERO DYNAMIC

NOTE
1 To Conform Generally To O E S 26 A
2 MIN FAILING LOAD = 80 KN
3. TOTAL CREEPAGE = 280 mm MIN
4. Insulator to be of areo dynamic open profile self cleaning type.
5 All ferrous parts to be galvanised to B S 729 in accordance with O E S 11 Minimum thickness of 127 microns

REV	DATE	DESCRIPTION	CKD	APD
B	12-5-90	Notes added		
A	21-6-89	Notes added		

MINISTRY OF ELECTRICITY & WATER

TITLE
33/11KV TENSION INSULATOR

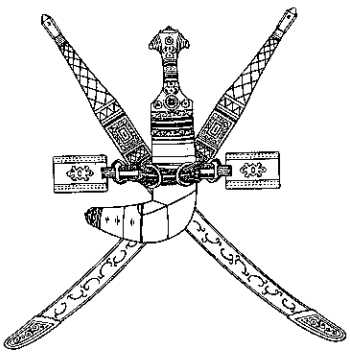
DRAWN BY	CHECKED BY	APPROVED BY
FRANCIS		

DRG.NO. MEW/OH/003 DATE : 07.10.1985

SCALE N.T.S.

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER



33KV LINE POST INSULATORS

STANDARD – OES 26B

BRIEF SPECIFICATIONS
AND
STANDARD DRAWINGS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 26B
33KV LINE POST INSULATORS

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SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 26B
33KV LINE POST INSULATORS

1.0 GENERAL

This specification covers the design, manufacture, testing and performance requirements of 33KV line post insulators for use on Ministry's 33KV Overhead lie network.

33KV line post insulator shall be of glazed porcelain conforming to BS 137 and suitable for operation under service conditions stated ion OES-11.

They shall generally conform to Drawing No. MEW/OH/001.

2.0 PERFORMANCE REQUIREMENTS

Nominal system voltage	:	33KV
System highest voltage	:	36KV
Minimum dry lightning impulse withstand (1.2/50)	.	250KV
Minimum wet power frequency withstand	.	135KV
Minimum mechanical failing load	.	11KN

3.0 CREEPAGE

The minimum creepage shall be 1320mm.

4.0 PROFILE

Line post insulators shall have aerodynamic open profile sheds with good self-cleaning properties and shall facilitate easy live line washing.

They shall have top and side grooves. The insulator shall have uniform sheds.

5.0 MATERIAL AND WORKMANSHIP

5.1 PORCELAIN INSULATORS

The porcelain shall be sound thoroughly vitrified and free from defects and blemishes which might affect the life of the insulator. The porcelain shall be produced by the wet process method and shall be non-porous with high fusion point. The surface of the porcelain shall be free from irregularities and rough particles. The exposed part of porcelain shall be smoothly glazed and shall be brown/chocolate in colour.

The cement used in the manufacture of insulators shall not cause fracture by expansion or loosening by contraction, and proper care shall be taken to locate the individual metal part correctly during cementing. The cement shall not chemically react with the metal base and its thickness shall be uniform.

5.2 METAL BASE

The metal base of line post insulators shall be of malleable iron. The metal part surface shall be smooth with no projecting points or irregularities. The threads of tapped holes shall be cut after galvanising.

5.3 FIXING STUD

Dimensions of fixing stud shall generally conform to Drawing No. MEW/OH/001 and shall be in accordance with fitting No. 16 of BS 3288.

6.0 PROTECTION OF FERROUS PARTS AGAINST CORROSION

All ferrous metal parts shall be hot dip galvanised in accordance with OES-11 minimum to BS 729 with thickness of 127 microns.

7.0 MARKING

Every insulator unit shall be legibly and permanently marked with the following information in English in accordance with relevent standard.

- Manufacturer's name and trade mark
- Year of manufacture
- Mechanical failing load

8.0 TESTS

The following tests on 33KV line post insulators shall be carried out in accordance with BS 137 : Part 2.

8.1 TYPE TESTS

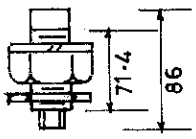
- Dry lightning impulse withstand
- Wet power frequency withstand
- Performance test
- Radio interference test

8.2 SAMPLE TESTS

- Verification of dimensions
- Temperature cycle test
- Mechanical failing load test
- Porosity test
- Galvanising test

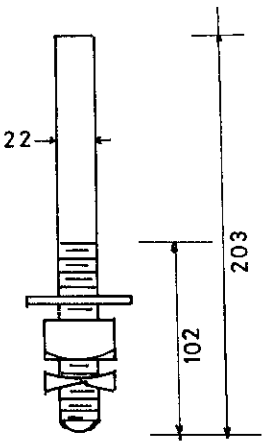
8.3 ROUTINE TESTS

- Visual examination
- Mechanical routine test



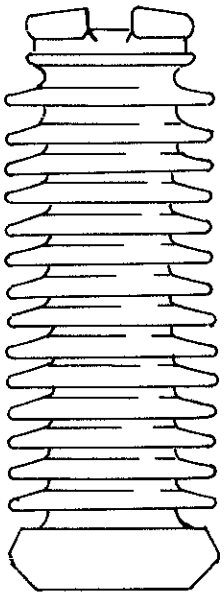
'A'

PIN FOR FIXING ON
SUITABLE M.S. ANGLE



'B'

PIN FOR FIXING ON
50 x 50 x 100mm M.S. CHANNEL



LINE POST INSULATOR

NOTE

1. To Conform Generally To O E S 26B
2. Creepage Distance 1320mm Min.
3. Cantilever Strength. 11 kN
4. Glaze. Chocolate
5. All Ferrous Parts Are Hot Dipped Galvanised To B.S.729 In Accodance with O.E.S.11 Minimum Thickness 127 Microns.
6. All Dimensions Are In Millimeters

REV	DATE	DESCRIPTION	CKD	APD.
B	12-5-90	Notes added		
A	21-6-89	Check nut added		

MINISTRY OF ELECTRICITY & WATER

TITLE.
33KV LINE POST INSULATOR

DRAWN BY	CHECKED BY	APPROVED BY
FRANCIS		

DRG.NO. MEW/OH/001

DATE. 07_10_1985

SCALE . N.T. S

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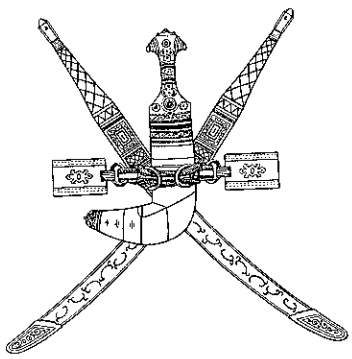


11KV LINE POST INSULATORS

STANDARD – OES 26C

BRIEF SPECIFICATIONS
AND
STANDARD DRAWINGS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 26C
11KV LINE POST INSULATORS

1.0 GENERAL

This specification covers the design, manufacture, testing and performance requirements of 11KV line post insulators for use on Ministry's 11KV Overhead lie network.

11KV line post insulator shall be of glazed porcelain conforming to BS 137 and suitable for operation under service conditions stated ion OES-11.

They shall generally conform to Drawing No. MEW/OH/002.

2.0 PERFORMANCE REQUIREMENTS

Nominal system voltage	11KV
System highest voltage	12.5KV
Minimum dry lightning impulse withstand (KV peak)	110KV
Minimum wet power frequency withstand	50KV
Minimum mechanical failing load	11KN

3.0 CREEPAGE

The minimum creepage shall be 440mm.

4.0 PROFILE

Line post insulators shall have aerodynamic open profile sheds with good self-cleaning properties and shall facilitate easy live line washing.

They shall have top and side grooves. The insulator shall have uniform sheds.

5.0 MATERIAL AND WORKMANSHIP

5.1 PORCELAIN INSULATORS

The porcelain shall be sound thoroughly vitrified and free from defects and blemishes which might affect the life of the insulator. The porcelain shall be produced by the wet process method and shall be non-porous with high fusion point. The surface of the porcelain shall be free from irregularities and rough particles. The exposed part of porcelain shall be smoothly glazed and shall be brown/chocolate in colour.

The cement used in the manufacture of insulators shall not cause fracture by expansion or loosening by contraction, and proper care shall be taken to locate the individual metal part correctly during cementing. The cement shall not chemically react with the metal base and its thickness shall be uniform.

5.2 METAL BASE

The metal base of line post insulators shall be of malleable iron. The metal part surface shall be smooth with no projecting points or irregularities. The threads of tapped holes shall be cut after galvanising.

5.3 FIXING STUD

Dimensions of fixing stud shall generally conform to Drawing No. MEW/OH/002. Insulator fixing stud shall conform to BS 3288.

PROTECTION OF FERROUS PARTS AGAINST CORROSION

All ferrous metal parts shall be hot dip galvanised in accordance with OES-11 as per BS 729 with minimum zinc thickness of 127 microns.

6.0 MARKING

Every insulator unit shall be legibly and permanently marked with the following information in English in accordance with relevent standard.

- Manufacturer's name and trade mark
- Year of manufacture
- Mechanical failing load

7.0 TESTS

The following tests on 11KV line post insulators shall be carried out in accordance with BS 137 : Part 2.

7.1 TYPE TESTS

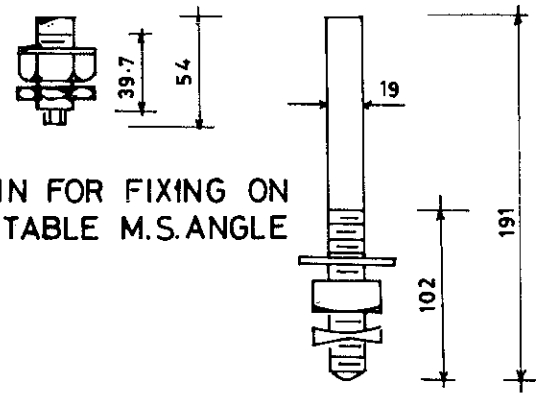
- Dry lightning impulse withstand
- Wet power frequency withstand
- Performance test
- Radio interference test

7.2 SAMPLE TESTS

- Verification of dimensions
- Temperature cycle test
- Mechanical failing load test
- Porosity test
- Galvanising test

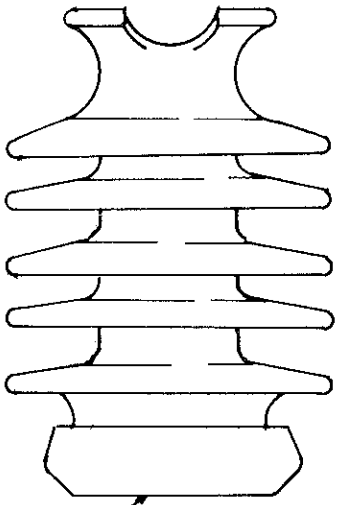
7.3 ROUTINE TESTS

- Visual examination
- Mechanical routine test



PIN FOR FIXING ON
SUITABLE M.S. ANGLE

PIN FOR FIXING ON
M.S. CHANNEL 50 x 50x100



19mm TAPPED HOLE

POST INSULATOR

NOTE

1. To Conform generally To O E S 26 C
2. Creepage Distance 440mm. Min.
3. Cantilever Strength 11 KN
4. Glaze Chocolate.
5. All Ferrous Parts Are Hot Dipped Galvanised To B.S. 729 In Accordance With O.E.S.11. Minimum Thickness of 127 Microns.
6. All Dimensions Are In Millimeters.

REV	DATE	DESCRIPTION	CKD	APD
B	12-5-90	Notes added		
A	21-6-89	Check nut added		

MINISTRY OF ELECTRICITY & WATER

TITLE
11KV LINE POST INSULATOR

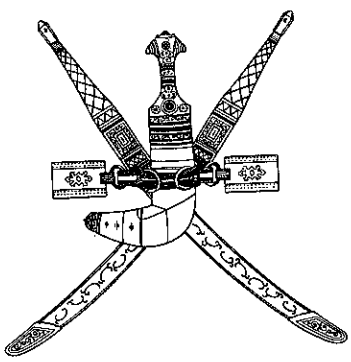
DRAWN	CHECKED	APPROVED
FRANCIS		

DRG. N O. MEW/OH/002 | DATE. 09-10-1985

SCALE N.T.S.

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER



11KV STAY INSULATORS

STANDARD – OES 26D

BRIEF SPECIFICATIONS
AND
STANDARD DRAWINGS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 26D
11KV STAY INSULATORS

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MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 26D
11KV STAY INSULATORS

1.0 GENERAL

This specification covers the design, manufacture, testing and performance requirements of 11KV stay insulators for use on 11KV overhead line network in MEW system.

11KV stay insulator shall be of glazed porcelain conforming to BS 137 and suitable for operation under service conditions stated in OES-11.

They shall generally conform to Drawing No. MEW/OH/015B.

2.0 PERFORMANCE REQUIREMENT

Nominal system voltage	11 KV
System highest voltage	12.5 KV
50 cycles dry flash over	40 KV
50 cycles wet flash over	22 KV
Leakage distance	80 mm
Tensile strength	90 KN

3.0 MATERIAL

Insulator material shall be porcelain. The porcelain shall be sound thoroughly vitrified and free from defects and blemishes which might affect the life of the insulator. The porcelain used shall be produced by the wet process methods and shall be non-porous wit high fusion point. The surface of the porcelain shall be free from irregularities and any rough particles. The exposed part of porcelain shall be smoothly glazed and shall be brown/chocolate in colour.

4.0 MARKING

Every insulator unit shall be legibly and permanently marked with the following information in English in accordance with relevent standard.

- Manufacturer's name and trade mark
- Year of manufacture
- Mechanical failing load

5.0 TESTS

The following tests on 11KV line post insulators shall be carried out in accordance with BS 137 : Part 2.

5.1 TYPE TESTS

- Dry lightning impulse withstand
- Wet power frequency withstand
- Performance test

5.2 SAMPLE TESTS

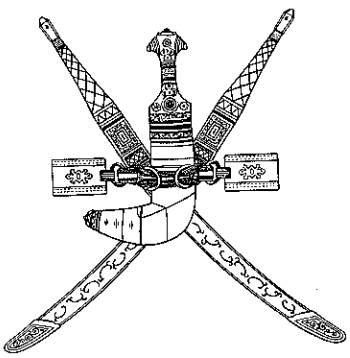
- Verification of dimensions
- Temperature cycle test
- Mechanical failing load test
- Porosity test
- Galvanising test

5.3 ROUTINE TESTS

- Visual examination
- Mechanical routine test

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER



WOOD POLES

STANDARD – OES 29

BRIEF SPECIFICATIONS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 29
WOOD POLES

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SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 29
WOOD POLES

01 STANDARD

Wood poles shall generally conform to BS 1990 and creosoting to BS 913 except for retention of 140 kgs per cubic meter.

02 SPECIES

Wood poles shall be Pinus Silvestris/Douglas Fir with minimum extreme fibre stress of 5.48 x 10^6 Kg/m^2 from regions north of latitude 60^0 N.

03 DIMENSION

	Length	Top dia min mm	Dia 1.5M from Butt end-min mm
medium	9.0	150	220
light	9.0	125	180
medium	11.0	150	240
stout	11.0	190	295
extra long (for special locations)	13.0	195	320

04 KNOTS

The poles shall be sound, straight and free from decay or dead knots especially knots forming a complete surface ring and free from other defects. They should be hard grown.

05 SEASONING

The poles shall be well seasoned with minimum of moisture (less than 25% prior to creosoting) with minimum of cracks not exceeding 3mm in width and 20mm in depth at the time of delivery to site.

06 MARKING

Every pole shall be marked, as per BSS 1990 the marking being gouged or branded 5mm wide and 3mm deep with characters having minimum height of 25mm.

The final dressing shall be carried out before impregnation.

07 INSPECTION

Every consignment to Oman shall be accompanied by a certificate of compliance from an international agency acceptable to MEW.

TECHNICAL PARTICULARS AND GUARANTEES (OES 29)

No.	Description		Particulars
01	Length of pole	m	
02	Top diameter minimum	mm	
03	Minimum diameter at 150cm from butt end	cm	
04	Ultimate extreme fibre stress	Kg/cm^2	
05	Modules of elasticity	Kg/cm^2	
06	Ultimate load at 15cm from top of pole with an assumed (depth of planting of 180 cm)	Kn	
07	Wood species		
08	Origin of timber		
09	Place of creosoting		
10	Inspection agency		

SULTANATE OF OMAN

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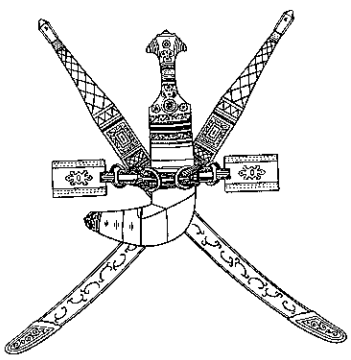


SPUN CONCRETE HOLLOW POLES

STANDARD – OES 33

BRIEF SPECIFICATIONS

First Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 33
SPECIFICATION FOR SPUN CONCRETE HOLLOW POLES

1.0 TYPES

The reinforced concrete spun poles used in MEW system shall be of following type :

A) 11 Mtr. – Intermediate Pole for 11 and 33KV – Sketch 1.
B) 11 Mtr. – Single Section Pole for 11 and 33KV – Sketch 2
C) 11 Mtr. – "H" Section Terminal Pole – Sketch 3
D) 13 Mtr. – Special Pole – Sketch 4
E) 9 Mtr. – L.T. Pole – Sketch 5

2.0 STRENGTH

Ultimate horizontal and vertical load at 0.6m from top of the pole shall be as follows :

Type A – 850 Kg
Type B – 1550 Kg
Type C – 850 Kg
Type D – 1600 Kg
Type E – 850 Kg

3.0 DIMENSION AND SHAPE

The poles shall be of hollow circular section with taper of 1:75. The diameter and thickness shall be as per design requirements. The structure design shall be in accordance withy B.S. 8110 - 1985 Part I (Design and Detailing pre-stressed concrete).

The dimensional tolerance shall be as follows :

Length of pole	+ or - 10 mm
Straightness of poles	2 mm/mm length
Full cross section dimension of pole	+ or - 2 mm
Distance between hole centre	+ or - 2 mm
Upper most hole from top of pole	+ or - 5 mm
Tolerance on hole position measured on pole circumference	+ or - 3 mm
Angle between holes and the longitudinal axis of the pole	2^0
Other dimension	+ or - 3 mm

4.0 MATERIALS

4.1 Cement

– Cement used shall be one of the following types complying wit the corresponding British Standard or American Standard.

i) Ordinary Portland Cement - BS 12 : 1989 or ASTM C 150 Type "I"
ii) Sulphate Resisting Cement - BS 4027 : 1980 or ASTM C 150 Type : V.

4.2 Aggregate

The Aggregate shall be in accordance with BS 882, 1973.

The nominal maximum size of aggregates shall not exceed 14mm or 1/4th the minimum thickness of pole whichever is less. The aggregate used shall be clean, rigid and durable and shall not contain dirt, mud, salts, organic substances or the like harmful to the concrete.

The nominal maximum size of aggregate shall be atleast 5 mm less than the spacing between the presstress wires and longitudinal reinforcement.

Contamination by clay, silt and dust

The percentage by weight passing 75 um sieve shall be as follows :

a) Fine aggregate	i)	Natural or crushed aggregate	1%
b) Coarse aggregate	i)	Natural or crushed aggregate	3%
	ii)	Crushed stone	5%

Contamination by chloride and sulphate

The chloride content as (CL) of the fine and coarse aggregate shall not exceed the following limits :

a) Fine aggregate	0.06 by weight
b) Coarse aggregate	0.03% by weight

The total sulphate content expressed as (SO3) of fine and coarse aggregate shall not exceed 0.25% by weight of aggregate.

– The above limits of chlorides and sulphates in aggregate may require to be adjusted to ensure that the total chlorides and sulphates in concrete is below the limits given in Table 1.

Water absorption

– The test value shall be less than 2.5%.
– All tests are to be carried out in accordance with BS.S. 812 - 1988.

4.3 Water

The water used shall not contain oils, acids, salts, organic substances or the like harmful to concrete. Potable water only shall be used for mixing concrete works.

The recommended general limits of organic contamination in water for mixing or curing reinforced concrete shall be as per the following table :

Form of Contamination	Maximum recommended Concentration (PPM)	(%)
Dissolved solids excluding those listed below :	2000	0.20
Sulphates, alkali carbonates or bicarbonates	1000	0.10
Chlorides	500	0.05
Suspended solids	2000	0.20

4.4 Admixtures

- Admixtures shall conform to ASTM C 494.
- Admixtures should not contain calcium chloride or other chlorides and salts which are likely to provide corrosion of prestressing steel.
- The Contractor shall submit test certificate from approved laboratory to confirm the complying of the admixtures.

4.5 Reinforcement

Reinforcing bars and wires used for the manufacture of prestressed concrete poles shall conform to BS 5996 - 1980.

The surface of all reinforcement shall be free from loose scale, oil, grease, clay or other material that may have deteriorating effect on the bond between the reinforcement and concrete. No rust is permissible.

5.0 CONCRETE

The concrete mix design shall comply with the requirement of B.S. 8110 - 1985 Part I and the CIRIA-1 guide to concrete construction in the Gulf Region - 1984 or updated.

The quality of the concrete used for the manufacture of poles shall be such that the compressive strength at 28 days should be at least 50 N/mm^2, the concrete strength at transverse stage should not be less than 25 N/mm^2.

The mix should contain as low a water content as is consistent with adequate workability.

The amount of flexural tensile stresses allowed under service loads shall be Class "1" or "2" as stated in B.S. 8110 - 1985 Part I; i.e. No. visible cracking is allowed.

6.0 MOULDS

Moulds shall be of steel and of rigid construction prevent distortion and so arranged as to provide smooth surfaces. The mould shall not allow any leakage of cement gout during casting. The holes in the end plates for the high tension wires shall be accurately drilled by jigs to ensure interchangeability. The end plates shall be designed to withstand the forces arising out of the change in direction of prestressing wires during tensioning.

7.0 TENSIONING OF WIRES

The presstressing wires shall be stretched by an proven method. The anchoring of the stretched wires shall be such that during manufacture and until the wires are released, no slipping occurs. The force at the time of initial stretching shall in addition to imparting of designed prestresses also be sufficient to overcome the friction on account of any change in the inclination of wires and slippage that might occur during the anchoring process.

The tensioning of prestressing steel shall be carried out in a manner that will induce a smooth and even rate of increase of stress in wires.

The pretensional concrete work the tension shall be fully maintained by some positive mechanized mans during setting and initial curing of concrete.

Pretensioning of the release of prestressing wires shall not be carried out until the strength of the concrete has attained the designed value for load transfer purposes.

The force induced in the prestressing wires shall be determined by means of gauges attached to the tensioning apparatus and cross checked by extension of wires.

The extension to be achieved shall be determined in advance, based on trials conducted on the prepresentative samples of wires as used in the pole. The accuracy of the devices for measuring of the tensioning forces shall be within + or - 5%.

8.0 MIXING AND CONSOLIDATION OF CONCRETE

Provision shall be made to measure the quantities of cement and of fine and coarse aggregate by weight only. The accuracy of measuring equipment shall be + or - 3%. All the measuring equipment shall be maintained in clean, serviceable condition and its accuracy checked regularly by the manufacturer. Modern high speed mixers preferably pan or turbine type shall be used for mixing the concrete.

Mixing and placing concrete shall be as far as possible be avoided during the extreme temperatures in summer and winter. The concrete shall commence within 2 hours of stressing the wiring, failing which the tensioned wire shall be checked.

The manufacture of poles shall be done under suitable cover and not in the open.

The concrete shall be thoroughly mixed and consolidated by means of an proven methods.

9.0 DETENSIONING OF WIRES

The anchoring system shall provide a device for gradual detensioning of wires. No back pulling of the wires shall be permitted in the gradual detensioning device for the purpose of release of any wedge or other parts of the detensioning device. Flame cutting of the wires before release of the full tension shall be stricktly prohibited.

The transfer of prestress shall not be effected until the concrete in the pole has attained the specified strength as established by control tests on cubes.

10.0 CURING

Curing shall be in saturated steam at 1000C to ensure that 2/3 of ultimate strength is obtained within a suitable time to allow for demoulding of poles after 24 hours of their casting.

The application of steam should not begin before six to seven hours after concrete mixing.

The steam should be gradually applied to the concrete. The rate of steam flow should be gradually increased and should not reached its maximum rate before two to four hours from the beginning of its application.

After demoulding , the poles shall be cured for a further period seven days of submerging in water pools.

11.0 CONCRETE COVER

All steel reinforcement (including wires) shall have concrete cove of not less than 20 mm.

12.0 EARTHING

The poles shall be provide with two tapped ferrules of stainless steel, one at the top and the other at the bottom, electrically connected to at least four continuous unstressed reinforcing rods and integrity of connection to be checked before and after concreting.

The earthing system of ferrules, electrical connections and longitudinal conductors in a completed pole have a cross section equivalent to 70 sq.mm copper.

13.0 FITTINGS

Weather Proof Seal

All poles shall have a weather proof seal at the top of the pole.

14.0 PROVISION OF HOLES AND FERRULES

Holes and ferrules shall be provided as shown in sketch (1, 2, 3, 4 and 5).

The holes shall pass diametrically through the pole perpendicular to longitudinal axis. All poles shall be designed and tested with standard holes and ferrules in pole.

The holes and ferrules shall be free from any obstructions which would prevent the insertion of bolts for securing line hardware to pole.

15.0 FINISH

15.1 The poles shall be free from surface defects including hair cracks. The surface of the pole in contact with steel mould shall be smooth and regular in shape and shall be free from pores. Water retaining pockets or honey-combing formation is not permitted.

Non-structural cracks on the inside surfaces will be permitted provided that surface width does not exceed 0.20mm.

15.2 The ends of the presstressing wires shall be cut flush the surface of the pole.

15.3 The ends of the prestressing wires shall be given two coats of suitable approved anti corrosive paints.

15.4 No touching up or finishing by cement grout shall be done on the poles after it is removed from the mould.

16.0 WELDING AND LAPPING OF STEEL

The high tension steel wire shall be continuous over the entire length of pole. Welding shall not be allowed.

17.0 TESTS

Concrete testing during manufacture.

17.1 During manufacture, tests on concrete shall be carried out as detailed earlier.

17.2 Finish Pole

Visual Inspection and dimensional check. To ensure that surface is smooth and there are no cracks, any blemishes. Dimension shall be as per specification.

17.3 Transverse Strength Test

Poles made of ordinary portland cement shall be tested only on the completion of 28 days and poles made from rapid hardening cement only on the completion of 14 days after the date of manufacture.

The pole may be tested in either horizontal or vertical position. If tested in horizontal position, provision shall be made to compensate for the over handing weight of the pole.

The pole shall be rigidly supported at the bolt end for a distance equal to the depth of planting (1800mm).

Load shall be applied at the point 600mm from the top of the pole and shall be steadily and gradually increased to the design value of the transverse test at first crack. The deflection at this load shall be measured.

A prestressed concrete pole shall be deemed not to have passed the tests if visible crack appears at a stage prior to the application of the designed transverse load for the first crack.

The load shall then be reduced to zero and increased gradually to load equal to the first crack plus 10% of the minimum ultimate transverse load, and held up for 2 minutes. This procedure shall be repeated until the load reaches the value of 80 percent of the minimum ultimate transverse load and thereafter increased by 5 percent of the minimum

ultimate transverse load until failure occurs. Each time the load is applied, it shall be held for 2 minutes. The load applied to prestressed concrete pole at the point of failure shall be measured to the nearest five kilograms.

The pole shall be deemed not to have passed the test if the observed ultimate transverse load is less than the design ultimate transverse load.

18.0 SAMPLING AND INSPECTION

18.1 Scale of Sampling

18.1.1 Lot

In a consignment, 500 poles or part thereof the same mounting height same dimensions and belonging to the same batch of manufacture, shall be grouped together to constitute a lot.

18.1.1.1 Sub-Lot

If the number of poles in a lot exceeds 500, the lot shall be divided into a suitable number of sub-lots such that the number of poles in a any sub-lot shall not exceed 50. The acceptance or otherwise of a sub-lot shall be determined on the basis of the performance of samples selected from it.

18.1.2 The number of poles to be selected from a lot or a sub-lot shall depend upon its size and shall be in accordance with Col. 1 and 2 of the following table :

Size of Lot or Sub-Lot	Samples Size & Criterion for Conformity		
	Dimensional Requirement		Number of Poles for Transverse Strength Tests
	Sample Size	Permissible No. Defective Samples	
1	2	3	4
Upto 100	10	1	2
101 to 200	15	1	3
201 to 300	20	2	4
301 to 500	30	3	5

18.1.3 These poles shall be selected at random. In order to ensure randomness, all the poles in the lot or the sub-lot may be arranged in a serial order and starting from ant random pole, every pole may be included in the sample, being the integral part of N were N is the size of the lot or the sub-lot and n is the sample size.

18.2 Number of Tests

18.2.1 All the poles as selected in 17.1.2 shall be tested for overall length, cross section and uprightness. The permissible tolerances shall be within the limits specified in Clause 3.0 of this specification.

18.2.2 The number of poles to be tested for transverse strength test shall be in accordance with Col.4 of the Table in 17.1.2. These poles may be selected from those already tested in 17.2.1.

18.3 Criteria for Conformity

18.3.1 A lot or sub-lot shall be considered as conforming to this specification if the conditions under 17.3.2 and 17.3.3 are satisfied.

18.3.2 The number of poles which does not satisfy the requirements of overall length, cross section and uprightness shall not exceed the corresponding number given in Col. 3 of the Table under Clause 17.1.2.

If the number of such poles exceeds the corresponding number, all poles in the lot or sub-lot shall be tested for these requirements, and those not satisfying the requirements shall be rejected.

18.3.3 All the poles tested for transverse strength test shall satisfy the requirements of the test. If one or more poles fail, twice the number of poles originally tested shall be selected from those already selected and subjected to the test. If there is not failure among these poles, the lot or the sub-lot shall be considered to have citified the requirements of this test.

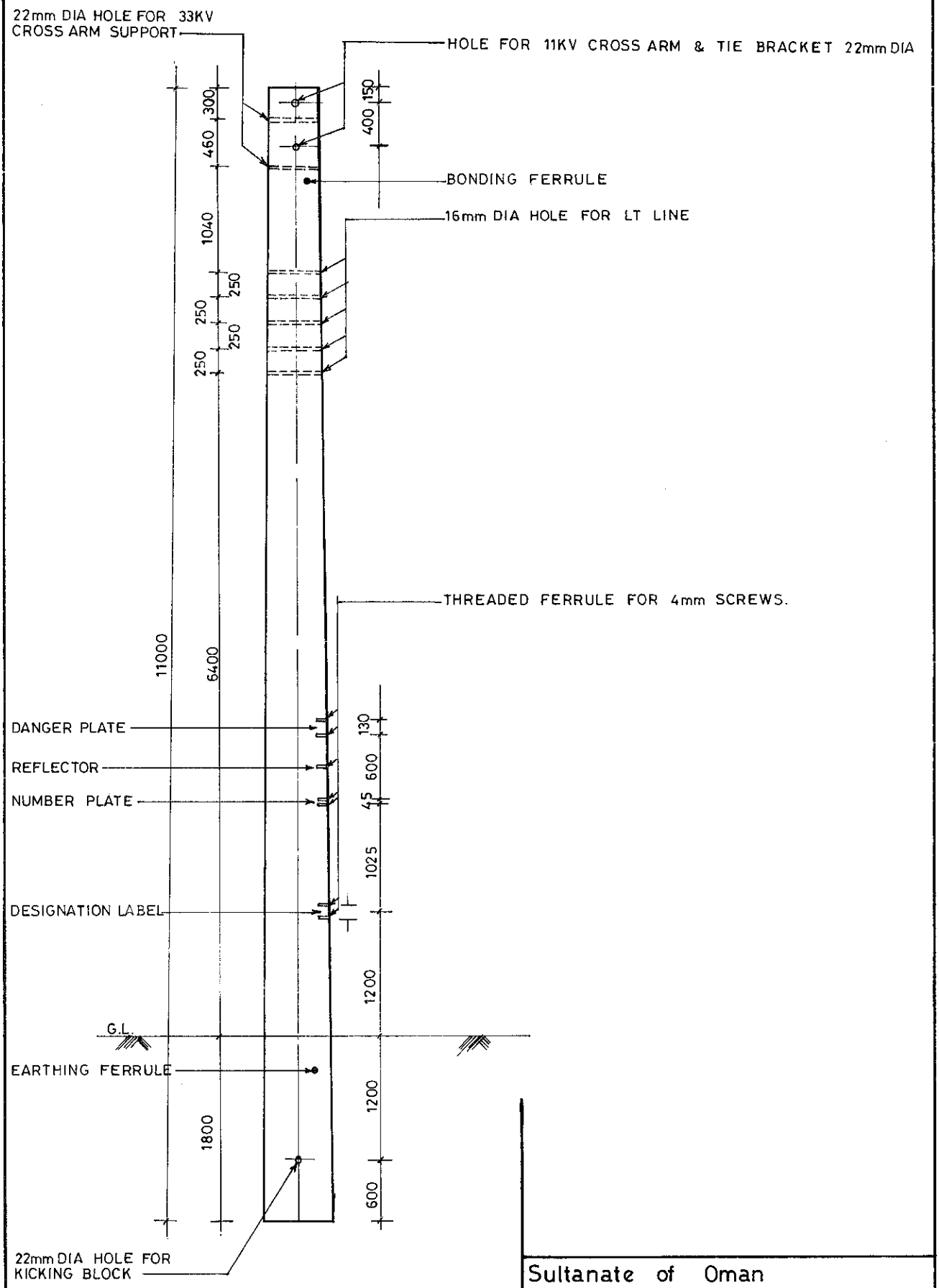
19.0 MARKING

The pole shall be clearly and indelibly marked with the following particulars either during or after manufacture but before testing at a portion as shown in sketches.

a) Name of manufacturer
b) Month and year of manufacture
c) Transverse strength of pole in Kg.
d) Length, serial number of the pole and batch number
e) Position of centre of gravity of the pole with the word Kg. shall be marked
f) MEW - Oman

20.0 HANDLING AND TRANSPORTING INSTRUCTION

The manufacturer shall supply instructions for handling, and transportation of poles to eliminate damage.



NOTE_

1_ FERRULES SHOULD BE WITH STAINLESS STEEL.

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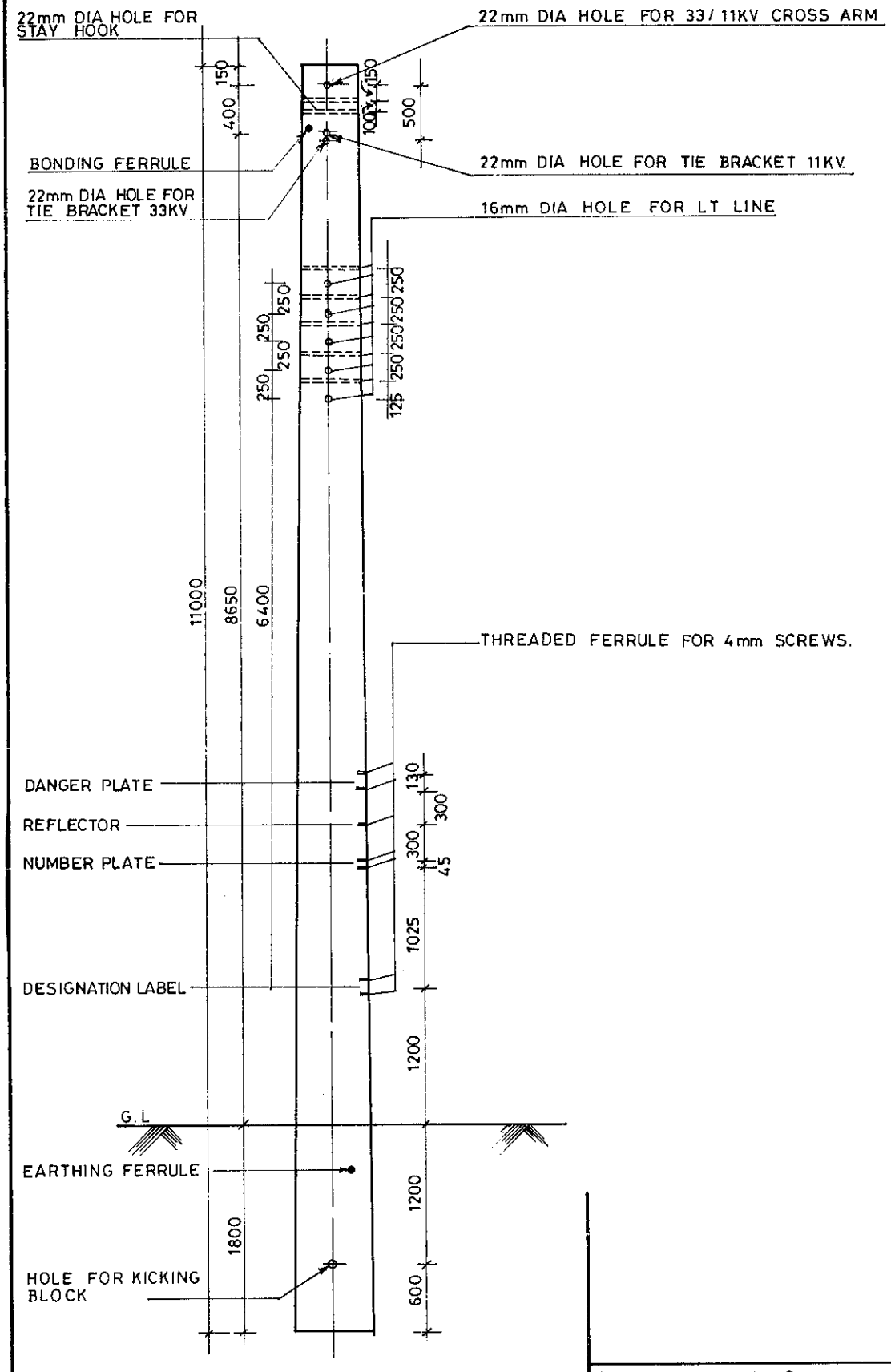
TYPE_A. 11mtr. INTERMEDIATE POLE FOR 33KV / 11 KV. (SPUN CONCRETE) SKETCH_1

DRN	CKD	APD
francis.		
Drg No: MEW/OH/056	Scale NTS	Date 06 05 92



NOTE.

1. FERRULESSHOULD BE WITH STAINLESS STEEL.
2. THE HOLES FOR LT LINE SHOULD BE PROVIDED IN 15° DEVIATION ANGLE (max)

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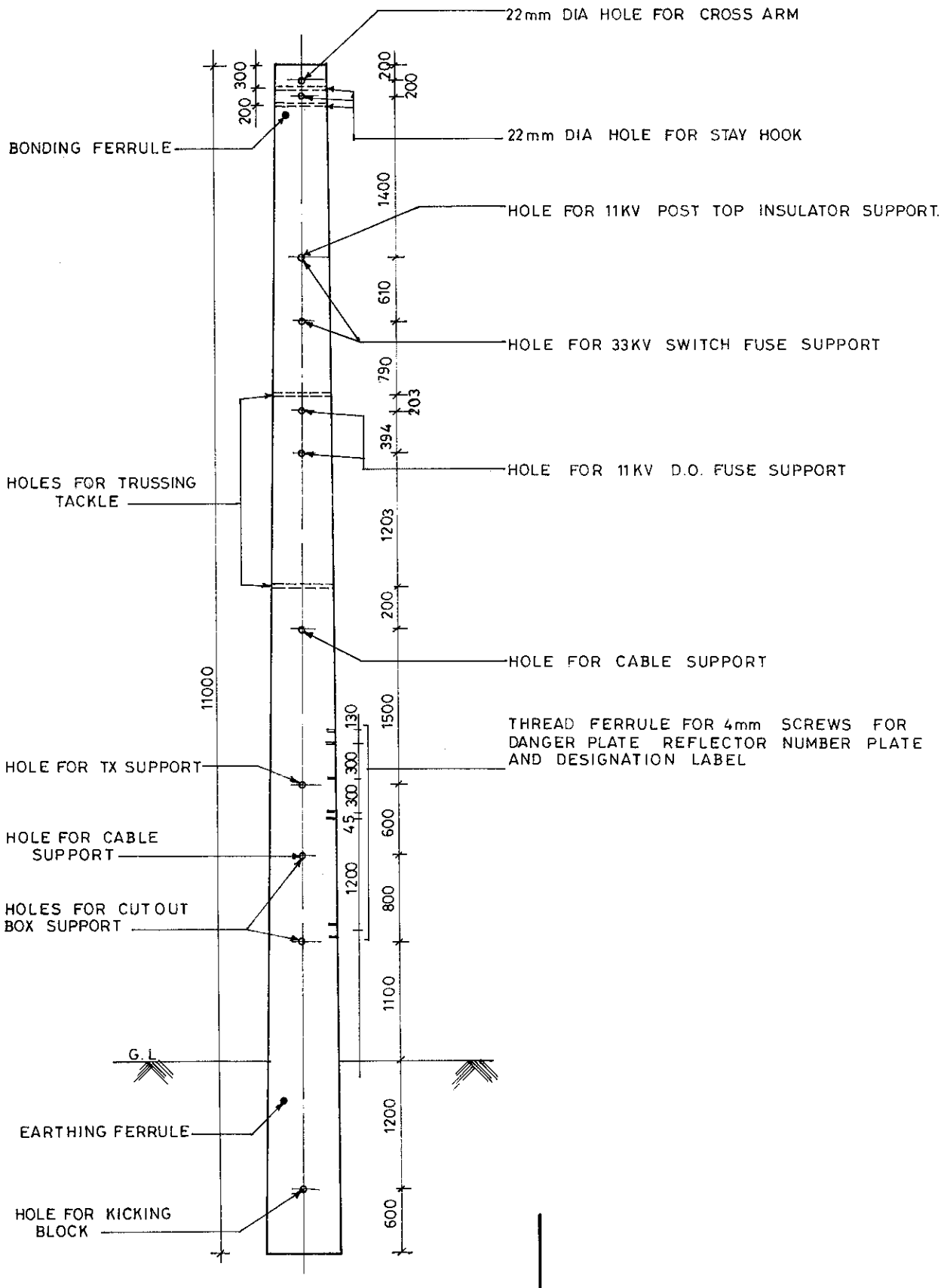
TYPE_B. 11mtr. SINGLE SECTION POLE FOR 33KV/11KV (SPUN CONCRETE)
SKETCH_2

DRN	CKD	APD
francis.		
Drg No.	Scale	Date
MEW/OH/057	NTS	05 05 92



NOTE.

1. FERRULESSHOULD BE WITH STAINLESS STEEL.
2. FERRULE FOR FIXING ANTICLIMBING DEVICE TO BE PROVIDED 200mm BELOW THE TX SUPPORT REF. DRG NO: MEW/OH-GA/37.

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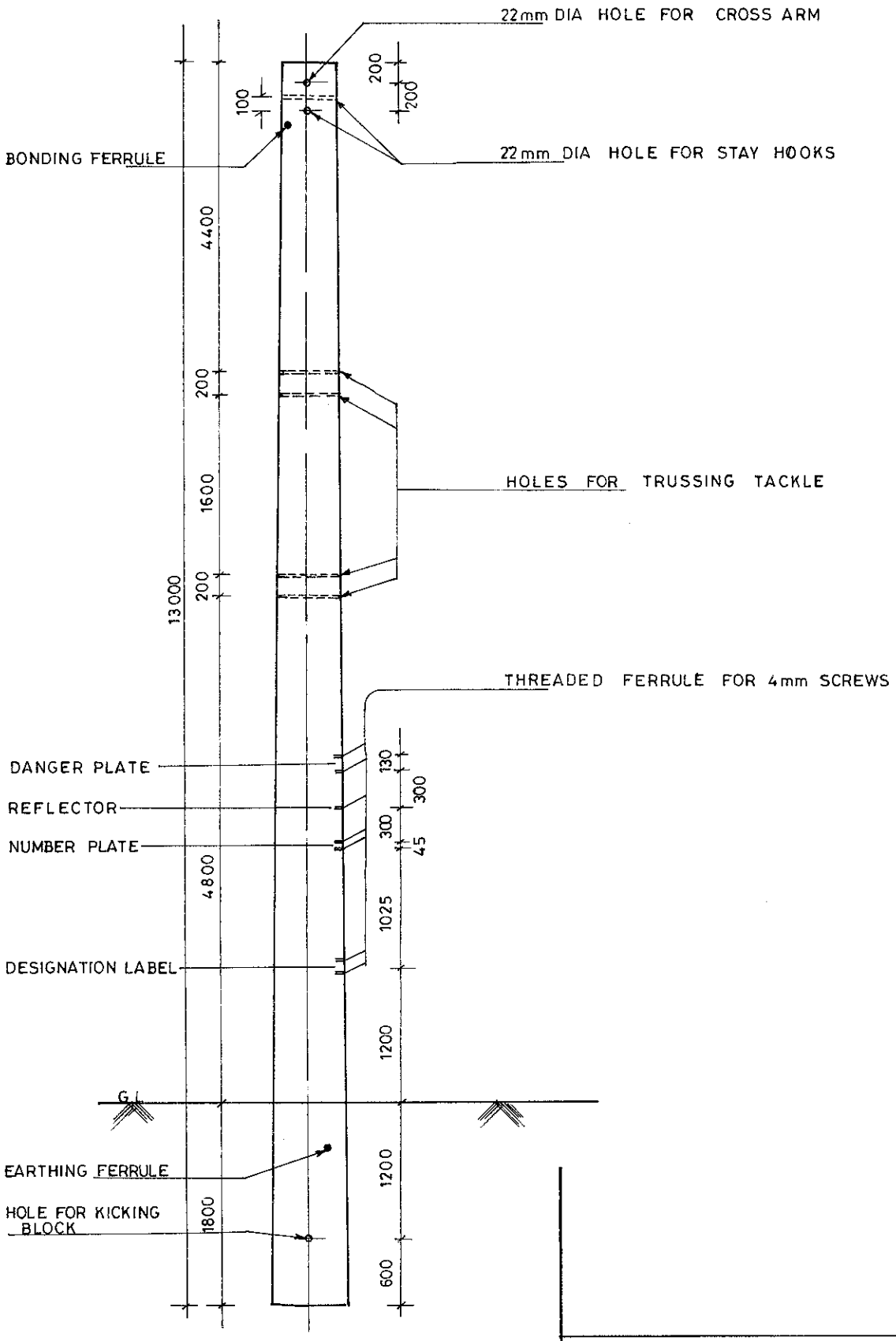
TYPE _C. 11mtr. 'H' SECTION/ TERMINAL POLE _ 33 KV / 11KV (SPUN CONCRETE)

SKETCH _ 3.

DRN.	CKD.	APD.
francis		
Drg No: MEW/OH/058	Scale NTS	Date 05 05 92



NOTE.

1. FERRULESHOULD BE WITH STAINLESS STEEL.

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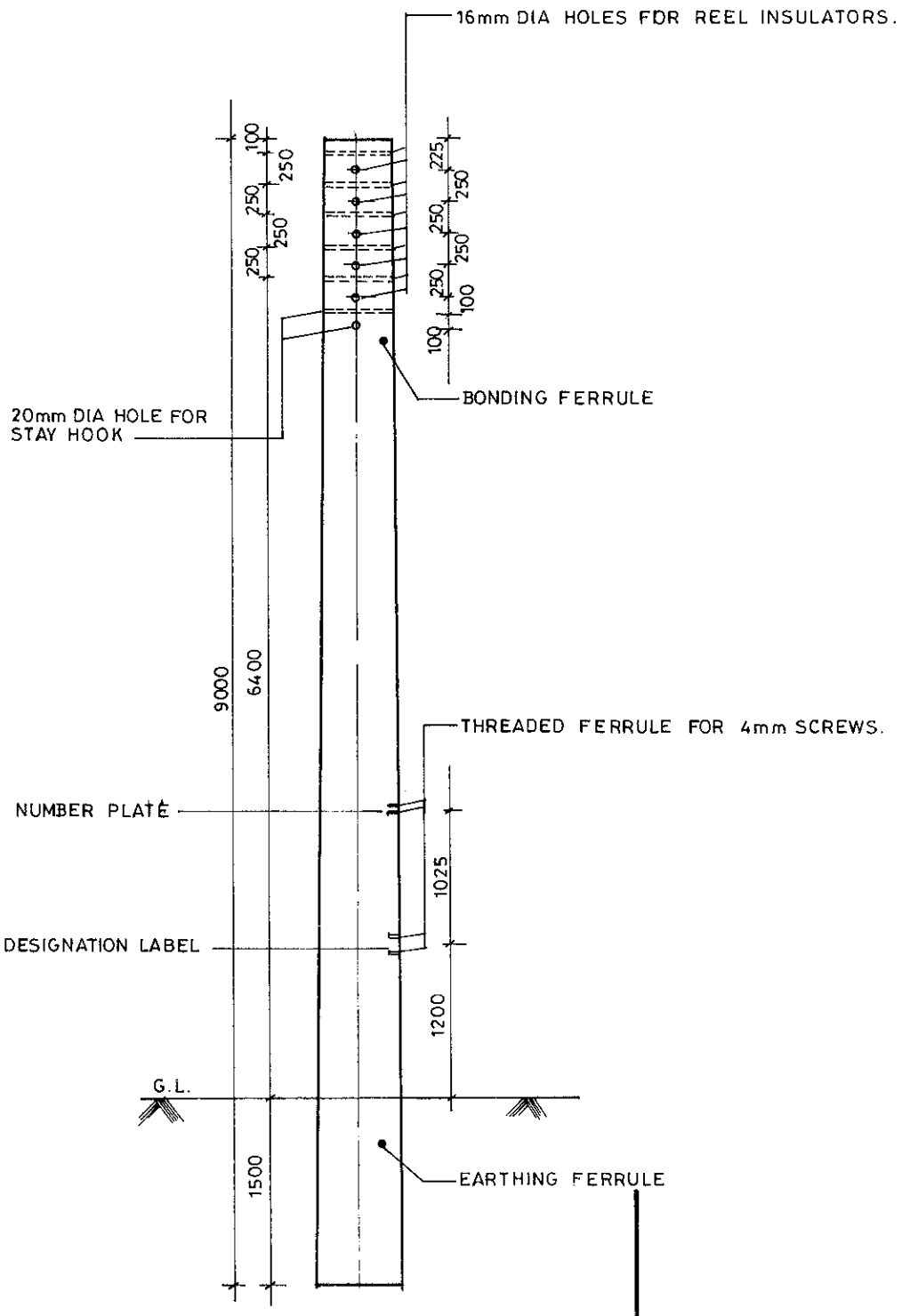
TYPE _ D.

13 mtr. SPECIAL POLE (SPUN CONCRETE)

SKETCH _ 4

DRN	CKD	APD
francis.		
DRG. No.	SCALE	DATE
MEW IOH1059	NTS	09 05 92



NOTE

1. FERRULESSHOULD BE WITH STAINLESS STEEL.

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TYPE_E.
9·0mtr. L.T. POLE.(SPUN CONCRETE)
SKETCH_5.

DRN.	CKD.	APD
francis		
Drg.No. MEW/OH/060	Scale	Date 06 05 92