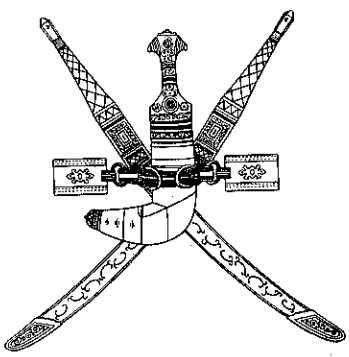
SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER



STANDARD - OES 2

33KV & PILOT, 11KV & L.T. UNDERGROUND CABLE INSTALLATIONS

Second Edition : January 1995

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD : OES - 2

33KV & PILOT, 11KV & L.T. UNDERGROUND CABLE INSTALLATIONS

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SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER

STANDARD OES - 02

33KV & PILOT, 11KV & L.T. UNDERGROUND CABLE INSTALLATIONS

1.0 **CABLES**

33KV, 11KV and LT cables shall be cross-linked polyethylene insulated PVC sheathed, galvanised steel wire armoured and PVC served overall (XLPE/PVC/SWA/PVC). The cables shall comply with the attached specifications UG1, UG2 and UG3.

Pilot cable for use in association with 33KV cable circuits (where applicable) shall be PVC insulated PVC sheathed, galvanised, steel wire armoured and PVC served overall (PVC/PVC/SWA/PVC) to specification UG4.

2.0 **JOINTS AND TERMINATIONS**

Joints and terminations for the cables (33KV and Pilot 11KV and LT) shall be approved dry type without the need for compound filling.

3.0 **INSTALLATION**

3.1 **GENERAL**

Underground cable installation, joining and termination shall be carried out by skilled, experienced workmen under competent supervision. The cable jointer shall be qualified.

3.2 **EXCAVATION OF CABLE TRENCHES AND JOINT PITS**

Prior to commencement of work, way leaves and consents shall be obtained for the execution of the work from the Ministry of Housing, Town Planning, Municipality, Ministry of Communications, Ministry of Electricity and Water, GTO, Royal Oman Police and (where applicable) from the Ministry of Defence, Ministry of Commerce and Industry, Petroleum Development of Oman etc.

Trenches shall be kept as straight as possible and shall be excavated to approved formations and dimension. Trenches shall have vertical sides and shall be close timbered and strutted where necessary to prevent subsidence.

All unsuitable excavated material shall be removed from site.

Adequate guarding and/or fencing shall be provided to all excavations for the protection and safety of the public, traffic and adjacent properties during excavation and before back filling.

The depth of excavated trenches with reference to the general ground level at the sites (and their width at the bottom) shall be as follows :

		DEPTH	WIDTH
a)	33KV 3 core 300 sq.mm copper cable with 19 core pilot cable (for each circuit)	100 cm	60 cm
b)	11KV 3 core 240/50 sq.mm copper cable (for each circuit)	80 cm	50 cm
c)	600 volt grade 4 core 240/16 sq.mm copper cable (for each circuit)	60 cm	40 cm

Drawings for the cable trench sections show the lay of the cables, layers of filling material, position of cable cover tiles, (Drg. Nos. MEW/E/UG/0103 (Rev. "A"), 0104 (Rev. "A") and 0105).

Where trench/joint pit excavations involve removal of pavement slabs/interlocked tiles, permission for taking them out shall be obtained from the Ministry of Communications/Municipality. All care and attention shall be exercised in their removal and later reinstatement to the entire satisfaction of the Ministry of Communications/Municipality etc.

3.3 ROAD CROSSING DUCTS

Cable ducts shall be in the form of asbestos cement or spun concrete pipes as per Drawing Nos. MEW/E/UG/0106 (Rev. "A"), 0107 (Rev. "A") and 0108. In case of bridge crossings, the ducts may be in the form of galvanised steel pipe built into the bridge structure.

Ducts shall be completely embedded in concrete with a minimum 100mm thickness of concrete surrounding the ducts on all sides. Ducts shall be sealed at each end, with split teak wood plugs and bitumen or by other approved means to prevent the ingress of water and vermin.

Alternatively, cable duct may be in the form of steel pipe driven under asphalted road by pipe ramming process.

All necessary diversions and warning signs and/or alternative diversion routes shall be provided in case existing roads or graded defined tracks are temporarily blocked for execution of the work. At least two spare ducts shall be provided.

3.4 CABLES CROSSING OR LAID PARALLEL TO THE INSTALLATION BURRIED UNDERGROUND

A) SPACING OF CABLES FROM THE CABLES OR INSTALLATION WHEN LAID PARALLEL

1) Spacing Between Cables

Cables of different voltage laid parallel shall generally be spaced as shown below: (Drawing No. MEW/E/UG0112).

	L.V.	11KV	33KV
L.V.	400mm	450	500
11KV	450mm	500	550
33KV	500mm	550	600

In locations where space restriction is encountered the following minimum space shall be maintained:

	L.V.	11KV	33KV
L.V.	200	250	300
11KV	250	250	300
33KV	300	300	300

2) **Between Telecommunication Cables and Power Cables**

Power cables shall not be laid in the same trench as GTO cables without written permission from GTO. When power cables laid in parallel with communication cable minimum distance from the trench shall be as follows :

L.V.	300mm
11KV	400mm
33KV	500mm

3) **Sewage Pipes and Water Pipes**

To allow for safe excavation and to permit maintenance work to be executed the following minimum clearance shall be maintained for power cable upto 33KV.

Drawing No. MEW/E/UG/0113.

House connection	< 50mm ϕ Pipe	500mm
	< 100mm ϕ Pipe	100mm
	100 - 300 mm ϕ Pipe	1500mm
	300 - 600mm ϕ Pipe	2000mm
	Above 600mm ϕ Pipe	3000mm

For 132KV cable minimum clearance of 2 mtr. upto 600mm ϕ pipe and 3 mtr. for pipes above 600mm ϕ.

B) CROSSING OF POWER CABLES

Generally, power cables crossing the other installations shall be avoided. If unavoidable, the following clearance shall be maintained :

1) **Crossing of Water Pipes/Sewage Pipes**

Drawing No. MEW/E/UG/0114.

Whenever cables are crossing the water sewage pipe line, minimum clearance of 500mm below the power cable shall be maintained and cable shall be protected by Asbestos cement duct 0 200/150mm encased in concrete to length of 2 mtr. on both sides of crossing for pipes upto 600mm diameter and 3.0 mtr. for pipes above 600mm dia and covered with a cable tiles, warning tapes and cable markers shall be fixed at both of the A.C. duct. Hand excavation will be done at point of crossing.

2) **Crossing of Power Cables**

Whenever power cables are crossing each other the top cable is to be protected by A.C. duct 150/200 mm for a length of 2 mtrs. over the crossing and cable marks shall be fixed at both ends. of the A.C. duct.

The clearance between cables of different voltage levels at crossings shall be as per depth of laying stipulated in the Standard.

In the case of cables of same voltage level clearance at crossing shall be equal diameter of the cable.

3) **Crossing of Communication/GTO Cable by Power Cable**

Drawing No. MEW/E/UG/0115.

Minimum clearance shall be as follows :

L.V.	300MM
11KV	400mm
33KV	500mm

Also telephone cables shall be protected by PVC duct over the crossing to a length of 1 mtr.

Special cable marker shall be fixed at the crossing point of the cables with identification showing the copper and lower cables $\frac{\text{GTO}}{\text{MEW}}$ or $\frac{\text{MEW}}{\text{GTO}}$

3.5 CABLE LAYING

Before the cables are laid, the bottom of the trench shall be lined with sifted soil or with approved soft sand well tamped down to a minimum depth of 100mm to form a bed. After the cables are laid, the first cover of backfill shall consist of sifted soil or approved soft sand well watered and tamped down to depth as shown on Drawing Nos. MEW/E/UG/0103 Rev. A, 0104 Rev. A and 0105.

Cables shall be laid direct from drums.

Sufficient number of rollers shall be provided to avoid twisting of cable on its longitudinal axis during the pulling operation.

Rollers shall be placed as close as possible to avoid abrasion to the cable serving.

If power driven cable pulling is employed, it shall be by bond pulling method using steel carrier wire.

Cable laying operations shall be carried out with all care and attention, to ensure that no damage to the sheath, armour or its serving is caused during the process.

The ends of cross linked polyethylene cables shall be capped to prevent ingress of moisture into the filler or other hygroscopic elements of cable. The caps shall remain intact during transport and laying operations.

3.6 BACKFILLING

After the cables have been laid, the trenches shall be backfilled in 15mm thick layers which shall be well watered and rammed and consolidated.

Unsuitable excavated material shall be removed from site and selected soil supplied and used for backfilling.

After backfilling to depth as shown in Drawing Nos. MEW/E/UG/0101, 0102 Rev. A, 0103 Rev. A interlocked polyethelene cover tiles shall be placed in continuous length. After backfilling to further depth as shown in the drawings, caution tape 150mm wide in (yellow) colour printed with black letters in indelible material shall be placed in continuous length.

Drg. Nos. MEW/E/UG/109 (Revised) shows details of cable cover tiles.

The surface of refilled trenches shall be temporarily reinstated in a thoroughly safe condition until complete consolidation of the soil is achieved.

3.7 JOINTING AND TERMINATION

Cable sealing and jointing shall be carried out strictly in accordance with the manufacturer's instructions and shall be of the best workmanship.

Cable sheaths and armour used as earth continuity conductors, shall be properly bonded to glands and bonding clamps to provide a low resistance path under fault conditions.

XLPE insulated termination cores shall be protected from UV radition by approved means.

3.8 CABLE RECORDS

Records of cables shall be carefully taken on site during the execution of the works. The records shall show the routes, the exact location of each cable, the position of joints and terminations, the date of jointing, weather conditions prevailing, the date of testing, the name of jointer, the lengths between joints, the serial number of cable drums, the direction of lay of cable, that is A to Z ends, and where more than one cable is laid, sectional insert of cable trench. Any other services that cross the route of the cable shall be recorded.

Format for cable records is shown in Drawing No. MEW/E/UG/0110.

3.9 EARTHING

All cable or armour to have links to earth to enable testing of sheath. Earth resistance shall not be greater than 10 ohms.

Where cables are connected between overhead line structures, armour not being bonded to substation earthing system, the armour of such cables shall be bonded to structure steel work earths at both ends.

3.10 CABLE IDENTIFICATION

3.10.1 Cable Route And Joint Markers

Cable route and joint markers shall be reinforced concrete 1:2:4 as shown in Drawing Nos. MEW/E/UG/0104 (Rev. "A"), 0105. Route markers shall be placed at intervals of 50 metres and at points of route alignment changes.

3.10.2 Cable Markers

All power and pilot cables shall be provided with identification markers at their terminations, and at points along the route at intervals of not more than 25 metres apart. Markers shall be made of permanent material of an approved type.

3.10.3 Core Markers

Cores of solid dielectric and plastic insulated low voltage multicore pilot/control cables shall be identified with lettered and numbered marking ferrules which shall be made of a permanent material and shall be of an approved type.

3.11 CABLE PROTECTION

Protection from the Sun

Where cable are installed and exposed to direct solar radiation, sunshields of approved material and design shall be provided.

3.12 BONDING

a) Pilot Cables

The armour of pilot cables with extruded outer sheaths shall be bonded together and connected to earth at all terminating and jointing accessories. Solid bonding connections shall also be made between adjacent multicore cables at terminations and joints.

b) Power Cables

All schemes employing cables having an extruded outer covering shall be installed as an insulated system.

Cable screens shall be solidly bonded to earth at each end of the route.

c) Copper Earthing Connections

Bonding leads shall be of sufficient cross sectional area to carry the maximum short circuit current.

3.13 SITE TESTS

a) Conductor Resistance Test

When the installation of cables and associated jointing accessories has been completed, the d.c. resistance of each conductor shall be measured and recorded and shall not exceed the values given in IEC/BSS.

b) High Voltage Test

After the conductor resistance test, each cable shall be subjected to a d.c. voltage of 2E (where E is the rated line voltage) applied for a period of 15 minutes between the conductor and the core screens which shall be connected to earth. The test voltage shall be raised gradually to the specified value at which points the test period shall begin. There shall be no breakdown of the electrical insulation..

For sections of cables already in service with new extensions, joints or terminations, test voltage shall be 70% of 2E.

c) Insulation Resistance Test

Insulation resistance test shall be carried out on all cables installed with an insulation resistance tester.

d) Continuity Tests

Continuity tests shall be carried out on all cables, after the cables are installed and jointed.

3.14 INSPECTION

Inspection by appropriate authority shall be carried out at the following stages of work :

a) Cable trench before laying of cables.
b) Cables laid in trench before backfilling.
c) After protection tiles are laid.
d) After warning tape is placed.

Further work at each stage shall proceed only after inspection and approval.

SPECIFICATION : UG1

33KV CABLES

1.0 GENERAL

The 33000 volts cable is for operation on MEW's 33KV system and shall be constructed in accordance with and conform to relevant IEC specification.

Highest system voltage	:	36,000 volts
Rated service voltage	:	33,000 volts
No. of phases	:	3
Design fault level	:	1500 MVA
Neutral	:	Earthed through 12.5 ohms resistor

2.0 CONDUCTOR

Cable conductors shall be compacted circular comprising stranded bare clean smooth annealed copper wires in accordance with IEC 228 class 2. The surface of the individual strands shall be smooth and clean and the circular conductor compacted before applying conductor shield.

3.0 CONDUCTOR SHIELD

The stranded and compacted conductor shall be shielded with an extruded semi-conducting layer before insulation is applied.

4.0 INSULATION

The insulation shall be cross linked polyethylene meeting the following basic requirements :

Normal operating temperature	:	90 Deg.C
Permitted overload temperature	:	130 Deg.C
Short circuit temperature	:	250 Deg.C
Chemical resistance	:	High
Moisture resistance	:	High
Thermal resistivity	:	Low
Fire resistance		Good
Min. average insulation thickness	:	9mm

5.0 INSULATION SHIELD

Individual Core insulation shall be shielded by a layer of extruded semi-conducting material applied directly over the insulation. Phase identification shall be provided on the shield in colour code - Red, Yellow and Blue. The semi-conducting insulation shield shall be covered by a bare copper shielding tape applied with a lap.

6.0 ASSEMBLY

The three insulated cores shall be laid up with necessary non-hygroscopic fillers and bound with nonvulcanisable tape to form a compact circular assembly. The fillers and tape shall be suitable to permit operation of the cable at sustained conductor temperature of 90^0C.

7.0 SHEATH

Sheath shall be extruded PVC complying with BS 6746 Table 1 Type 9. The minimum average thickness of sheath shall be 2.4mm.

8.0 BEDDING

Over the sheath shall be applied a bedding fabric tap minimum thickness 0.6mm.

9.0 ARMOUR

Armouring shall consist of single galvanized steel wires complying with BS 1442 for 3 core cable and aluminium armour for single core cable.

10.0 OVERALL SERVING

The overall serving shall consist of extruded PVC over the armour. The serving material to be Type 9 Table 1 of BSS 6746. The minimum thickness of serving shall be 3mm. The voltage designation, cable size, number of cores, manufacturer's name shall be embossed on the PVC serving. The PVC shall be fire retardant and termite resistant.

11.0 DRUM LENGTH

Nominal drum length shall be as follows :

3 core 300 sq.mm	:	250 mtrs.
3 core 50 sq.mm	:	500 mtrs.
1 core 630 sq.mm	:	500 mtrs.

SPECIFICATION : UG2

11KV CABLES

1.0 GENERAL

The 11000 volts cables are for operation on MEW's 11KV system and shall be constructed in accordance with and conform to relevant IEC specification.

Rated service voltage	11,000 volts
Highest system voltage	12,500 volts
No. of phases	3
Design fault level	350 MVA
Neutral	Solidly earthed

2.0 CONDUCTOR

Cable conductors shall be compacted circular comprising stranded bare clean smooth annealed copper wires in accordance with IEC 228 class 2. The surface of the individual strands shall be smooth and clean and the circular conductor compacted before applying conductor shield.

3.0 CONDUCTOR SHIELD

The stranded and compacted conductor shall be shielded with an extruded semi-conducting layer before insulation is applied.

4.0 INSULATION

The insulation shall be cross linked polyethylene to suit the following basic requirements :

Normal operating temperature	90 Deg.C
Permitted overload temperature	130 Deg.C
Short circuit temperature	250 Deg.C
Chemical resistance	High
Moisture resistance	High
Thermal resistivity	Low
Fire resistance	Good
Min. average insulation thickness	3.4 mm

The insulation thickness and dielecctric strength shall be adequate and suitable in all respects for a highest system voltage of 12.5KV continuously, system neutral being solidly earthed.

5.0 INSULATION SHIELD

Individual Core insulation shall be shielded by a layer of extruded semi-conducting material applied directly over the insulation. Phase identification shall be provided on the shield in colour code - Red, Yellow and Blue. The semi-conducting insulation shield shall be covered by a bare copper shielding tape applied with a lap.

6.0 ASSEMBLY

The three insulated cores shall be laid up with necessary non-hygroscopic fillers and bound with non-vulcanisable tape to form a compact circular assembly. The fillers and tape shall be suitable to permit operation of the cable at sustained conductor temperature of 90^0C.

7.0 SHEATH

Sheath shall be extruded PVC complying with BS 6746 Table 1 Type 9. The minimum average thickness of sheath shall be 2mm.

8.0 BEDDING

Over the sheath shall be applied a bedding fabric tape minimum thickness 0.5 mm.

9.0 ARMOUR

Armouring shall consist of single galvanized steel wires complying with BS 1442 for 3 core cable and aluminium armour for single core cable.

10.0 OVERALL SERVING

The overall serving shall consist of extruded PVC over the armour. The serving material to be Type 9 Table 1 of BSS 6746. The minimum thickness of serving shall be 2.8mm. The voltage designation, cable size, number of cores, manufacturer's name shall be embossed on the PVC serving. The PVC shall be fire retardant and termite resistant.

11.0 DRUM LENGTH

Nominal drum length shall be as follows :

	3 Core					**Single Core**
Size in Sq.mm	50	70	120	185	240	500
Drum length in Mtrs.	500	500	500	250	250	500

SPECIFICATION : UG3

600/1000 VOLTS CABLES

1.0 GENERAL

The 600/1000 volts cables are for operation on MEW's 415/240 volt system, the characteristics of which are given below and shall be constructed in accordance with BSS 5467.

Rated service voltage	:	415V
No. of Phases	:	3
Design fault level		31MVA
Neutral	:	Solidly earthed

2.0 CONDUCTOR

Cable conductors shall be stranded copper with full size neutral that is, same as phase conductor.

3.0 SHAPE OF CORE

Cables shall have shaped or circular conductors for phase and neutral.

4.0 DRESSING

The conductor shall be rendered smooth, clean and free from defects likely to injure the insulation.

5.0 INSULATION

The insulation shall be cross linked polyethylene to suit the following requirements :

Normal operating temperature	:	90 Deg.C
Permitted overload temperature	:	130 Deg.C
Short circuit temperature	:	250 Deg.C
Chemical resistance	:	High
Moisture resistance	:	High
Thermal resistivity	:	Low
Fire resistance		Good

Min. average insulation thickness shall be as follows :

	4 Core							**Single Core**
Size sq.mm	16	35	50	70	120	185	240	630
Thickness mm	0.7	0.9	1.0	1.1	1.2	1.6	1.7	2.4

6.0 SHEATH

The sheath shall consist of an extruded of PVC. The material to be Type 9, Table 1 of BSS 6746, thickness complying with BSS 5467 and shall be as follows :

	4 Core							Single Core
Size sq.mm	16	35	50	70	120	185	240	630
Thickness mm	0.8	1.0	1.0	1.2	1.4	1.4	1.6	1.2

7.0 ARMOURING

The armouring shall consist of single galvanised, steel wires complying with BS 1442 for 3 core cable and aluminium strip armour for single core cable. Size of the armour shall be as follows :

	4 Core							Single Core
Size sq.mm	16	35	50	70	120	185	240	630
Thickness mm	1.25	1.6	1.6	2.0	2.5	2.5	2.5	2.0

8.0 SERVING

The serving shall comprise an extruded PVC Sheath applied over the armour. The material to be Type 9, Table 1 BSS 6746, thickness complying with BSS 5467, termite resistant, fire retardant and in all respects suitable for site service conditions and thickness shall be follows :

	4 Core							Single Core
Size sq.mm	16	35	50	70	120	185	240	630
Thickness mm	1.6	1.8	1.9	2.1	2.3	2.6	2.7	2.2

The serving to be embossed with cable size, number of cores, manufacturer's name.

9.0 DRUM LENGTH

Nominal drum length shall be as follows :

	4 Core							Single Core
Size in sq.mm	16	35	50	70	120	185	240	630
Drum length in Mtrs.	1000	1000	500	500	500	250	250	500

SPECIFICATION : UG4

600 VOLT 19 CORE PILOT CABLE

1.0 GENERAL

The 19 core pilot cables shall be PVC sheathed, wire armoured and PVC served overall and shall in general conform to BSS 6346.

2.0 CONDUCTORS

Cable conductors shall comprise bare clean smooth annealed wires. The surface of individual wires shall be smooth and clean before the insulation is applied.

3.0 INSULATION

PVC insulation Type 5 Table 1 of BSS 6746, thickness complying with BSS 6346. The PVC to be fire retardant.

4.0 SHEATH

The sheath shall consist of an extruded layer of PVC. The material to be type 5 of Table 1 of BSS 6746 thickness complying with BSS 6346. The PVC to be fire retardant.

5.0 ARMOURING

The armouring shall consist of a single layer of galvanised steel wires over the sheath. The galvanised steel wires shall comply with BSS 1442 as a minimum.

6.0 SERVING

The serving shall consist of an extruded PVC sheath applied over the armour. The number and sizes of cores and manufacturer's name shall be embossed on the PVC serving.

The serving shall be termite resistant and fire retardant.

The PVC shall be type 5 Table 1 of BSS 6746.

7.0 MAKE UP OF PILOT CABLES

a) 7 Cores : Each core being a stranded conductor 2.5 sq.mm.

b) 2 Cores : Each core being a stranded conductor 2.5 sq.mm the two cores twisted together and metal foil screened for use with pilot wire protection system.

c) 10 Cores : Each core 11Kgs. per KM (40 lbs. per mile) telephone conductor, in the form of two screened and twisted pairs.

d) Voltage Grade : The telephone pairs shall be 500 V D.C. volt grade and the rest of the cores shall be A.C. 600 volt grade.

e) Identification : Cores shall be numbered in accordance wit BSS 6346.

8.0 DRUM LENGTH

The cable shall be in lengths of 500 metres.

APPENDIX

Tests on XLPE Cables

The following tests shall be carried out at the factory to determine if the materials and cables comply with MEW specification.

Power Cables and Pilot Cable

a) Cable High Voltage (Routine Tests)

Each drum length or coil of completed cable shall be tested in accordance with the relevant IEC recommendation/BSS.

b) Conductor Resistance (Routine Tests)

The resistance of the conductors shall be measured in accordance with relevant IEC 228 recommendations/ BSS 6360.

c) Galvanising Tests

Samples from each 15 or part of 15 drum lengths of all steel wire armoured cables shall be subjected to galvanising tests in accordance with IEC recommendations/BSS 729.

d) Insulation, Bedding and Sheath

The insulation, bedding and sheath shall be tested in accordance with relevant IEC 304 recommendations/ BSS 6746 as the case may be.

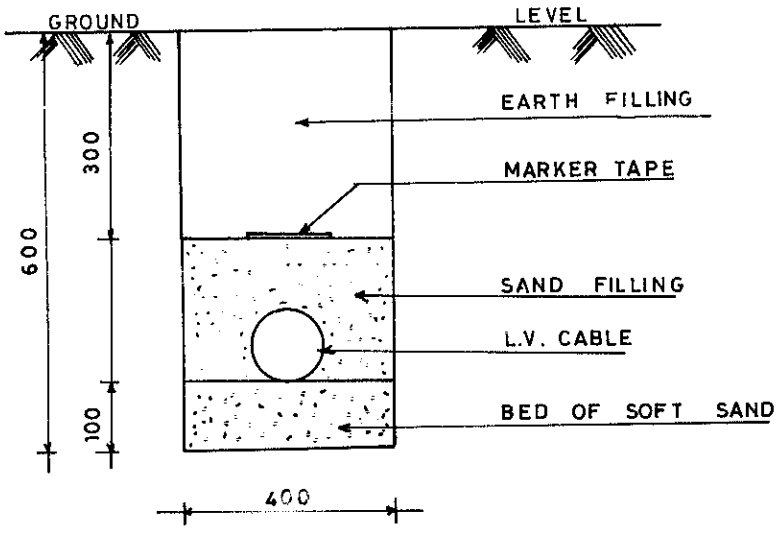
e) Measurements of Thickness and Weights

One metre length cable shall be cut from every 10 drums of finished cable, examined in detail and the following measurements and weights taken.

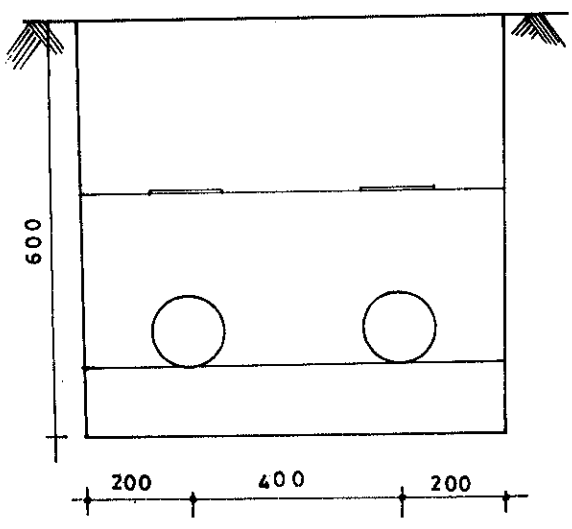
i) Thickness of insulation in mm.
ii) Thickness in mm of conductor insulating shield, and copper shielding tape where applicable.
iii) Thickness of PVC sheath in mm.
iv) Thickness of bedding in mm where applicable.
v) Number and thickness of armour steel wire.
vi) Thickness of PVC overall serving in mm.
vii) Weight of copper conductors in gm.

f) Accelerated Treeing Test

Accelerated treeing test shall be carried out on a sample of XLPE cable by use of high frequency power heating to operating temperatures (90 Deg. or above) and introduction of liquids into the conductor and into a container surrounding the insulation shield.



DETAILS FOR TWO CABLES



ALL DIMENSIONS IN MILLIMETERS.

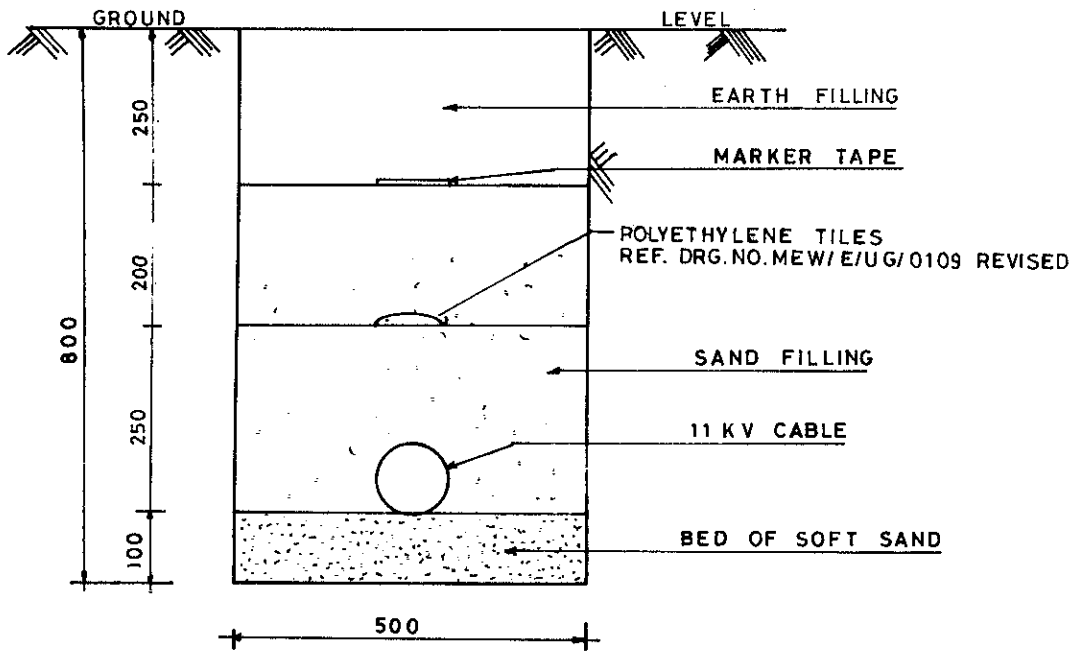
MINISTRY OF ELECTRICITY & WATER
DIRECTORATE GENERAL OF ELECTRICITY
PLANNING DEPARTMENT

DETAILS OF L.V. CABLE TRENCH

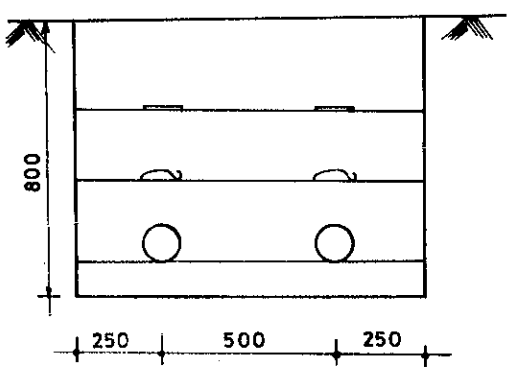
DRAWN	CHECKED	APPROVED
FRANCIS		

DRAWING. NO: MEW / E / U.G / 0101

SCALE. 1:10 | DATE. 03.12.1985



DETAILS FOR TWO CABLES



SCALE.1:20

A MINIMUM OF TWO SPARE DUCTS SHALL BE PROVIDED

ALL DIMENSIONS IN MILLIMETERS

REV	DATE	DESCRIPTION	CKD	APD
A	18-05-92	Material of cable tiles changed.		

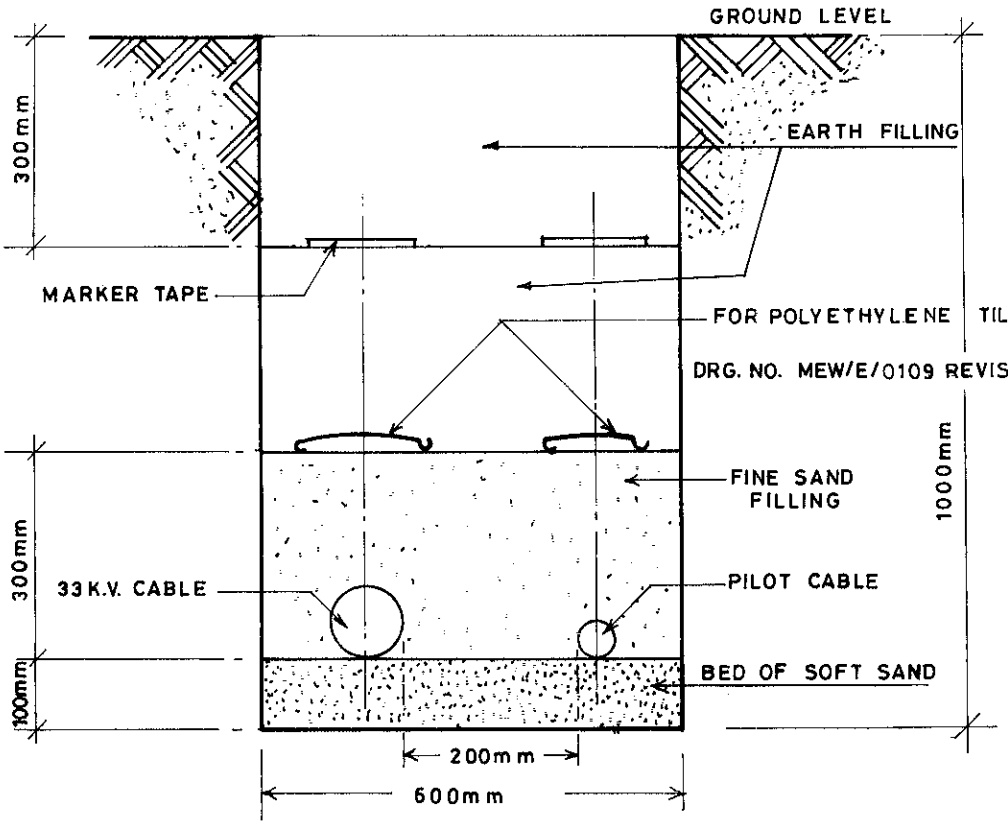
MINISTRY OF ELECTRICITY & WATER
DIRECTORATE GENERAL OF ELECTRICITY
PLANNING DEPARTMENT

DETAILS OF 11KV CABLE TRENCH

DRAWN	CHECKED	APPROVED
FRANCIS		

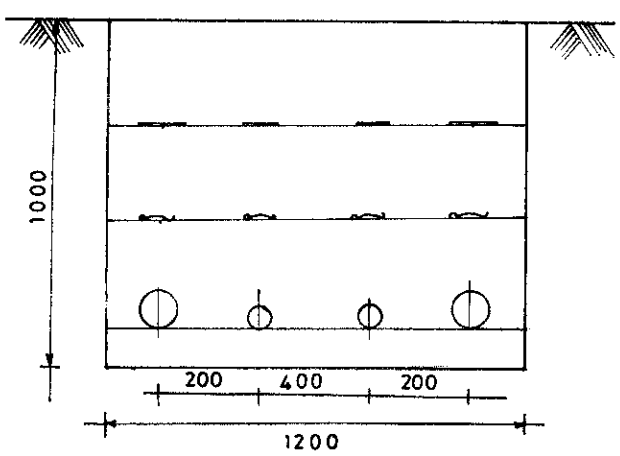
DRAWING.NO: MEW / E / U.G / 0102

SCALE. 1 : 10 | DATE. 03_12_1985



ALL DIMENSIONS ARE IN MILLIMETERS.

DETAILS FOR DOUBLE CIRCUIT



REV	DATE	DESCRIPTION	CKD	APD
A	18-05-92	Material of cable tiles changed		

SULTANATE OF OMAN

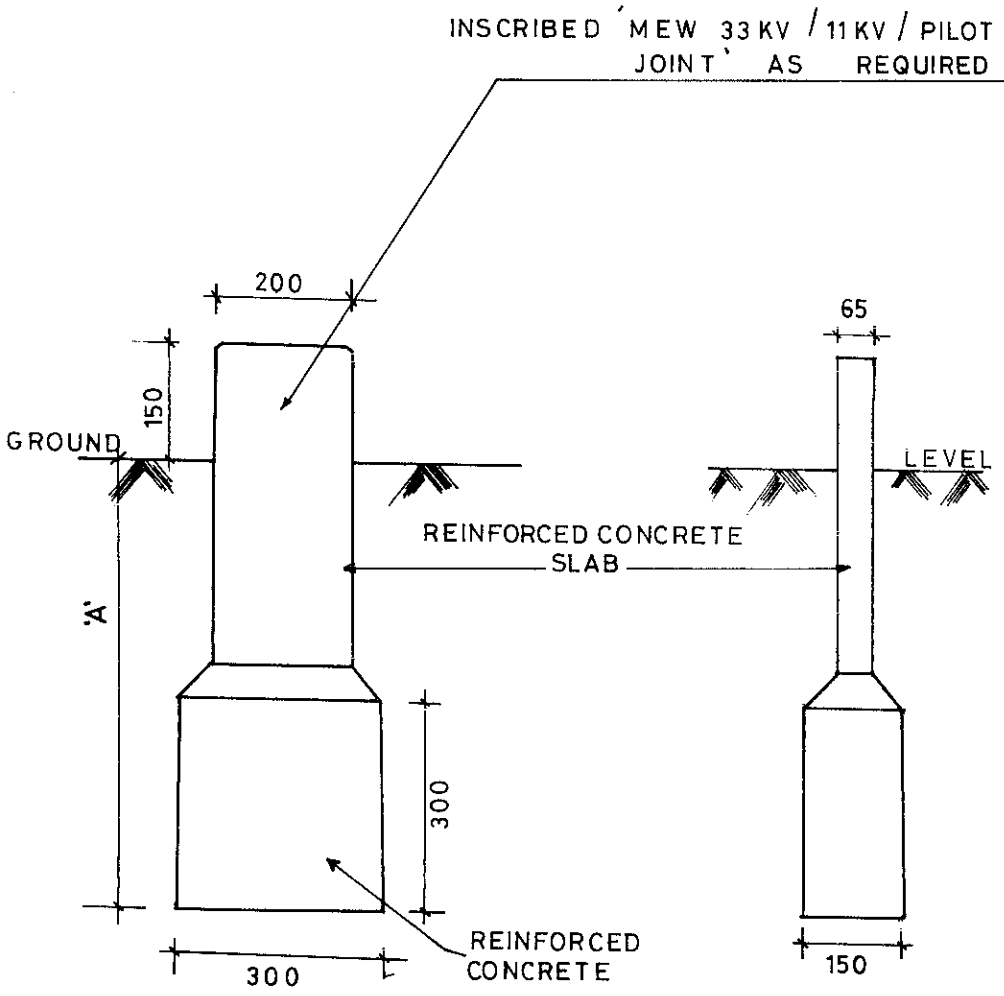
MINISTRY OF ELECTRICITY & WATER
DIRECTORATE GENERAL OF ELECTRICITY
PLANNING DEPARTMENT

SECTION OF 33K.V. & PILOT CABLE TRENCH

DRAWN BY	CHECKED	APPROVED
JOSE		

SCALE - 1:10 | DATE - 7-8-1984.

DRG. NO. MEW/E/ U.G./0103



ALL DIMENSIONS ARE IN MILLIMETERS

'A'	33 KV	600
'A'	11 KV	400
'A'	LV	300

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER
DIRECTORATE GENERAL OF ELECTRICITY
PLANNING DEPARTMENT

DETAILS OF JOINT / ROUTE MARKERS FOR POWER CABLES

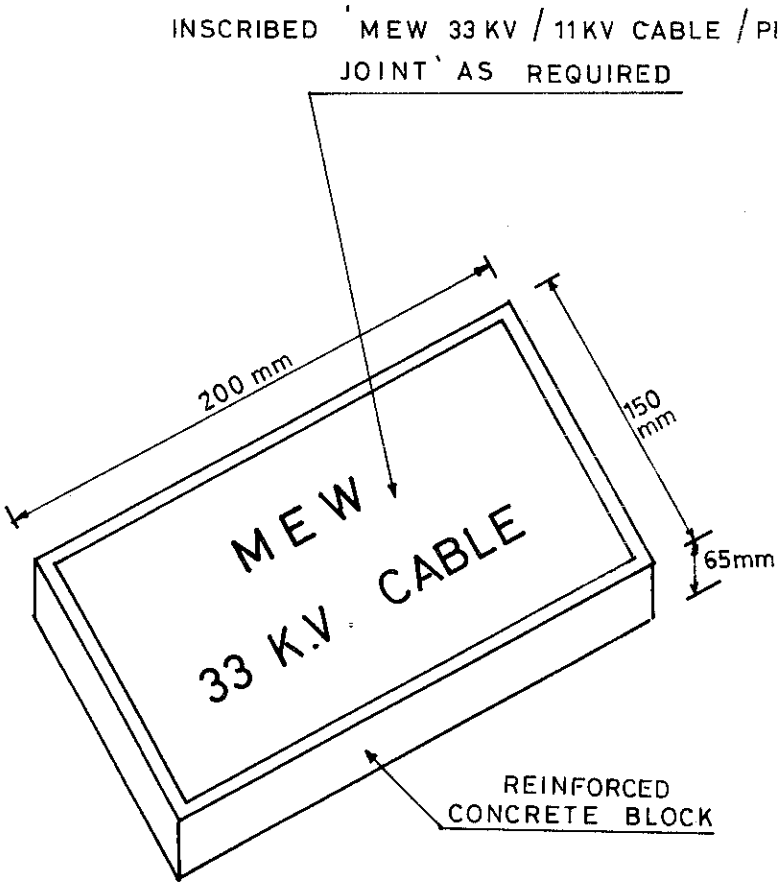
DRAWN	CHECKED	APPROVED
FRANCIS		

REV	DATE	DESCRIPTION	CKD	APD.
A	11/5/92	Drawing error		

DRAWING. NO: MEW / E / UG / 0104

SCALE. N.T.S.

DATE. 02_12_1985.



SULTANATE OF OMAN

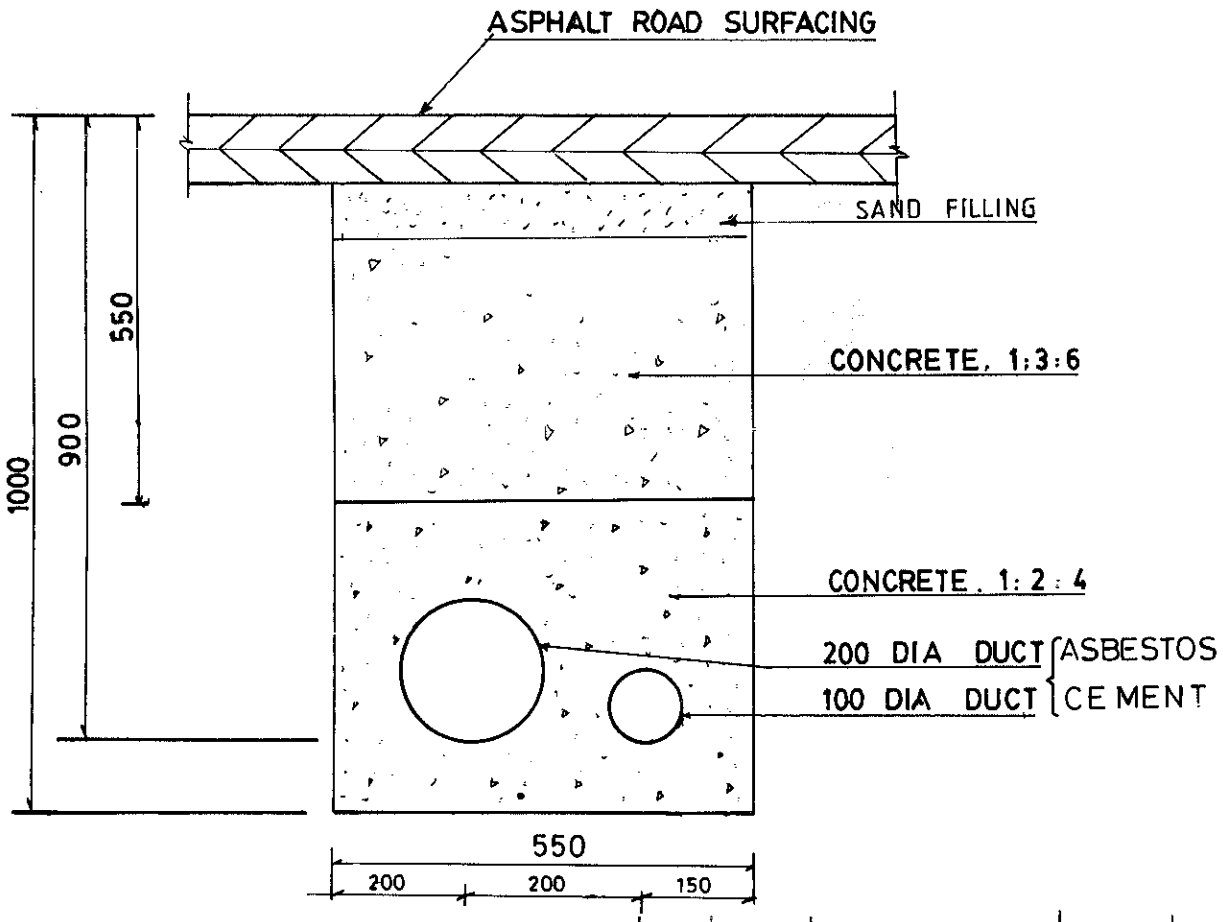
MINISTRY OF ELECTRICITY & WATER
DIRECTORATE GENERAL OF ELECTRICITY
PLANNING DEPARTMENT

DETAILS OF CABLE MARKERS FOR SIDE WALKS

DRAWN	CHECKED	APPROVED
FRANCIS		

DRAWING.NO: MEW / E / U.G / 0105

SCALE. N.T.S. | DATE. 02_12_1985

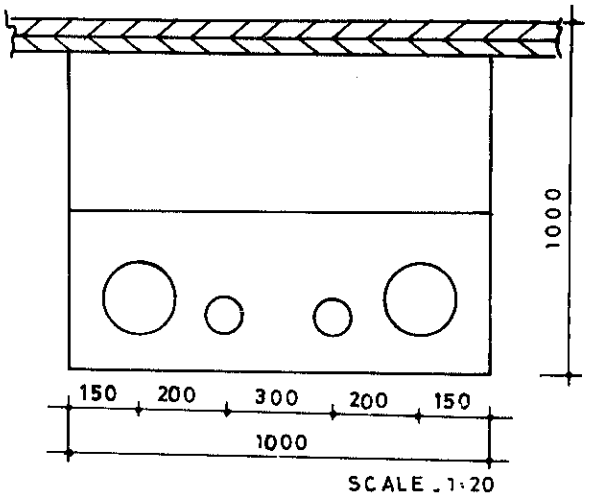


REV	DATE	DESCRIPTION	CKD	APD
A	19.05.92	Sand filling added		

A MINIMUM OF ONE SET OF SPARE DUCTS SHALL BE PROVIDED

ALL DIMENSIONS IN MILLIMETERS

DETAILS FOR TWO CABLES



SCALE . 1:20

SULTANATE OF OMAN

MINISTRY OF ELECTRICITY & WATER
DIRECTORATE GENERAL OF ELECTRICITY
PLANNING DEPARTMENT

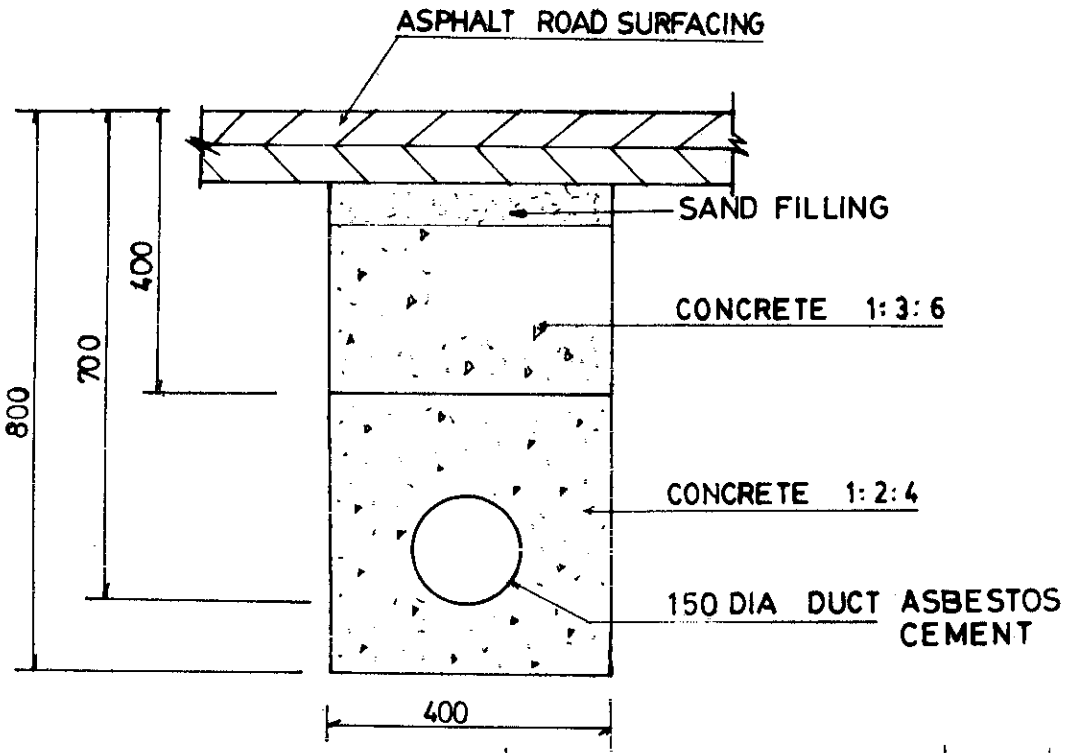
DETAILS OF ROAD CROSSING DUCTS FOR 33KV CABLE & PILOT CABLE

SCALE 1 : 10

DRAWING NO MEW/E/ U G / 0106

DRAWN FRANCIS | CHECKED

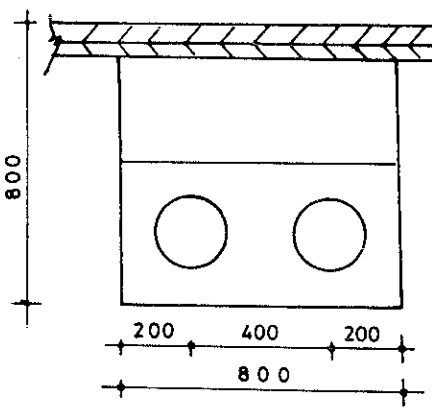
APPROVED | DATE 10. .12 .1985



A MINIMUM OF TWO SPARE DUCTS SHALL BE PROVIDED

ALL DIMENSIONS IN MILLIMETERS

DETAILS FOR TWO CABLES



SCALE 1:20

REV	DATE	DESCRIPTION	CKD	APD
A	19 05 92	Sand filling added		

SULTANATE OF OMAN

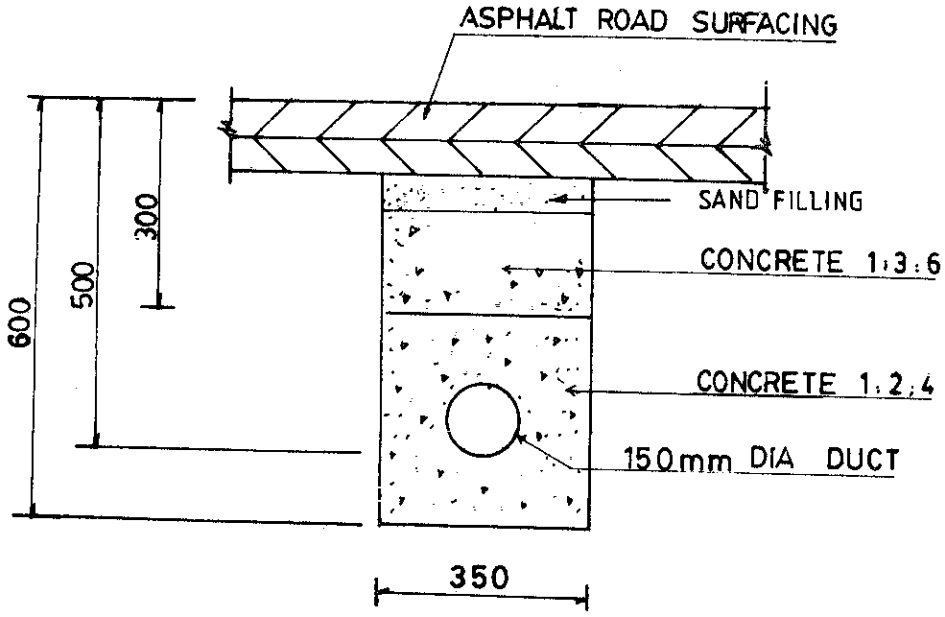
MINISTRY OF ELECTRICITY & WATER
DIRECTORATE GENERAL OF ELECTRICITY
PLANNING DEPARTMENT

DETAILS OF ROAD CROSSING DUCT FOR 11KV CABLE

SCALE. 1:10

DRAWING NO MEW/E/ .U.G./ 0107

DRAWN	FRANCIS	CHECKED	
APPROVED		DATE	10 . 12 . 1985

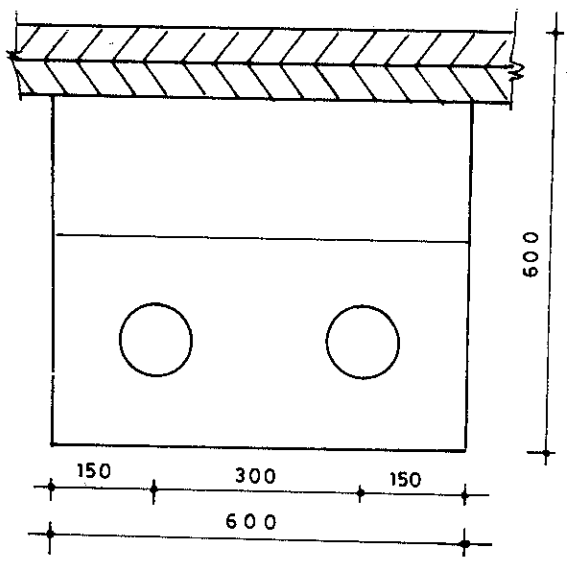


ROAD CROSSING L V CABLE

A MINIMUM OF TWO SPARE DUCTS SHALL BE PROVIDED

ALL DIMENSIONS ARE IN MILLIMETERS

DETAILS FOR TWO CABLES



REV	DATE	DESCRIPTION	CKD	APD
A	19-05-92	Sand filling added		

SULTANATE OF OMAN

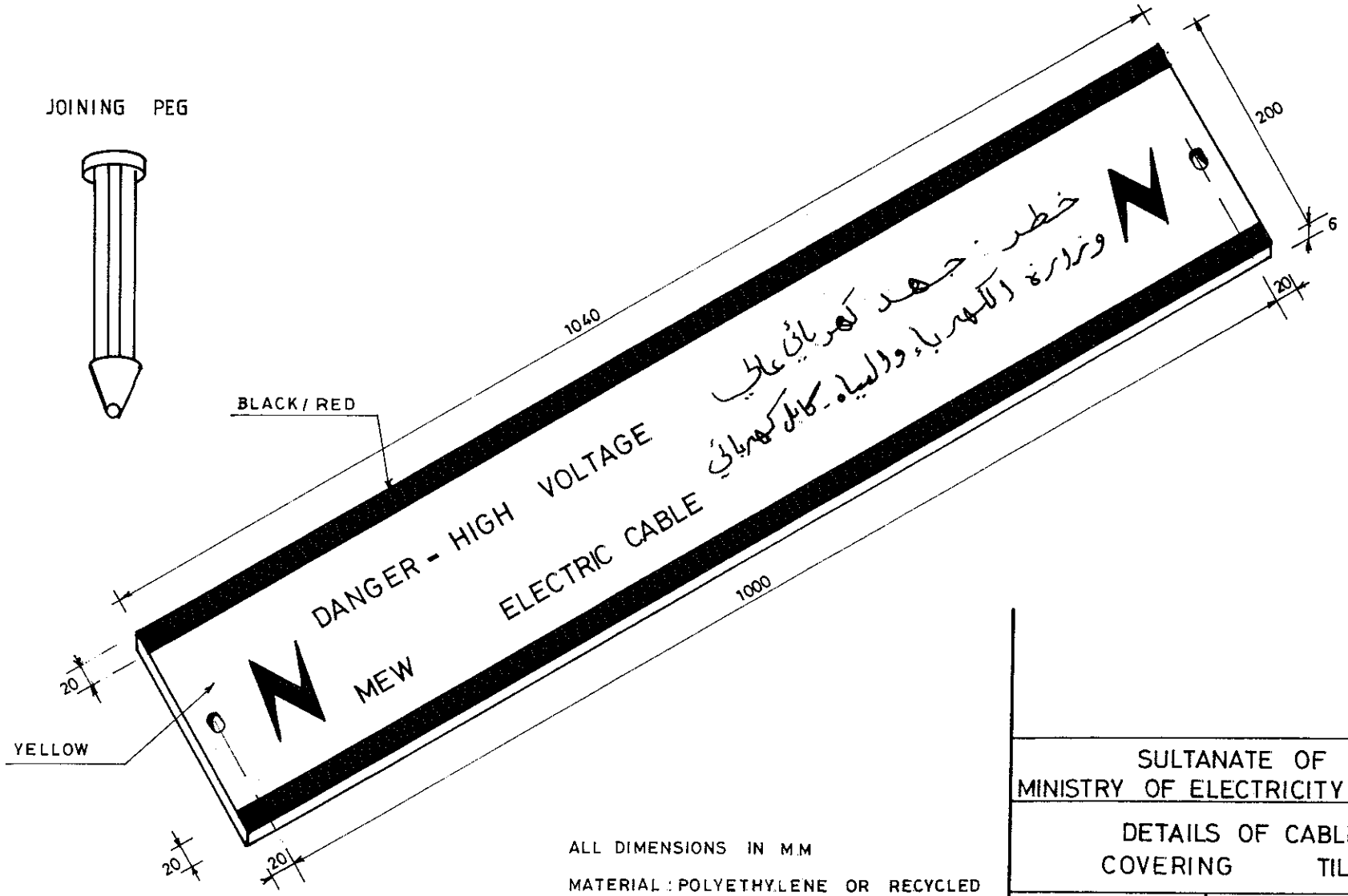
MINISTRY OF ELECTRICITY & WATER
DIRECTORATE GENERAL OF ELECTRICITY
PLANNING DEPARTMENT

DETAILS OF ROAD CROSSING DUCT FOR L.V. CABLE

SCALE. 1:10

DRAWING NO MEW/E/ .U.G./ 0108

DRAWN	FRANCIS	CHECKED	
APPROVED		DATE	10.12.1985



ALL DIMENSIONS IN M.M

MATERIAL : POLYETHYLENE OR RECYCLED POLYETHYLENE

ONE JOINNG PEG PER TILE WILL BE FITTED ON ONE SIDE

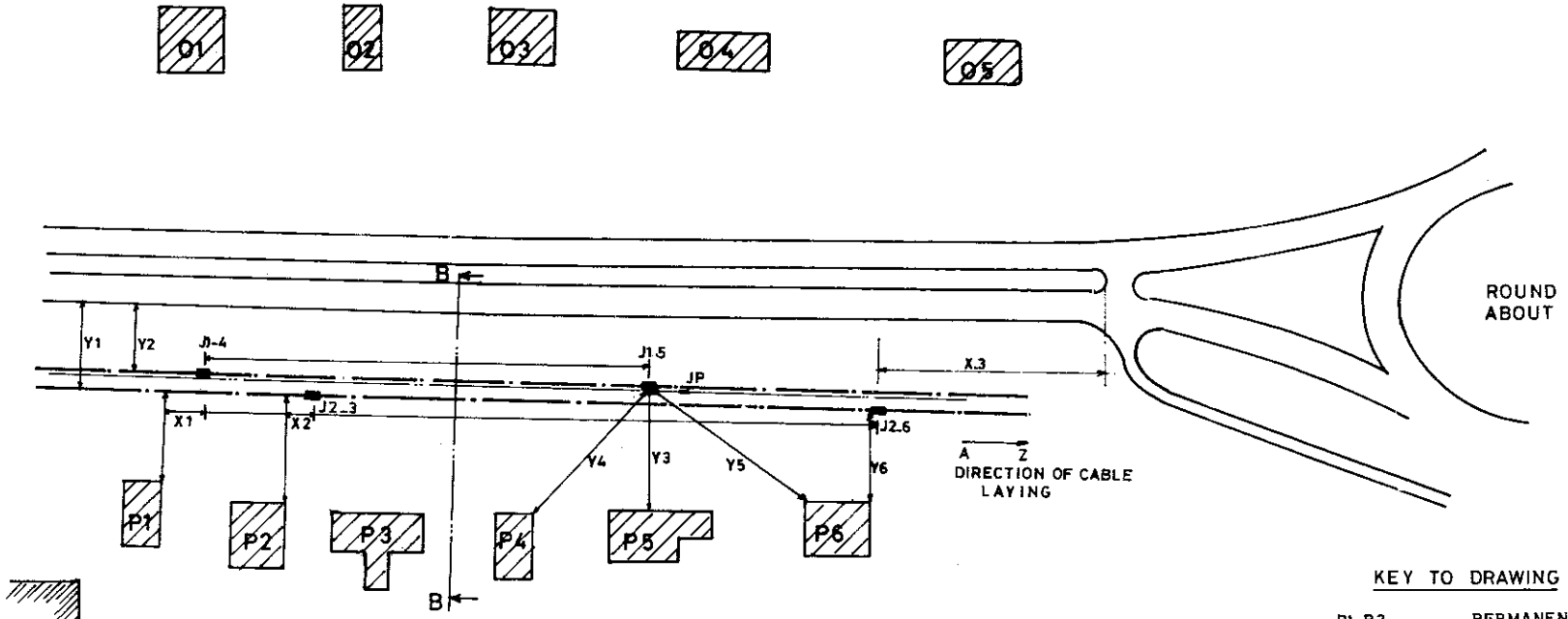
SULTANATE OF OMAN
MINISTRY OF ELECTRICITY AND WATER

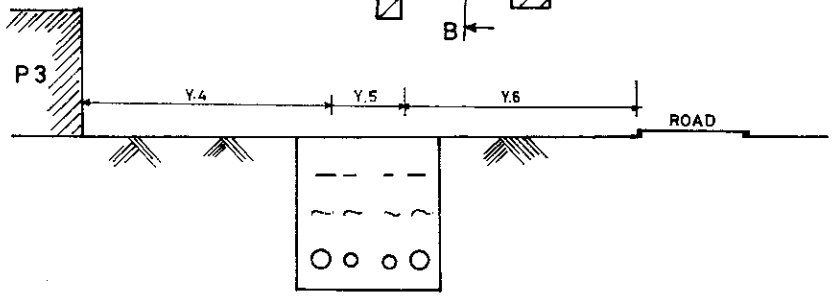
DETAILS OF CABLE COVERING TILES

DRAWN	CHECKED	APPROVED
FRANCIS		

DRAWING NO: MEW/E/UG/0109 REVISED.

SCALE 1:5 | DATE : 31 · 10 · 1989



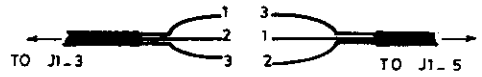


SECTION B B

KEY TO DRAWING

P1, P2..	PERMANENT STRUCTURE
O1 O2..	PERMANENT STRUCTURE
X , Y	OFFSETS / DISTANCES IN METRES
J1-4, J2-3	POWER CABLE JOINTS
JP	PILOT CABLE JOINTS

DETAILS OF J1-4



MAKE :

JOINTER :

DATE :

WEATHER :

NOTE: SIMILAR DETAILS FOR J1-5 J2-3 ETC

MINISTRY OF ELECTRICITY & WATER

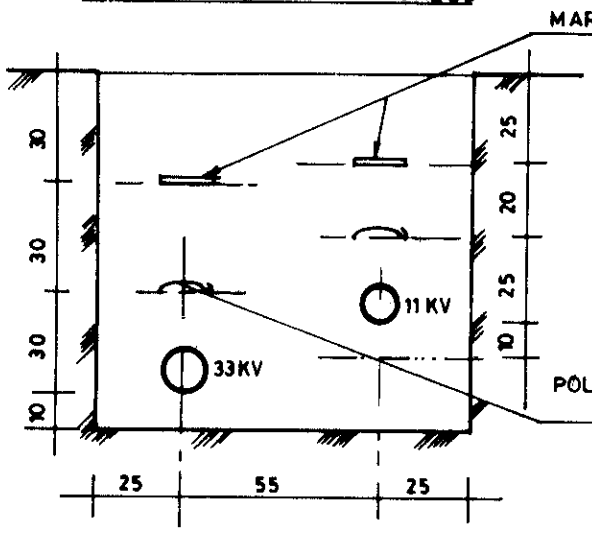
FORMAT FOR UNDERGROUND POWER CABLE RECORD

DRAWN	CHECKED	APPROVED
FRANCIS		Bagpai

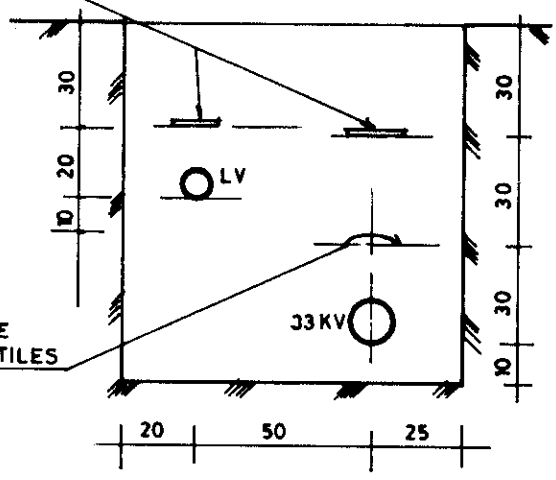
SCALE | DATE 27 - 11 - 1985

DRG. NO. MEW / E / U.G / 0110

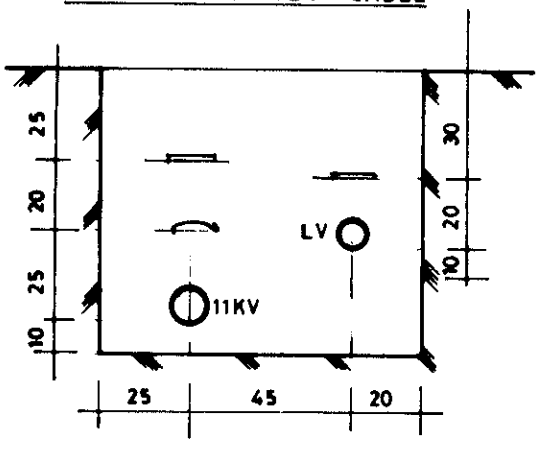
1.33KV AND 1. 11KV CABLE



1.33KV AND 1.LV CABLE



1. 11KV AND 1.LV CABLE



ALL DIMENSIONS IN CENTIMETERS.

DIFFERENT VOLTAGE CABLE SPACING CHART

	L.V	11 KV	33 KV
L.V.	40cm	45cm	50cm
11 KV	45cm	50cm	55cm
33 KV	50cm	55 cm	60 cm

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PLANNING DEPARTMENT

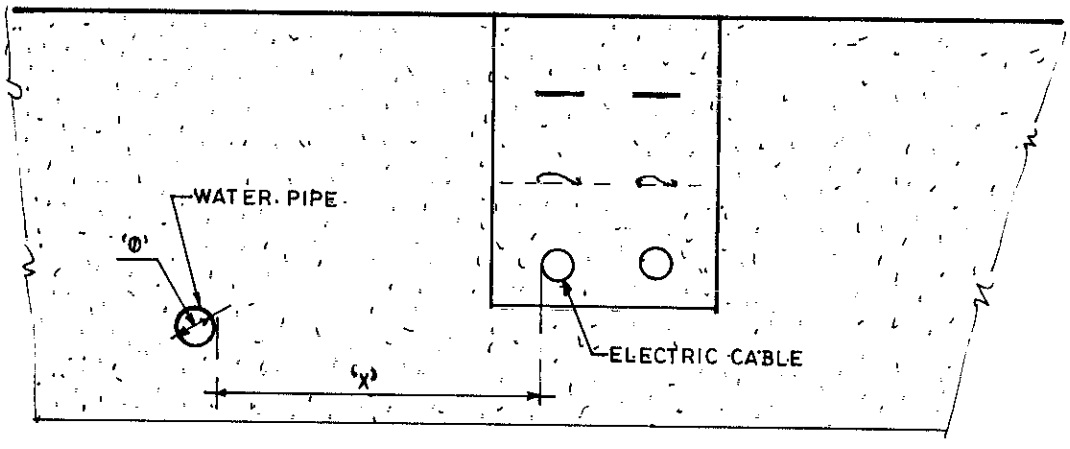
CABLE TRENCH DETAILS FOR DIFFERENT VOLTAGE CABLES LAID PARALLEL.

DRAWN	CHECKED	APPROVED
FRANCIS		

DRAWING No: MEW/E/UG/0112

SCALE: 1:2

DATE. 04 - 04 - 1990



'Φ' DIA OF WATER PIPE	DISTANCE 'X' IN M.M.	
	UPTO 33 KV	132 KV
in mm	in mm	in mm
LESS THAN 100	1000	2000
100 TO 300	1500	2000
300 TO 600	2000	3000
ABOVE 600	3000	3000

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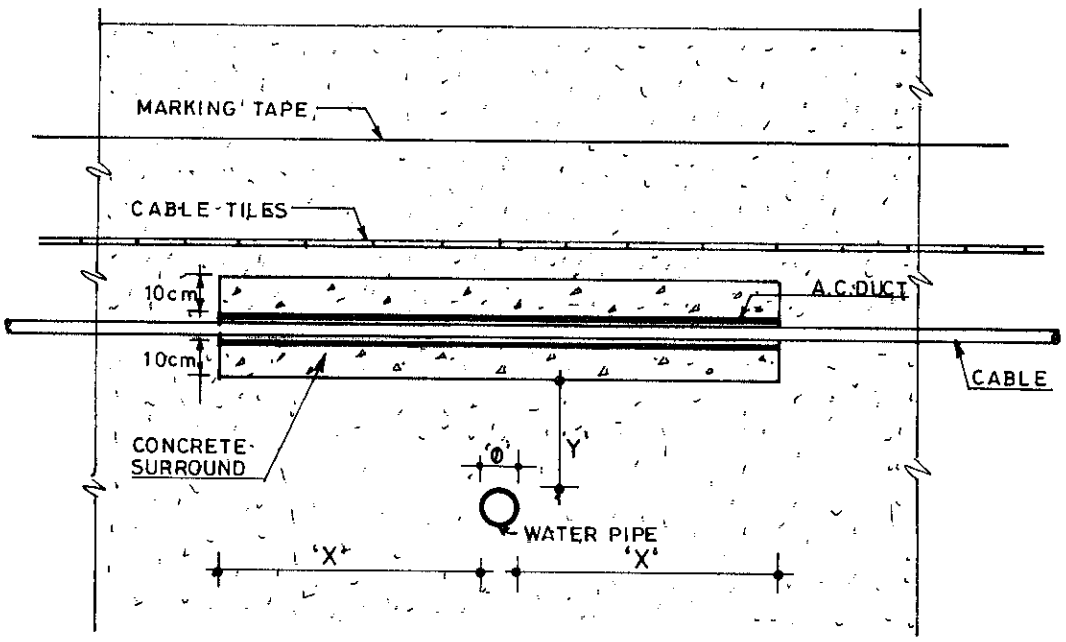
DIRECTORATE GENERAL OF ELECTRICITY
PLANNING DEPARTMENT

DETAILS OF CABLES LAID PARALLEL TO WATER PIPE LINE

DRAWN	CHECKED	APPROVED
FRANCIS		

DRAWING No : MEW / E / UG / 0113

SCALE : N.T.S. | DATE : 06 - 03 - 1990



SL. Nö	'Ø' OF WATER PIPE	'Y' IN M.M.	'X' IN MM.
1	UPTO 600mm	500	2000
2	ABOVE 600 mm		3000

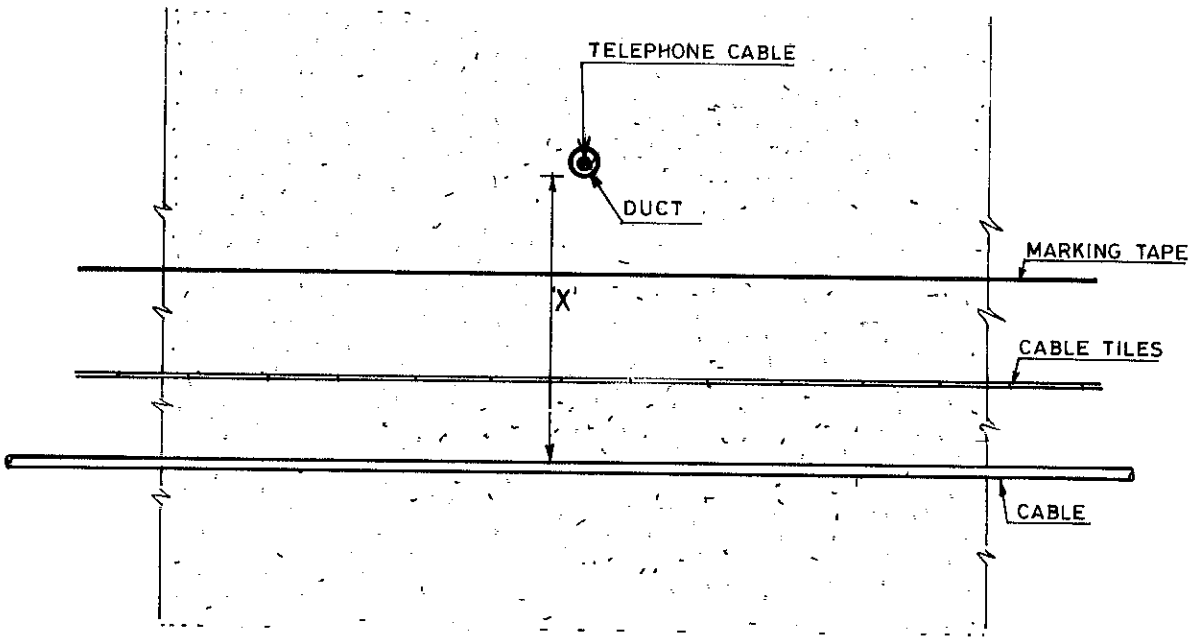
SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER
DIRECTORATE GENERAL OF ELECTRICITY
PLANNING DEPARTMENT

DETAILS OF CABLE CROSSING BY WATER PIPE LINE

DRAWN	CHECKED	APPROVED
FRANCIS		

DRAWING NO: MEW / E / UG / 0114

SCALE N.T.S. | DATE : 10 - 04 - 1990



SL. NO	SIZE OF CABLE	'X' IN MM	DUCT BOTH SIDES IN MM
1	L.T.	300	1000
2	11 KV	400	1000
3	33 KV	500	1000

SULTANATE OF OMAN
MINISTRY OF ELECTRICITY & WATER
DIRECTORATE GENERAL OF ELECTRICITY
PLANNING DEPARTMENT

DETAILS OF CABLE CROSSING BY TELEPHONE CABLES.

DRAWN	CHECKED	APPROVED
FRANCIS		

DRAWING No: MEW / E / UG / 0115

SCALE: N.T.S

DATE 14 - 04 - 1990