

UNITED ARAB EMIRATES
FEDERAL ELECTRICITY & WATER AUTHORITY

PILOT CABLE

SPECIFICATION OF PILOT CABLES

1.1 DESIGN

Pilot Cables shall be of the filled type and shall have plain copper conductors insulated with polyethylene, armoured and sheathed overall with PVC. They shall be suitable for internal and external use in the prevailing climate and for an induced voltage upto 15 kV.

1.2 CABLE CONSTRUCTION

Pilot Cables shall have 1.13 mm diameter annealed copper conductors each polyethylene insulated. The conductors shall form twisted pairs and shall be laid up with the length of lay of adjacent pairs chosen to reduce cross talk to a minimum. Each core shall be clearly identified by colours. An open spiral binder shall be applied over each layer of pairs with a laped tape over its final layer. The laid up pairs shall be screened with a layer of protected aluminium tape screen coated with co-polymer on both sides and black Polyethylene sheathed, galvanized round steel wire armoured and black PVC sheathed.

1.3 INSULATION

The conductor insulation shall be extruded polyethylene Type 03C in accordance with BS 6234 and shall have a minimum radial thickness 0.8 mm for 15 kV type cables. The insulation thickness shall be determined in accordance with Clause 5 of BS 6346. The average thickness of insulation shall not fall at any point below the specified thickness by more than 5% + 0.1 mm.

1.4 CORE IDENTIFICATION

Cores shall be colour coded in accordance with the code given in IEC 189.2.

The Tenderer shall submit with his tender cross sectional drawings of auxiliary cables marked to indicate the method adopted for core identification, which shall be to the Authority/Engineer's approval.

1.5 TWINNING

The insulated conductors shall be uniformly twisted together in pairs with a right hand lay. The length of lay shall not exceed 150 mm and the lays of pairs which are adjacent within the finished cable shall differ in length and shall be so chosen that crosstalk is as small as possible.

1.6 LAYING UP

The cable cores shall be laid up to form a compact and symmetrical cable. The direction of lay shall alternate for successive layers. The first layer being right hand.

1.7 FILLERS

Where fillers are necessary for the satisfactory laying up of the cable pairs, they shall be of polyethylene

Textile fillers are not acceptable.

1.8 BINDERS

Where cables consist of ten or more pairs, a polyethylene terephthalate (PTP) tape having a thickness of not less than 0.013 mm shall be applied as an open helix over the centre cores if more than one pair and over each successive layer except the outer layer over which the tape shall be applied with a 50 per cent overlap.

1.9 BEDDING AND ARMOUR

The pilot cables shall be provided with armour bedding of extruded polythene Type 03C in accordance with BS 6234 and shall have a radial thickness of not less than 1.80 mm. The bedding thickness shall not fall below the specified value by more than 15% + 0.1mm.

Armour

The armour shall consist of one layer of galvanized steel wire to BS 1442. The diameter of armour wires shall be min 1.40 mm.

When joints in armour wire are necessary they shall be brazed or welded and any surface irregularities shall be removed.

A joint in any wire shall be not less than 1 metre from the nearest joint in any other armour wire in the completed cable, unless otherwise approved by the Purchaser. The direction of lay of the armour shall be opposite to that of the cores unless the transport and/or installation conditions are such that the reverse lay will be more satisfactory. Any modification considered necessary to the standard lay shall be submitted with the relevant supporting data for approval by the Purchaser.

1.10 OVERSHEATH

The outer covering shall be of black PVC to meet the requirements of BS 6746 incorporating fire retardant characteristics to meet the requirements of BS-4066 and IEC 332.

1.11 IDENTIFICATION OF THE MANUFACTURER

The PVC over sheath shall be embossed in English along two lines equally spaced around the circumference of the cable with the name of the manufacturer and year of manufacture followed by details given below :-

"ELECTRIC CABLE - PILOT" "PROPERTY OF FEWA"

"Year of Manufacturing - Manufacturer"

The letters and figures shall be raised and shall consist of upright block characters arranged along two or more lines approximately equally spaced around the circumference of the cable. The maximum height of the characters shall be 13 mm and the minimum size 15 percent of the approximate overall diameter of the cable or 4 mm whichever is the greater. The space between the end of one set of embossed characters and the beginning of the next shall be not greater than 1 metre.

1.12 CABLE LENGTH

Pilot Cables shall be supplied in drum lengths of not less than 1000 m unless shorter lengths are specified or are required to complete a specific order.

1.13 STRAIGHT THROUGH JOINTS AND TERMINATION'S

The pilot cable joints must be watertight and provided with satisfactory continuity of screens and armour, the conductors shall be jointed by crimped ferrules covered with insulating sleeves and insulated to withstand induced voltages up to 15 kV core to earth.

The Contractor shall submit drawings of the joints and termination's for the Engineer's approval.

2.0 TESTS ON PILOT AND TELEPHONE CABLES

2.1 General

The works tests shall include all routine electronics, electrical and mechanical tests in accordance with the appropriate IEC Standard, to ensure that the individual plant or equipment being supplied meets the requirements of the specification.

The pilot cables shall be inspected and tested at works before shipment. The supplier shall make provision in his offer to bear all cost that are incurred in carrying out these tests to the satisfaction of FEWA. However, cost towards travel, accommodation, etc. of FEWA representatives shall not be included in the quoted price.

2.2 Type Tests

a) The attenuation of audio and any carrier pairs shall be measured and the corrected values shall not exceed those stated in the schedule of particulars and guarantees. The measured attenuation shall be corrected by, multiplying the value recorded by, $1 + 0.0016 (T-20)$ where T is the temperature of the cables in degree °C.

b) Cross-Talk

The cross-talk between all pairs shall be measured and shall not be less than the values stated in the guaranteed particulars.

c) Impedance

Measurement of the impedance of all pairs shall be made over a range of frequencies to be agreed and to record the spread of values.

2.3 Routine Tests at Works:

a) Conductor Resistance

The dc resistance of conductors shall not be greater than the values stated in the Schedule of Particulars and Guarantees when corrected at 20^o C.

b) Armour Resistance

The d.c. resistance of the armour shall be measured and shall not be greater than the figure stated in the Schedule of Particulars and Guarantees when corrected to 20^o C.

c) Insulation Resistance

The Insulation resistance shall be measured between each conductor and the other conductors connected to the armour. After the application of 500 v dc for one minute, the measured value shall not be less than 5000Megohms/ km for filled cables at 20^o C.

The group test procedure detailed below may be adopted to facilitate testing. Each layer of the cable shall be made up into four groups, each group consisting of one wire from every other pair. The insulation resistance shall be measured between each group and all other conductors connected to the armour. After the application of 500 V dc for one minute, the measured value shall not be less than 20^o C appropriate value given in the following table :

Number of Pairs	1-5	6-10	11-15	16-20	21-25
Insulation resistance (Mohms)	5000	3400	2500	2000	1550

Should the measured group insulation resistance be less than specified, then the individual cores shall be tested and the measured values shall not be less than the value for one wire when corrected to 20^o C.

d) Voltage Withstand Tests

A test voltage shall be applied continuously for one minute without breakdown as follows :

- i) Between each conductor and the remaining conductors connected to the armour and earthed :- 10 kV ac
- ii) Between all conductors bunched together and armour which shall be earthed :- 15 kV ac

e) Mutual Capacitance Test

The mutual capacitance shall be measured between the two conductors of each pair with the other conductors and armour earthed. The measurement shall be made using ac and a suitable bridge. The mean value obtained shall not exceed 50 nF/Km for 15 kV type cable.

f) Capacitance Unbalance Test

The capacitance unbalance shall be measured in accordance with the requirements of BS 3573. In order to limit the amount of testing, measurements will normally be made between adjacent pairs.

g) Mutual Inductance Test

Mutual inductance shall be made at 5 k Hz on carrier pairs. The measured values shall be divided by 0.5 ($L/500 + v L/500$) where L is the length in metres of the cable under test. Lengths less than 100 metres shall be considered as 100 metres. The corrected mutual inductance shall not exceed 0.5 mH.

h) Spark Test

The PVC oversheath shall be subject during manufacturing to a spark test in an approved manner. The voltages applied between the electrode and armour shall be 6 kV ac per mm of thickness or 9 kV dc per mm of thickness.

2.4 Tests at Site

Continuity

After laying and before jointing the continuity of all conductors shall be confirmed.

Conductor Resistance Test

The dc resistance of conductors for each completed circuit shall be measured and recorded it is not to be greater than the values stated in Schedule of Particulars and Guarantees when corrected to 20 ° C and with suitable adjustment for the length of the route.

Voltage Test on Anti corrosion Covering

The cable lengths shall withstand, after laying and before jointing, a dc voltage of 4 kV per mm of sheath thickness applied for one minute between the armour and the outer surface of the sheath.

This test shall be repeated on each completed circuit.

Insulation Resistance

After laying and before jointing the insulation resistance of individual lengths shall be measured between each conductor and the other conductors connected to the armour. After the application of 500 vdc for one minute, the measured value shall not be less than the values indicated below :

at 20 ° C	at 70 ° C	
5000	100	(Mohms/km)

Voltage Withstand Test

After completion of the installation, the cables shall be subjected to the following voltage tests. The voltage shall be increased gradually and maintained continuously for one minute. The voltages shall be as follows :

- i) Between each conductor and the remaining conductors connected to the armour and earthed : 15 kV dc
- ii) Between all conductors bunched together and armour which shall be earthed : 25 kV dc.

Cross Talk

Far and cross talk between all pairs shall be measured and shall not be worse than 74 dB at 1300 Hz when the cable has been balanced.

SCHEDULE 'A'

SUB-MANUFACTURERS

The Tenderer shall state below the names of the sub-manufacturers to the main manufacturer and details of the equipment proposed to be manufactured or supplied by them:

Name & Address of the Sub-Manufacturer	Description of Equipment

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____

SCHEDULE 'B'

PLACE OF MANUFACTURE, TESTING AND INSPECTION

The Tenderer to complete the following schedule for all materials he proposes to supply

Item No.	Description	Manufacturer	Place of manufacture	Place of testing and inspection

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____

SCHEDULE 'C'

DEVIATION FROM TENDER SPECIFICATION

The Tenderer to state in the following schedule the deviations from the tender specifications proposed in his offer. Deviations other than those specifically listed below will not be taken note of:

Item No.	Description	Precise Details of the Deviations

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____

SCHEDULE - D

MULTIPAIR PILOT CABLES

S.I No.	Description	Unit	Particulars	
			Specified	Tendered
1.	Name of the Manufacturer			
2.	Country of Origin			
3.	Applicable Standards			
4.	Type of Pilot Cables			
5.	Number of twisted pair	Pair	20	
6.	Conductor :			
	i) Material		Annealed copper	
	ii) Nominal diameter	mm	1.13	
	iii) Cross Section	sq.mm		
7.	Insulation :			
	i) Applicable standard			
	ii) Material		Polyethylene	
	iii) Type of insulation			
	iv) Nominal thickness	mm		
	v) Minimum thickness	mm	0.8	
8.	Protection against water penetration in longitudinal axis		Yes	
9.	Screen : Material : Aluminium tape coated with co- polymer on both sides Thickness	mm		
10.	Fillers material (if applicable)			
11.	Binder (core wrappings)			
	i) Material			
	ii) Thickness			
	iii) % of overlap in outer lap	%		
12.	Bedding (inner sheath)			
	i) Applicable Standard			
	ii) Material			
	iii) Thickness	mm		

S.I No.	Description	Unit	Particulars	
			Specified	Tendered
13.	Armour			
	i) Applicable standards			
	ii) No. of galvanised wires			
	iii) Dia of each wire	mm	min 1.4	
	iv) DC resistance at 20 ^o C	ohms/k m		
14.	Outer Sheath			
	i) Applicable standards			
	ii) Material		PVC	
	iii) Thickness	mm		
	iv) Conductive Coating		Yes	
15.	Completed Cable			
	i) Length/drum	mm		
	ii) Weight/km	kgs.		
16.	Completed Drum			
	i) Length/drum	mtr.		
	ii) Net weight of cable	kg.		
	iii) Gross weight of drum with cable	kg.		
17.	Max. DC resistance of conductor per km at 20 ^o C (loop)	ohms	< 58.2	
18.	Mutual capacitance	nF/km	< 50	
19.	Capacitance Unbalance between any two pairs at frequency of 1300Hz.	nF/km	As per BS 3573	
20.	Near end and far end cross talk at 1300 Hz when cable has been balanced	dB/km	< 74	
21.	Attenuation for 1000m cable at frequency 1000Hz and at 20 ^o C	dB/km	< 0.86	
22.	Mutual Inductance	mH/km	< 0.50	
23.	Minimum insulation resistance at 20 ^o C for 1000 meter cable between the cores.	M ohms	< 5000	

SCHEDULE 'E'

DETAILS OF PAST EXPERIENCE OF MANUFACTURER

Name and address	Quantity supplied	Year of supply	Remarks

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____