

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

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

Revision	Year 2015
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1.0 SCOPE

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

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

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

2.0 GENERAL REQUIREMENTS

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

2.1 Ambient temperature:

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

2.2 Temperature under sun:

Black object under direct Sun shine attain a temperature of + 80 C°

2.3 Air humidity:

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

2.4 Altitudes:

From sea level up to 1000 m

2.5 Dust storms:

The materials are subjected to strong & frequent dust storms.

3.0 APPLICABLE CODES AND STANDARDS

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

IEC

International Electrotechnical Commission

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

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

ANSI **American National Standards Institute**

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

ASTM **American Society for Testing & Materials**

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

BS **British Standards Institute**

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

4.0 MV, LV INSULATORS AND ACCESSORIES SPECIFICATIONS

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

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

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

4.7 Technical specification of disc insulator accessories

4.7.1 Ball eyes

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

4.7.2 Socket eyes

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

4.7.3 Strain & suspension clamps

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

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

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

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

Note:

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

5.0 Marking

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

6.0 TESTING AND INSPECTION

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

6.1 Type Tests

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

6.2 Routine Tests

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

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

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

6.4 Special Tests

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

6.5 Inspection

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

7.0 PACKING AND SHIPMENT

Packing and shipping of the insulators shall conform the following:

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

8.0 GUARANTEE

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

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

9.0 SUBMITTALS

9.1 Submittals required with tender:

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

9.1.2 Detailed dimensional drawing of insulators.

9.1.3 Type test certificates.

9.1.4 Catalogues.

9.2 Submittals required following award of contract are given below.

9.2.1 Manufacturing schedule, progress report and test schedule.

9.2.2 Test reports

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

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