

**Ministry of Electricity
Planning and Studies Office
Baghdad – Iraq**

Specification No.	D-04
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**TECHNICAL SPECIFICATION
OF
LOW VOLTAGE POWER CABLES**

REVISION	December 2013
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1. **Scope:**

The specification includes the design, manufacture, test, suitable packing, transportation of 0.6/1 (1.2) kV cables.

2. **General Requirements:**

The materials shall be of first class quality and designed for continuous satisfactory operation as continuity of supply is of prime importance and to operate satisfactorily under variation of load, voltage and short circuit or other conditions which may occur on the system provided that these variations are within the assigned rating of the apparatus. The materials used shall be suitable for the following climatic and soil conditions.

2.1 **Ambient temperature:**

Highest maximum (in the shade) 55 °C for about 6 hours a day

Lowest minimum (-10) °C

Maximum yearly average (+30) °C

Maximum daily average (+40) °C

2.2 **Sun shine temperature:**

Black objects under direct sunshine attain a temperature of 80 °C

2.3 **Air humidity:**

Maximum: 92% at 40 °C

Minimum : 12%

Yearly average : 44%

2.4 **Altitudes:**

From sea level up to (1000m)

3. **Technical Requirement:**

System Data:

Nominal voltage	400 volts
System	3-phase, 4 wire with neutral solidly grounded.
Frequency	50 Hz

4. **Standards:**

The cable should be in accordance with the latest edition of the IEC standard particularly IEC no. 60502, 60228 and all other relevant IEC standards.

5. Deviations:

The tenderer shall particularly mention in the tender all deviations of the offer from the specifications described in these tender documents.

6. General Cable Characteristics:

6-1 Conductor:

The conductor shall be class 2 ,compacted annealed stranded circular copper conductor having resistance within the limits specified in table No.1 mentioned below. The minimum number of strands in the conductor shall not be less than the appropriate minimum numbers specified in table No.1. The conductor shall be according to the IEC 60228 and all other relevant IEC standards.

6-2 Insulation:

The insulation of the cable shall be extruded polyvinyl chloride PVC, designed and manufactured for the specified voltage. The insulation shall withstand mechanical and thermal stress under steady state and transient operating conditions. The insulation of the cables shall be of high standard quality. The thickness of the insulation shall not be less than that specified in the relevant standards.

6.3 Phase Identification:

Red, Yellow, Blue color for phases and black for neutral.

6.4 Filler:

The four cores then laid up with a suitable extruded material to provide a substantially circular cross section before the inner covering is applied. The filler material should be non-hygroscopic, easy to be removed and good flexibility material, suitable for the operating temperature and compatible with the insulating material. The materials shall be new, unused and of finest quality.

6.5 Inner sheath:

a PVC inner covering then extruded over the circular assembly with a thickness proportional to the fictitious diameter over laid-up cores as specified in IEC 60502-1/Clause 7.1.3 .

6.6 Metallic Armour:

The four cores then armoured with double galvanized steel tapes of thickness not less than that specified in IEC 60502-1/Clause 12.5 applied helically in two layers so that the outer tape is approximately central over the gap of the inner tape .The gap between adjacent turns of each tape shall not exceed 50 % of the width of the tape.

6.7 Outer sheath:

Over all, an oversheath is extruded and should be as follows:

- a. Material: extruded PVC .
- b. Color: Grey .
- c. Thickness: According to the formula ($t_s = 0,035 D + 1,0$) where D is the fictitious diameter immediately under the oversheath, in millimeters.
- d. Suitable for the operating temperature.
- e. Has a good corrosion and humidity protection.
- f. Suitable additives to be added to prevent attack by rodents and termites.
- g. Identification:

The following identification marks shall be permanently embossed along two lines diametrically opposite to each other on the cable at suitable intervals:
----- Volts; mm^2 , copper cable; PVC insulated , MoE - IRAQ , Year of manufacture , manufacturer's name.

Length of cable on one meter intervals shall be embossed on the outer jacket. Marking on the over-sheath shall indicate cumulative length of the cable, wound on the drum, such marking starting with "000" on the inner end and actual length on the drum.

6.8 Packing:

Packing shall be sturdy to protect the cable from any injury during transportation, handling and storage. The cut ends of the cable shall be sealed by means of non-hygroscopic sealing material. The cable shall carry the following information either stenciled on the drum or contained in a label attached to it:-

- a. Reference to the standard.
- b. Manufacturer's name, brand or trade mark.
- c. Type of cable and voltage grade.
- d. Order No. .
- e. No. of cores, material and nominal cross-sectional area of conductor.
- f. Actual length of cable on drum.
- g. Drum number.
- h. Gross and net weight of the cable.
- i. Country of manufacture.
- j. Year of manufacture.
- k. Direction of rotation of drum (an arrow).

No drum shall contain more than one length of cable. The inner as well as outer end of cable shall be brought out on the drum flange and shall be clamped in such a manner to make the cable length marking easily visible. The diameter of bore for the cable drum for inserting the shaft shall not be less than 120 mm.

Cable Drum Length:

The length of cable for drum shall be according to the table No.2 below unless the directorate specifies a certain length .Variation of ± 5 % of the cable drum length is acceptable.

7. Types of Cables:

7.1 **Single core cables:**

- 50 sq. mm
- 70 sq. mm
- 95 sq. mm
- 120 sq. mm
- 150 sq. mm
- 185 sq. mm
- 240 sq. mm

For these cables the applicable paragraphs are 6.1,6.2,6.7 and 6.8 .

7.2 **Four core cables:**

- 3x240+120 sq. mm
- 3x185+95 sq. mm
- 3x150+95 sq. mm
- 3x120+70 sq. mm
- 3x95+50 sq. mm
- 3x70+35 sq. mm
- 4x50 sq. mm
- 4x25 sq. mm
- 4x16 sq. mm

For these cables the applicable paragraphs are 6.1,6.2,6.3,6.4,6.5,6.6,6.7 and 6.8.

8. Tests:

Certified copies of type test certificates shall be submitted along with the offer. Cables and accessories shall be subjected to inspections and tests by our inspectors or international inspectors at any time during manufacture. The manufacturers shall provide inspection facilities for the said inspection shall be made at place of manufacture or at international testing facilities.

9. Technical Information for Cables:

The tenderer is requested to give the following information with the offer as listed in schedule A below.

N.B:-

1. The prices shall be based on L.M.E. price for copper bar () US\$/ton. The formula for price variation shall be given.
2. The total length of the cable on drums should not exceed the total required amount stated in the contract. Otherwise, any extra amount should be free of charge.

Table No. (1)

	cross sectional area mm ²	Min. No. of wires	Max. D.C resistance at 20 °C (ohm/km)	Short circuit current for 1 sec. in kA
1.	16	6	1.15	1.84
2.	25	6	0.727	2.88
3.	35	6	0.524	4.03
4.	50	6	0.387	5.75
5.	70	12	0.268	8.05
6.	95	15	0.193	10.9
7.	120	18	0.153	13.8
8.	150	18	0.124	17.3
9.	185	30	0.0991	21.27
10.	240	34	0.0754	27.6

Table No. (2)

	Cable size	Drum length (m)		Cable size	Drum length (m)
1.	1x50 sq. mm	250	9.	4x25 sq. mm	1000
2.	1x70 sq. mm	250	10.	4x50 sq. mm	1000
3.	1x95 sq. mm	250	11.	3x70+35 sq. mm	500
4.	1x120 sq. mm	250	12.	3x95+50 sq. mm	250
5.	1x150 sq. mm	250	13.	3x120+70 sq. mm	250
6.	1x 185 sq. mm	250	14.	3x150+70 sq. mm	250
7.	1x240 sq. mm	250	15.	3x185+70 sq. mm	250
8.	4x16 sq. mm	1000	16.	3x240+120 sq. mm	250

Schedule A
GUARANTEED TECHNICAL INFORMATION

S.NO.	Description	Unit	Bidder's data
1.	Manufacturer and country of origin		
2.	Applicable Standards		
3.	Voltage grade of cable Vo/V (Vmax)	kV	
4.	Number of cores	Single/Three	
5.	Conductor details: a. Material b. Compacted c. Number of wires in each conductor d. Diameter of wire in each conductor e. Area f. Diameter of conductor in stranded shape	Yes/No No. mm Sq. mm mm	
6.	Insulation: a. Material b. Nominal thickness of insulation c. Minimum thickness of insulation d. Total diameter	mm mm mm	
7.	Phase identification description		
8.	Filler description		
9.	Inner covering: a. Material b. Extruded c. Nominal thickness d. Minimum thickness at any point	Yes/No mm mm	
10.	Armour: a. Material b. Type c. Thickness of tape d. Total diameter e. Galvanizing thickness	mm mm mm micron	
11.	Outer sheath: a. Material b. Nominal thickness c. Minimum thickness at any point d. Termite resistant e. Rodent resistant	mm mm Yes/No Yes/No	
12.	Nominal overall diameter of completed cable	mm	

13.	Minimum weight of copper	Kg/km	
14.	Weight of completed cable	Kg/km	
15.	Allowable minimum radius of bend around which cable can be laid	mm	
16.	Maximum DC resistance of phase conductor at 20° C	Ohm/km	
17.	Maximum DC resistance of neutral conductor at 20° C	Ohm/km	
18.	Inductance of cable for 1000m length	mH	
19.	Capacitance of cable for 1000m length	μF	
20.	Maximum conductor temperature for continuous operation	deg. C	
21.	Maximum conductor temperature under short circuit	deg. C	
22.	Insulation resistance a) For phase insulation b) For neutral insulation	M.OHMS	
23.	Voltage drop per 1000 m cable at rated current: When laid in air at 40 deg. C	volts	
24.	Voltage drop per 1000 m cable at rated current: When laid in ground at 30 deg. C	volts	
25.	Maximum dielectric loss of three phase circuit when operating at normal voltage and frequency at maximum conductor temperature of 70° C	W/km	
26.	Maximum continuous current carrying capacity per conductor for a single circuit when laid direct in the ground at : Maximum conductor temperature 70 °C Ambient air temperature 30 °C Ground temperature 20 °C Depth of laying 0.8 m Thermal resistivity of soil 1.5 K.m/W	Amp	
27.	Conductor short-circuit current permissible for a period of 1 second	kA	
28.	Maximum dielectric loss angle at normal voltage and frequency at a conductor temperature of :- a. 20 ° C b. 90 ° C	Tan δ	
29.	Maximum permissible pulling force at total cable in drums	kN	
30.	Cable drum details :- a. Nominal delivery length per drum b. Maximum gross weight of full drum c. Steel or wooden drums d. Weight of empty drum e. Drum dimensions: • Flange diameter	m Kg Kg mm	

	<ul style="list-style-type: none">• Bore diameter• Width	mm mm	
31.	Cross section drawing and details of cable layers and catalogues.		

30/01/2016