

**Ministry of Electricity
Power Distribution Office
Baghdad - Iraq**

Specification No.	D 22-
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**TECHNICAL SPECIFICATION
OF
TUBULAR STEEL POLES**

REVISION	YEAR 2001	YEAR 2009	YEAR 2012
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1- Scope of supply:

Suppliers are called upon to deliver tubular steel poles to MOE which are required for the installation of medium voltage (11 kV) and low voltage (0.4kv) Electricity Distribution Network.

The Japanese Industrial Standards (JIS) or British Standards (BS) are to be considered in the design, manufacture and testing have above mentioned materials. Similar or equivalent international standards such as A.P.I or DIN etc. Shall be likewise.

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 conditions.

2 1-A mbient 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)

2-5 Sand storm:

The equipments shall be suitable for outdoor installations and subjected to frequent sand storms and heavily polluted atmosphere.

2-6 Wind Velocity:

Max velocity (for design purpose) (140 KM/ HR) or 39m/sec.

2-7 Composition of Soil:

The soil consists mainly of hard clay containing deposit gravel.

3- Technical Requirement:

3-1 System Data

a. 11 KV System	
Nominal voltage	11000 volts
Highest system voltage	12000 volts
System	3-phase, 3wire neutral earthed through resistance of 21.1 Ohm limiting the earth fault current to 300A
Short circuit breaking current	25 KA R.M.S at 11000 volts

b. 0.4 kV system	
Nominal voltage	400 Volts
System	3phases, 4 wires with neutral solidly grounded.
Frequency	50 Hz

4- materials and process:

The poles shall be made from longitudinally welded tube sections of hot rolled structural carbon steel in accordance with JIS-G-3444 or in accordance with BS-4360 or in accordance with any international equivalent standards like DIN 17100 with considering the design factor of safety for design of the poles shall be considered (2.0). Then the materials having the following properties.

Characteristics	Unit	type of steel standards			
		High tensile steel		Medium tensile steel	
		according to JIS-G-3444	according to BS-4360 DIN-17100	according to JIS-G-3444	according to BS-4360 DIN-17100
Tensile strength	Kg f/mm ² (min)	ST-51	ST-52	ST-41	ST-42
Yield strength	Kg f/mm ² (min)	36	36	24	24
Design bending stress	Kg f/mm ² (min)	25.5	26	20.5	21

Poles shall be delivered in a swaged or stepped form.

Swaged poles shall be manufactured from tubes brought together when hot. Stepped poles shall be made from one length of tube with its diameter being reduced in parallel steps by passing the tube through a series of dies. Stepped poles shall have the same wall thickness at any section of its whole length.

A swaged pole shall consist of three-tube section with diminishing diameters, the bottom Section being the biggest in size. See fig (1).

The length of the overlap shall be at least 3 times . The diameter of the smaller tube. The supplier should state the overlapping length in his offer. The upper edge of tube at the joint shall be chamfered off at an angle of 45°

The top end of all poles shall be rounded off and sealed completely. Welded type poles made out of three- sections similar to the design but jointed together via reducers welded to the pole section shall also be accepted subject that the mechanical characteristics and tests are the same as for swaged or stepped poles.

a. The pole design shall be in accordance with the following: -

Characteristics	Unit	9m poles (LV)	11m poles (MV)
Effective length of pole	m	9	11
Length of top section	m	2	2.5
Outside diameter of top section	mm	89	114
Length of middle section	m	2.3	3
Outside diameter of middle section	mm	114	139
Length of bottom section	m	4.7	5.5
Outside diameter of bottom section	mm	139	165
Planting depth	m	1.5	2
Working load	kgf	210	285
Point of application of load		60 cm below top	120 below top
Allowable bending stress For JIS-G-3444 ST-51 & DIN-17100 ST-52	kgf/mm ²	26	26
Wall thickness (t) of the poles must be for ST-51 or ST-52	mm	≥ 3.7	≥ 4.4
Allowable bending stress For ST-41 JIS - G - 34444 & ST 42 according to DIN - 17100 and any equivalent	kgf/mm ²	21	21
Wall thickness (t) of the poles must be for ST-41 or ST-42	mm	≥ 4.4	≥ 5.3

b. All (11 m) pole shall be fitted with (A) shaped clamped welded to the poles top and having an approximate height of (25 cm). The clamp which shall be fixing the upper (11 kv) pin insulator, is to be made of plate steel having of chemical and mechanical properties similar to that of the tubular poles.

The plate shall have a width of (75mm) and (6mm) thickness with two holes (25 mm) diameter of steel (ST-41) or (ST-42), each drilled at center coincident with the centerline of the pole.

The extra length of ((A)) clamp shall not be considered in the effective length of the (11 m) pole.

c. Five nos. (17.5mm) dia. Through holes shall be drilled at the top sections of poles for the purpose of fixing low tension shackle insulators. The upper-most hole shall be located (120 cm) below the top of the (11 m) pole, the rest spaced (30 cm) between centers vertically downwards.

The same number of holes shall be drilled through the (9 m) poles, but the upper-most hole shall be drilled (15 cm) below the top.

For earthing purposes a (20-mm) dia. Hole shall be drilled at the bottom of each pole at a distance of (15-cm) there from and a suitable length (M-18) galvanized bolt, nut & washer shall be supplied with each pole.

Tolerance in diameter and thickness of tube section shall be within the limits specified in (JIS-G-3444, or BS 4360, or DIN 17100) the complete pole shall be out of straightness more than (1/1000) of length of pole.

d. Loading process (type test):

The design of each pole shall has the acceptance criteria as follows when conducting loading tests:

Load	Measuring item	Acceptance criteria
Ps	Specified working load	Any defect should not be produced
O	-----	-----
Pp	1.5 load × Ps	Any defect should not be produced
O	-----	Permanent set shall not exceed (13 mm) from zero position
Pb	2.0 load × Ps	Destruction

Where: -

Ps = Specified working load.

Pp = Load for permanent set not exceeding (13 mm).

b = Breaking load.

5- Protection: -

The poles shall be hot-dip galvanized thoroughly internally and externally as per (BS 729) but zinc distribution shall not be less than (650 gr. /m).²

6- Testing and inspection:

The poles are subject to inspection by (MOE) inspection authority during manufacture and before shipment to verify compliance of poles with our specifications. The fees shall be borne by (MOE) but the supplier shall submit all necessary facilities to our inspector to conduct such tests without-extra charge.

7- Specification For Cross-Arms & Clamps

Generally these cross-arms and clamps shall be used for (11 m) poles at the rate of one set of cross-arm and clamp per each pole shall be steel (St-41) or (St-42). The set shall be fastened at a distance of (0.9 m) below pole top (excluding A - clamp). Generally the design shall be complying fully with the attached drawings No.2 & No.3 . Every set shall include the followings: -

- One No. Channel steel (75x40x6 mm) length (1250 mm).
- One No. Clamp having cross-section (75x6 mm).
- Tow Nos. high stress ((M-16)) Hexagonal headed bolts, nuts, plain washer & spring washers, the length of bolt (excluding head shall be 60 mm, fully threaded 50 mm).With spare bolts, nuts. etc of 5% for the whole quantity required.

8. Protection:

- a. All channel steels and clamps shall be hot dip galvanized to (BS 729), with same zinc distribution as above.
- b. All bolts nuts and washers shall be electrically galvanized.

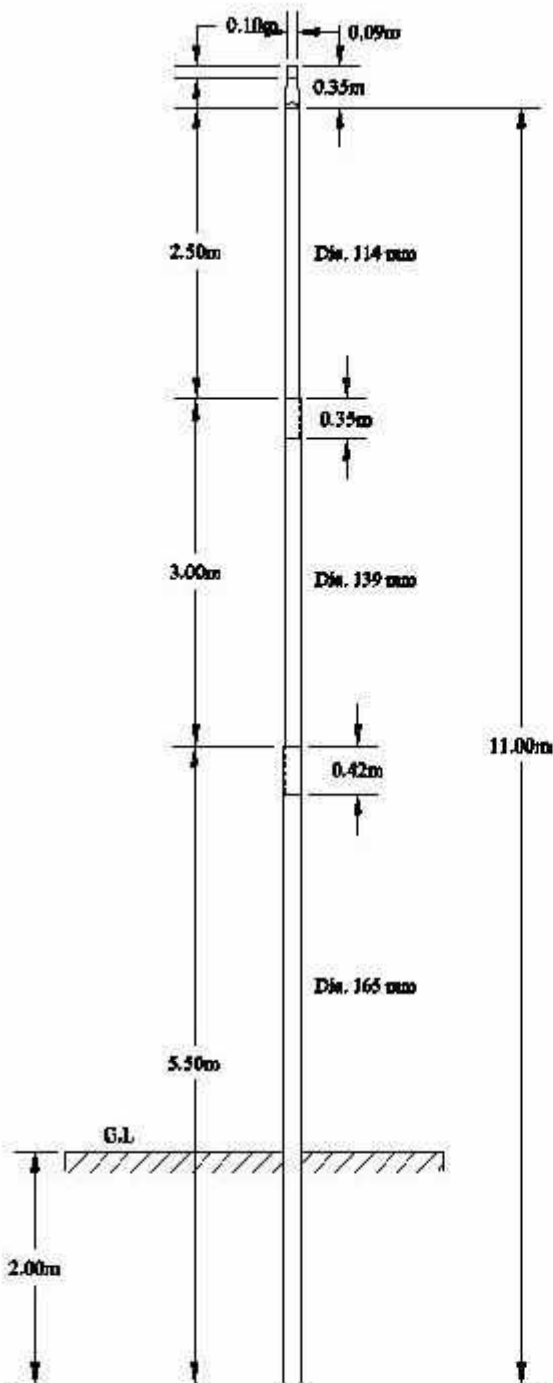
9. Packing:

- a. Channel steels and clamps in bundles.
 - b. Bolts nuts and washers in proper wooden or steel cases.
- Details shall be stated clearly in the offer.

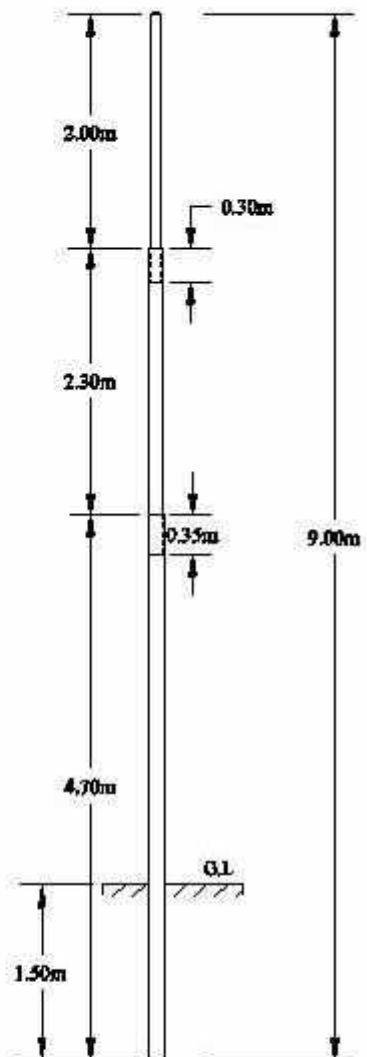
Note:

All drawings of the pole and its accessories subjected to our approval before start manufacturing.

11m poles

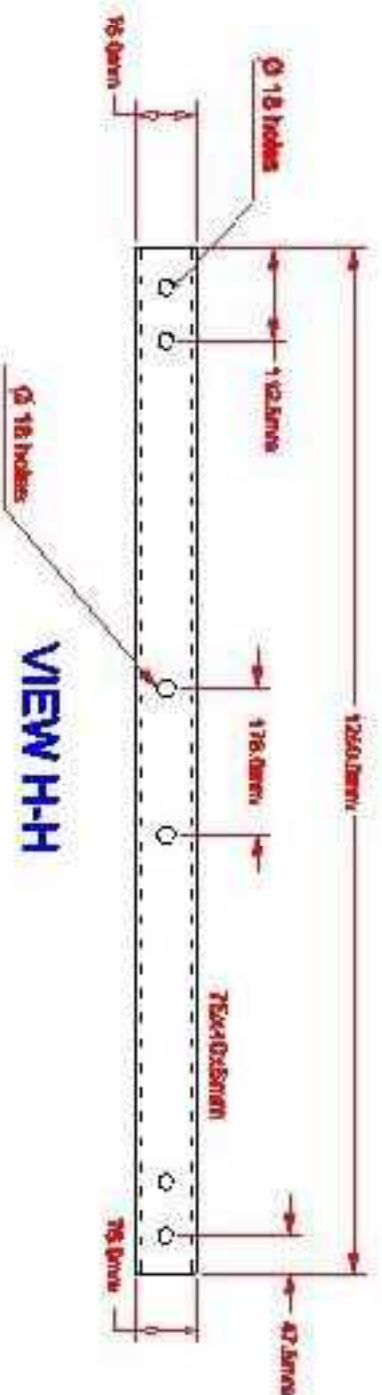
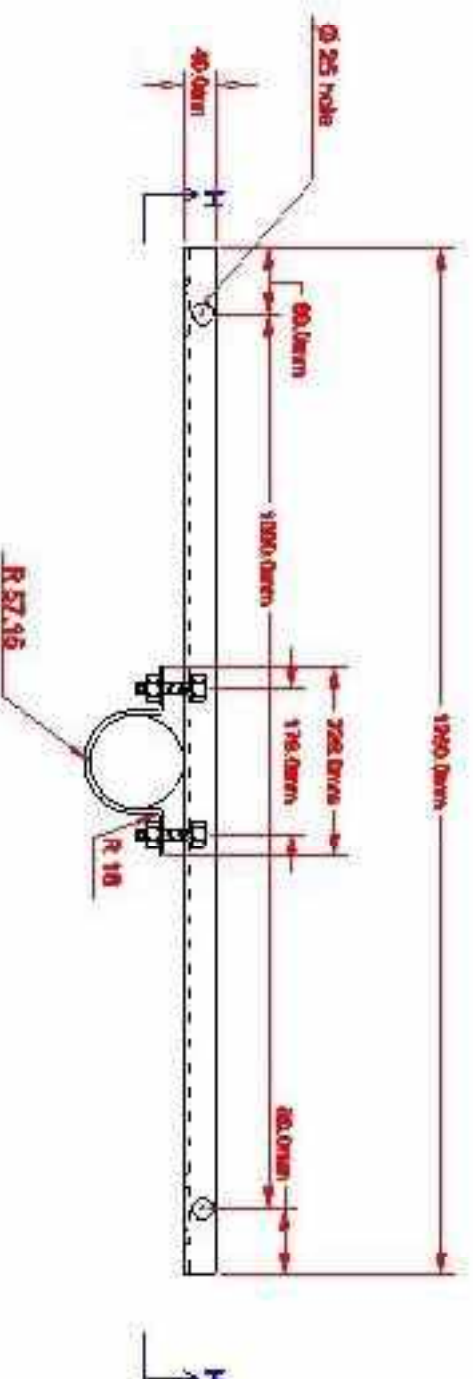


9m poles



Drawing no. (1)

11m & 9 m Tubular steel poles



All materials STK-41 or ST-42 or ST-44 Hot
dip galvanization to B.S729 for all steel works
except bolts which should be electrically
galvanized

Drawing no. (2)

CROSS ARM FOR 11m TUBULAR POLES

**Ministry of Electricity
Power Distribution Office
Baghdad - Iraq**

Specification No.	D 46-
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**TECHNICAL SPECIFICATION
OF
LATTICE STEEL POLES**

REVISION	YEAR 2001	YEAR 2009	YEAR 2012
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1- Scope of supply: -

Suppliers are called upon to deliver lattice steel poles and cross-arm to MOE which required for the installation of medium voltage (11 kV), and low voltage (0.4 kV) Electricity Distribution Network usually our network using tubular steel poles but the lattice pole shall be used in - between for the following purposes: -

- a- Tensioning of the Network.
- b- At corners of Network.
- c- At end of Network.

The Japanese Industrial Standards (JIS) are to be considered in the design, manufacture and testing of the above mentioned materials. Similar or equivalent international standards such as BS or DIN shall be treated likewise. Specifications and quantities are stated in the following items.

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 conditions.

2 1-A 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)

2-5 Sand storm:

The equipments shall be suitable for outdoor installations and subjected to frequent sand storms and heavily polluted atmosphere.

2-6 Wind Velocity:

Max velocity (for design purpose) (140 KM/ HR) or 39m/sec.

2-7 Composition of Soil:

The soil consists mainly of hard clay containing deposit gravel.

3- Technical Requirement:

3-1 System Data

a.11 KV System	
Nominal voltage	11000 volts
Highest system voltage	12000 volts
System	3-phase, 3wire neutral earthed through resistance of 21.1 Ohm limiting the earth fault current to 300A
Short circuit breaking current	25 KA R.M.S at 11000 volts

b. 0.4 kV system	
Nominal voltage	400 Volts
System	3phases, 4 wires with neutral solidly grounded.
Frequency	50 Hz

4- Materials and process: -

The poles shall be made from hot rolled I- joists and angle-steel sections with steel plates specified in JIS-G-3101 (STK-51) or in accordance with BS 4360 (Steel 52) or in DIN 17100 or in accordance with any international equivalent standard with considering the design factor of safety equals to (2.0) having the following properties:

Characteristics	Unit	Steel type		
		STK-51	Steel 52 (to BS 4360)	Steel 52 (to DIN 17100)
Tensile strength	Kg f/mm^2 (min)	51	52	52
Yield strength	Kg f/mm^2 (min)	36	36	34.5
Design bending stress	Kg f/mm^2 (min)	25.5	26	26

Materials for A-clamps used at the top of (11 m lattice steel poles) and cross-arms shall be made of hot rolled structural carbon steel in accordance with the same specifications above but either STK-51, Steel-52 (to BS or DIN) having the following mechanical properties: -

5- Lattice-steel poles:

Each low voltage lattice steel pole shall be made out of two Nos. I-steel joists which are to be welded together and cross-braced with angle iron size (30×30×3) of steel (ST-41) or (ST-37) or any equiv. forming the shape of latter (A) as shown in drawings No. (2). I-steel sizes for low voltage is as follows: -

(120×58×5.1×7.7) ST-52 according to DIN-17100.

(125×75×5.5×9.5) STK-51 according to JIS-G-3101.

Any equivalent sections ST-52 according BS-4360.

And for medium voltage lattice steel pole is as follows: -

(140×66×5.7×8.6) ST-52 according to DIN-17100.

(150×75×5.5×9.5) STK-51 according to JIS-G-3101.

Any equivalent sections ST-51, ST-52 according BS-4360.

And any other size having the same modulus of section shall be acceptable.

a- Low-Voltage Lattice Poles:

The lattice pole which is shown in drawing No. (1) shall serve as a tension, angle and end-pole for low voltage network using straight-line tubular poles. The lattice pole should be capable of withstanding a working load of (700 Kgf) acting vertical to its plan in the transverse and longitudinal directions at the poles top. Planting depth shall be (1.5 m) for (9 m) poles. The rest of dimensions and parameters as per drawing No. (2) attached and also for locations of holes. Inspection shall takes into consideration (JIS-G-3101, G-3191 & G-3192) . The whole pole shall be hot-dip galvanized according to BS 729.

b- Medium Voltage Lattice Poles: -

This pole shall be used as a tension, angle (0-65°) and end-pole for (11 kV) power transmission lines together with straight line tubular poles. Referring to drawing No. (1) this pole has to withstand the max. working loads (700) Kgf. Planting depth shall be (2m) for (11 m) poles. The rest of dimension, parameters, locations of hole shall be as per drawing no. (1) attached. (A-clamp) as per drawing no. (2) shall be welded to the top of each pole. Inspection shall takes into consideration (JIS-G-3101, G-3191 & G-3192). The whole pole shall be hot-dip galvanized according to BS 729.

c- Common Remarks For Lattice Poles: -

c-1 Each of the (9&11 m) lattice steel poles shall have an earthing hole (18 mm dia.) located at the center of the lower plate for earthing purposes.

c-2 Every steel lattice pole shall be supplied with (11 Nos.) electrically galvanized, high stress, hexagonal -headed (M-16) fully threaded bolt (35 mm) length of screw with nut, plain washer & spring washer as they are used as follows.

(10 Nos.) For the 2 rows of (5x18 mm) dia. holes of each pole. (1 No.) For the (18 mm) dia. earthing these bolts, nuts...etc shall be firmly tightened in their places on the poles at the manufacturing works to guarantee supplying each pole to our job-site complete. (5%) spare bolts, nuts...etc shall be supplied as a spare individually.

6- Testing

All materials under contract shall be tested at the manufacturing works to verify compliance to our specifications. The MOE shall appoint an inspector for this purpose and paid accordingly, but the manufacturer shall supply all equipment and facilities to our inspector necessary for conducting all such tests without extra charge, the tests shall include the followings: -

a- Mills certificate approved by the manufacturer for the materials like I-joist, angle-steel, steel plates, channel steel, bolts & nuts...etc.

Complying fully with the international specifications based upon.

b- Dimensional tests in quantities not less than (5%) of the quantity of each batch, taking into consideration that eccentricity between top and bottom part of the pole shall not exceed 1/1000.

c- Welding tests by x-ray at the rate of two tests per each 100 Nos. of lattice poles.

d- Loading Tests (type test):

The design of each pole shall have the acceptance arteries as follows when conducting loading tests.

Load	Measuring item	Acceptance criteria
Ps	Specified working load	Any defect should not be produced
O	-----	-----
Pp	Ps × 1.5 load	Any defect should not be produced
O	-----	Permanent set shall not exceed (13 mm) from zero position
Pb	Ps × 2.0 load	Destruction

Where: -

Ps = Specified working load.

Pp = Load for permanent set not exceeding (13 mm).

Pb = Breaking load.

The loading test shall be carried out at rate of one test per each batch of 500 Nos. of lattice poles manufactured. The distracted pole shall not be considered from our poles. The manufacturer to replace the tested sample shall supply another.

e- Galvanizing:

Test shall be carried out on samples of the materials under contract as per BS 729.

7- Packing:

The manufacturer shall states clearly in his offer the proposed packing of the materials under contract mainly for the lattice poles and how many poles in each bundle. The cross arms and accessories shall be supplied in suitable bundles as well.

8- Alternative design:

The tendered may offer an alternative design for the lattice poles, but the new design shall take the following points into consideration.

- a- Same applied working load.
- b- Same total lengths of pole.
- c- Same locations of the medium voltage and low voltage conductor.
- d- Suitability of the cross-arms to the (11 m) lattice poles.

9- Specification For The Cross-Arms

The cross-arm shall be used to support insulators carrying bare copper or aluminum conductors on the medium voltage poles (11 m) they are to be made of section (channel steel) (ST-41), (ST-42) , (ST-44) or any equiv. Flat steel, bolts, nuts and washers according to (JIS-G-3101 and JIS-G-1186) or equivalent and as per drawing (No. 3) attached. All steel work shall be hot dip galvanized to BS 729 but bolts nuts; washers shall be electrically galvanized.

- 10. **Options:** as an option the poles could be painted type with two anti-oxide (red laite) paint layers with cross arms. According to the tender's request bolts and nuts to be electrically galvanized.

Note:

All drawings of the pole and its accessories subjected to our approval before start manufacturing.

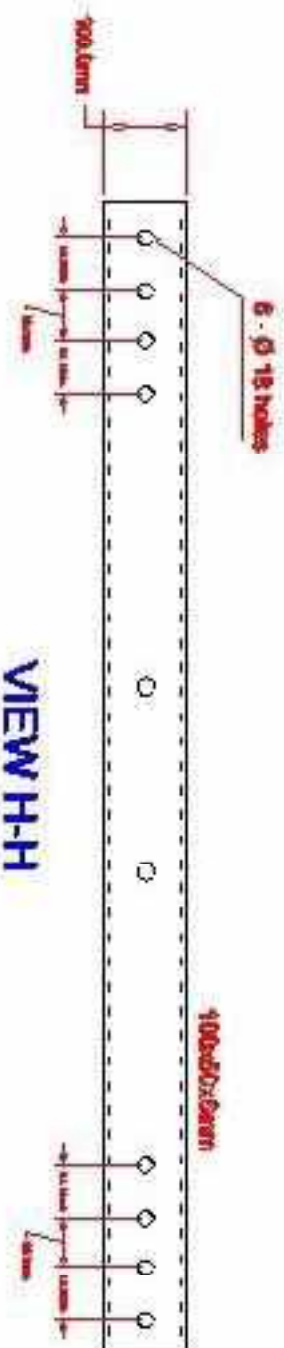
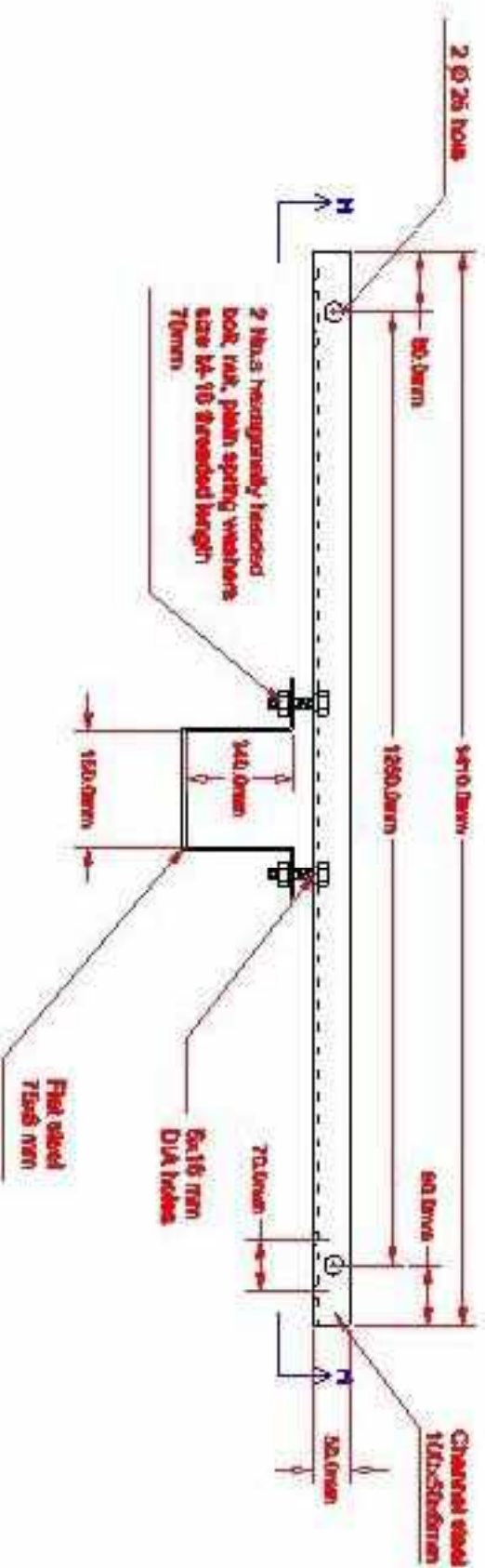
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The drawing consists of two views of a tower:

- Elevation View:** Shows the front profile of the tower. It has a total height of 100m. The top section is a solid rectangular cap with a height of 6.100m. Below this is a section with a height of 1.700m, containing horizontal lines at 0.500m, 0.700m, and 0.900m from the top. The main body of the tower is a lattice structure with a height of 87.00m. The base of the lattice is at the Ground Level (G.L.). The tower has a width of 3.000m at the base.
- Side view:** Shows the side profile of the tower. It is a simple vertical rectangle with a total height of 100m and a width of 0.700m. The base is also at the Ground Level (G.L.).

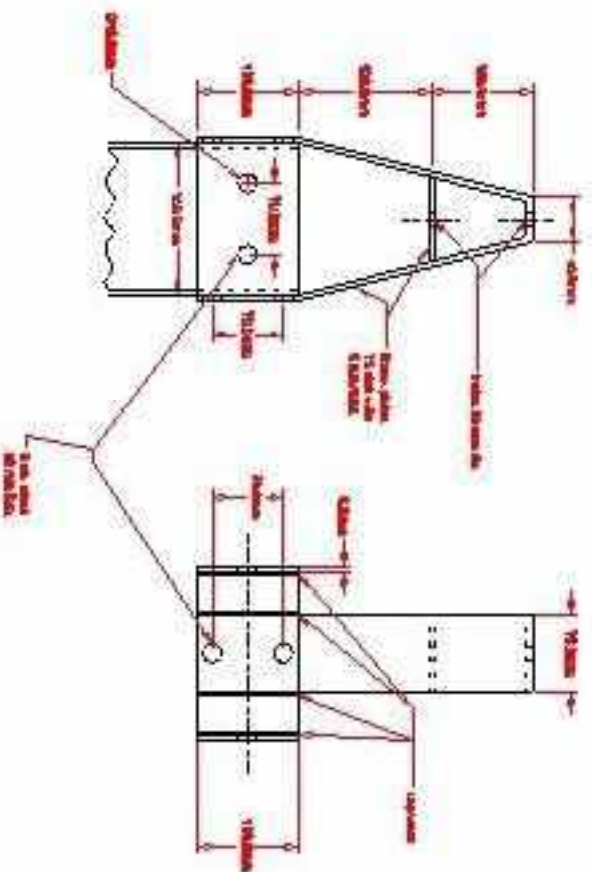
Note:
Materials:
Steel pole: JIS G 3101 SS ST-51 or DIN 17100 (ST-52)
A clamp & cross arm: JIS G 3101 SSSS (ST-41)
Bolt: JIS B 1180 S1
Galvanization: bolts, nuts electrogalvanized
All steel, Hot dip galvanized to BS 729

Drawing no. (1)

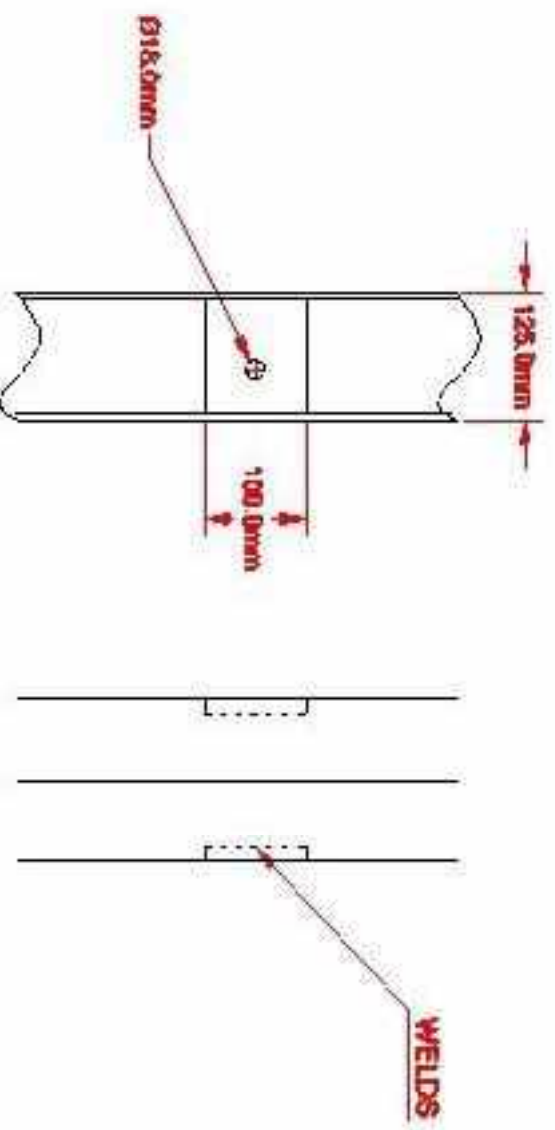
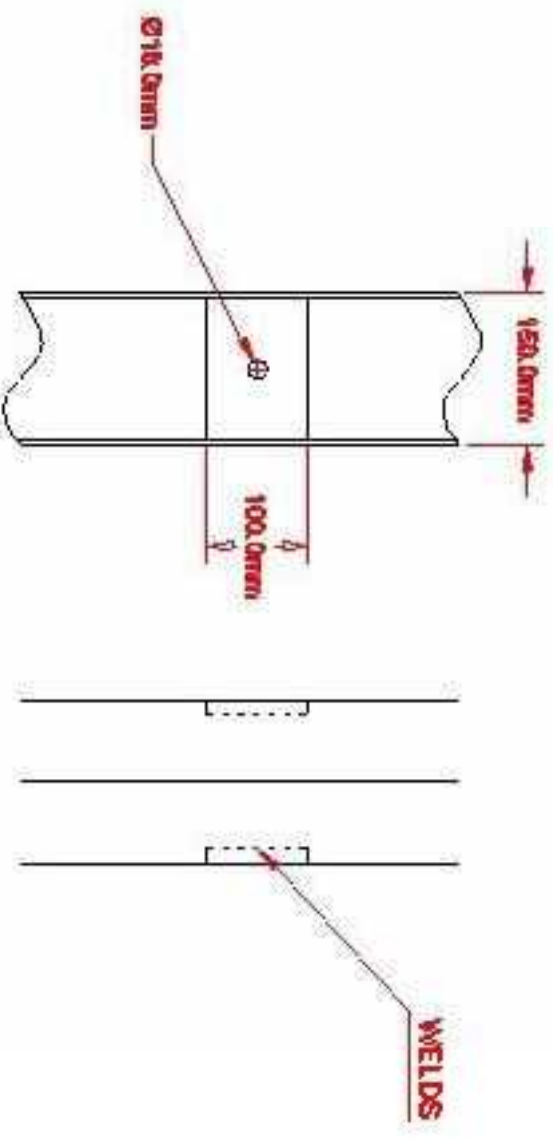


VIEW H-H

All materials STK-41 or ST-42 Hot dip galvanization to B.S.729 for all steel works except bolts which should be electrically galvanized



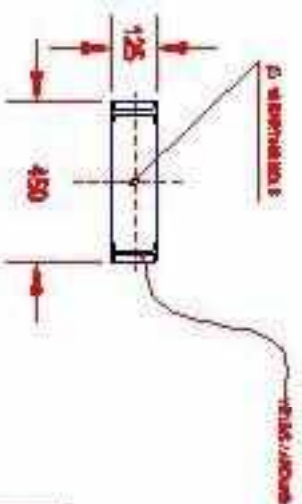
A Clamp for the pole
Material STK-41 or ST-42
Hot dip galvanized to B.S 729



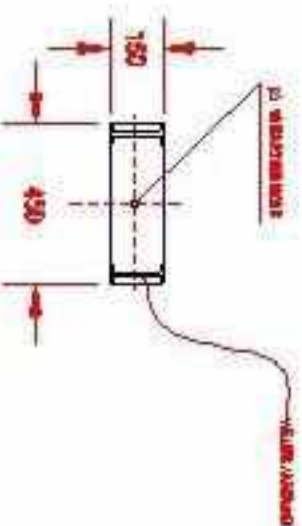
Drawing no (3)



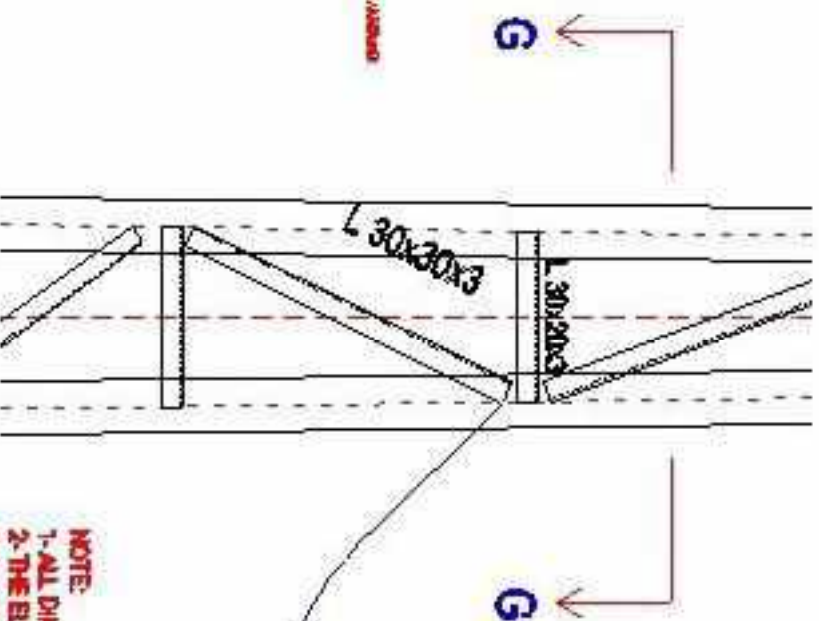
VIEW G-G



SECTION E-E



SECTION A-A

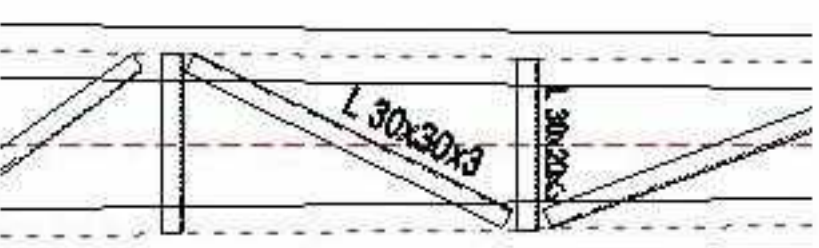


FRONT ELEVATION

ALL BRACES WELDING

NOTE:

- 1- ALL DIMENSIONS ARE IN MILLIMETERS
- 2- THE ELEVATION OF TWO HOLES CAN BE CHANGED
- 3- ALL BRACING & WELDING OF L 30x30x3 (ST-37) SHALL BE DOWN INSIDE THE L JOISTS
- 4- 11 NOS. BOLTS, NUTS, WASHERS, ETC. SHALL BE FIXED ON EACH POLE BEFORE SHIPMENT WHICH ARE USED FOR FIXATION OF D ROP SHACKLE INSULATORS BARTING.



BACK ELEVATION

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

Specification No.	D-24
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**TECHNICAL SPECIFICATION OF
OVERHEAD LINE PORCELAIN
INSULATORS**

Revision	Year 2015
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1.0 SCOPE

This Specification specifies the minimum technical requirements for design, materials, manufacturing, testing, and performance of the following porcelain insulators:

- 1.1 L.T shackles insulators.
- 1.2 15 kV brown glazed porcelain pin insulator with spindle.
- 1.3 15 kV disc insulator with tension string.
- 1.4 36 kV brown glazed porcelain pin insulator with spindle.

These insulators are intended to be used in the overhead line distribution system of (MOE).

2.0 GENERAL REQUIREMENTS

The equipment shall be of first class quality and designed for continues satisfactory operation as continuity of supplies of prime importance. The materials shall be suitable for the following climatic conditions prevailing at site:

2.1 Ambient temperature:

- Highest maximum (in the shade) 55 C° for about 6 hours a day
- Lowest minimum - 10 C°
- Max. Yearly average + 30 C°
- Max. Daily average + 30 C°

2.2 Temperature under sun:

Black object under direct Sun shine 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 1000 m

2.5 Dust storms:

The materials are subjected to strong & frequent dust storms.

3.0 APPLICABLE CODES AND STANDARDS

The latest revision of the following codes and standards shall be applicable for the equipment/material covered in this specification. In case of any deviation, the vendor/ manufacturer may propose equipment/ material, conforming to an alternate code or standard. However, the provision of MOE standards shall supersede the provisions of these alternate standards in case of any difference:

IEC

International Electrotechnical Commission

IEC 60168	Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1000V.
IEC 60273	Characteristics of indoor and outdoor post insulators and post insulator units for systems with nominal voltages greater than 1000V.
IEC 60383	Tests on insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1000V.
IEC 60437	Radio interference test on high voltage insulators.

IEC 60471	Characteristics of clevis and tongue couplings of string insulator units.
IEC 60507	Artificial pollution tests on high voltage insulators to be used on AC systems.
IEC 60575	Thermal – Mechanical performance test and mechanical performance test on string insulator units.
IEC60720	Characteristics of line post insulators.

ANSI **American National Standards Institute**

ANSI C29.1	Test methods for electrical power insulators.
ANSI C29.2	Wet process porcelain and toughened glass insulators- suspension type.
ANSI C29.3	Wet process porcelain insulators (Spool type).
ANSI C29.7	Wet process porcelain insulators (High voltage line- post type).
ANSI C29.9	Wet process porcelain insulators (Apparatus, post type).

ASTM **American Society for Testing & Materials**

ASTM- A153	Standard specification for Zinc coating (Hot Dip) on iron and steel hardware.
ASTM-C151	Test method for Autoclave expansion of Portland cement.

BS **British Standards Institute**

BS 137	Insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1000V.
BS 3288	Insulators and conductor fittings for overhead power lines (Parts 1&2).
BS 729	Galvanizing.

4.0 MV, LV INSULATORS AND ACCESSORIES SPECIFICATIONS

- 4.1 15 kV and 36 kV, 50 HZ brown glazes porcelain type insulators. The pin hole thread is of the cemented zinc thimble type. The top grooves of the insulator shall be suitable for bare conductor ACSR 120/20 mm². Overall diameter (15.5) mm for 15 kV, ACSR 210/35 mm². Overall diameter (20.3) mm for 36 kV.
- 4.2 Galvanized steel spindles for 15 kV and 36 kV. The minimum height shall not be less than 125 mm and 18.5 mm in diameter. Having tapered body and 75 mm threaded and out of 150 mm shank. The spindles shall be supplied complete with spring washers and nuts. As it illustrated in table (1 & 2) attached.
- 4.3 LV (1200 V) brown glazes shackle insulators having conductor groove of 15mm.
- 4.4 D-bracket & accessories for LV insulators complete with all necessary bolts (16 x 120), nuts and washers.

4.5 Hexagon head deck bolt (16 x 180) to be used with D-bracket.

4.6 15 KV disc insulator brown glazed porcelain ball and socket type coupling suitable combined mechanical and electrical strength.

4.7 Technical specification of disc insulator accessories

4.7.1 Ball eyes

The ball eye shall be manufactured from forging quality medium carbon and hot dip galvanized according to (BS-729) the ball dimension shall be (16mm) the minimum failing load shall be (75kn).

4.7.2 Socket eyes

The socket eye shall be manufactured from forging quality medium carbon steel and hot dip galvanized according to (BS-729) the socket dimension shall be suitable for (16mm) ball eye diameter the minimum failing load shall be (75kn). The security clip shall be of phosphor bronze material and the split pins shall be stainless steel.

4.7.3 Strain & suspension clamps

4.7.3.1 Strain clamp U-bolted type suitable for (AAC & ACSR) conductors overall diameter (12.5-18.0) mm with aluminum tape. The material of clamp should be cast iron and galvanized according to (BS-729).

The connecting of conductor with clamp should be by (2-3) U-bolts and nuts manufactured from galvanized mild steel minimum ultimate strength (75kn). The conductor seating area shall be free from any roughness and burrs. The outer and inner edges shall be rounded to avoid any damage on the conductor after assembly the slip strength of the clamp should be (95%) of the breaking load of conductor or (43kn).

4.7.3.2 Strain clamp U-bolted type suitable for (ACSR) conductors overall diameter (15.5-23.0) mm with the same specification of item (5.3.1) above but the minimum ultimate strength (90kn). And slip strength of clamp (68kn).

4.7.3.3 Suspension clamp U-bolted type suitable for (ACSR) conductors with overall diameter (15.5-23.0) mm. the material of clamp body and keepers are malleable iron hot dip galvanized according to (BS-729) cotter pins should be bronze. The connecting of conductor with clamp should be by (2) U-bolts and nuts manufactured of the hot dip galvanized mild steel the minimum ultimate strength of clamp (40kn). The conductor strength area shall be free from any roughness and burrs. The outer and inner edge shall be rounded to avoid any damage on the conductor after assembly. The slip strength of the clamp should be (20%) of the breaking load of conductor or (15kn).

Note:

1. The dimensions, electrical and mechanical withstand specification of (15 and 36) kV pin insulators, (1.2 kV) shackle insulator and (15 kV) disc insulator is as stated in table (3).
2. Samples are required with the offers.

5.0 Marking

- 5.1 Each insulator shall bear a marking as per ANSI or IEC Standards, Identifying the following (English):
 - a. Manufacturer name.
 - b. Year of manufacturing.
 - c. Designation number.
 - d. Cantilever strength (Combined M&E strength suspension insulator).
 - e. Country of origin.
- 5.2 Crate Marking (English and/or Arabic):
 - a. Nominal System voltage.
 - b. Type of insulator.
 - c. MOE purchase order number / contract number.
 - d. MOE Item number.
 - e. Weight, Kg.
 - f. Manufacturer name / Country of origin.

6.0 TESTING AND INSPECTION

All test results shall be provided for review and acceptance by MOE.

6.1 Type Tests

- 6.1.1 All type tests prescribed in the relevant IEC or equivalent ANSI standards shall be performed on the representative unit or on the first unit of every new design or rating to be supplied to MOE.
- 6.1.2 The certified test reports of type tests performed on a unit of identical design and rating may be submitted to MOE for review and approval during bidding stage.
- 6.1.3 In addition to the above IEC or ANSI type test requirements, the following type tests shall be carried out for suspension insulators:
 - a. Thermal–Mechanical performance test on suspension insulator units in accordance with IEC 60575.
 - b. Autoclave Expansion Test for Portland cement - The soundness of Portland cement to be used as the bonding agent for wet- process aluminous porcelain insulators shall be tested in accordance with the ASTM C151. Ten (10) samples of cement for the test specimen shall be selected at random from the batch to be used for insulators. The bars prepared from neat cement when subjected to high pressure steam at 2 ± 0.07 Mpa for three hours at 216° C shall not show expansion of more than 0.12 percent. The expansion of cement more than 0.12 percent in the test shall be the cause for rejection of the whole batch of cement.

6.2 Routine Tests

6.2.1 All routine tests prescribed in the relevant IEC or equivalent ANSI standards shall be performed on all units prior to delivery to MOE.

6.2.2 Electrical routine tests shall be carried out on each stand off insulator:

- a. The ultrasonic test shall be performed on solid core and the puncture test shall be performed on hollow core porcelain insulators.
- b. Routine flashover test shall also be performed on hollow core porcelain insulators.

6.4 Special Tests

The pollution test, as an option shall be performed in accordance with IEC 60507, if requested by MOE prior to delivery.

6.5 Inspection

MOE may wish to witness tests or visit the factory during manufacture of any or all Items covered by this specification. Accordingly the supplier shall be give the purchaser adequate notice of manufacturing program and test to be witnessed. MOE may require certificates and data from the manufacturer/supplier on all pertinent aspects of the manufacturing process.

7.0 PACKING AND SHIPMENT

Packing and shipping of the insulators shall conform the following:

- a. All parts shall be carefully packed for transport in such a manner that they are protected against mechanical damage and climatic conditions during transportation or storage.
- b. Suppliers shall contact Materials Management Department for additional packing, handling and shipment instructions, as applicable.

8.0 GUARANTEE

8.1 Supplier shall guarantee the insulators against all defects arising out of faulty design, workmanship, or defective material for a period of two (2) years from date of delivery.

8.2 If no exceptions are taken to this specification and no list of deviation is submitted, it shall be deemed that in every respect the offered insulators conform to this specification. MOE interpretation of this specification shall be accepted.

9.0 SUBMITTALS

9.1 Submittals required with tender:

9.1.1 The vendor shall complete and return one copy of the attached technical data schedule with quotation.

9.1.2 Detailed dimensional drawing of insulators.

9.1.3 Type test certificates.

9.1.4 Catalogues.

9.2 Submittals required following award of contract are given below.

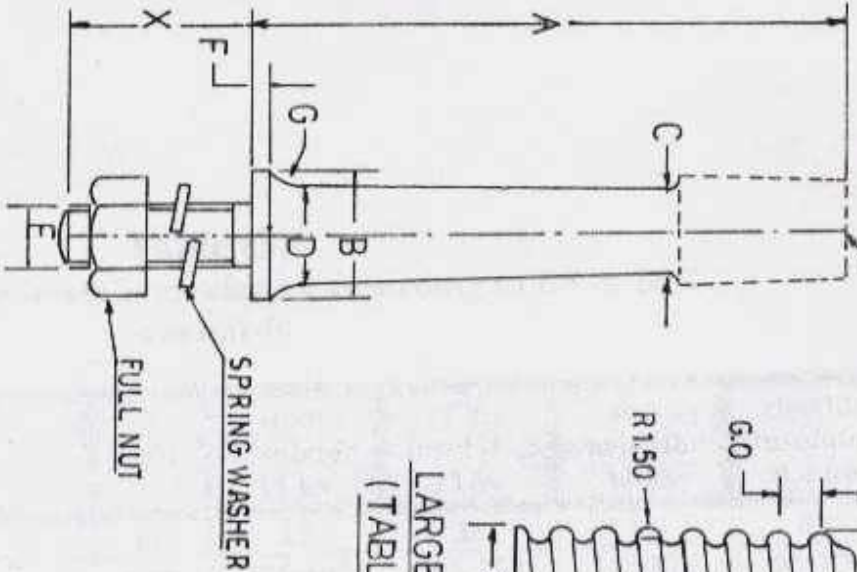
9.2.1 Manufacturing schedule, progress report and test schedule.

9.2.2 Test reports

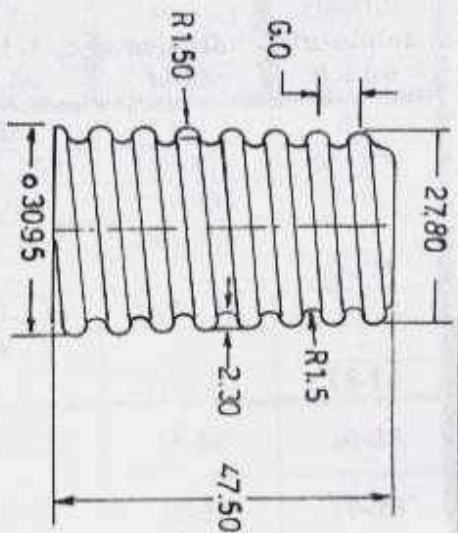
Table (3)
Specifications of porcelain insulators according to BS & IEC standards

shackle insulator 0.4 kV	disc insulator 11 kV	pin insulator 33 kV	pin insulator 11 kV	unit	type of insulator		
0.6	15	36	15	kV	highest system voltage		
65-100	145-170	203-250	135-160	mm	total high " H "		
75-115	255-280	≥280	140-175	mm	total diameter " D "		
-	290-350	580-685	270-320	mm	total creepage distance		
66-75	-	-	-	mm	leakage distance		
-	165-230	300-335	120-140	mm	protected creepage distance (90°)		
-	-	10-12	10-12	kn	cantilever strength (min)		
15-16	70-120	-	-	kn	combined Electro mechanical strength		
20-35	75-80	110-130	70-80	kV	flashover voltage	one minute dry	
10-25	45-50	85-95	40-55	kV		power frequency wet	
-	115-130	205-210	105-115	kvp		impulse + ve	
-	120-135	225-250	110-140	kvp		- ve	
≥23	70-75	100-110	65-75	kV	dry	withstand voltage	one minute power frequency
≥10	40-45	80-90	35-50	kV	wet		impulse
-	110-120	180-200	95-105	kvp	+ ve		
-	115-125	190-220	105-120	kvp	- ve		
power frequency puncture voltage dry F.O.V			kV	105-120	200-210	110-130	1.3 actual
-	9-18	≥ 29	≥ 9	kV		visible discharge voltage	
0.6-1.0	5-8	7.5-9.5	1.8-2.5	kg		net weight (approx.)	
-	16	-	-	mm		ball and socket size	

LARGE STEEL HEAD



LARGE STEEL HEAD
(TABLE-2)



NOTES :-

1. DIMENSIONS X TO BE 150 mm SCREWED 10 mm
2. ALL DIMENSIONS ARE AFTER HOT DIP GALVANIZING GALVANIZING TEST TO CONFORM TO B.S: 779
3. 15% MAXIMUM DEFLECTION PERMISSIBLE AT A MINIMUM SPECIFIED FAILING LOAD
4. PIN WILL BE SUPPLIED WITH SPRING WASHER & FULL NUT
5. MASS OF ZINC COATING (MIN) 510 gm/m² (85 u)

ALSO PASS 4*1 MINUTE DIP TEST

MINIMUM FAILING LOAD	REF NO	A	B MIN	C	D MIN	E	F	G RAD	X*
10 kN	31	305	63	27	40	22	6	16	150

STATE COMPANY OF ELECTRICITY DISTRIBUTION
FOR THE MIDDLE

LARGE STEEL HEAD SPINDLE
(B.S: 3288 PART-11)

ALL DIMENSIONS IN. mm

DRAWN MAY

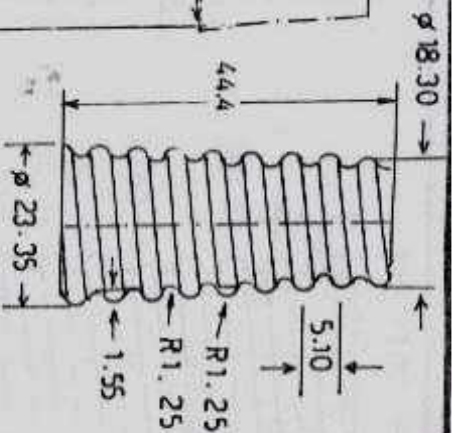
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DATE : 1-8-2001

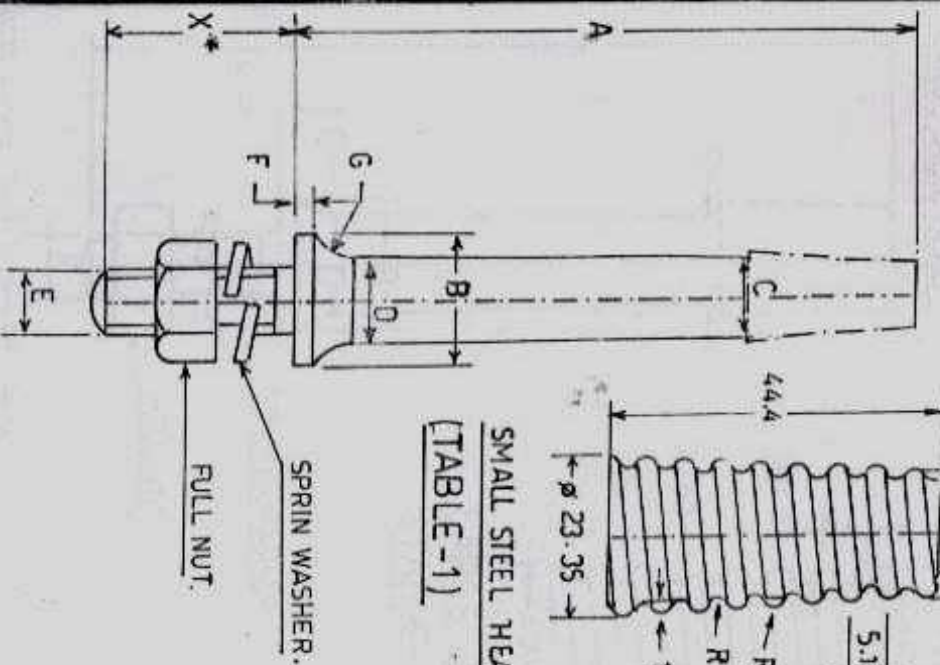
NOTES:-

1. DIMENSIONS 'X' TO BE 150 mm. SCREWED 80 mm.
2. MATERIAL:- FORGED STEEL.
3. ALL DIMENSIONS ARE AFTER HOT DIP GALVANIZING. GALVANIZING TO CONFORM TO BS. 729.
4. PIN WILL BE SUPPLIED WITH SPRING WASHER & FULL NUT.
5. 15% MAXIMUM DEFLECTION PERMISSIBLE AT A MINIMUM SPECIFIED FAILING LOAD.
6. MASS OF ZINC COATING 9 mm² 610 gm/m² (85u) ALSO PASS 4x1 MINUTE DIP TEST.



SMALL STEEL HEAD.

(TABLE-1)



MINIMUM FAILING LOAD	REF NO.	A.	B. MIN	C.	D. MIN	E.	F.	G. RED.	X"
10KN.	23	165	43	24	31	M18	6	13	150

STATE COMPANY OF ELECTRICITY DISTRIBUTION FOR THE MIDDLE

SMALL STEEL HEAD SPINDLE (B.S 3288 PART II)

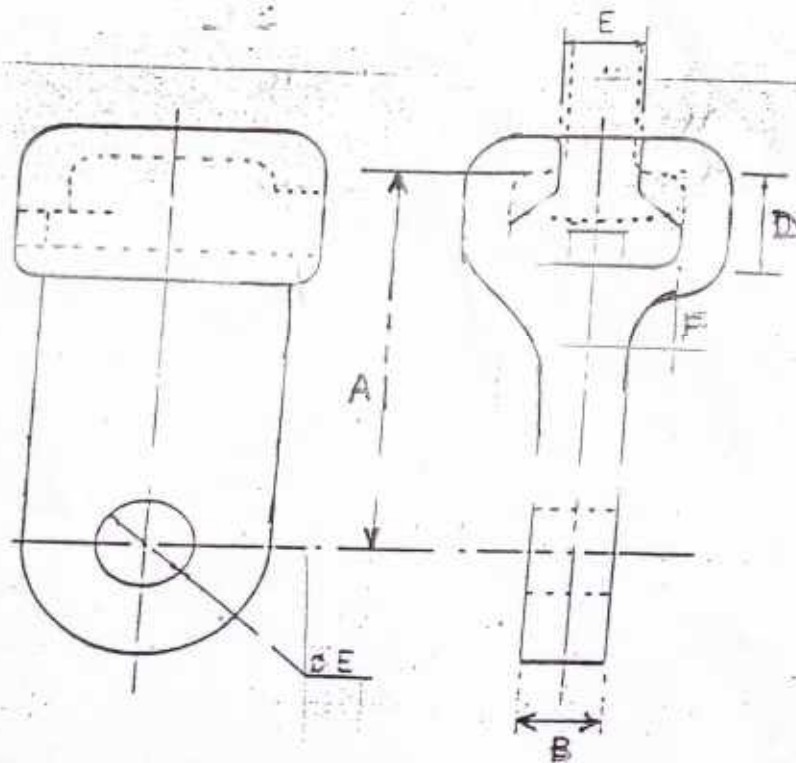
ALL DIMENTION IN mm

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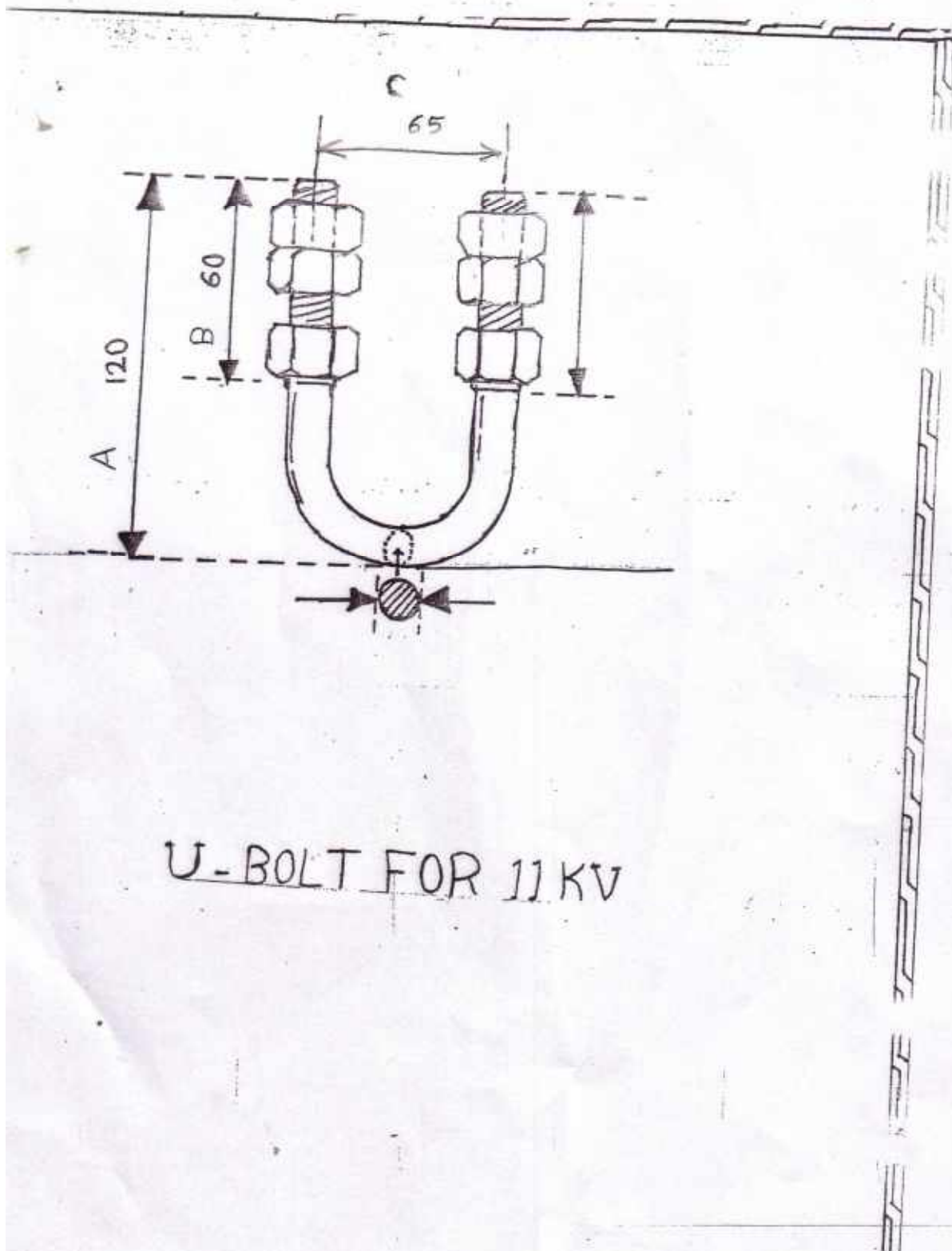
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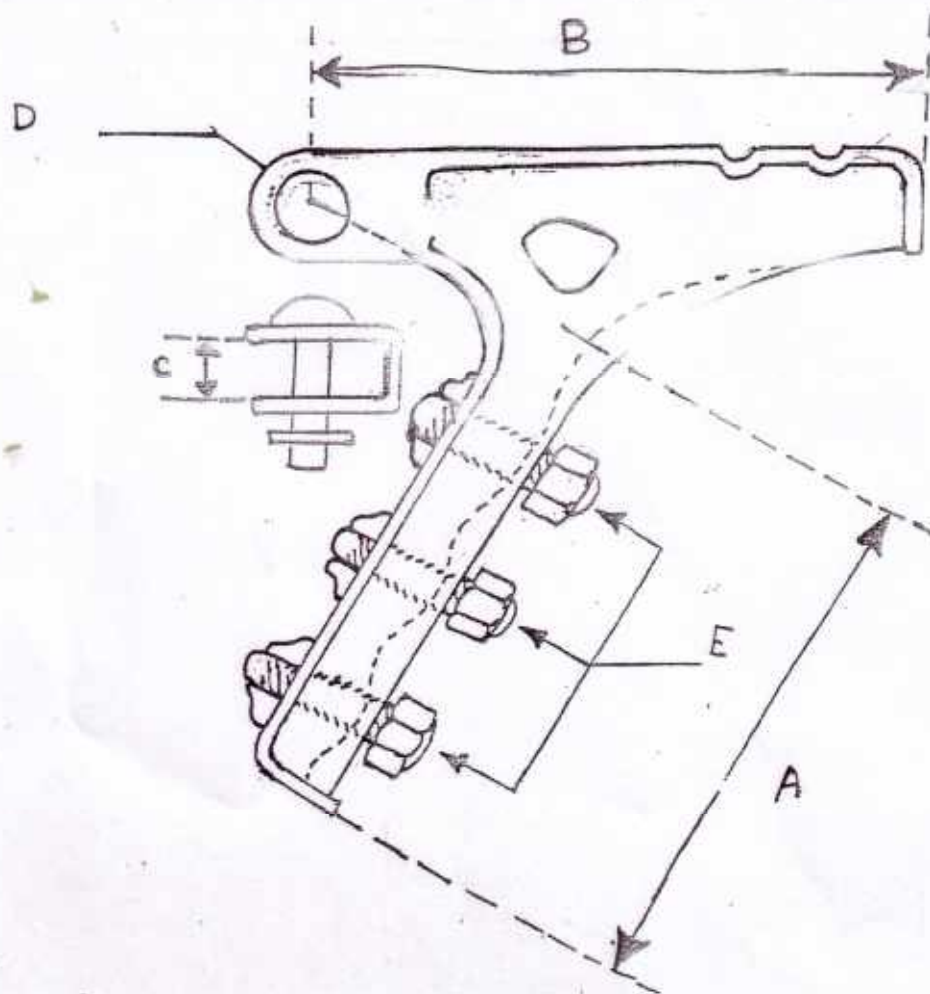
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DATE : 1-8-2001



Socket Eye





Tension clamp

Specifications For Cable Terminals

Cable terminals connectors used to join a copper conductor to a copper stud. This electrolytic copper lug shall be of tubular type, tin coated 3 – 4 microns. The lug shall be made of a barrel intend to receive the conductor.

The barrel shall be suitable for intend compression by compression tools.

The following sizes and quantities are required :-

NO.	SPECIFICATION
1-	For copper conductor of 50mm ² Cross-section
2-	For copper conductor of 70mm ² Cross-section
3-	For copper conductor of 95mm ² Cross-section
4-	For copper conductor of 120mm ² Cross-section
5-	For copper conductor of 150mm ² Cross-section
6-	For copper conductor of 200mm ² Cross-section

COMMISSION of ELECTRICITY
Planning and Studies division
Baghdad – IRAQ

Specification NO.	D-47
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Technical Specification

OF

ALMINUM – BARE WIRES

REVISION	Year 2001		
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STATE COMPANY FOR ELECTRICITY DISTRIBUTION FOR MIDDLE

AL- BARE WIRES

1. SCOPE OF THE TENDER: -

This tender includes for the manufacturing, testing, packing, and shipping delivery exworks, FOP & CIF of bare conductors.

2. GENERAL REQUIREMENT: -

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 conditions.

2-1 Ambient temperature:

Highest maximum in the shade 50C° for about 6 hours a day.

Lowest minimum (-10) C°.

Maximum yearly average (+ 30) C°.

Maximum daily average (+ 40) C°.

2-2 Sun temperature:

Black objects under direct sunshine attain a temperature of 75 C°.

2-3 Air humidity:

Maximum	92% at 40C°
Minimum	12%
Yearly average	44%

2-4 Altitudes:

From sea level up to (1000 m).

3. TECHNICAL REQUIREMENT:

3-1 STANDARDS:

3.1.1. The bare aluminum conductor shall be in accordance with the latest issues DIN (48201) and IEC (207) publication.

3.1.2. The aluminum conductors, steel reinforced shall be in accordance with the latest issues of the DIN (48204) & IEC (209) publication.

3.1.3. The copper conductors shall be in accordance with the latest issues of BSS 125.

3-2

DEVIATIONS:

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

4. GENERAL CONDUCTOR CHARACTERISTICS:

4-1 The bare copper conductor should be composed of stranded hard drawn electrolytic copper conductor of 99.97% purity.

4-2 The bare aluminum conductor should be composed of stranded hard drawn aluminum.

4-3 The A.C.S.R conductor shall have bare stranded hard drawn aluminum conductor's steel reinforced. The conductors shall be internally protected with appropriate grease suitable for a working temperature of 80C°.

4-4 Packing

The required conductor lengths are to be supplied on seaworthy wooden drums of lengths as specified in item 5.

The drums should be steel reinforced radically and round the borehole after winding the conductor on the drum, it should be covered with suitable stand. Wooden lagging the overall construction must be of robust. Quintile to withstand rough handling.

The drum should have a nameplate stating the following in both English and Arabic languages.

- a- Type & size of conductor.
- b- Net weight & gross weight.
- c- Total length of conductor on the drum.
- d- Our purchase order number.

5. TYPE OF CONDUCTOR:

5-1 Copper conductor

For this conductor, the applicable paragraphs of article 4 are: 4.1 & 4.4

The sizes of conductor required are as follows:

- ❖ 16 mm², conductor details 7/1.75 mm & 3000 m \pm 2% per drum.
- ❖ 25 mm², conductor details 19/1.32 mm & 3000 m \pm 2% per drum.
- ❖ 50 mm², conductor details 19/1.8 mm & 2000 m \pm 2% per drum.
- ❖ 70 mm², conductor details 19/2.1 mm & 2000 m \pm 2% per drum.
- ❖ 95 mm², conductor details 19/2.5 mm & 1500 m \pm 2% per drum.

5-2 AL – Aluminum conductor - AAC

For this conductor, the applicable paragraphs of article 4 are: 4.2 & 4.4

The sizes of conductor required are as follows:

- ❖ 95 mm² 19/2.5 mm & 2000 m \pm 2% per drum.
- ❖ 70 mm² 19/2.1 mm & 3000 m \pm 2% per drum.
- ❖ 50 mm² 19/1.8 mm & 3000 m \pm 2% per drum.
- ❖ 35 mm² 7/2.5 mm & 3000 m \pm 2% per drum.

5-3 A. C. S. R conductor

For this conductor, the applicable paragraphs of article 4 are: 4.3 & 4.4

The sizes of conductor required are as follows:

- ❖ 210/35 AL 26/3.20 mm St 7/2.49 mm & 2000 m \pm 2% per drum.
- ❖ 120/20 AL 26/2.44 mm St 7/1.90 mm & 2000 m \pm 2% per drum.
- ❖ 95/15 AL 26/2.15 mm St 7/1.67 mm & 2000 m \pm 2% per drum.

6. TECHNICAL INFORMATION:

The tenderer is requested to give the following information with his offer:

- 6-1 Nominal sectional area in sq. mm.
- 6-2 Stranding details i.e. number of strands and strand diameter.
- 6-3 Sectional and overall diameter.
- 6-4 Weight of conductor in Kg. Per Km – in case of ACSR the weight of steel is also to be given.
- 6-5 Percentage conductivity at 20 C°.
- 6-6 Percentage elongation.
- 6-7 Minimum breaking strength.
- 6-8 Maximum resistance at 20 C°.
- 6-9 Maximum permanent current carrying capacity under Iraqi climatic conditions (A).
- 6-10 (1) sec. Short – circuit current carrying capacity (KA).

7. TESTS:

- 7-1 All tests are to be carried out according to the relevant specifications.
- 7-2 The tests shall be carried out in the presence of an authorized body appointed and paid by you to verify the compliance with the specifications. The contractor shall at his own expense, provide all necessary-testing facilities at his work for carrying out the requested tests.
- 7-3 The test reports shall contain clear and detailed references to the relevant IEC recommendations and national standards, comparing the requested values and the actual ones.

NOTE

- ❖ The prices for Aluminum should be based on L. M. E USD 1600/MT.
- ❖ Variation formula should be stated clearly to indicate the price.
- ❖ Variation related to Km of manufactured conductors.

قابلو

.Specification NO	D-30
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Technical Specification of Twisted Cables

REVISION	Year 2001		
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L.T TWISTED INSULATED CABLE

SCOP OF THE TENDER: -

This tender includes for the manufacturing, Testing, packing, delivery CIF Baghdad of low voltage twisted over-head cables.

1. GENERAL REQUIRMENT: -

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 & soil conditions.

2. CLIMATE CONDITION:

2-1 Ambient temperature:

Maximum	55C°
Minimum	(-10) C°.

Black objects exposed to direct solar radiation shall attain a temperature of 80 C°.

2-2 RELATIVE HUMIDITY:

Maximum	95%
Minimum	10%

2-3 ALTITUDES: 1000 MA.S.L

3. TECHNICAL REQUIREMENT:

3-1 CABLE Date:

- Rated voltage	0.6 / 1 kV
- Max Voltage	1000 volts
- Test voltage	4 kV 50HZ for 4 hour duration

3-2 STANDARDS:

The cable shall be manufactured in accordance with the latest issue of the I.E.C standards particularly IEC 540 & 538 and ASTM- D1693-70 .

3-3

DEVIATIONS:

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

4. CONSTRUCTIONAL REQUIREMENTS

The over-head cables for the L.V distribution consist of bundle assembled single core cable twisted together with a neutral messenger of insulated stranded aluminum alloy conductor. The bundle comprises three cores with neutral plus one for public lighting conductors.

The conductors are round, stranded aluminum. The properties of the wire before stranding shall be:

- Tensile strength (To be specified by tenderer)
- Resistivity at (+20 C°) not exceeding

4 – 1 Insulation:

The insulation shall be extruded black high density polyethylene of 1.4mm thickness for messenger for main conductors and 1.2 mm for messenger Conductor, Street Lighting conductors.

4 – 2 Phase identification:

1, 2, 3 or 4 durable and clearly visible longitudinal ridges of each insulated conductor as follows.

Phase conductors 2, 3,4

Public lighting No marking

Neutral conductors 1

5- TECHNICAL INFORMATION

The tenderer is requested to give the following information with his offer:

- 5-1 Resistance per KM of cable.
- 5-2 Inductance per KM of cable.
- 5-3 Capacitance per KM of cable.
- 5-4 Insulation resistance in M. ohms between cores / screen.
- 5-5 Weight of aluminum per KM of cable.
- 5-6 Overall weight per KM of cable.
- 5-7 Overall diameter of finished cable in mm.

6- TESTS

All type and routine tests shall be carried according to the IEC standards or any approved National standards.

The manufacturer shall furnish the purchaser with certificate of compliance issued by reputed lab.

7- PACKING

The Cable shall be packed on seaworthy wooden drums of the robust construction. The drums shall be covered with heavy wood lagging after winding the cable.

8- MARKING

Two name plates shall be fixed on each cable drum, the name plates shall contain the following information.

- cable type.
- cable length $1000 \pm 2\% M$
- Net weight.
- gross weight.
- drum number.
- purchase order number.
- packing list.

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

Specification No.	D-03
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**TECHNICAL SPECIFICATION
OF
MEDIUM VOLTAGE POWER CABLES**

REVISION	December 2013
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1. Scope:

The specification includes the design, manufacture, test, suitable packing, transportation of 18/30 (36) kV and 12/20 (24) kV cables. Including installation , energizing

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:

a. 33 KV System	
Nominal voltage	33000 volts
Highest system voltage	36000 volts
System	3-phase, 3 wire with neutral grounding zig-zag transformer to limit the earth fault current to 1000 Amp.
Frequency	50 Hz
Short circuit breaking current	25KA. R.M.S at 33000 volts

b. 11 KV System	
Nominal voltage	11000 volts
Highest system voltage	12000 volts
System	3-phase, 3wire neutral earthed through resistance of 21.1 Ohm limiting the earth fault current to 300A
Short circuit breaking current	25 KA R.M.S at 11000 volts

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 Conductor screen:

Conductor screen shall be non-metallic and shall consist of a layer of extruded semi-conducting compound which shall be firmly bonded to the inner surface of the insulation. The contact of the semi-conducting shields with the cable insulation must be perfect without void creation at the inner surfaces. The interfaces must be smooth in a regular geometric shape and avoid stress concentration and the semi-conducting compound must have homogeneous structure particularly at the interfaces. The semi-conducting shields must be mechanically stable under load cycling of the power cable and high temperature conditions.

6-3 Insulation:

The insulation of the cable shall be extruded XLPE cured with dry curing process, designed and manufactured for the specified voltage. The manufacturing process shall ensure that insulation shall be free from voids. The insulation shall withstand mechanical and thermal stress under steady state and transient operating conditions. The extrusion method should give very smooth interface between semi-conducting screen and insulation. 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.

- a- For 24 kV , nominal thickness is 5.5 mm
- b- For 36 kV , nominal thickness is 8 mm

Conductor screen, insulation and insulation screen shall be extruded by triple extrusion method.

6-4 Insulation screen:

- a- Non-metallic screen: shall consist of a layer of extruded semi-conducting compound firmly bonded provided over the insulation simultaneously with the extrusion of the insulation. Semi-conducting swelling tape with suitable overlap over the extruded semi-conducting layer of compound shall be applied.
- b- Metallic screen: a combination of copper wires with copper counter spiral tape shall be applied over the non-metallic insulation screen. The equivalent total cross sectional area of metallic screen shall be not less than:
 - a. 25 sq. mm for cables having a conductor size up to 150 sq. mm.
 - b. 35 sq. mm for cables having a conductor size more than 150 sq.mm.

6.5 Phase Identification:

For 3 core cables, Red, Yellow and Blue colored strips shall be applied under the metallic screen throughout the length of the cable for phase identification.

6.6 Filler:

The three 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.

6.7 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 60502-2/Clause 8.1.3 .

6.8 Waterproof tape:

A layer of suitable tape (swelling tape) for water proofing to be laid over the armour layer.

6.9 Metallic Armour:

The three cores then armoured with double galvanized steel tapes of thickness not less than 0.5 mm and the gap between adjacent turns of each tape shall not exceed 50 % of the width of the tape. The metallic armour shall confirm to IEC 60502 standard with latest addendums and amendments.

6.10 Outer sheath:

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

- a. Material: extruded PVC .
- b. Color: RED for 36 kv and BLACK for 24 kv .
- 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; XLPE 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.

6.11 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. 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, variation of $\pm 5\%$ of the cable drum length is acceptable.

7. Types of Cables:

7.1 36 KV cables:

7.1.1 1x400 mm²

For this cable the applicable paragraphs of article 6 are :-
6.1, 6.2, 6.3, 6.4, 6.8, 6.10, 6.11 with rated voltage 18/30 (36) kV.

7.1.2 3x150 mm²

For this cable the applicable paragraphs of Article 6 are :-
6.1,6.2,6.3,6.4,6.5,6.6,6.7,6.8,6.9,6.10,6.11 with rated voltage 18/30 (36) kV.

7.2 24 KV cables:

7.2.1 1x400 mm²

For this cable the applicable paragraphs of Article 6 are :
6.1,6.2,6.3,6.4,6.8,6.10,6.11 with rated voltage 12/20 (24) kV.

7.2.2 1x150 mm²

For this cable the applicable paragraphs of Article 6 are: 6.1,6.2,6.3, 6.4,6.10,6.11, (same note as para.7-2-1) .

7.2.3

1x95 mm²

1x70 mm²

1x50 mm²

(same statement as 7.2.2)

7.2.4 3x150 mm²

For this cable, the applicable paragraph of Article 6 is:
6.1,6.2,6.3,6.4,6.5,6.6,6.7,6.8,6.9,6.10,6.11 with rated voltage 12/20 (24) kV.

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.

10. Cables joints and terminations:

Cable joints and terminations to be slip on or heat shrinkable type complete with all necessary jointing materials suitable for 24 & 36 kV underground cable from qualified manufacturers, The terminations and joints should be as follows :-

- A. Straight through joint for cable shown under 7.1.1 complete.
- B. Outdoor terminations suitable for cable shown under 7.1.1 complete.
- C. Indoor terminations suitable for cable shown under 7.1.1 complete.
- D. Straight through joint suitable for cable shown under 7.1.2 complete.
- E. Outdoor terminations suitable for cable shown under 7.1.2 complete.
- F. Indoor terminations suitable for cable shown under 7.1.2 complete.
- G. Straight through joint suitable for cable shown under 7.2.4.
- H. Indoor terminations suitable for cable shown under 7.2.4 complete.
- I. Outdoor terminations suitable for cable shown under 7.2.4.
- J. Indoor terminations suitable for cable shown under 7.2.2.
- K. Indoor terminations suitable for cable shown under 7.2.3.

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.	50	6	0.387	7.5
2.	70	12	0.268	10.5
3.	95	15	0.193	15
4.	150	18	0.124	21.5
5.	400	53	0.0470	55

Table No. (2)

	Cable size	Drum length (m)		Cable size	Drum length (m)
1.	1x400 sq. mm / 36 kv	500	5.	1x95 sq. mm /24 kv	500
2.	3x150 sq. mm /36 kv	250	6.	1x70 sq. mm /24 kv	500
3.	1x400 sq. mm /24 kv	250	7.	1x50 sq. mm /24 kv	500
4.	1x150 sq. mm /24 kv	500	8.	3x150 sq. mm /24 kv	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 and compacted shape	Yes/No No. mm Sq. mm mm	
6.	Conductor screen: a. Material b. Nominal thickness c. Minimum thickness d. Total diameter after conductor screen e. Whether extruded f. Resistivity	mm mm mm Yes/No Ohm-m	
7.	Insulation: a. Material b. Nominal thickness of insulation c. Minimum thickness of insulation d. Total diameter	mm mm mm	
8.	Insulation screen: A. Semi-conducting screen (extruded) i. Material ii. Nominal thickness iii. Minimum thickness iv. Total diameter v. Resistivity B. Semi-conducting tape i. Material ii. Nominal thickness iii. Minimum thickness iv. Width v. Total diameter vi. Swelling	mm mm mm Ohm-m mm mm mm mm mm Yes/No	

	<p>C. Metallic screen</p> <p>i. Material</p> <p>ii. Electrical cross section</p> <p>iii. Minimum cross section of each wire</p> <p>iv. Number of wires</p> <p>v. Total diameter</p> <p>vi. Fault current rating for 1.0 sec</p> <p>vii. Spiral equalizing tape</p> <ul style="list-style-type: none"> • Material • Width and thickness • Lay length 	<p>Sq. mm</p> <p>Sq. mm</p> <p>Pcs</p> <p>mm</p> <p>kA</p> <p>mm</p> <p>mm</p>	
9.	Phase identification strips	Yes/No	
10.	<p>Filler:</p> <p>a. Material</p> <p>b. Extruded</p>	Yes/No	
11.	<p>Inner covering:</p> <p>a. Material</p> <p>b. Extruded</p> <p>c. Nominal thickness</p> <p>d. Minimum thickness at any point</p>	<p>Yes/No</p> <p>mm</p> <p>mm</p>	
12.	<p>Armour:</p> <p>a. Material</p> <p>b. Type</p> <p>c. Thickness of tape</p> <p>d. Total diameter</p> <p>e. Galvanizing thickness</p>	<p>mm</p> <p>mm</p> <p>micron</p>	
13.	<p>Waterproof tape</p> <p>a) Tape description</p> <p>b) location</p>		
14.	<p>Outer sheath:</p> <p>a. Material</p> <p>b. Nominal thickness</p> <p>c. Minimum thickness at any point</p> <p>d. Termite resistant</p> <p>e. Rodent resistant</p>	<p>mm</p> <p>mm</p> <p>Yes/No</p> <p>Yes/No</p>	
15.	Nominal overall diameter of completed cable	mm	
16.	Minimum weight of copper (conductor + metallic screen)	Kg/m	
17.	Weight of completed cable	Kg/m	
18.	Allowable minimum radius of bend around which cable can be laid	mm	
19.	Maximum DC resistance of conductor at 20° C	Ohm/km	
20.	Maximum DC resistance of metallic screen	Ohm/km	

21.	Inductance of cable for 1000m length	mH	
22.	Capacitance of cable for 1000m length	μ F	
23.	Maximum conductor temperature for continuous operation	deg. C	
24.	Maximum conductor temperature under short circuit	deg. C	
25.	Insulation resistance between cores / screen	M.OHMS	
26.	Voltage drop per 1000 m cable at rated current: When laid in air at 40 deg. C	volts	
27.	Voltage drop per 1000 m cable at rated current: When laid in ground at 30 deg. C	volts	
28.	Maximum dielectric loss of three phase circuit when operating at normal voltage and frequency at maximum conductor temperature of 90° C	W/km	
29.	Maximum continuous current carrying capacity per conductor for a single circuit when laid direct in the ground at : Maximum conductor temperature 90 °C Ambient air temperature 30 °C Ground temperature 20 °C Depth of laying 1 m Thermal resistivity of soil 1.5 K.m/W	Amp	
30.	Conductor short-circuit current permissible for a period of 1 second	kA	
31.	Maximum dielectric loss angle at normal voltage and frequency at a conductor temperature of :- a. 20 °C b. 90 °C	Tan δ	
32.	Maximum permissible pulling force at total cable in drums	kN	
33.	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 • Bore diameter • Width	m Kg Kg mm mm mm	
34.	Cross section drawing and details of cable layers and catalogues.		

XXXXXXXXXX

**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; mm² , 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.		

30/06/2016

Ministry of Electricity (MOE)
Power Distribution Office
Baghdad – IRAQ

Specification No.	D-26
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*Technical Specification of
Distribution Transformer
11 / 0.416 kV*

Revision	Year 2017
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1- Scope of the Tender

Tenderer are invited for the design , manufacture , testing and supply of a 11000/416 volt, oil immersed copper winding outdoor type (Directly under the sun) transformers to be supplied complete with all necessary fittings , accessories off-load tap changer , insulating oil and spare parts . . . etc.

The transformer is to be hermetically sealed (without conservator tank) bolted cover with bushing insulators on both H.T and L.T sides for the following ratings: 100, 250, and 400. For 630, and 1000 kVA should be plug in type (according to the tender requirements), a valid ISO 9001 certificate required.

2- General Requirements

The transformers shall be of first class quality and design for continuous satisfactory operation as continuity of supply is of prime consideration. The design shall be allow all necessary precaution for the safety of operation and maintenance personnel. The transformers shall operate satisfactorily under variations of load, voltage or short circuit or other conditions which may occur on the system provided that these variations are within the assigned rating of the apparatus. All the equipment shall be designed to obviate the risk of accidental short circuit.

2-1 Climatic Conditions

The materials used shall be suitable for the following climatic conditions prevailing at the site:

2.1.1 Ambient temperature

Highest maximum (in the shade) +55⁰ C for about 6 hrs a day.

Lowest minimum -10⁰ C

Maximum yearly average +30⁰ C

Maximum daily average +40⁰ C

2.1.2 Sun temperature

Black objects under direct sunshine attain a temperature of 80⁰ C.

2.1.3 Air humidity

Maximum	92% at 40° C
Minimum	12%
Yearly average	44%

2.1.4 Sand storm

In general, the atmosphere is dusty which may result in a layer of dust being deposited on all exposed surfaces. Also fine dust particles may penetrate even through minute openings.

2-2 Altitudes

From sea level up to (1000m).

2-3 System Data

2-3-1 High voltage side:-

Nominal voltage	11000 Volts
Short circuit level	25 kA at 11000 volts
Frequency	50 HZ.
Highest system voltage	12000 volts
System	3-phase, 3-wire with neutral isolated but provision is made for earthing through an earthing resistance of 21.1 ohms to limit the earth fault current to 300 Amp.

2-3-2 Low voltage side:-

Nominal voltage	400/230 volts \pm 10%
System	3-Phase, 4-wire neutral solidly earthed.
Short circuit level	According to the short circuit level of H.T side and the rated power and impedance voltage of the transformer

2-4 Standards

All the equipment shall be in accordance with the latest issue of the International Electro-technical Commission (IEC specification).

2-5 Deviation:

The tenderer shall particularly mention in his tender all deviations from the specification described in these tender specification.

2-6 Schedules:

The tender shall duly fill in the schedules A&B of guaranteed technical particulars, prices, delivery and deviations attached to this specification. Incomplete tenders are liable to rejection.

2-7 Guarantee:

The tenderer shall confirm than the transformer guaranteed against all defects arising from faults design, materials and workmanship, for a period of (12) months from commissioning or (18) months from arrivals, whichever period expires earlier.

3- System Composition

The transformer shall operate in distribution systems where most of the network is overhead lines and comprising partly underground cable.

4- **Technical Specification**

- 4.1 The transformers shall be copper winding. Hermetically sealed of the bolted cover and should have the following characteristics:-

Rated outputs	100, 250, 400, 630, and 1000 kVA
Duty	Step-down, outdoor bushing type for 100, 250, and 400 kVA. Plug in type for 630 and 1000 kVA (according to the tender requirements)
Type	3-phase
Rated voltage at no load ...	HV side -11kV LV side - 416 volts
System Highest Voltage ...	HV side 12 kV
System frequency	50 HZ
Interphase Connection	HV side - Delta LV side - star with neutral brought out
Vector Group	Dyn 11
Type of cooling	ONAN
Temperature rise	(i) 45 K in top oil by thermometer (ii) 50 K in winding by resistance

- 4.2 The efficiency (at unity power factor and 100% of rated power) of the transformer should be not less than the following:

1. 100 kVA 98.1%
2. 250 kVA 98.6%
3. 400 kVA 98.7%
4. 630 kVA 98.8%
5. 1000 kVA 98.9%

- 4.3 The duration of the short circuit to rise the temperature of windings from 105 °C to 250 °C should be not less than (5 Sec.) according to IEC 60076, part 5 , clause (4.1.5).

- 4.4 The thickness of the radiator plates should be shock resistant and do not affect heat dissipation according to tender requirements as follows:

- For 250 and 400 kVA transformer, not less than 1.2 mm.
- For 630 and 1000 kVA transformer, not less than 1.5 mm.

- 4.5 The noise level should be ≤ 55 dB at 0.3 meter distance according to IEC standards
- 4.6 The low voltage winding must be of copper foil for 250, 400, 630, and 1000 kVA transformers.
- 4.7 Off-load tap changer should be five tapping for ($\pm 2.5\%$, $\pm 5\%$) on the HV winding for off-circuit operation externally. The mechanical operation must be of the robust and definite position type with a click indicating position arrived during tap changing with suitable pad-lock.
- 4.8 Terminal arrangement of transformers.
- 4.8.1 The HV side:
- Terminal is to be a clamp type with eyebolt or flat bar type with nut suitable for conductors up to 70 mm² copper (for 100, 250, 400 kVA).
- 4.8.2 The low voltage terminals are to be flat bar type with holes suitable for compression type thimble the sizes of LV side:
- For 100 KVA transformer 4x1x70 mm² copper (1 hole per phase).
 - For 250 KVA transformer 8x1x95 mm² copper (not less than 2 holes per phase).
 - For 400KVA transformer 7x1x150 mm² copper (not less than 3 holes per phase).
 - For 630 KVA transformer 11x1x240 mm² copper (not less than 3 holes per phase).
 - For 1000 KVA transformer 14x1x240 mm² copper (not less than 3 holes per phase).
- 4.9 Terminal arrangement of outdoors transformers must be porcelain bushing insulator (brown colored preferable) mounted on the top cover of transformer for both HV and LV, with arcing horn (double air gap is preferable) on HV bushing for outdoor transformer only. Neutral bushing should distinguished from phase bushing by longer distance of separation.

5- Fittings and Accessories

- Terminal marking plate.
- Tapping switch.
- Two valves (3/4 inches) diameter fitted on cover and bottom of tank, switch locks.
- Thermometer pocket with thermometer including maximum temperature measurement indicator with two separate free contacts.
- Lifting lugs.
- Pressure relief valve.
- Earthling terminal on tank.
- Rating and diagram plate to be chromium plated of the engraved type with kVA rating and serial number engraved inside on the cover of the transformer at a suitable place.
- Skid mounting to be vertical with the length of the transformer.
- Oil level indicator, to be of mechanical type located on the top cover of transformer to indicate the oil level with the temperature variation, protected by metallic envelop.

6- Painting

- The painting should be oil and weather (dust, humidity and heat etc.) resistant type and the final coat is to be aluminum paint or equivalent. Any alternative finishing which gives better heat radiation is accepted and must be confirmed by calculations.
- Ministry of Electricity logo must be engraved on the cover or side of the transformer at a suitable place.

7- Insulating oil

The transformer is to be shipped with first filling of oil which shall be (uninhibited insulation oil), according to the latest IEC 60296.

8- Tender Price Evaluation (losses considerations)

8.1 Cost of the transformer

The cost of transformer will consider the age of the transformer, the iron losses, copper losses, and the initial price of the transformer. This cost will be used for comparison between the values of different tenderers and not the initial price of the transformer only.

The following equation will be applied to calculate the cost of transformer.

Cost according to loss evaluation (for one transformer) = Initial price + (Guaranteed $I_e \times 1800$ + Guaranteed $C_u \times 600$)

Where:

- I_e = Iron (no-load) losses: 1800 USD per kW at rated voltage and frequency.
- C_u = Copper (Load) losses: 600 USD per kW at rated power and principle tapping at 75°C.

8.2 Loss evaluation

The tolerance permitted is +10% of the evaluated guaranteed total losses mentioned in the offer. Any transformer with total losses more than + 10% will be rejected. For transformer with total losses within +5% of the evaluated guaranteed losses , no penalty shall be made , for transformers where the total losses between 105% to 110% of the total evaluated guaranteed losses , the contract price shall be reduced by the cost of the difference between the total losses and the 100% of the total evaluated guaranteed losses according to the following values.

- I_e = Iron losses (kW).
- C_u = Copper losses (kW).
- Q = number of transformers required in the tender.

For any transformer with total losses less than 100% of the guaranteed losses, no variation to the contract price shall be made.

Total penalty (USD) = $Q \times [(Measured I_e - Guaranteed I_e) \text{ kW} \times 1800 \text{ USD/kW} + (Measured C_u - Guaranteed C_u) \text{ kW} \times 600 \text{ USD/kW}]$

9- Tests

9.1 Inspection:

The material shall be subjected to inspection and test by owner inspectors or international inspector at any time during manufacture. The manufacture shall provide all inspection facilities for the said inspection and inspection shall be made at the place of manufacture or at international testing facilities according to the tender requirements. The inspector shall have the right of rejecting any portion of the material at any time during manufacture if it does not meet with the requirements of this specification in all particulars. He shall have the right of overseeing the packing and shipping of all material to be supplied.

9.2 Tests at manufacture work:

Tests at manufacture's factory shall comprise type tests (if required according to the tender requirements) and routine tests according to the approved parameters in schedules A & B.

a) Type tests

The type tests prescribed shall be carried out on one unit of each capacity:

- 1- Test of temperature rise according to the latest IEC 60076.
- 2- Full wave impulse voltage withstand test according to the latest IEC 60076.
- 3- Cost of these tests to be borne by the manufacturer.

b) Routine tests

Each transformer shall be subjected to all the routine tests specified according to the latest IEC 60076.

c) Special tests

(If required according to the tender requirements).

9.3 Test reports

Five copies of the test reports will be mailed within 8 days after the tests have taken place. These reports will indicate:

- a) The results of the tests.
- b) The calculation of performance of the items.

- c) The guarantee figures to show that each apparatus performs the conditions of the specification within the guaranteed values (schedules A & B).

9.4 Test Certificates

- a) The tenderer shall furnish the Ministry of Electricity (MOE) with six copies of test certificates.
- b) No equipment shall be shipped without obtaining the (MOE) inspector prior approval of the certificates.

9.5 Witnessing tests

Unless otherwise agreed to, all tests at factory shall be witnessed by an authorized representative from (MOE).

The cost of travelling & accommodation of the authorized inspectors to witness the test at the place of manufacture for required days, to be on tenderer account.

10- Drawing, Instruction Book and Literature.

10.1 Documents to be submitted with the tender

The following documents shall be submitted by the tenderer along with his offer:-

- a) Full and technical specification of transformer including schedule A&B of guaranteed technical particulars.
- b) An outline drawing showing the plan , front and side elevation of the transformers , dimensions , terminals , equipment , and all accessories of the transformers.
- c) Catalogues of the manufacturer for transformers.
- d) Valid ISO-9001 certificate of the manufacturer for transformers.
- e) Test certificate for identical transformers.
- f) Reference list of manufactured and exported transformers.
- g) Incomplete offers are liable to rejection.

10.2 Documents to be furnished by the successful tenderer

Within a period of 2 weeks from the commencement date, the successful tenderer shall furnish the following documents for final approval:-

- a) 24 sets (or according to the tender requirements) of prints on paper on all drawings.
- b) 24 copies (or according to the tender requirements) of all instruction books and technical maintenance of the transformer, OFF Load tap changing gear and other ancillary equipment.
- c) 24 copies (or according to the tender requirements) of instruction for erection of the equipment.
- d) 24 copies (or according to the tender requirements) of spare parts list with catalogue number.

10.3 Language

The language to be used in the drawings and instruction book shall be English.

10.4 Dimension:

Due to the space requirement in our system it is important for the participants in this tender to make sure that the dimension of each type of the required transformers to be as small as possible the following table is indicative as a maximum for each single dimension:-

Table of Dimension

Transformer (kVA)	Length (mm)	Width (mm)	Height (mm)
100	1220	600	1200
250	1230	700	1300
400	1400	1000	1400
630	1500	1200	1600
1000	1700	1400	1800

10.5 Approval of drawings:

The successful tenderer shall prepare and submit to the (MoE) all necessary drawings and specifications (schedule A & B) complete with explanations in due time and obtain approval of the same before commencing manufacture.

Failure to comply with this clause shall make the equipment or parts or parts there of liable to rejection.

11- Packing

The supplier will pack or protect the goods in the most appropriate manner.

He will be responsible for any loss or damage arising from careless packing or protection up to the place of final destination after completion of the inspection and tests at the factory, each item shall be packed for export shipment. All parts provided for shipping purposes only and which are to be removed at the time of erection shall be conspicuously tagged.

The method of packing shall be such as to protect all the items against excessive corrosion of dampness, and shall afford adequate protection against breakage or other injury, or loss due to breakage of cases or crates from the time the items leaves the factory until finally installed at the substation during which time, the apparatus will travel by rail by a long sea voyage again by rail or truck to the site of the substation. The equipment will also undoubtedly stand on wharves and in the open during and in between periods of transportation and will thereby be exposed to heavy rain, hot sun, humid climate and sudden changes of temperature.

Owing to the numerous handlings, the containers should be very strong also extra ordinary care should be given to the packing of the equipment and especially the items having insulating material to prevent the injury due to moisture, from sources external to the packing or from excessive condensation with the packing.

12- Spare parts and special tools for each rating

This clause is optional according to tender requirements.

12.1 Spare parts

No.	Item	Quantity (from the total quantity of the contract)
1	HV / LV winding	3%
2	HV bushing with its accessories	10%
3	LV bushing with its accessories	10%
4	Tap changer	3%
5	Pressure relief valve	2%
6	Oil level indicator	10%
7	Cover gasket	10%

Note: Unit price per set and per piece for each item are required.

12.2 Special tools:

All special tools required for maintenance of transformer shall be included in the scope of supply. An itemized list of special tools together with prices shall be submitted with the tender.

Schedule "A"

Schedule of the Guaranteed Performance and Other Technical Particulars (To be filled by the Tenderer for each rated capacity of 100, 250, 400, 630, and 1000 kVA).

No.	Description	Unit	Specifications	
			Required	Proposed
1	General			
1.1	Manufacturer Name		To be filled in	
1.2	Country of Manufacturing		To be filled in	
1.3	Type			
1.4	Model		To be filled in	
1.5	Applicable Standards		IEC 60076	
1.6	Location of service		Outdoor	
1.7	Short circuit Test Report			
1.8	Date of carried out		To be filled in	
1.9	Testing laboratory name and country		To be filled in	
1.10	Certificate Provided		Yes	
2	Ratings			
2.1	Continuous maximum rating	KVA	To be filled in	
2.2	Rated voltage ratio			
	• Primary	kV	11(+2 x 2.5%/- 2 x 2.5%)	
	• Secondary	kV	0.416Y/0.24	
2.3	Number of phase		3	
2.4	Frequency	Hz	50	
2.5	Vector group symbol		Dyn11	
2.6	Cooling method		ONAN	
2.7	Maximum temperature rise at rated power			
	• Top oil by thermometer	K	45	
	• Winding by resistance	K	50	
	• Hot spot of winding max ambient temperature (55 ⁰ C)	K	To be filled in	
2.8	Impedance voltage at continuous rated power	%	To be filled in	
2.9	Winding connection:			
	• Primary		Delta	
	• Secondary		Star (Neutral brought out)	

3	Rated insulation level for Primary			
	• Impulse withstand voltage (1.2/50 μ s)	kV peak	75	
	• One minute 50Hz withstand voltage	kV rms	28	
4	Design Details			
4.1	Off-load tap changer			
	• manufacturer		To be filled in	
	• Tapping range		+5%/-5%	
	• Tapping step		2.5%	
4.2	Exciting current referred to HV side and 50 Hz			
	• At 90% rated voltage.	A	To be filled in	
	• At 100% rated voltage.	A	To be filled in	
	• At 110% rated voltage.	A	To be filled in	
4.3	Power factor of exciting current at 100% rated voltage and 50 Hz	%	To be filled in	
4.4	Iron losses at 50 HZ			
	• At 90% rated voltage.	kW	To be filled in	
	• At 100% rated voltage.	kW	To be filled in	
	• At 110% rated voltage.	kW	To be filled in	
4.5	Copper losses at full load (on rating) and at 75 ^o C	kW	To be filled in	
4.6	Total losses.	(kW)	To be filled in	
4.7	Resistance voltage at full load and at 75 ^o .	(%)	To be filled in	
4.8	Reactance voltage at full load and at 75 ^o	(%)	To be filled in	
4.9	Impedance voltage at full load 75 ^o :			
	• At normal tap.	(%)	To be filled in	
	• At highest tap.	(%)	To be filled in	
	• At lowest tap.	(%)	To be filled in	
4.10	Resistance of HV winding per phase at 20 ^o C	Ω	To be filled in	
4.11	Resistance of LV winding per phase at 20 ^o C	Ω	To be filled in	
4.12	Regulation at full load at 75 ^o C			
	• At 1.0 power factor.		To be filled in	
	• At 0.8 p.f lagging.		To be filled in	
4.13	Efficiency at 75 ^o C:			
	• At 100% load	(%)	To be filled in	
	• At 75% load	(%)	To be filled in	

	• At 50% load	(%)	To be filled in	
	• At 25% load	(%)	To be filled in	
4.14	Calculated thermal time constant	Hrs.	To be filled in	
4.15	Maximum flux density at normal voltage and frequency and at normal ratio for:			
	• Core.	(KI/sq.cm)	To be filled in	
	• Yoke.	(KI/sq.cm)	To be filled in	
4.16	Maximum flux density at 110% voltage and frequency and at normal voltage and frequency and at normal ratio for:			
	• Core	(KI/sq.cm)	To be filled in	
	• Yoke	(KI/sq.cm)	To be filled in	
4.17	Insulation level of:			
	• Core bolts.	kV	To be filled in	
	• Core bolts washer.	kV	To be filled in	
	• Side plates.	kV	To be filled in	
	• Core laminations.	kV	To be filled in	
4.18	Current density in windings for:			
	• H.V. winding	(Amps/sq.cm)	To be filled in	
	• L.V. winding	(Amps/sq.cm)	To be filled in	
4.19	Insulation on copper.	kV	To be filled in	
4.20	Insulation strength of winding.			
	a) Impulse full wave for:			
	(I) H.V.	(kV)	To be filled in	
	(II) L.V.	(kV)	To be filled in	
	b) Impulse chopped wave for:			
	(I) H.V.	(kV)	To be filled in	
	(II) L.V.	(kV)	To be filled in	
	c) Applied voltage test	(kV)	To be filled in	
	d) Induced voltage test	(kV)	To be filled in	
4.21	Insulation strength of terminals.			
	• Over voltage test	(kV)	To be filled in	
	• Minimum wet withstand voltage	(kV)	To be filled in	
	• Minimum impulse withstand	(kV)	To be filled in	
	• Minimum puncture or oil-immersed withstand voltage	(kV)	To be filled in	

4.22	Type of core		To be filled in	
4.23	Max. noise level at 0.3 meter	(dB)	55	
4.3	Type of oil (As per IEC requirement)		Yes	
4.4	Standards		IEC 60296	
4.5	Type of corrosion protection			
	• Inside tank		To be filled in	
	• Outside tank		To be filled in	
4.6	Type of valves		Clobe or gate valve	
5	Dimension And Weight			
5.1	Dimension of Transformer			
	• Under base to top most point.	mm	To be filled in	
	• Under base to bushing mounting flanges.	mm	To be filled in	
	• Overall breadth.	mm	To be filled in	
	• Overall length.	mm	To be filled in	
	• Crane lift for untanking core and coils	mm	To be filled in	
	• Crane lift for removal of bushings	mm	To be filled in	
5.2	Overall shipping dimensions of the largest package	mm	To be filled in	
5.3	Thickness of transformer tank			
	• Sides.	(mm)	To be filled in	
	• Bottom.	(mm)	To be filled in	
	• Corrugated radiators.	(mm)	To be filled in	
5.4	Volume of insulating oil	(liter)	To be filled in	
5.5	Net weight of insulating oil	(Kg)	To be filled in	
5.6	Total weight of transformer less oil	(tons)	To be filled in	
5.7	Weight of the largest shipping package	(tons)	To be filled in	
5.8	Net weight of core	(Kg)	To be filled in	
5.9	Net weight of copper			
	• H.V.	(Kg)	To be filled in	
	• L.V.	(Kg)	To be filled in	
5.10	Net untanking weight of:			
	• Core	(Kg)	To be filled in	
	• Frame	(Kg)	To be filled in	
	• Coil	(Kg)	To be filled in	

Schedule "B"
Oil Characteristics Table (To be filled by the Tenderer).

No.	Description	Unit	Specifications	
			Required	Proposed
1	Name of manufacturer		To be filled in	
	Country of manufacturing		To be filled in	
	Type		To be filled in	
	Standards		IEC 60296	
2	Reference Name of Oil		To be filled in	
3	Sludge Value	%	0	
4	Flash Point (Closed)	°C	To be filled in	
5	Pour Point	°C	To be filled in	
6	Viscosity at 21° C	CST	To be filled in	
7	Breakdown voltage (after treatment)	kV	>60 ex works (>70 upon treatment)	
8	Acidity(Neutralization Value): • Total • Inorganic	mgKOH/ g	To be filled in	
9	Saponification Value	mgKOH/ g	To be filled in	
10	Copper Diceleration		To be filled in	
11	Crackle		To be filled in	
12	Specific Gravity		To be filled in	
13	Sulfur Content		To be filled in	
14	Dielectric Dissipation Factor at 90 °C (after treatment)		≤ 0.001	

COMMISSION of ELECTRICITY
Planning and Studies division
Baghdad – IRAQ

Specification NO.	D-09
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Technical Specification
OF
Outdoor L.V switchgear
Pole - mounted

REVISION	Year 2012	2016
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Outdoor L.V. Switchgear pole - mounted

1.SCOPE OF THE TENDER :

The tender includes ,design ,manufacture ,testing ,supply, packing ,shipping and delivery of circuit breaker's cabinet, and all necessary fittings for connecting cables ,accessories ,spare parts ,tools and handling equipment .etc. for 100KVA ,250KVA,400KVA

Transformer KVA	100KVA	250KVA	400KVA
C.B rated current	200 A	250A	400A

The switchgear panel composed of:-

- a- Sheet steel construction cabinet not to be less than 2 mm thickness.
 - b- Three pole 416/240 V, 50HZ , one circuit breaker for outgoing feeder control equipped with parallel or sleeve type cable connection on both sides for single core PVC insulated copper of 95 and 150 sq.mm . The C.B to be designed with thermal or micro logic O/C protection (80 -100)%, and magnetic short circuit shall be between 5-10 times rated current. The rated ultimate breaking capacity (Icu) and rated service breaking capacity (Ics) of C.B should be 35KA for both. The current capacity of C.B should be minimum 80% of its rated current at 55C.
 - c- The panel shall have hinged door type with tow screws for locking (the bolts and nuts should be non-removable type) with provision namely
 - c-1 Flap opening for circuit breaker (ON/OFF) operation.
 - c-2 Bolted type cover for the C.B. cable connections.
 - c-3 the cabinet shall be provided with mounting bracket.
 - d- copper bus bar of suitable cross section area according to C.B current rating for connect incoming and outgoing cables and ambient temperature 55C
- Note :The C.B should be provided with free contacts for external tripping.

1- GENERAL REQUIREMENTS :

The equipments shall be of first class quality and designed for continuous satisfactory operation as continuity of supply , is of prime consideration the design shall allow all necessary precautions for the safety of the operation and maintenance personnel. All, equipment shall operate satisfactorily under variations of load ,voltage and short circuit or other conditions which may occur on the system provided that these variations are within the assigned ratings the apparatus .

All the equipments shall be designed to obviate the risk of accidental short circuit or damage due to vermin's .

All openings for ventilation must have wire mesh screen .

The equipments used shall be suitable for the following climatic conditions prevailing at site .

2-1 Ambient temperature:

Highest maximum (in the shade)	55 deg.C. for about 6. Hours aday
Lowest minimum	-10 deg.C.
Maximum yearly average	+ 30 deg .C.
Maximum daily average	+ 40 deg .C.

2-2 Sun Temperature

Black objects under direct sunshine may attain a temperature of 80 deg.C.

2-3 Air humidity :

Maximum	92% at 40 deg. C.
Minimum	12%
Yearly average	44%

2-4 Altitudes

From sea level up to (1000m)

2-5 Sand storm:

The equipments are subjected to strong and frequent sand storms. Adequate precaution must be taken to cater for this.

2-6 Condensation:

Enclosed compartments shall have interior surfaces treated with approved materials and shall be adequately ventilated to prevent condensation.

The interior surfaces shall be treated and approved manner to prevent mould growth. Such treatment should in no way interfere with the satisfactory operation of the equipment electrically or mechanically.

3- Technical requirement

3-1 System Data:

Nominal voltage.....	416/240 Volts (+4%) (- 10%)
Frequency.....	. 50 HZ.
System	3 phase,4-wire with neutral solidly earthed.
Short circuit level	according to the transformer capacity

3-2 Standards:

All the equipments and accessories shall be in accordance with the latest issue of the international Electro – technical commission (I.E.C) specification.

Where these specifications are incomplete or not yet published, then the National standards of tender's country shall be considered subject to our approval.

4- SWITCHGEAR

The low voltage switchgear are intended to be used on the L.V side of the 11/0.416KV 400KVA 250KVA and 100 KVA transformer. The switchgear shall be of out door type, pole mounted. The cabinet should be of sheet steel construction not less than 2mm thickness with electro-static and thermal painting. The switchgear shall be provided double roof with space for maximum ventilation (Sun-shield to extend from all sides by 10cm except rear). With louvers covered with mesh wire screen. The circuit breaker shall be accommodated in a panel. Please refer to scope of operation of circuit breaker to be from outside after opening the Flap, following points are to be equipped with:

a-Sleeves type connection for all cables (cable thimbles with bolts, nuts and washer).

b- Cabinet supporting brackets to be provided.

The cabinet is to be water-proof and entirely protected against the danger of vermin and dust, the degree of protection is to be IP55. The degree of protection is to be IP34 for ventilation inlets. The synthetic material should be resistant to the atmospheric conditions of para . 2-1 to 2-6 and immune from corrosive actions of chemicals and fire proof. The cabinet should be provided with the facility of earth connection.

c-cable glands suitable for incoming and outgoing cables and also suitable with the degree of protection of the cabinet

d- Name plate

The switchgear shall be incorporated with the following:-

4-1 Circuit Breaker:

The Circuit breaker shall comply with IEC 947-2 category B and shall be air break , molded case type of the ratings specified in the schedule attached herewith. The operating machine shall be of trip free type.

. A mechanical ON/OFF indication for C.B. position is to be provided. Provision for pad locking the door or the C.B. position is to be provided and the operating handle to be engaged when the door is closed. cabinet serial No. from origin manufacturer is required.

4-2 Selectivity:

The 11KV side of the transformer is protected by means of H.R.C current limiting fuses.

The tendered will have to insure that the protection setting of the circuit breaker will make it possible to obtain selective tripping between the circuit breaker and the fuses on the 11KV sides. The selective tripping will have to be maintained throughout the ambient temperature variation.

The successful tender will be supplied with type, rating and the time/current characteristics of the fuses mounted on the 11KV side in order to insure selectivity of tripping. A mechanical (ON/OFF) indication for C.B position is to be provided.

5- DRAWING AND INSTRUCTION BOOKS

5-1 The following documents shall be submitted in three copies with the tender documents in the English language.

Technical literature giving full details of the switchgear offered also out line drawings with dimensions showing top, front and side elevation.

Technical literature giving full description of C.B offered.

5-2 The document to be furnished by the successful tenderer in the English language should includes three copies of the following drawings within two months from the date of the order.

Schedule of the anticipated shipping dates.

Installation drawings.

Outlined drawings & sectional elevation.

All instruction for maintenance, testing and commissioning.

Renewal part list sufficient for 5 years operation.

NOTE

It must be noted that all drawings are subjected to approval by us before manufacturing.

6- PACKING

The supplier will pack each set of the panels or protect the goods in the most appropriate manner. He will be responsible for any loss or damage rising from careless packing or protection up to the place of final destination after completion of the inspections and tests at the factory, each item shall be packed for export shipment. All parts provided for shipping purposes only and which are to be removed at the time of erection shall be consequently tagged.

The method of packing shall be such as to protect all item against excessive corrosion or dampness, and shall afford adequate protection against breakage or other injury, or loss due to breakage of cases or crates from the time the items leaves until finally installed at the substation during the apparatus will travel by rail by along sea voyage again by rail or truck to the site of the substation.

The apparatus will also undoubtedly stand on whares and in the open during and in between periods of transportation and will thereby be exposed to heavy rains, hot sun, humid climate and sudden changes of temperature.

Owing to the numerous handlings, the container should be very strong. Also extra ordinary care should be given to the packing of the equipment and especially the items having installing material to prevent the injury due to moisture from sources external to the packing or from excessive condensation with the packing.

7- TESTS

7-1 Inspection:

The material shall be subject to inspection by our inspectors at any time during manufacture. The manufacture shall provide all inspection facilities for the side inspection and testing. All testing and inspection shall be made at the place of manufacture. The inspector shall have the right of rejecting any part or all of the material at any time during manufacture if it dose not meet with the requirements of this specification in all particulars. He shall have the right of overseeing the packing and shipping of all materials to be supplied.

7-2 Tests at Manufacturer Work:

tests requirements at manufacturer work shall be as follows:-

a- Type test :

Type test certificates to prove the general design of the equipment must be submitted by the tenderer.

The certificates are to be for tests which have been carried out on identical equipment. These tests are in general those detailed in the relevant IEC which pertain to the equipment being tested.

b- Routine test

the routine test shall be carried out of each of the following equipment according to IEC recommendation:

a-Switchgear – Enclosure.

b-Circuit breaker.

8- PAINTING

Electro-static and thermal painting.

NOTE: The tenderer should be submit all technical information according to IEC 947-2 and fill the data which is required in the attached sheet.

Attach sheet

Items	unit	200A C.B	250A C.B	400A C.B
Degree of protection According to IEC 529				
Ambient temperature -Storage(min-max) -operation(min-max) In open air In enclosure	C			
Tightening torque	N.M			
Rated operational voltage According IEC 947-2	V			
Rated insulation voltage According IEC 947-2	V			
Rated impulse withstand voltage According IEC 947-2	KV			
Mechanical durability (C.O: closing ,opening)	C.O			
Electrical durability (C.O: closing ,opening)	C.O			
Duty class	C.O/h			
Rated ultimate short-circuit breaking capacity(Icu)	KA			
Rated service short-circuit breaking capacity (Ics)	KA			
Rated short-circuit making capacity (peak value)				
Rated short –time withstand current(Icw)	Icw(1s) KA			
	Icw(3s) KA			

مواصفات فنية لممانعات الصواعق
11KV

SPECIFICATIONS

FOR

METAL OXIDE SURGE ARRESTERS



SCOPE

- This Distribution Materials Specification describes the minimum technical requirements for design, materials, manufacturing, testing, inspection, delivery and performance requirement for surge arresters for 11KV and 33KV to be used in the overhead distribution system .

- The surge arresters and its fittings shall withstand effect of direct solar radiation at their installed locations. The temperature of exposed surfaces shall be regarded as 80C plus the effect of internal heating.

SYSTEM PARAMETER	SYSTEM	
	11KV	33KV
Frequency	50 HZ	50 HZ
Nominal Voltage	11KV	33KV
Highest System Voltage	12KV	36KV
Creepage Distance	25/40mm/KV	25/40mm/KV

- This covers one type surge arrester namely Metal oxide non-linear resistor type gapless, designed for outdoor service and shall be housed in sealed casing to prevent ingress of moisture and dust.

Duty Class:

- Surge arrester distribution classes shall be as defined in IEC 60099-4.

- 10KA Arrester-heavy duty class.

- Over Pressure Relief Device:

Arrester shall be provided with a pressure relief device, a mean for relieving internal pressure in an arrester and preventing explosive shattering of the housing following prolonged passage of flow current or internal flashover of the arrester.

- Disconnection Feature:

Disconnecter shall be incorporated. It is a device for Disconnecting an arrester from the system in the event of arrester failure to prevent a persistent fault on the system and to give visible indication of the

All the insulator shall have the rated withstand voltage Given in Table No. 1. Creepage distance is based on Nominal line-to-line voltage and shall be 25/40mm/KV minimum for dry and wet areas respectively. Insulator sheds shall be designed to minimize trapping of contamination . It be made porcelain having glazed brown color.

MARKINGS:

Each arrester shall be provided with a name plate, bearing the following information as a minimum, in English and/or Arabic:

- Rated voltage .
- Nominal discharge current .
- Short circuit level .
- Maximum continuous operating voltage (MCOV).
- Manufacturer's name or trademark .
- Year of manufacture .
- Country of origin .
- Manufacturer serial number .

Type Tests:

All arrester shall be fully type tested in accordance with the IEC .

Routine Test:

Supplier shall provide detail of the routine tests, which will be performed on the arresters with the minimum requirement being following .

Leakage current test:- Measurement of the leakage Current of the arresters at voltage to 100%, 80% and 60% of the rated voltage .

Power frequency reference or low current .

Residual voltage test .

Insulator tests .

**Ministry of Electricity
Planning and Studies Office**

Baghdad – Iraq

SPECIFICATION NO.

D-25

**TECHNICAL SPECIFICATION
OF
EXPULSION FUSE CUTOUT**

REVISION

YEAR 2015

1.0 SCOPE:

This tender includes for the manufacturing, testing, packing, shipping, of outdoor type 24 kV and 36 kV expulsion fuse cutouts.

2.0 SERVICE CONDITIONS:

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 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 Temperature under sun:

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)

2.5 Sand storm:

The equipments shall be suitable for outdoor installations and subjected to frequent sand storms and heavily polluted atmosphere.

3.0 APPLICABLE CODES AND STANDARDS:

The latest revision of the following codes and standards shall be applicable for the equipment/materials covered in this specification. In case of any deviation, the vendor/manufacturer may propose equipment/material conforming to an alternate code or standard. However, the provision of MOE standards shall supersede the provisions of these alternate standards in case of any difference.

<u>IEC</u>	<u>International Electrotechnical Commission</u>
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- | | | |
|-----|-------------|---|
| 3.1 | IEC 60060 | High voltage test techniques. |
| 3.2 | IEC 60168 | Test on indoor and outdoor post insulators of ceramic material or glass for system with nominal voltages greater than 1000 V. |
| 3.3 | IEC 60282-2 | High voltage fuses part2: Expulsion and similar insulators. |
| 3.4 | IEC 60437 | Radio interference test on high voltage insulators. |
| 3.5 | IEC 60507 | Artificial pollution test on high voltage insulators to be used on A.C system. |

3.6 ANSI C 37.41 Design tests for high voltages fuses, distribution including air switches, fuse disconnecting switches and accessories.

3.7 ANSI C 37.42 Specification for distribution cut outs and fuse links.

NEMA National Electrical Manufacturers Association.

3.8 NEMA S.G 2 High voltage fuses

Note: In case of any deviation from the listed standards, it should be indicated in the list of deviations submitted by the supplier.

4.0 TECHNICAL REQUIREMENTS (DESIGN AND CONSTRUCTION):

4-1 System Data

a. 33KV System	
33000 volts	Nominal voltage
36000 volts	Highest system voltage
3-phase, 3 wire with neutral grounding zig-zag transformer to limit the earth fault current to 1000 Amp.	System
50Hz	Frequency
25KA. r.m.s at 33000 volts.	Short circuit breaking current

b. 11 KV System	
11000 volts	Nominal voltage
12000 volts	Highest system voltage
3-phase, 3wire neutral earthed through resistance of 21.1 Ohm limiting the earth fault current to 300A	System
25 KA R.M.S at 11000 volts	Short circuit breaking current

The cut out is fastened on a common cross arm which can be of steel, The contacts of the expulsion fuses are chosen in such a way as to ensure reliable contact pressure and drop out of the fuse carrier when operating.

The fuse carrier consists of an insulating tube into which the fuse link is built-in. The fuse link consists of a standard copper wire and a gauged silver wire as a fuse element. The fuse links are designed for standard rated current from 10A to 50A.

By its methods of operation the expulsion fuse cut outs is a switch-disconnector which breaks current within approximately 20msec and does not limit the current. After the fuse element is being melted the fuse carrier drops out from the upper fuse-base contact and performs reliable disconnection. The use carrier stays hanging on the bottom of the fuse-base contact. The operation of operator removes the fuse carrier by an insulating rod, insert a new fuse link and close it again. Expulsion fuse cutouts are applied as protection for distribution transformers and supply mains especially for the protection against the undesired action of the short circuit current and earth fault current. Technical data, dimensions, catalogues required. The expulsion fuse cutouts should be supplied with the necessary element fuses rating 20A, 40A according to the approval of the client.

4.2 Minimum Dielectric withstand values:

4.2.1 Power frequency withstand 1min Dry and wet.

To earth and between poles. 24, 33 kV ----- 50, 70 kV

Across the isolating distances. 24, 33 kV ----- 60, 80 kV

4.2.2 Impulse (1.2x 50 μ sec)

To earth and between poles. 24, 33 kV ----- 145/170 kV

Across the isolating Distances 24, 33 kV ----- 145, 200 kV

4.3 Fuse tube:

Fuse tube shall be bone fiber lined epoxy fiber glass with exterior ultra violet (U.V) protected, solid cap and single vented with arc shortening rod. Solid link shall also be used in place of as and when required.

4.4 Main assembly construction:

The main assembly shall be mounted on a single insulator of 660 mm creepage distance in the case of 24 kV fuse cutouts and single insulator along with stand off insulator arrangement of total creepage of 825 mm or 1320 mm for 33 KV fuse cutouts.

4.5 Mounting arrangement:

The expulsion fuse cutouts shall be suitable for vertical mounting. NEMA brackets shall be provided for both type of expulsion fuse cutouts. The brackets including bolts, nuts, lock washers etc. shall be in accordance with ANSI C 37.42 to prevent swiveling. The upper, lower fuse unit and fitting shall be reusable. The fuse holder shall be easy to operate with hot stick.

4.6 Contacts:

All contacts shall be designed to give continuous rated current carrying capacity after exposure to marine and desert climates for the service life. Contacts shall be silver clad on each side. Embossed surfaces with wiping action are preferred. Top and bottom contacts, sub assemblies and mounting fitting shall be potted into the porcelain insulators. The upper fixed contacts assembly shall not be corroded when exposed to atmosphere. Upper contacts shall positively latch in the closed position. The lower contacts shall be with stainless steel backup springs to prevent arcing that may occur as the fuse tube rises slightly in the hinge during operation.

4.7 Terminals:

The terminals shall be made in such away that ACSR/AW conductors can be connected without any risk of corrosion. The material used shall be copper and plated with suitable alloy. The terminals shall be of parallel groove type and shall be suitable for the standard sizes of conductors used by MOE.

4.8 Insulators:

The insulators shall be porcelain and bird proof. There shall be no steel bands around the insulator. In case of stand off insulator, the insulators shall be rigidly connected to the channel base where provided so that deflection of the insulators under short circuit conditions is kept to a minimum and there is no tendency for them to work loose from base. All the openings in the insulator shall be completely potted with inorganic sulfur cement and all exposed areas of the sulfur cement shall be coated with an enamel- based paint to minimize the ingress of moisture.

4.9 Load break hook:

The expulsion fuse cutouts shall be provided with load break hooks to facilitate the use of portable load break tools. The attachment hooks shall be made of galvanized steel, not less than 9.54 mm (3/8" in) diameter. They shall be resistance welded to the upper contacts assembly. Spot welding, which can produce localized rust and weaken the hooks, shall not be acceptable.

4.10 Galvanizing:

All iron components shall be galvanized. The supplier /vendor shall state weight / thickness of zinc coating on the attached technical data schedule.

4.11 Construction:

The expulsion fuse cutout shall be designed suitable for pole mounting on cross arms. Therefore it should be supplied completely with fuse holder and fuse link elements with holder bimetal clamp connectors. The fuse link element shall be of a current limiting type in accordance of IEC 60282. The rating of both 33 and 24 kV fuses cutouts shall be 100A.

4.12 Short circuit interrupting ratings:

The fuse cut-out short circuit interrupting ratings should be according to the following table:

current rating (A)	BIL (kV)	Rated voltage (kV)	#
100	145	24	1
100	200	36	2

4.13 Deviations

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

5.0 MARKING:

Each fuse tube shall be permanently marked with the following information as minimum, in English and /or Arabic.

- 5.1 Rated voltage
- 5.2 Maximum continuous current rating.
- 5.3 Rated interrupting current symmetrical.
- 5.4 Basic insulation level.
- 5.5 Manufacturers' name or trade mark.
- 5.6 Year of manufacture.
- 5.7 Country of origin.

6.0 TESTING AND INSPECTION:

6.1 General:

All expulsion fuse cutouts shall be tested in accordance with the latest standards and as specified herein.

The supplier/vendor shall provide acceptable type test certificates for his fuse cutouts. Two certified copies of the test reports shall be submitted to the MOE for approval. No equipment shall be shipped until approval of the test reports has been given by MOE.

6.2 Type tests:

The expulsion fuse cutouts offered shall meet the type test requirements of the standards given below:

6.2.1 Dielectric tests to IEC 60282-2 (clause 11).

- Power frequency withstand (1 minute dry and wet)
- Impulse withstand (1.2 x 50 μ sec).

6.2.2 Interrupting capacity to IEC 60282-2, clause 13.

6.2.3 Radio interference test to IEC 60437.

6.2.4 Temperature rise tests to IEC 60282-2, clause 12.

6.2.5 Pollution performance test as per IEC 60507.

- Salt spray corrosion performance tests for 1000 hours.
- Solid layer pollution test.

6.2.6 Expendable caps shall be subject to a static relief pressure test to ANSI C 37.42, clause 2.2.7.

6.2.7 Load break tests to ANSI C 37, 41, clause 7.

Tests shall be made with the manufacturers recommended portable load break device.

6.3 Routine tests:

Supplier shall provide detail of the routine tests, which will be performed on the expulsion fuse cutouts with the minimum requirements listed as follows:

6.3.1 Insulator tests.

6.3.2 Power frequency reference or low current.

6.4 Inspection:

MOE may wish to witness tests or visit the factory during manufacture of any or all items covered by this specification. Accordingly the supplier shall give MOE adequate notice of manufacturing and test schedules. MOE may require certificates and data from the manufacturer/supplier on all pertinent aspects of the manufacturing process.

7.0 PACKING AND SHIPMENT:

Each expulsion fuse cutout shall be packed individually in a strong non returnable wooden crate/ card board box in such manner to prevent damage to components during transportation and handling up to installation site. Packing shall be designed to prevent entry of dust, ingress of moisture and other foreign materials. The mounting bracket, where required, shall be packed separately. Each container shall have the following information stenciled on it in English and /or Arabic.

- Manufacture's name.
- Country of origin.
- MOE item number.
- MOE purchase order number.
- Weight in kilogram.
- Handling instruction.
- Voltage and current rating.

7.1 Supplier shall contact material department for additional packing, handling and shipment instructions as applicable.

7.2 Packing note in Arabic and/or English shall be included in each case giving description of goods packed.

7.3 Expulsion fuse cutouts shall not be packed in any organic material.

8.0 GUARANTEE:

8.1 Vendor shall guarantee the expulsion fuse cutouts against all the defects arising out of faulty design, workmanship or defective material for a period of one (1) year from the date of installation or two (2) years from the date of delivery, unless and otherwise specified in tender documents.

8.2 If no exception/deviations are taken to this specification and no list of deviations is submitted, it shall be deemed that, in every respect, the offered expulsion fuse cutouts and their accessories conform to this specification.

9.0 TECHNICAL DATA:

9.1 The vendor shall complete and return one copy of the attached data Schedule with quotation. In addition to data Schedule, clause by clause compliance to this specification shall be confirmed/ submitted.

9.2 Detail dimensional drawing of the expulsion fuse cutout and mounting arrangements shall be submitted.

9.3 The supplier shall provide literature describing field experience under similar service conditions.

9.4 A reference sale list shall be included. This shall detail the quantities sold, name and address of users, the number of years in service in each case. The literature shall show at least 10 years service in each environment.

9.5 Type test certificates.

9.6 Submittal required following award of contract, are given below:

- Manufacturing schedule, progress report and test schedule.
- Test report.

TECHNICAL DATA SCHEDULE
24 kV EXPULSION FUSE CUTOUT
(sheet 1 of 3)

S.No.	DESCRIPTION.	UNIT.	MOE SPECIFIED VALUES.	VENDOR PROPOSED VALUES.
1	System voltage	kV	24	
2	Max design voltage	kV	24	
3	Continuous current capacity	A	100	
4	Interrupting current (symmetrical)	kA	8	
5	BIL at altitude ≤ 1000 m	kV	145	
6	BIL at altitude > 1000 m	kV	145	
7	Total minimum creepage distance	mm		
8	Power frequency with stand 1 min dry and wet: To earth and between poles. Across the isolating distances.	kV	50 60	
9	Impulse (1.2 μ sec) To earth and between poles. Across the isolating distances.	kV	145 145	
10	Max radio interference voltage	μ V	250	
11	Ambient temperature during temperature rise tests	$^{\circ}$ C	*	
12	Temperature rise of contacts	$^{\circ}$ C	*	
13	Temperature rise of terminals	$^{\circ}$ C	*	
14	Material of support insulators		Porcelain	
15	Color of the insulator		Glazed brown / grey	
16	Manufacturer of insulator a) Main insulator b) Stand off insulator			
17	Type of main contacts material		Copper	

* To be specified in tender documents.

TECHNICAL DATA SCHEDULE
33 kV EXPULSION FUSE CUTOUT
(sheet 2 of 3)

S.No.	DESCRIPTION	UNIT	MOE SPECIFIED VALUES	VENDOR PROPOSED VALUES
1	System voltage	kV	33	
2	Max design voltage	kV	36	
3	Continuous current capacity	A	100 *	
4	Interrupting current (symmetrical)	kA	8	
5	BIL at altitude ≤ 1000 m	kV	170	
6	BIL at altitude > 1000 m	kV	200	
7	Total minimum creepage distance	mm	825, 1320 *	
8	Power frequency with stand 1 min dry and wet: To earth and between poles. Across the isolating distances.	kV	70 80	
9	Impulse (1.2 μ sec). To earth and between poles. Across the isolating distances.	kV	170 200	
10	Max radio interference voltage	μ V	650	
11	Ambient temperature during temperature rise tests	$^{\circ}$ C	*	
12	Temperature rise of contacts	$^{\circ}$ C	*	
13	Temperature rise of terminals	$^{\circ}$ C	*	
14	Material of support insulators		Porcelain	
15	Color of the insulator		Glazed brown/ grey	
16	Manufacturer of insulator a) Main insulator b) Stand off insulator			
17	Type of main contacts material		Copper	

* To be specified in tender documents.

TECHNICAL DATA SCHEDULE
24, 33 kV EXPULSION FUSE CUTOUT
(sheet 3 of 3)

S.No.	DESCRIPTION	UNIT	MOE SPECIFIED VALUES	VENDOR PROPOSED VALUES
18	Fuse cut-out with single or stand-off insulator NEMA brackets		Required	
19	Cutout suitable for removable button head fuse link		Yes/ no	
20	All assemblies potted into the porcelain		Required	
21	Angle of the fuse insulator to the vertical		15° - 20°	
22	Shed to be incorporated into upper contact assembly		Required.	
23	All current carrying parts of copper or copper alloy		Required.	
24	Conductors terminals tin plated		Required.	
25	Contacts silver clad		Required.	
26	All ferrous components galvanized		Required.	
27	Load break hooks fitting		Required.	
28	Arc interruption assisted by a spring operated flipper		Required.	
29	The protection of fuse link from mechanical shock by latching of toggle mechanism		Required.	
30	Non expendable type fuse cap		Required.	
31	The fuse tube marked with manufacturer, model continuous and interrupting current rating,, rated voltage and date of manufacture		Required.	
32	Routine tests carried out on 100% of the offered items		Required.	
33	Type test certificates included in the tender along with complete descriptive literature		Required.	

MINISTRY OF ELECTRICITY
Planning and studies Office
Baghdad – Iraq

Specification No.

D-41

TECHNICAL SPECIFICATION
Of
11KV &33KV POLE MOUNTED
LOAD BREAK SWITCH

REVISION

YEAR 2012

1.SCOPE OF WORK

Tenderers are invited for the design, manufacture, testing and supply for air type load break switch(LBS) for 11kv and 33kv .

2.DESIGN AND CONSTRUCTION

2.1 general

This standard applies to outdoor type device ,pole mounted, three phase ,three pole load break switch complete with mechanism for operating from ground level.

The load break switch is intended for the general purpose switch on-load type, gang operated with an operating handle, the switch is capable of making ,carrying ,and breaking the rated normal current 400 amp for 11kv and 600 amp for 33kv ,the load breaking switch shall according to IEC 60265-1 & IEC 60129, the switch is suitable for operating on 11kv and 33kv system and used for sectionalizing over head main lines and branches. The switch shall be able to bear the mechanical force on terminals when installed according to the instructions as well as electro-dynamic forces without reduction of their reliability or current carrying capacity .

2.2 operating mechanism

2.2.1 The load break switch shall be provided with an operating mechanism to enable it to be operated from ground level using a standard operating stick. The opening/closing operations shall be spring assisted so that the speed of operations is completely independent of the operator's effort. The operating mechanism shall be lockable either on the "ON" position or the "OFF" position.

2.2.2 . Mechanical indicator for the switch status shall be clearly visible to an observer eight meters below the switch. Symbols and colors for the indicators shall be a Red "ON" for ON and Green "OFF" for OFF. The colors shall remain vivid for the products working life.

2.3 Enclosure

The enclosure should be galvanized steel, with earthing point to connect earthing cable.

3. service conditions

The air is not normally ,heavily polluted by dust ,smoke ,or corrosive gases ,vapor or salt spray. However at certain times of the year severe dust storms may be experienced.

4.general requirement

The equipment shall be of first class quality and designed for continuous satisfactory operation as continuity of supply is of prime consideration. The design shall allow all necessary precaution for the safety of operation and maintenance personnel. All equipment shall 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 assigned ratings of the apparatus . All the equipment shall be designed to withstand the accidental short circuit.

The equipment used shall be suitable for the following climatic conditions prevailing at site.

4.1 Ambient Temperature

Highest maximum – in the shade	+ 55 deg. C. for about 6 Hours a day
Lowest minimum	-10 deg .C.
Max. Yearly average	+ 30 deg .C.
Max. daily average	+ 40 deg .C.

4.2 Sun Temperature

Metal object under direct Sunshine attain a temperature	+ 80 deg .C.
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4.3 Air Humidity

Maximum	92 % at 40 deg .C.
Minimum	12 %
Yearly average	44 %

4.4 Altitudes

From sea level	up to 1000 M
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4.5 Sand storms

The equipment are subjected to strong and frequent sand storms. Adequate precaution must be taken to cater for this.

4.6 Condensation

Enclosed compartments shall have the interior surfaces treated with approved materials. Such treatment should in no way interfere with the satisfactory operation of the equipment either electrically or mechanically.

5. Technical requirement.**5.1 System data 11KV.**

Nominal voltage	11000 volt
Highest system voltage	12000 volt
Frequency	50 HZ
Short circuit level	25 kA r.m.s at 11kV
System	3- Phase, 3 wires with neutral earthed through an earthing resistance of 21.1 ohm. limit the earth fault current to 300 Amps.

5.2 System data 33KV.

Nominal voltage	33000 volt
Highest system voltage	36000 volt
Frequency	50 HZ
Short circuit level	25 kA r.m.s at 33kV
System	3- Phase, 3 wires with neutral grounding transformer to limit the earth fault current to 1000A Amps.

6. Standards

The latest relevant issue of the international electro-technical commission (IEC) specifications:

Where these specifications are incomplete or not yet published then the national standards of tenderers country shall be considered & subject to our approval.

7. Rating & characteristics

The 11kv & 33kv load break switch shall have the following respective rating & characteristic.

item	33kv	11kv
Nominal voltage	33000 volt	11000volt
Highest system voltage	36000 volt	12000volt
Frequency	50 HZ	
Short circuit current (1 sec)	25 kA	25KA
Rated max.con.current	600A	400A
Max over load breaking current	800A	800A
Basic impulse with stand voltage level (BIL)	175 kv	92 kv

8. operating system and installation

The installation heights of the switch will be about 9 meter & the operating handle about 1.8 meter above ground level. There should be provision for locking the handle by padlock to be included in the scope of supply in (on) & (off) positions. The operating mechanism shall be so constructed that they cannot come of their open or closed positions by gravity ,wind pressure ,vibrations, reasonable shocks or accidental touching of the connecting rods.

9. Terminal bushings

The bushings of the switch are made of porcelain & the base of each phase pole should be separate with suitable insulated , inside and outside .

10. Earthing terminal

The enclosure of the switch provides the earthing terminals which is suitable for the copper wire size(35-70mm²).

11. Breaking capacity (as minimum)

- | | |
|--------------------------------|----------------------|
| - Mainly active load current | 100 operating cycles |
| - Transformer off-load current | 200 operating cycles |
| - Line charging current | 200 operating cycles |
| - Cable –charging current | 200 operating cycles |

12. Mechanical endurance

1000 operating cycles as minimum.

13. MARKING

Each load break switch (L.B.S) shall be provided with a weather proof and corrosion proof name plate and shall give the following information in English and/or Arabic.

- 15.1 Purchase order /tender No.
- 15.2 Manufacturer name.
- 15.3 Year of manufacturing.
- 15.4 Type of load break switch (L.B.S).
- 15.5 Rated current.
- 15.6 Rated short time withstand current.
- 15.7 Rated voltage& frequency.
- 15.8 rated making current.
- 15.9 BIL.
- 15.10 MOE brand should be printed on enclosure.

14. PACKING

The supplier will pack or protect the goods in the most appropriate manner. He will be responsible for any loss or damage arising from careless packing or protection up to the place of final destination. After completion of the inspection and test at the factory each item shall be packed for export shipment.

15. TESTS**15.1 INSPECTION**

The material shall be subject to inspection and test by our inspectors at any time during manufacture. All testing and inspection shall be made at the place where the material manufactured. The manufacturer shall provide all inspection facilities for the site inspection and testing. The inspector shall have the right to reject any portion of the material at time during manufacture if it does not meet with the requirements of this specification in all particulars. He shall have the right of overseeing the packing and shipping of all materials to be supplied.

15.2 TEST AT MANUFACTURES WORK

Test at manufactures work shall comprise type tests & routine tests according IEC standard.

16. TECHNICAL DATA SCHEDULE LOAD BREAK SWITCH

The tenderer should be filled the technical data which is required in the schedule below.

S/N	DESCRIPTION	UNIT	VENDOR PROPOSED VALUES
1	System Voltage	kV	
2	Rated Voltage	kV	
3	Continuous current capacity	A	
4	Breaking current capacity	kA	
5	Short time withstand current (1sec)	kA	
6	Creepage distance	mm/kV	
7	Dry flash over voltage	kV	
8	Wet flash over voltage	kV	
9	Max radio interference voltage	μV	
10	Ambient temperature during temperature rise test	°C	
11	Temperature rise of contacts	°C	
12	Temperature rise of terminals	°C	
13	Material of support insulators and color.		
14	Minimum clearance between phase and earth.	mm	
15	Minimum clearance between phases.	mm	
16	State main contacts material.		
17	State main contacts plating material.		
18	All current carrying parts of copper or copper alloy.		
19	Operating speeds		
20	Short circuit current	KA	