MATERIAL SPECIFICATION CELL

TECHNICAL SPECIFICATION

OF

11 KV 45 KN AND 11 KV 70 KN

PORCELAIN DISC INSULATORS

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1.0 SCOPE

This Specification covers the manufacture, testing, works supply and delivery of 11 kV 45 kN & 11 kV 70 kN Porcelain Disc Insulators. These Porcelain Insulators shall conform to IS 731-1971 amended upto date. Insulators shall be of Ball & Socket Type.

2.0 SERVICE CONDITIONS

The Insulators to be supplied against this Specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

Environmental Conditions

a)	Maximum ambient temperature	50^0 C
b)	Maximum ambient temperature in shade	45^0 C
c)	Minimum temperature of air in shade	35^0C
d)	Maximum daily average Temperature	40^0C
e)	Maximum yearly weighted average Temperature	32^0C
f)	Relative Humidity	10 to 100 %
g)	Maximum Annual rainfall	1450 mm
h)	Maximum wind pressure	150 Kg/m^2
i)	Maximum wind velocity	45 km/hour
j)	Maximum altitude above mean sea level	1000 meters
k)	Isoceraunic level	50 days/year
l)	Seismic level (Horizontal acceleration)	0.3 g

m) Climate: Moderately hot and humid tropical climate conducive to rust and fungus growth.

3.0 SYSTEM PARTICULARS

a)	Nominal System Voltage	11 kV
b)	Corresponding Highest system Voltage	12 kV
c)	Frequency	50 Hz with 3% tolerance
d)	Number of Phases	3
e)	Neutral earthing	Effectively grounded
f)	Min. Impulse Withstand Voltage	75 kV (Peak)

4.0 APPLICABLE STANDARDS

Unless otherwise specified elsewhere in this Specification, the Insulators shall conform to the IS 731-1971 amended upto date & other relevant standards amended up to date. The standards are listed in Annexure-I.

5.0 GENERAL REQUIREMENTS

5.01 The Porcelain Insulators shall generally conform to IS 731-1971 amended upto date.

5.02 Conductors

The Disc Insulators will be used on lines on which the conductors will be A.A.A. Conductor of size up to 200 Sq. mm. and ACSR of any size up to Panther (0.2 sq. inch Copper equivalent). The Insulators should withstand the conductor tension, the reversible wind load as well as the high frequency vibrations due to wind.

5.03 Type

5.03.1 Insulator shall be suitable for both the suspension and strain type of load. Insulators shall be of Ball and Socket type. The Insulators shall conform to Type 'B' of IS 731-1971 amended upto date.

5.03.2 Diameter of Porcelain Disc Insulators shall be 255mm except for 70kN Anti fog type Disc Insulators. Diameter of 70 kN Anti fog type Disc Insulators shall be 280 mm. The center to center distance between Ball & Socket shall be 145mm.

5.03.3 Insulator Ends

Disc Insulators shall have `Ball and Socket' ends. The Security clips ("W" Clips) will have to be provided as per IS 2486 (Part-3) 1974 (amended up to date).

5.03.4 The colour of the units shall be brown for 45 kN Disc Insulators & Greenish for 70 kN Disc Insulators for identification.

5.03.5 The number of units to be used both on suspension and tension strings shall be as given below :

Voltage Class	Suspension Single	Strings Double	Tension Single	Strings Double
33	3	3×2	3	3×2
22	2	2×2	2	2×2
11	1	1×2	1	1×2

5.04 Mechanical & Electromechanical Strength

The mechanical and electromechanical strength of the individual and the complete Disc shall be as specified below. The Ball & Socket will generally conform to IS 2486 (Part-2)-1989 amended upto date.

Failing Load (kN)	Pin Balls (mm)	Socket (mm)
45	16	16
70	16	16

The accuracy and Alternative `B' of these shall be checked with the corresponding `GO' and `NOT GO' gauge.

5.05 Creepage Distances

The minimum creepage distance for each Disc Insulator shall as mentioned below.

Voltage (kV)	Min. Creepage Distance (mm)		Min. Creepage Distance (mm)	
11 kV	45 kN		70 kN	
	Normal	Antifog	Normal	Antifog
	230 mm	320 mm	320 mm	430 mm

5.06 Interchangability

The Insulator together with the Ball and Socket fittings shall be of standard design suitable for use with the hardware of any other indigenous make conforming to relevant standards referred above.

6.0 MATERIAL QUALITY AND WORKMANSHIP

The quality of Porcelain material, hardware shall be of the highest grade and best workmanship such as, is suitable and customary for extra high tension lines and shall conform to current IS or IEC.

The porcelain shall be sound, free from defect, thoroughly vitrified and smoothly glazed.

Unless otherwise specified the glaze shall cover all exposed Porcelain parts of the Insulator.

Glazing shall be uniform and free from defects. Small and isolated defects in the Insulator glaze of a total surface less than 0.5 sq.cm. will however be ignored. Deviation on this account may be supported by relevant IS.

7.0 MECHANICAL DESIGN

The design shall be such that stresses due to expansion and contraction in any part of Insulator shall not lead to deterioration.
Cement used in manufacture of the Insulators shall not cause fracture due to expansion or loosening due to contraction.

8.0 TESTS

Suitable number of individual units and complete string shall be subjected to the following Tests in accordance with IS 731-1971 with its latest amendments.

8.01 **TYPE TESTS**

The following Type Tests shall be carried out on offered Porcelain Insulators as specified in IS 731-1971 amended upto date.

i)Visual Examination
ii)Verification of dimensions
iii)Visible Discharge Test
iv)Impulse Voltage Withstand Test
v)Impulse Flashover Voltage Test
vi)Wet One Minute Power Frequency Voltage Withstand Test
vii)Wet Flashover Voltage Test
viii)Temperature Cycle Test
ix)Electromechanical Failing Load Test
x)Mechanical Performance Test & Thermal Mechanical Performance Test
xi)Power Frequency Puncture Test
xii)Porosity Test
xiii)Galvanizing Test

All the above Type Tests shall be carried out as per IS 731-1971 amended upto date at laboratories which are accredited by the National Accreditation Board of Testing and Calibration Laboratories (NABL) of Govt. of India. These Type Tests should have been carried out within five years prior to the date of opening of the Tender.

The Tenderer shall submit all the Type Test reports as per IS 731-1971 amended upto date to the office of the Chief Engineer (Testing & QC) and get it approved as per Tender conditions.

8.02 ACCEPTANCE TESTS

The test samples after having withstood the routine test shall be subjected to the following acceptance tests in order as indicated in IS 731-1971 amended upto date.

i)Verification of dimensions
ii)Temperature Cycle Test
iii)Mechanical Performance Test & Thermal Mechanical Performance Test
iv)Electromechanical Failing Load Test
v)Power Frequency Puncture Test
vi)Porosity Test
vii)Galvanizing Test

8.03 ROUTINE TESTS

i)Visual Examination
ii) Mechanical routine Test
iii)Electrical routine Test

9.0 TESTING FACILITIES

The tenderer shall clearly indicate what testing facilities are available in the works of manufacturer & whether testing facilities are adequate to carry out all Acceptance and Routine Tests. These facilities should be available to MSEDCL's Engineers if deputed or carry out or witness the tests in the manufacturer works. If any test cannot be carried out at the manufacturer's work, the reasons should be clearly stated in the tender. The Insulators shall be tested in accordance with the procedure detailed in IS 731-1971 amended up to date.

10.0 DRAWINGS

The tenderer shall submit the detailed drawings showing the dimensions of the individual Disc, Ball & Socket, complete strings giving all the design dimensions of various component parts. The drawing for Insulators should clearly show the method of cementing the Porcelain to the metal caps and balls. Generally it shall be as per IS.

The tenderer shall furnish above drawing to the office of Chief Engineer (Testing & QC) and get it approved as per tender conditions.

11.0 INSPECTION

The inspection may be carried out by the MSEDCL at any stage of manufacture. The successful tenderer shall grant free access to the MSEDCL's representative at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the MSEDCL, shall not relieve the supplier of his obligation of furnishing equipment in accordance with the Specification and shall not prevent subsequent rejection if the equipment is found to be defective. The supplier shall keep the MSEDCL informed in advance, about the manufacturing programme so that arrangement can be made for inspection.

12.0 RETEST & REJECTION

12.01 **C-2.1** Sample Procedure for testing of Insulators shall be as per Appendix 'C' of IS 731-1971 for Acceptance & Routine Tests.

All the Insulators selected at random according to col. 1 & 2 of Table 5 of IS-731-1971 shall be subjected to dimensions and temperature cycle tests. The Insulators failing to satisfy either of the requirements shall be termed as defectives. The lot shall be considered as conforming to these requirements if the number of defectives found in the sample is less than or equal to corresponding acceptance number given in col. 4 of Table 5. The lot shall be rejected if the number of defectives in the same lot is greater than or equal to the first rejection number (r_1) given in col. 5.

If the number of defectives is between the acceptance number and the first rejection number, a second sample of the same size (see col. 3 of Table 5) shall be selected from the lot at random and subjected to these tests. The number of defectives in the first sample and second sample shall be combined. If the combined number of defectives is less than the second rejection number (r_2) given in col. 6 of Table 5, the lot shall be considered as confirming to these requirements. Otherwise the lot shall be rejected without further testing.

C-2.2 The lot which has been found as confirming to the above requirements shall then be divided into two parts, as shown in col. 7 and 9 of Table 5. The number of Insulators to be tested for mechanical, electromechanical and porosity tests shall be in accordance with col. 7 of Table 5. The lot shall be considered as confirming to these requirements if no defective is found in the sample and shall be rejected if there are two or more defectives. If there is one defective, a second sample of the same size (see col.8 of Table 5) shall be selected at random and subjected to the tests. The lot shall be considered as confirming to these requirements if no defective is found in the second sample; otherwise the lot shall be rejected without further testing.

C-2.3 The lot which has been found as confirming to the above requirements of C-2.1 shall then be tested for galvanizing test and puncture test. For this purpose, the sample size is given in col. 9 of Table 5. The lot shall be considered as confirming to these requirements if no defective is found in the sample and shall be rejected if two or more defectives are found in the sample. If there is one defective, a second sample of the same size (see col. 10 of Table 5) shall be selected at random and subjected to the tests. The lot shall be considered as confirming to these requirements if no defective is found in the second sample; otherwise the lot shall be rejected without further testing.

C-2.4 The lot shall be considered as conforming to the requirements of acceptance tests if conditions in C-2.1, C-2.2 and C-2.3 are satisfied.

13.0 MARKING :

13.01 Each Insulator shall be legibly and indelibly marked to show the following :

i)Name or Trademark of manufacturer
ii)Highest System Voltage & Type
iii)Month & Year of manufacture
iv)Electromechanical Strength in kN
v)MSEDCL marking
vi)Country of manufacture

13.02 The "W" Clip shall be marked with/punched with the Ball and Socket sizes for which it is meant e.g.16B,20 etc.

13.03 Marking on Porcelain shall be printed and shall be applied before firing.

14.0 PACKING

All Insulators shall be packed in crates or boxes suitable for rough handling. Packing shall be marked with the strength and kV rating.

15.0 SCHEDULE:

The tenderer shall fill in the following Schedule which form part of tender Specification & offer. If the schedule is not submitted duly filled in with the offer, the offer shall be liable for rejection.

SCHEDULE 'A' – GUARANTEED TECHNICAL PARTICULARS

ANNEXURE-I

LIST OF APPLICABLE STANDARDS

Sr. No.	Particulars	MSEDCL Requirement
1.	Porcelain Insulators for overhead power lines with a nominal voltage greater than 1000 V	IS 731-1971
2.	Metal fittings of Insulators for overhead power lines – General requirements & Tests	IS 2486 (Part-1) - 1993
3.	Dimensional Requirements for Insulators fittings	IS 2486 (Part-2) - 1989
4.	Locking devices	IS 2486 (Part-3) - 1974
5.	Test for locking devices	IS 2486 (Part-4) - 1981
6.	Method of High Voltage Testing	IS 2071 (Part -1, 2 & 3)
7.	Dimensions of Disc Insulators	IS 3188 - 1980
8.	Methods for Testing uniformity of coating of zinc coated articles	IS 2633 - 1986
9.	Zinc ingot Specification	IS 209 -1992

GUARANTEED TECHNICAL PARTICULARS REQUIREMENTS

Sr. No.	Particulars	11 kV 45 kN Normal	11 kV 45 kN Anti fog	11 kV 70 kN Normal	11 kV 70 kN Anti fog
		230 mm	320 mm	320 mm	430 mm
1.	Working Voltage	11 kV	11 kV	11 kV	11 kV
2.	Highest System Voltage	12 kV	12 kV	12 kV	12 kV
3.	Impulse Withstand Voltage kV (Peak)	75 kV(Peak)	75 kV(Peak)	75 kV(Peak)	75 kV(Peak)
4.	Impulse flashover voltage kv (Peak) (+ve 1.2/50 wave)	95 kV(Peak)	95 kV(Peak)	95 kV(Peak)	95 kV(Peak)
5.	Impulse flashover voltage kv (Peak) (-ve 1.2/50 wave)	95 kV(Peak)	95 kV(Peak)	95 kV(Peak)	95 kV(Peak)
6.	Dry 1 min. power frequency withstand Voltage kV(rms)	35 kV(rms)	35 kV(rms)	35 kV(rms)	35 kV(rms)
7.	Wet 1 min. power frequency withstand Voltage kV(rms)	35 kV(rms)	35 kV(rms)	35 kV(rms)	35 kV(rms)
8.	Puncture withstand Voltage kV(rms)	105 kV(rms)	105 kV(rms)	105 kV(rms)	105 kV(rms)
9.	Minimum Failing Load (kN)	45 kN	45 kN	70 kN	70 kN
10.	Min. Creepage Distance (mm)	230 mm	320 mm	320 mm	430 mm
11.	Center to center distance between 'Ball & 'Socket' (mm)	145 mm	145 mm	145 mm	145 mm
12.	Diameter of Disc Insulator (mm)	255 mm	255 mm	255 mm	280 mm
13.	Diameter of Ball & Socket (mm)	16 mm	16 mm	16 mm	16 mm
14.	Colour of Disc Insulator	Brown	Brown	Greenish	Greenish

SCHEDULE – 'A'

GUARANTEED TECHNICAL PARTICULARS
11KV 45KN PORCELAIN B&S DISC INSULATOR (NORMAL TYPE)
(MIN. CD 230MM)

Sr. No.	Particulars	MSEDCL Requirement	To be offered by Bidder
1.	Name of Manufacturer	Mfg to give details	Text
2.	Works address	Mfg to give details	Text
3.	Type of Insulator	Type B	Text
4.	Material used for Insulator housing	Porcelain	Text
5.	Colour of Disc Insulator	Brown	Text
6.	Diameter of Disc Insulator (mm)	255 mm	Text
7.	Center to center distance between Ball & Socket (mm)	145 mm	Text
8.	Diameter of Ball & Socket (mm)	16 mm	Text
9.	Creepage distance minimum (mm)	230 mm (min.)	Text
10.	Minimum Failing Load (kN)	45 kN	Text
11.	Working Voltage (kV)	11 kV	Text
12.	Highest System Voltage (kV)	12 kV	Text
13.	Impulse Withstand Voltage kV (Peak)	75 kV (Peak)	Text
14.	Impulse flashover Voltage kV (Peak) (+ ve 1.2/50 wave)	95 kV (Peak)	Text
15.	Impulse flashover Voltage kV (Peak) (- ve 1.2/50 wave)	95 kV (Peak)	Text
16.	Dry 1 min. power frequency withstand Voltage kV (rms)	35 kV (rms)	Text
17.	Wet 1 min. power frequency withstand Voltage kV (rms)	35 kV (rms)	Text
18.	Puncture Withstand Voltage kV (rms)	105 kV (rms)	Text
19.	Approximate Weight of single Disc (kg)	Mfg. to give details	Text
20.	No. of Insulators per crate	Mfg. to give details	Text
21.	Packed wt. of each crate (kg)	Mfg. to give details	Text

SCHEDULE – 'A'

GUARANTEED TECHNICAL PARTICULARS
11KV 45KN PORCELAIN B&S DISC INSULATOR (ANTIFOG TYPE)
(MIN. CD 320MM)

Sr. No.	Particulars	MSEDCL Requirement	To be offered by Bidder
1.	Name of Manufacturer	Mfg to give details	Text
2.	Works address	Mfg to give details	Text
3.	Type of Insulator	Type B	Text
4.	Material used for Insulator housing	Porcelain	Text
5.	Colour of Disc Insulator	Brown	Text
6.	Diameter of Disc Insulator (mm)	255 mm	Text
7.	Center to center distance between Ball & Socket (mm)	145 mm	Text
8.	Diameter of Ball & Socket (mm)	16 mm	Text
9.	Creepage distance minimum (mm)	320 mm (min.)	Text
10.	Minimum Failing Load (kN)	45 kN	Text
11.	Working Voltage (kV)	11 kV	Text
12.	Highest System Voltage (kV)	12 kV	Text
13.	Impulse Withstand Voltage kV (Peak)	75 kV (Peak)	Text
14.	Impulse flashover Voltage kV (Peak) (+ ve 1.2/50 wave)	95 kV (Peak)	Text
15.	Impulse flashover Voltage kV (Peak) (- ve 1.2/50 wave)	95 kV (Peak)	Text
16.	Dry 1 min. power frequency withstand Voltage kV (rms)	35 kV (rms)	Text
17.	Wet 1 min. power frequency withstand Voltage kV (rms)	35 kV (rms)	Text
18.	Puncture Withstand Voltage kV (rms)	105 kV (rms)	Text
19.	Approximate Weight of single Disc (kg)	Mfg. to give details	Text
20.	No. of Insulators per crate	Mfg. to give details	Text
21.	Packed wt. of each crate (kg)	Mfg. to give details	Text

SCHEDULE – 'A'

GUARANTEED TECHNICAL PARTICULARS
11KV 70KN B&S PORCELAIN DISC INSULATOR (NORMAL TYPE)
(MIN. CD 320MM)

Sr. No.	Particulars	MSEDCL Requirement	To be offered by Bidder
1.	Name of Manufacturer	Mfg to give details	Text
2.	Works address	Mfg to give details	Text
3.	Type of Insulator	Type B	Text
4.	Material used for Insulator housing	Porcelain	Text
5.	Colour of Disc Insulator	Brown	Text
6.	Diameter of Disc Insulator (mm)	255 mm	Text
7.	Center to center distance between Ball & Socket (mm)	145 mm	Text
8.	Diameter of Ball & Socket (mm)	16 mm	Text
9.	Creepage distance minimum (mm)	320 mm (min.)	Text
10.	Minimum Failing Load (kN)	70 kN	Text
11.	Working Voltage (kV)	11 kV	Text
12.	Highest System Voltage (kV)	12 kV	Text
13.	Impulse Withstand Voltage kV (Peak)	75 kV (Peak)	Text
14.	Impulse flashover Voltage kV (Peak) (+ ve 1.2/50 wave)	95 kV (Peak)	Text
15.	Impulse flashover Voltage kV (Peak) (- ve 1.2/50 wave)	95 kV (Peak)	Text
16.	Dry 1 min. power frequency withstand Voltage kV (rms)	35 kV (rms)	Text
17.	Wet 1 min. power frequency withstand Voltage kV (rms)	35 kV (rms)	Text
18.	Puncture Withstand Voltage kV (rms)	105 kV (rms)	Text
19.	Approximate Weight of single Disc (kg)	Mfg. to give details	Text
20.	No. of Insulators per crate	Mfg. to give details	Text
21.	Packed wt. of each crate (kg)	Mfg. to give details	Text

SCHEDULE – 'A'

GUARANTEED TECHNICAL PARTICULARS
11KV 70KN B&S PORCELAIN DISC INSULATOR (ANTIFOG TYPE)
(MIN. CD 430MM)

Sr. No.	Particulars	MSEDCL Requirement	To be offered by Bidder
1.	Name of Manufacturer	Mfg to give details	Text
2.	Works address	Mfg to give details	Text
3.	Type of Insulator	Type B	Text
4.	Material used for Insulator housing	Porcelain	Text
5.	Colour of Disc Insulator	Brown	Text
6.	Diameter of Disc Insulator (mm)	280 mm	Text
7.	Center to center distance between Ball & Socket (mm)	145 mm	Text
8.	Diameter of Ball & Socket (mm)	16 mm	Text
9.	Creepage distance minimum (mm)	430 mm (min.)	Text
10.	Minimum Failing Load (kN)	70 kN	Text
11.	Working Voltage (kV)	11 kV	Text
12.	Highest System Voltage (kV)	12 kV	Text
13.	Impulse Withstand Voltage kV (Peak)	75 kV (Peak)	Text
14.	Impulse flashover Voltage kV (Peak) (+ ve 1.2/50 wave)	95 kV (Peak)	Text
15.	Impulse flashover Voltage kV (Peak) (- ve 1.2/50 wave)	95 kV (Peak)	Text
16.	Dry 1 min. power frequency withstand Voltage kV (rms)	35 kV (rms)	Text
17.	Wet 1 min. power frequency withstand Voltage kV (rms)	35 kV (rms)	Text
18.	Puncture Withstand Voltage kV (rms)	105 kV (rms)	Text
19.	Approximate Weight of single Disc (kg)	Mfg. to give details	Text
20.	No. of Insulators per crate	Mfg. to give details	Text
21.	Packed wt. of each crate (kg)	Mfg. to give details	Text