

مواصفات فنية لممانعات الصواعق  
11KV

**SPECIFICATIONS**

**FOR**

**METAL OXIDE SURGE ARRESTERS**

  
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## **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  
Power Distribution Office  
Baghdad - Iraq**

**Specification No.**

**D 22-**

**TECHNICAL SPECIFICATION  
OF  
TUBULAR STEEL POLES**

**REVISION**

**YEAR 2001**

**YEAR 2009**

**YEAR 2012**

## 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 <sup>2</sup> (min)	ST-51	ST-52	ST-41	ST-42
Yield strength	Kg f/mm <sup>2</sup> (min)	36	36	24	24
Design bending stress	Kg f/mm <sup>2</sup> (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 <sup>2</sup>	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 <sup>2</sup>	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 have 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 $\times$ Ps	Any defect should not be produced
O	-----	Permanent set shall not exceed (13 mm) from zero position
Pb	2.0 load $\times$ 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 ).<sup>2</sup>

**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.

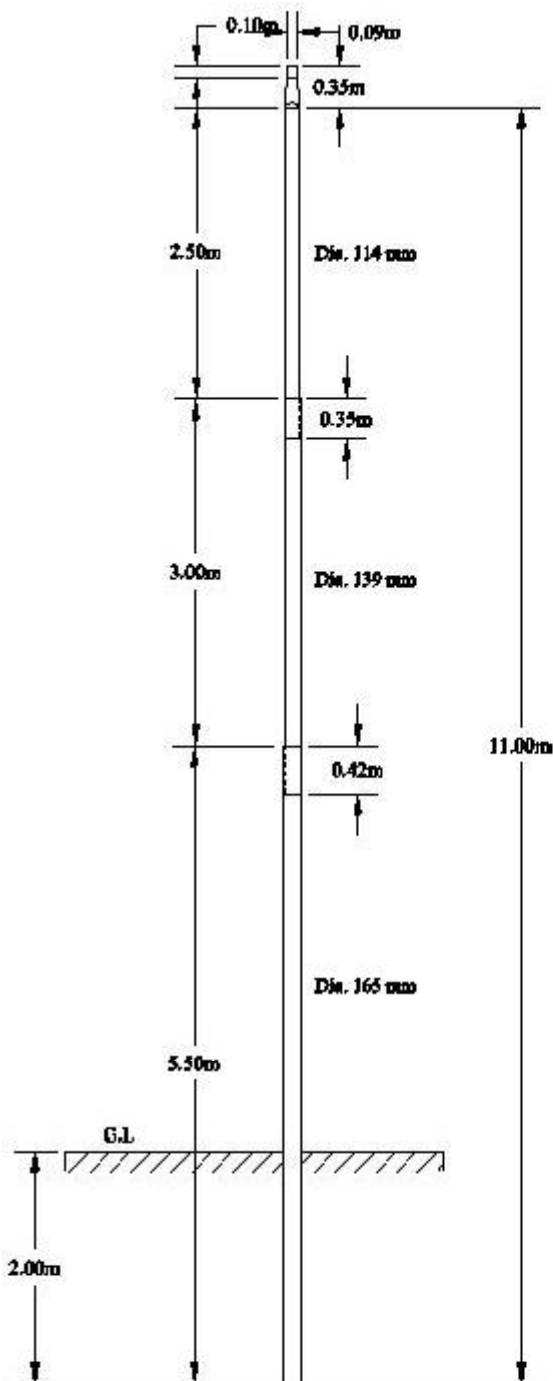
**9. Packing:**

- 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.

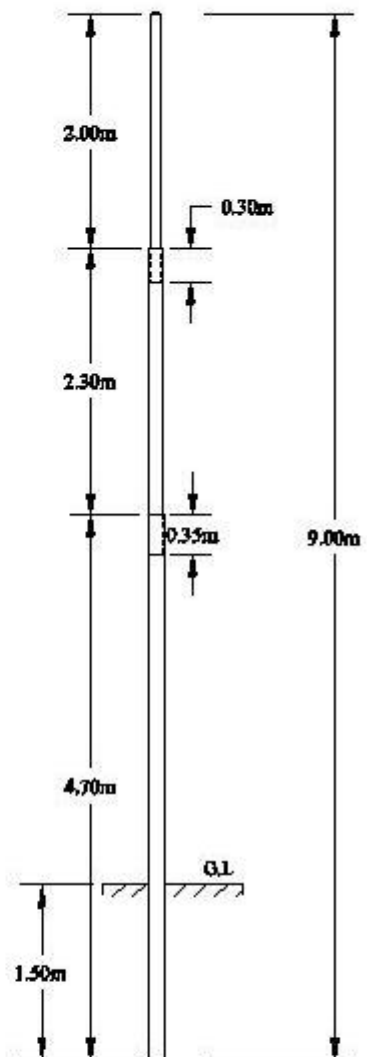
**Note:**

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





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#### **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 .
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- Manufacturer's name or trademark .
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#### **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 .**

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 continuos 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. 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 approve 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.



## **Section IV**

### **TECHNICAL SPECIFICATION**

### **SF6 GAS INSULATED 11 kV LOAD BREAK SWITCHES**

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## **PART 1: GENERAL**

### **1. Scope**

This specification covers the general requirements of design, manufacturing, testing, supply, delivery and performance requirements of three phase, SF6 gas insulated Load Break Switches (LBS) with operating device for 11 kV overhead power distribution system in Iraq.

### **2. Standards**

The equipment shall comply with the latest editions and amendments of the international standards listed below as a minimum.

#### **IEC International Electro technical Commission**

IEC 62271-100: High Voltage alternative current circuit breakers

IEC 62271-102: Alternating current disconnectors and earthing switches

IEC 60059: IEC standard current ratings

IEC 60071-1 & 60071-2: Insulation Coordination

IEC 60129: Alternating Current Disconnections (Isolators) and earthing switches

IEC 60265-1: High-voltage Switches for Rated voltages above 1 kV and less than 52 kV

IEC 60694: Common specifications for High voltage switchgear and control gear

IEC 60298: Medium voltage metal enclosed switchgear and control gear

IEC 60376: Specification of technical grade SF6 for use in electrical equipment

IEC 60273: Characteristics of Indoor & Outdoor Post Insulators for Systems with Nominal Voltage greater than 1000 V

IEC 60437: Radio Interference test on high-voltage insulators

IEC 60507: Artificial pollution tests on high-voltage insulators to be used in alternating current systems

IEC 60529 : Degrees of protection provided by enclosures (IP code)

IEC 60060-2: High voltage test techniques

IEC 60815: Guide for the selection of insulators in respect of polluted conditions

BSEN ISO 1460:1999: Hot dip galvanized coatings on iron and steel

#### **ISO International Organization for Standardization**

ISO 9000: Quality management and quality assurance standards - Guidelines for selection and use.

ISO 1459: Metallic Coatings - Protection against Corrosion by Hot Dip Galvanizing - Guiding Principles.

#### **CENELEC/CEN Harmonized European Standards or Other**

Where any provision of this specification differs from those of the standards listed above, the provision of this specification shall apply. In case of conflict, the order of precedence shall be:

- This specification
- IEC standards
- ISO standards
- Other standards

Equipment confirming to alternative standards may be accepted provided it is demonstrated that they give a degree of quality and performance equivalent or better than that of the reference standards. Acceptability of any alternative standard is at the discretion of Purchaser.

### 3. Service Conditions

The equipment shall be suitable for use in the following Service Conditions:

#### 3.1 Outdoor

The Outdoor service conditions shall be as follows:

Item	Description
<b>Altitude above sea level:</b>	Up to 1,000m above sea-level
<b>Ambient Temperature:</b>	
Maximum outdoor - shade	+55 °C
Minimum outdoor	-10 °C
Maximum outdoor daily average	+40 °C
Maximum outdoor yearly average	+30 °C
Maximum ground at depth 1m	+35 °C
Maximum Black Body (black objects in direct sun)	+80 °C
<b>Relative Humidity:</b>	
Maximum	92 %
Minimum	12 %
Yearly Average	44 %
Maximum wind velocity:	140 kilometer per hour
<b>Rainfall per year:</b>	
Maximum	500 mm
Minimum	50 mm
Maximum in one day	65 mm
Yearly Average	150 mm
<b>Atmosphere:</b>	Subject to sand storms and wind blown dust
Average number of days per year of dust storms	30
Average number of days per year of thunder storms	15

### 4. System Parameters



The equipment shall be suitable for use in supply systems of the following parameters::

Description	Parameters for 11 kV level
Nominal Voltage	11 kV
Highest System Voltage	12 kV
Number of Phases	3
Frequency	50 Hz
Neutral Point	See note below
3 Phase Short Circuit Level	25 kA

**Note:** The 11 kV networks are normally operated with the neutral point earthed through a resistor to limit earth fault current. However, the 11 kV networks may also be operated with the neutral isolated from earth during abnormal conditions. The unearthed 11 kV equipment shall be suitable for continuous operation with an earth fault on one phase and shall be designed to withstand the over voltage that may occur due to arcing to earth.

## **5. Spare Parts**

The supplier shall include following items as mandatory spares.

Three (3) 11 kV bushings for each 10 LBS for incoming side of the LBS

Three (3) 11 kV bushings for each 10 LBS for outgoing side of the LBS

## **6. Inspection, Testing and Quality Assurance**

### **6.1 Inspection**

The Supplier shall submit a detailed program covering the design, manufacture and testing of the Load Break Switch within one month of receipt of the contract award. Reports shall subsequently be submitted at intervals, outlining progress.

The Purchaser or its nominated entity shall have free entry at all times, while work on the contract is being performed, to all parts of the manufacturer's works which concern the processing of the work. The manufacturer shall afford Purchaser without charge, all reasonable facilities to verify that the equipment being furnished is in accordance with this specification.

### **6.2 Testing**

The equipment shall have been type tested and successfully passed all type tests referred to in Part 2 "Technical", and in the most recent editions of the international standards referenced in Clause 2. Certificates of type tests already carried out shall be submitted with the bid for evaluation.

Fresh type tests shall be carried out if required by the Purchaser at an independent certified/accredited testing laboratory and witnessed by Purchaser or some other representative acceptable to the Purchaser. If Purchaser wishes to witness tests, then the Supplier shall give Purchaser a minimum of one-month notice that the

equipment/material is ready for testing. If Purchaser does not indicate an intention to participate in the testing, the manufacturer shall carry out the tests and the Supplier shall furnish the results thereof to Purchaser for review and acceptance. Cost of type tests shall be included in the Price Schedule.

All routine tests required by the relevant standards shall be carried out even though they are not listed in this specification, at the expense of the Supplier and these tests shall be carried out at the manufacturer's works. The Supplier shall submit full details of the proposed methods of testing, including connection diagrams to the Purchaser for approval, at least one month before testing.

The Supplier shall submit to the Purchaser five signed copies of the test certificates, giving results of the prescribed tests. Equipment shall not be dispatched until the Purchaser has received the test certificates and the Supplier has been informed that they are acceptable. The Purchaser reserves the right to reject any item of the equipment if the test results do not comply with the values specified or with the data given in the Schedule of Technical Data.

### **6.3 Quality Assurance**

The manufacturer must operate a quality assurance system that complies with ISO 9000. The Supplier shall provide current certification showing the manufacturers' compliance with ISO 9000 or equivalent national standard. The certificate must have been issued by an independent, accredited issuing authority.

## **7. Packing and Shipping**

### **7.1 Packing**

Each unit shall be securely and individually packed and securely clamped against movement in robust, non-returnable wooden boxes suitable for overseas shipment to a tropical country and to withstand rough handling. Supplier is responsible for any loss or damage arising from careless packing or protection up to the place of final destination.

Each packing shall contain a copy of installation instruction and erection drawings and maintenance instructions in the English language.

Each packing case shall be indelibly marked, on two adjacent sides and on the top, with the following:

- Individual serial number
- Purchaser's name
- Contract number
- Supplier's name
- Manufacturer's name
- Description of contents
- Country of origin
- Case measurements
- Gross and net weights in kilograms

- All necessary slinging and stacking instructions

Each case shall contain a fully detailed packing list in a sealed waterproof envelope. Five copies of each packing list shall be sent to Purchaser prior to dispatching the equipment.

## **7.2 Hazardous Substances**

The Supplier shall submit safety data sheets for any hazardous substances used with the equipment. These substances shall be classified in accordance with the European Union SI 426 or similar standards.

If such substances are not used in with the equipment, the Supplier shall give an assurance that there are no substances classified as hazardous in the equipment supplied.

## 8. Submittals Required By Purchaser after Contract Award

The Supplier shall submit a detailed programme covering the manufacture, testing and delivery of the materials and equipment within the time stated in the following table.

#	Description	Delivery Time	Objective	No. of Copies
1.	Programme for production and testing	Within one month of contract award	Approval	3
2.	Detailed dimension drawings for all components, general arrangement drawings showing detailed component layout and overall assembly drawings			
3.	Detailed drawing of mounting arrangements			
4.	Certificates of compliance and certificates of origin			
5.	Progress reports	At agreed intervals	Monitoring	3
6.	Notification of inspection and tests	One month before inspection / testing	Review and necessary action	3
7.	List of tests and description of the tests to be performed		Approval	3
8.	Test reports for all type tests, routine tests and special tests and inspection reports	Immediately after tests/inspection are completed	Approval	5
9.	Technical Data Schedule with approved revisions if any	One month before delivery	Approval	5
10.	Detailed schematic and wiring drawings for all components			5
11.	General description of the equipment and all components including brochures			5
12.	Installation and commissioning instructions			5
13.	Operation and maintenance instructions			5

The programme for production and testing should be in the form of a Gantt chart.

The Supplier shall submit progress reports detailing progress against this programme and explaining any variations. The progress reports shall be submitted at defined intervals agreed by Purchaser.

At each of the approval stages indicated in above table, the Supplier should not proceed to the next step in the programme until the Purchaser gives approval.

## PART 2: TECHNICAL

### 9. GENERAL

This specification covers the general requirements of design, manufacturing, testing, supply, delivery and performance requirements of three phase, SF6 gas insulated Load Break Switches (LBS) with operating device. The LBS will be used in 11 kV overhead power distribution lines to isolate sections of the main distribution lines / branches (spurs) of the distribution networks.

The SF6 LBS shall be 12 kV, 3 phase, SF6 gas insulated, pole mounted type suitable for outdoor use in service conditions specified in Clause 3 in Part 1 of this specification.

### 10. MINIMUM TECHNICAL REQUIREMENTS

The minimum technical requirements shall be as follows.

9.1	Rated Voltage	kV	12
9.2	Operating Voltage	kV	11
9.3	Rated frequency	Hz	50
9.4	Number of phases		3
9.5	Rated continuous current	A	630
9.6	Rated fault making capacity	kA	40
9.7	Rated mainly active load-breaking current	A	630
9.8	Rated insulation level		
9.8.1	Lightning Impulse withstand voltage (1.2/50 $\mu$ s) wet & dry		
	a) Phase to earth	kV(peak)	75
	b) Across the terminals of open switch (of same phase)	kV(peak)	85
9.8.2	1 minute power frequency withstand voltage wet & dry		
	a) Phase to earth	kV	28
	b) Across the terminals of open switch (of same phase)	kV	32
9.9	Rated short time current (rms) / duration	kA/s	25/1
9.10	Rated transformer off load breaking capacity	A	2.5
9.11	Rated line charging breaking capacity	A	10
9.12	Minimum creepage distance	mm	300
9.13	Radio Influence Voltage when measured at 1 MHz in accordance with IEC 60437	$\mu$ V	250
9.14	The mechanical endurance of Load Break Switches shall ensure at least 1000 on/off operations without maintenance.		

9.15 The electrical endurance of load break switches shall ensure at least

- 10 making operations at rated short circuit making current without maintenance
- 400 making and breaking operations at rated breaking current without maintenance

## **11. BASIC FEATURES**

### **11.1 Design**

The LBS shall be a compact, light weight, maintenance free type that can be easily installed on a frame/platform on a single steel tubular pole approximately at 220 mm diameter section with vertical, horizontal or triangular conductor lay out options of 11kV lines. The frame/platform shall be suitable for single pole mounting structure.

The LBS shall be complete with operating mechanism and all other components necessary for installation and operation including mounting frame/platform, adjustable support brackets, clamp plates, cross arms, bolts, nuts and washers.

The mechanical design and strength of the unit and all components shall be able to bear the mechanical forces on the switch terminals when installed and during operation. They should withstand the electrodynamic forces without any reduction in reliability and/or current carrying capacity of the switches.

Evidence of operational endurance in service and design features to guarantee maintenance free performance shall be furnished with the offer.

An operation counter shall be provided to positively indicate the number of operations of the LBS.

All non-metallic parts including insulating materials of cables shall be able to withstand effects due to ultra violet radiation.

### **11.2 Operating Mechanism**

The minimum distance between the live parts of the LBS and the ground will be 5 m and the maximum distance will be 9 m. SF6 LBS shall be complete with operating mechanism and other components necessary for operation.

LBS shall be able to control as follows;

- a) The operation (ON/OFF) shall be carried out manually by means of a Hot-Stick. The operating rod shall be adjustable and enables operation at above distances (5-9 m). The adjustable section ends shall have suitable locking facilities. Total of 1 operator kit and 1 operating rod per 5 LBS shall be provided.



- b) All three poles of the LBS shall be operated simultaneously by the operating mechanism. Sufficient insulation between the live parts and the operating handle shall be provided for the safety of the operator
- c) The source side and the load side of the LBS shall be interchangeable. Provision of Surge arrestor mounting brackets on either side shall be provided.

All hardware shall conform to the specified standard. The nuts and heads of all bolts to be hexagonal type.

### **Provision for Remote Control**

The LBS shall be upgradeable, when necessary, by adding necessary modules to operate remotely in conjunction with SCADA system, which will be installed in future. Therefore the LBS shall contain Remote / Local / Manual switch to select the required operating mode and provision shall be kept to install control facilities such as Remote Terminal Unit for operation and monitoring of the LBS remotely which will be installed when required.

### **11.3 Connection**

Suitable terminals / connectors to be provided for accommodating Al / Cu conductors ranging from 50 sqmm to 240 sqmm.

### **11.4 Degree of Protection**

All components of the LBS that might be adversely affected by water and / or dust shall be housed in water and dust proof cabinets having a degree of protection to IP54. Anti condensation heaters or equivalent means to eliminate the formation of condensation shall be included as required.

### **11.5 Earthing**

An earthing terminal shall be provided for connecting the LBS metal work and mounting frame to the local earthing electrodes / galvanized steel mounting structure. The mounting frame shall have an earthing terminal suitable for accommodating two earthing conductors ranging from 5 mm to 15 mm in diameter.

### **11.6 Breaking and Disconnecting**

The breaking chamber of the switch shall be a SF<sub>6</sub> gas-immersed type. The SF<sub>6</sub> breaking chamber shall be a “sealed pressure system” and sealed for life in accordance with IEC 60694. The service life shall be at least 30 years. The pressure inside the tank shall be according to the requirements specified in the relevant standards. No refilling of the gas shall be required over the service life. The SF<sub>6</sub> used shall be new in accordance with the requirements of IEC 60376.

The disconnecting function shall be carried out when the separation of the main contacts is certain. It will be certain when a position indicator shall be shown by reliable indication device directly connected to the movable contacts. Therefore a

mechanical position indicator shall be provided to indicate ON/OFF position of the LBS.

The position indicator mechanism shall be simple, robust, and it shall give a true reflection of the main contacts. This reliable indicating device shall be in accordance with IEC 62271-102. The indicator shall be such that the position of the switch shall be clearly visible from the ground even under bad weather conditions.

### **11.7 Insulators and Bushings**

The load break switch shall be supplied with insulators or bushings made of high quality polymer or porcelain. Parts carrying heavy current shall be made of copper or copper alloy. The minimum creepage distance shall be 25 mm/kV.

### **11.8 Protection against corrosion**

The unit shall be weatherproof in the climate conditions defined in the part 1 of this specification.

The tanks of the load break switch shall be made of stainless steel, galvanized steel or aluminium alloy and strong enough to withstand dynamic short circuit forces and the vibration of the switch.

Except where specified to the contrary, all iron and steel parts shall be galvanized after the various processes such as sawing, shearing, drilling, punching, filing, bending, machining etc.

The zinc coating shall be applied using the hot dip process in accordance with the relevant standards. The galvanizing process effectively deposit a zinc coating of not less than 610 gm of zinc per square metre of surface and uniform thickness of not less than 86  $\mu\text{m}$ . All threaded sections shall have a coating of at least 493 gm of zinc per square metre.

## **12. RATING PLATE**

### **12.1 Load Break Switch**

The rating and data of the LBS shall be engraved or embossed on a weather and corrosion proof metal plate. The rating plate shall contain the following information as a minimum and shall be fixed to the base-supporting frame or on the lower part of the tank in a clearly visible place.

- a) Manufacturer
- b) Country and year of manufacture
- c) Number and year of conforming standard
- d) Type designation, class, manufacturer's serial No., etc.
- e) Rated voltage (kV) and frequency (Hz)
- f) Rated lightning impulse withstand voltage (kV) dry
- g) Rated power frequency withstand voltage (kV) wet
- h) Rated continuous current (A)

- i) Rated short circuit making current (kA)
- j) Rated short time (1 s) current (kA)

### **12.2 Operating device**

- a) Manufacturer
- b) Designation of type and class

## **13. OPERATING INSTRUCTIONS**

One installation and operating instruction manual shall be delivered with each Load Break Switch.

## **14. TOOLS**

Any special tools or devices necessary for operation and maintenance of the Load Break Switches shall be supplied and the cost of such tools shall be included in the price quoted for the equipment. A list of such tools shall be provided separately.

**ELECTRICITY COMMISSION  
PLANNING AND STUDY DEPT.  
BAGHDAD, REPUBLIC OF IRAQ**

<b>SPECIFICATION No.</b>
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<b>D-26</b>
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# **DISTRIBUTION TRANSFORMER**

## **0.416/11kV**

<b>REVISION</b>
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<b>YEAR 2001</b>
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# **DISTRIBUTION TRANSFORMERS**

## **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 rating : 100 , 250 , 400 , Box type for rating 630 and 1000 KVA .

And a valid ISO 9001 certificate.

## **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) +55C for about 6 hrs a day.

Lowest minimum -10C

Maximum yearly average+30C

Maximum daily average +40C

#### **2-1-2 Sun Temperature:**

Black objects under direct sunshine attain a temperature of 80 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 system	12000 volts 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: 416/240 volts system

phase,4-wire neutral solidly earthed.

Short circuit level

According to the short circuit level of H.T side and the rated power of the transformer

### **2-4 Standards:**

All the equipments 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 that 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 net work is overhead lines and comprising partly underground cable.

## **4- TECHNICAL SPECIFICATION**

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

Rated outputs ONAN .... 100, 250, 400, 630, and 1000 KVA.

Duty.....step-down, outdoor bushing type for 100,250,400,Box type for 630 & 1000 KVH.

Type .....wound, 3-phase

Rated voltage at no load .... H.V. 11kv L.V- 416 volt.

System frequency .....50HZ

Interphase Connection ... H.V. Delta L.V- star with neutral brought out.

Vector relation ship ..... Dyn 11

Type of Cooling .... ONAN

Temperature rise .....( i ) 45 °C in top oil by thermometer (ii) 50 °C in winding by resistance.

Off circuit tapings . . . . . five tapping for – 2.5% - 5% on the H.T winding for off circuit operation externally. The machine must be of the robust and definite position type with a click indicating position arrived during tap changing.

System Highest Voltage . . H.V side 12 kV

Terminal arrangement of transformers:-

The 11 kV side terminal is to be a clamp type with eyebolt and nut suitable for conductors up to 150 mm<sup>2</sup> copper.

The low voltage terminal are to be flat bar type with holes suitable for compression type thimble the sizes of L.V side:

For 100 KVA transformer 4x1x70 mm<sup>2</sup> copper.

For 250 KVA transformer 6x1x195+1 70 mm<sup>2</sup> copper

For 400KVA transformer 7x1x150 mm<sup>2</sup> copper

For 630 KVA transformer 11x1x240 mm<sup>2</sup> copper

For 1000 KVA transformer 14x1x240 mm<sup>2</sup> copper

Terminal arrangement of outdoors transformers must be brown colored bushing insulator mounted on the top cover of transformer for both H.T. and L.T, with arcing horn on H.T.bushing for outdoor transformer only. Neutral bushing should distinguished from phase bushing,

- For box-type transformer a suitable iron box cover the top bushings.

## **5- Fittings and Accessories:**

- Terminal marking plate.
- Tapping switch.
- Valves 3 / 4 B.S.P fitted on cover and bottom of tank, switch cocks.
- Thermometer pocket.
- Lifting lugs.
- Pressure relief valve.
- Earthling terminal on tank.
- Rating and diagram plate to be chromium plated of the engraved type.
- 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 avoid oil leakage , covered by metallic envelop.

## **6- painting**

A primary coat shall be applied immediately after cleaning all ungalvanized metallic parts thoroughly. An oil and weather resistant type second coat shall then be applied and the transformer finished in aluminum paint.

## **7- insulating oil**

The transformer is to be shipped with first filling of oil which shall be SHELL DIALA (B).

## **8- 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 variation to the contract price 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 105% of the total evaluated guaranteed losses according to the following values.

Iron losses 1800 USD per kW.

Copper losses 600 USD per kW.

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



## **9- Test**

### **9-1 Inspection:**

The material shall be subjected to inspection and test by our 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.

The inspector shall have the right of rejecting any portion 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 material to be supplied.

### **9-2 Test at manufacture work:**

Test at manufacture's work shall comprise type tests if required and routine tests.

#### **a-Type tests**

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

- 1- Test of temperature rise – clause 41 of IEC 76/1967.
- 2- Full – wave impulse-voltage withstand test clause test  
45 of IEC 76/1967.
- 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 in section twelve of IEC 76/1967.

### **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:

- The results of the tests.
- The calculation of performance of the items.
- The guarantee figures to show that each apparatus performs the conditions of the specification within the guaranteed limits.

### **9-4 Test Certificates:**

The tenderer shall furnish the Electricity Commission (EC) with 6 copies of test certificates.

No equipment shall be shipped without obtaining the (EC) 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 of our (EC).

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

## **10- Drawing , Instruction Book And Litreature.**

### **10-1 document to be submitted with the tender:**

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

- 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 manufacture r for transformers.
- e- Test certificate for identical transformers.
- f- Reference list of manufactured and exported transformers.
- g-Incomplete tenders are liable to rejection.

### **10-2 Document to be furnished by the successful tenderer:**

Within a period of 4 months from the date of award of the contract , the successful tenderer shall furnish the (EC) with the following documents:-

- a- 24 sets of prints on paper on all drawings.
- b- 24 copies of all instruction books and technical maintenance of the transformer, OFF Load tap changing gear and other ancillary equipments.
- c- 24 copies of instruction for erection of the equipment.
- d- 24 copies 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	1500	1300	1800

### **10-5 Approval of drawings:**

The successful tenderer shall prepare and submit to the (EC) all necessary drawings 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**

### **12-1 Spare parts:**

1-	H.T / L.T winding.	3%
2-	H.T bushing with it's accessories.	10%
3-	L.T bushing with it's accessories.	10%
4-	Tap changer.	3%
5-	Pressure relief valve.	2%
6-	Oil level indicator.	10%
7-	Cover gasket	10%

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 COMPLETED BY THE TENDERER)**

	Unit	100	250	400	630	1000
		KVA	KVA	KVA	KVA	KVA
		Tr.	Tr.	Tr.	Tr.	Tr.

- 1- Name of manufacturer.
- 2- Country of origin.
- 3- Standard on which performance data is based.
- 4- Continuous maximum rating for the specified.  
Temperature rise and ambient temperature ( valid clause 5 (1) ONAN rating-(KVA)
- 5- Rated temperature rise – ( C )
  - a- Oil by thermometer.
  - b- Winding by resistance
- 6- Hottest spot temperature-(c).
- 7- No-load voltage ratio at normal tap & vector relationship>
- 8- Exciting current referred to H.V. and 50 c/s and at . . – (Amps)
  - a- 90% rated voltage.
  - b- 100% rated voltage.
  - c- 110% rated voltage.
- 9- Power factor of exciting current at100% rated voltage and 50 HZ . . – (%).
- 10- Iron losses at 50 HZ and at .. – (kW).
  - a- 90% rated voltage.
  - b- 100% rated voltage.
  - c- 110% rated voltage.
- 11- Copper losses at full load (O.N.rating) and at 75 C – (kW)
- 12- Total losses ... .. – (kW).
- 13- Resistance voltage at full load and at 75 C ... (%)
- 14- Reactance voltage at full load and at 75 C ... (%)
- 15- Impedance voltage at full load 75 C ...
  - a- At normal tap.
  - b- At highest tap.
  - c- At lowest tap.
- 16- Resistance of H.V. winding per phase at 20 C... -(ohms).
- 17- Resistance of L.V. winding per phase at 20 C... -(ohms).
- 18- regulation at full load at 75 C ...
  - a- 1.0 power factor.
  - b- 0.8 P,F lagging.
- 19- Efficiency at 75 C... -(%)
  - a- 100% load
  - b- 75% load

- |    |   |         |
|----|---|---------|
| c- | 50% load  |         |
| d- | 25% load  |         |
|    | 20- Calculated thermal time constant  | -(Hrs). |
|    | 21- Maximum flux density at normal voltage and frequency and at normal ratio...                                   | -       |
|    | (KI/sq.cm)  |         |
|    | a- core   |         |
|    | b- yoke   |         |
|    | 22- Maximum flux density at 110% voltage and frequency and at normal voltage and frequency and at normal ratio... |         |
|    | a-Core  |         |
|    | b- Yoke   |         |
|    | 23- Insulation of   |         |
|    | a-Core bolts  |         |
|    | b- Core bolts washer  |         |
|    | c-Side plates   |         |
|    | d- Core laminations   |         |
|    | 24- Current density in windings – Amps/sq.cm.   |         |
| a- | H.V. winding  |         |
| b- | L.V. winding  |         |
|    | 25- Insulation on copper  |         |
|    | 26- insulation strength of winding.   |         |
| a- | Impulse full wave   | -(kV)   |
|    | ( I ) H.V.  |         |
|    | ( I I ) L.V.  |         |
| b- | Impulse chopped wave  | -(kV)   |
|    | ( I ) H.V.  |         |
|    | ( I I ) L.V.  |         |
| c- | Applied voltage test.   | -(kV)   |
| d- | Induced voltage test.   | -(kV)   |
|    | 27- Insulation strength of terminals.   |         |
| a- | Over voltage test   | -(kV)   |
|    | b- Minimum wet withstand voltage.   | -(kV)   |
| c- | Minimum impulse withstand.  | -(kV)   |
|    | d-Minimum puncture or oil-immersed withstand voltage.   | -(kV)   |
|    | 28- Type of core  |         |
|    | 29- Tap changer   |         |
| a- | Manufacturer  |         |
| b- | Type  |         |
| c- | Step of one tap in per cent of rated voltage  |         |
|    | 30- Thickness of transformer tank   | (mm)    |
|    | a-Sides   |         |
|    | b-Bottom  |         |
|    | c-Corrugated radiators  |         |

31- Weights and dimensions

a-Net weight of core -(Kg)

b-Net weight of copper -(Kg)

(i) H.V.

(i) L.V.

c-Net untanking weight of

(i) Core -(Kg)

(i) Frame -(Kg)

(ii) Coil -(Kg)

d- Volume of insulating oil -(IMP.Gall)

e- Net weight of insulating oil -(Kg)

f- Total weight of transformer less oil -(tons)

g- Weight of the largest shipping package -(tons)

h- Crane lift for untanking core and coils -(m)

i- Crane lift for removal of bushings -(m)

j- Dimensions of transformer -(m)

(i) Under base to top most point

(i) Under base to bushing mounting flanges

(ii) Overall breadth

(i) Overall length

k- Overall shipping dimensions of tee largest package.

32- Noise level .....dB.



## SCHEDULE "B"

### OIL CHARACTERISTICS TABLE (TO BE COMPLETED BY THE TENDERER)

NO.	DESCRIPTION	UNIT	SPECIFICATIONS
1.	MAKER'S NAME		
2.	REFERENCE NAME OF OIL		
3.	SLUDGE VALUE	0%	
4.	FLASH POINT (CLOSED)	°C	
5.	POUR POINT	°C	
6.	VISCOSITY AT 21	CST	
7.	ELECTRIC STRENGTH(BREAKDOWN	KV	VOLTAGE)
8.	ACIDITY(NEUTRALIZATION VALUE)		
	-TOTAL	mg/KOH/g	
	-INORGANIC		
9.	SAPONIFICATION VALUE	mg/KOH/g	
10.	COPPER DISCELERATION		
11.	CRACKLE		
12.	SPECIFIC GRAVITY		
13.	SULFUR CONTENT		
14.	DIELECTRIC DISSIP ATION FACTOR (tend)		

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 mm<sup>2</sup>, conductor details 7/1.75 mm & 3000 m  $\pm$  2% per drum.
- ❖ 25 mm<sup>2</sup>, conductor details 19/1.32 mm & 3000 m  $\pm$  2% per drum.
- ❖ 50 mm<sup>2</sup>, conductor details 19/1.8 mm & 2000 m  $\pm$  2% per drum.
- ❖ 70 mm<sup>2</sup>, conductor details 19/2.1 mm & 2000 m  $\pm$  2% per drum.
- ❖ 95 mm<sup>2</sup>, 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 mm<sup>2</sup>    19/2.5 mm   & 2000 m  $\pm$  2% per drum.
- ❖ 70 mm<sup>2</sup>    19/2.1 mm   & 3000 m  $\pm$  2% per drum.
- ❖ 50 mm<sup>2</sup>    19/1.8 mm   & 3000 m  $\pm$  2% per drum.
- ❖ 35 mm<sup>2</sup>    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.

**COMMISSION of ELECTRICITY**  
**Planning and Studies division**  
**Baghdad – IRAQ**

<b>Specification NO.</b>	<b>D-4</b>
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**Technical Specification**  
**OF**  
**L.V POWER CABLE**

<b>REVISION</b>	<b>Year 2001</b>		
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## **1- SCOPE OF TENDER:**

This tender includes for the manufacturing, testing packing shipping delivery ex-works, FOB & C&F of (6.0/1K) (1.2/2kV).

## **2- GENERAL REQUIREMENTS:**

The material 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 of other conditions which may occur on the system provided that these variations are within the designed rating of the apparatus.

The material used shall be suitable for the following climate and soil condition.

### **2-1 Ambient temperature**

Highest maximum (in the shade) 55 C for about six hours a day.

Lowest minimum (-10) C.

Maximum yearly average (+30) C.

Maximum daily average (+40) C.

### **2-2 Sun temperature**

Black objects under sunshine attain a temperature of 80C.

### **2-3 Air humidity**

maximum 92% at 40 C

minimum 12%

yearly average 44%

### **2-4 Altitudes**

From sea level up to (1000 m)

## **3-TECHNICAL REQUIREMENT:**

### **3-1 System Data**

a. Nominal voltage	400 Volts
System	3phases, 4 wires with neutral solidly grounded.
Frequency	50 HZ

### **3-2 Standards**

the cable shall be in accordance with the latest issue of the I.E.C (particularly NOS502 & 228).

### **3-3 Deviations**

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

## **4-GENERAL CABLES CHARACTERISTICS:**

### **4-1 Conductor**



Non-compact electrolytic annealed stranded plain circular copper conductor of high conductivity 99-9% purity.

#### **4-2 Insulation**

Extruded PVC (polyvinyl chloride) according to I.E.C table.

#### **4-3 Core colours**

Coloured for phase identifications (Red, Yellow, blue for phase) and black neutral.

#### **4-4 Filler and Bedding**

The four core then laid up with suitable fillers to form a compact circular assembly and bedded with a layer of extruded P.V.C.

#### **4-5 Metallic Armour (for multi-core cables)**

The four cores then armoured with double galvanized steel tapes of thickness according to I.E.C clause 12.4.

Each tape layer shall be applied in open helix with the second tape covering the gap left by the first, the gap shall be more than 25% of tape width.

#### **4-6 PVC jacket (st2 table 4 in IEC 502)**

Over all extruded PVC sheath water proof grey colour of thickness according to IEC and across section marking of (400 Volts) in the Arabic language should be stamped each one meter cable length and chemically antitermite and pollution. Also name, year of manufacturing, voltage and cross-section in the Arabic language.

#### **4-7 Packing**

The required cable length are to be supplied on sea.

Worthy good quality drums of length as specified NO.5 below.

### **5-TYPES OF CABLES**

#### **5-1 Single core cable**

50mm<sup>2</sup>

5-1-2 70 mm<sup>2</sup>

5-1-3 95mm<sup>2</sup>

5-1-4 150mm<sup>2</sup>

5-1-5 240 mm<sup>2</sup>

For these cables the applicable paragraph are 4.1,4.2 and 4.6 on 250m length drums.

#### **5-2 Four core cables**

3x240+120mm<sup>2</sup>

3x150+70mm<sup>2</sup>

3x95+50mm<sup>2</sup>

3x70+35mm<sup>2</sup>

4x50mm<sup>2</sup>

4x25mm<sup>2</sup>

4x50mm<sup>2</sup>

For these cables, the applicable paragraphs are 4.1,4.2,4.3,4.4,4.5, and 4.6 for the cables from 240mm<sup>2</sup> to 95mm<sup>2</sup> on 250m good quality drums for cables from 50mm<sup>2</sup> to 16mm<sup>2</sup> on 1000m drums.

### **6- TECHNICAL INFORMATION:**

The tendered is requested to give the following information with the offer:

6-1 Resistance of copper per km of cable.

6-2 Inductance of copper per km of cable.

6-3 Capacitance of copper per km of cable.

6-4 Insulation resistance in M. ohms between core/screen.

6-5 Weight of copper per km of cable.

6-6 Overall weight per km of cable

6-7 Overall diameter of cable

6-8 Type of technical treatment against termite in outer sheath.

### **7-TESTS**

Cable shall be subjected to inspection and tests by our inspectors or international inspectors at any time during manufacturing. The manufacturers shall provide inspectors facilities for any said inspection shall be made at place of manufacturer or at international testing facilities.

<b>Specification NO.</b>	<b>D-09</b>
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**Technical Specification**  
**OF**  
**Outdoor L.V switchgear**  
**Pole - mounted**

<b>REVISION</b>	<b>Year 2012</b>		
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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 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 items 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 leave 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 wharves 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 manufacturer 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 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.

### **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 on 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	100A 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			

**Commission of Electricity**

**Planning & studies Division**

**Baghdad –**

**IRAQ**

Specification NO.	<b>D-24</b>
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**Technical Specification  
For  
Porcelain Insulators**

Revision	Year 2001	
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### **33 & 11 KV PORCELAIN TYPE INSULATORS WITH ACCESSORIES**

#### **1- SCOPE OF THE TENDER:**

Tenderers are invited for the design manufacture testing and supply of the fitting and accessories for: -

- ❖ L.T shackles insulators.
- ❖ 12 kv brown glazed porcelain pin insulator with spindle.
- ❖ 12 kv disc insulator with tension string.
- ❖ 36 kv brown glazed porcelain pin insulator with spindle.

#### **2- GENERAL REQUIREMENTS:**

The equipment shall be of first class quality and designed for continuous 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) | 50 C° for about 6 hours a day |
| - Lowest minimum                 | - 10 C°                       |
| - Max. Yearly average            | + 30 C°                       |
| - Max. Daily average             | + 30 C°                       |

##### **2-2 Sun temperature:**

Black object under direct

attain a temperature of + 75 C°

Sun shin

##### **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.

## 11 & LOW TENSION INSULATORS AND ACCESSORIES SPECIFICATIONS

1.a 12 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 mm<sup>2</sup>. Overall diameter (15.5) mm.

1.b Galvanized steel spindles for item 1.a.

The minimum height shall not be less than 125 mm & 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 & nuts. As it illustrated in table (1) attached.

2.a As for (1.a) but for 36 KV, 50 HZ & grooves for 210/35 mm<sup>2</sup>. Overall diameter (20.3) mm.

2.b As for (1.b) but for the 36 KV. Pin insulators. As it illustrated in table (2) attached.

3.a L.T (600 V) brown glazes shackle insulators having conductor groove of 15mm.

3.b D-bracket & accessories for item 3.a complete with all necessary bolts (16 x 120), nuts & washers.

3.c Hexagon head deck bolt. (16 x 180) to be used with item 3.b.

4. 12 KV discs insulator brown glazed porcelain ball & socket type coupling suitable combined mechanical & electrical strength.

The dimensions, electrical and mechanical withstand specification of (12 & 35) kv pin insulators, (0.6kv) shackle insulator and (12 kv) disc insulator is as stated her below in the table (No.3)

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

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

## 5. Technical specification of disc insulator accessories

### 5.1 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).

### 5.2 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.

### 5.3 Strain & suspension clamps

5.3.1 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 of the 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).

5.3.2 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).

5.3.3 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 of the 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).

#### N. B:

1. All the insulators & accessories shall be in accordance with the latest IEC or equivalent standard which must be stated together with a copy of standard spec.
2. Samples are required with the offers.

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

<b>Specification No.</b>	<b>D 46-</b>
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**TECHNICAL SPECIFICATION  
OF  
LATTICE STEEL POLES**

<b>REVISION</b>	<b>YEAR 2001</b>	<b>YEAR 2009</b>	<b>YEAR 2012</b>
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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	$\text{Kg f/mm}^2$ (min)	51	52	52
Yield strength	$\text{Kg f/mm}^2$ (min)	36	36	34.5
Design bending stress	$\text{Kg f/mm}^2$ (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 then (5%) of the quantity of each batch, taking into consideration that eccentricity between top and bottom part of the pole shell 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**

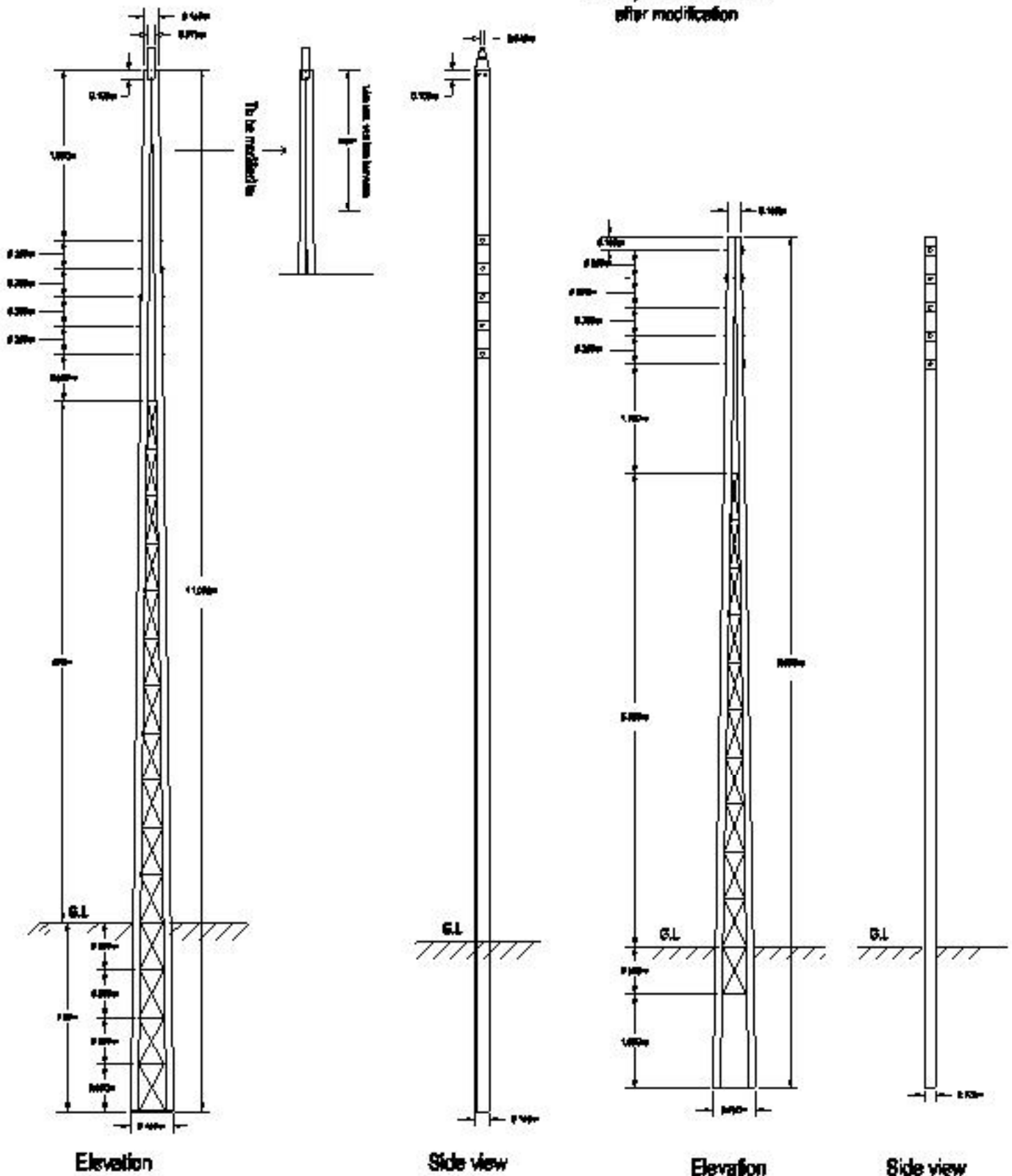
The cross-arm shall be used to support insulators carrying bare copper or aluminum conductors on the medium voltage poles (11 m) they are to be made of section (channel steel) (ST-41), (ST-42) , (ST-44) or any equiv. Flat steel, bolts, nuts and washers according to (JIS-G-3101 and JIS-G-1186) or equivalent 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.

Note: accessories on the top  
of the pole are the same  
after modification



11m Lattice poles

Elevation

Side view

9m Lattice poles

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)

Bolts: JIS B 1180 BL

Galvanization: bolts, nuts electrogalvanized

All steel, Hot dip galvanized to SS 728

Drawing no. (1)

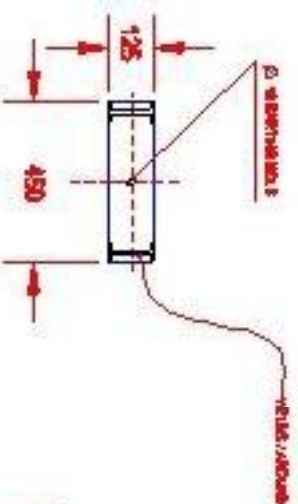




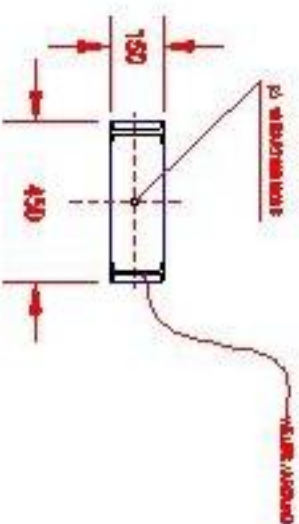




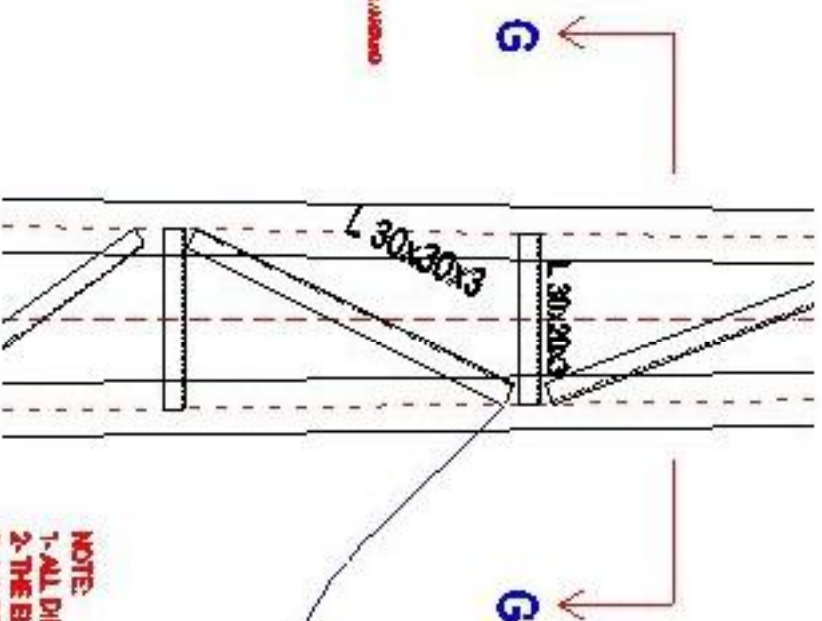
**VIEW G-G**



**SECTION E-E**

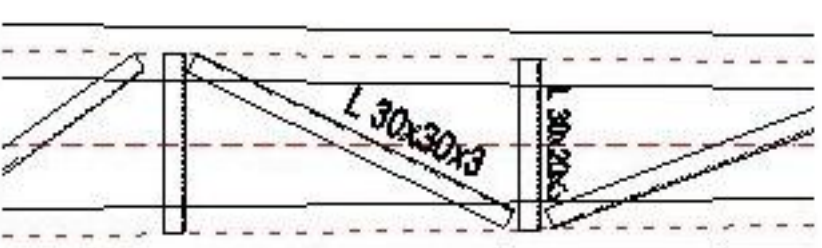


**SECTION A-A**



**FRONT ELEVATION**

**ALL BRACES WELDING**



**BACK ELEVATION**

**NOTE:**

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



**Electricity Commission**  
**Planning and Studies Division**  
**Baghdad – IRAQ**

Specification No	D- 25
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**11 kv**  
**EXPULSION FUSE**  
**CUTOUTS TECHNICAL**  
**SPECIFICATION**

Revision	Year 2001		
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## 11 KV and 33 KV

### EXPULSION FUSE CUTOUTS TECHNICAL SPECIFICATION

#### SCOPE OF TENDER

This tender includes for the manufacturing. Testing. Packing .delivery CIF Baghdad of outdoor type 11 kv and 33 kv expulsion fuse cutouts

#### 1- General requirments

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 satis factorly 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 fuse cutouts shall be designed to work at it rated performance at the following climatic conditions.

#### 2- Climatic conditions

##### 2.1 –Ambient temprature

Max 55 C

Min - 10

Black object exposed to direct solar radation shall attain atemperature of 80C

##### 2.2 Relative humidity

Max 95%

Min 10%

##### 2.3- Altitude : 1000 m A.S.L

##### 2.4 Sand storms

The equipments shall be suitable for outdoor installation subgeted to strong frequent sand storms and heavily polluted atmosphere.

### 3- Technical requirements

#### 3-1- construction .

The expulsion fuse cutout shall be designed As a single pole outdoor type suitable for pole mounting on cross arms. Therefore it shall be supplied complete 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 with IEC 282 .

The rating of both 33 and 11 kv fuses cutouts shall be 100 A.

#### 3-2 system data

- Nominal voltage (KV )	11	33
- Highest system voltage (KV)	12	36
- Frequency(HZ)	50	50
- Symetrical short circuit current ( KA)	25	25
- Condition of neutral point	isolated	earthed

#### 3.3 – Standards

All equipments and accessories shall be manufactured in accordance with the latest publications of IEC standards.

#### 3-4 – Deviations

The tenderer shall particularly mention in his tender any deviation from this specification

## 4- TESTS

All type and routine tests prescribed in relevant IEC standards shall be carried out by the manufacturer . test certificates for identical equipments should be included with the offer.

## 5- 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 .

The method of packing shall be such as to protect all of the items 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 item leaves the factory until finally installed during which time . the apparatus will travel by rail . by long sea voyage again by rail or truck to the site or store.

<b>Note: For spare element fuse</b>
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