

MATERIAL SPECIFICATION CELL

TECHNICAL SPECIFICATION
OF

11KV, 22KV & 33KV PORCELAIN PIN INSULATORS

TECHNICAL SPECIFICATION OF 11KV, 22KV & 33KV PORCELAIN PIN INSULATORS

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1.0 SCOPE

This Specification covers the manufacture, testing and works supply and delivery of 11 kV, 22 kV & 33 kV Pin Insulators. The Insulators shall be Porcelain type Pin Insulators.

- 1.1** Bidder must be an indigenous manufacturer and supplier of Porcelain type Insulators of ratings 33 kV or above or must have developed proven in house technology and manufacturing process for Porcelain type Insulators of above rating or possess technical collaboration/association with a manufacturer of Porcelain type Insulators of ratings 33 kV or above. The bidder shall furnish necessary evidence in support of the above along with the bid, which can be in the form of certification from the utilities concerned, or any other documents to the satisfaction of the MSEDCL.

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° C |
| b) Maximum ambient temperature in shade | 45° C |
| c) Minimum temperature of air in shade | 35° C |
| d) Maximum daily average Temperature | 40° C |
| e) Maximum yearly weighted average Temperature | 32° C |
| 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, 22 kV, 33kV |
| b) Corresponding highest System Voltage | 12 kV, 24 kV, 36 kV |
| c) Frequency | 50 Hz with 3% tolerance |
| d) Number of Phases | 3 |
| e) Neutral earthing | Effectively grounded |
| f) Min. Impulse withstand voltage | 75 kVp, 125 kVp, 170kVp |

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. The Insulators shall conform to type 'B' of IS 731-1971.

5.02 Conductors

The Pin Insulators will be used on lines on which the conductors will be A.A.A. Conductor 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 set up to due to wind.

5.03 Design Specification

5.03.1 The Porcelain Pin Insulators shall conform to the provisions of IS 731-1971 amended upto date. The Pin Insulators shall be suitable for the spindle detailed below.

| Pin Insulator | Suitable for head | Shank Dia. | Remarks |
|---------------|--|------------|--|
| 11 kV | Small head as per Fig. 1 A of IS 2486 (Part 2) -1989 or latest version | 20 mm | Lead thimbles suitable for the Pin heads shall be provided |
| 22 kV & 33 kV | Large head as per Fig. 1 B of IS 2486 (Part 2) -1989 or latest version | 24 mm | Lead thimbles suitable for the Pin heads shall be provided |

For H. T. Pin Insulators, the top and neck of the Insulators should have dimensions as shown in the indicative Drawing enclosed herewith.

5.03.2 Strength

For Pin Insulators of 11 kV the minimum failing load shall be 5 kN and for 22 kV and 33 kV the minimum failing load shall be 10 kN.

5.03.3 Creepage Distance

The minimum Creepage Distance shall be those given below.

| Insulators | Min. Creepage Distance (mm) |
|---------------------|-----------------------------|
| 11 kV Pin Insulator | 320 mm |
| 22 kV Pin Insulator | 560 mm |
| 33 kV Pin Insulator | 840 mm |

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6.0 MATERIAL QUALITY AND WORKMANSHIP

The quality of Porcelain material, hardware shall be of the highest grade & 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 and brown in colour.

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

Following Tests shall be carried out on offered Porcelain Pin Insulators in accordance with IS 731-1971 amended upto date.

8.01 TYPE TESTS

The following Type Tests shall be carried out on offered Porcelain Pin Insulators & the tests shall conform to the requirements as per Table 1A & as per Clause No. 10.1.1 of IS 731-1971 amended upto date.

- i) Visual Examination
- ii) Verification of dimensions
- iii) Visible Discharge Test
- iv) Impulse Voltage Withstand Test
- v) Wet One minute Power Frequency Voltage Withstand Test
- vi) Temperature Cycle Test
- vii) Mechanical Failing Load Test
- viii) Power Frequency Puncture Test
- ix) Porosity 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 to the office of the Chief Engineer (Testing & QC) and get it approved as per Tender conditions.

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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 Clause No. 10.1.2 of IS 731-1971 amended upto date.

- i) Verification of dimensions
- ii) Temperature Cycle Test
- iii) Mechanical Failing Load Test
- iv) Power Frequency Puncture Test
- v) Porosity Test

8.03 ROUTINE TESTS

Following Routine tests shall be made on every Porcelain Pin Insulator as per Clause No. 10.1.3 of IS 731-1971 amended upto date.

- i) Visual Examination
- ii) Electrical routine Test

9.0 TESTING FACILITIES

The tenderer shall clearly indicate what testing facilities are available in the works of manufacturers & whether testing facilities are adequate to carry out all Acceptance & 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 with dimensions for each ratings of Pin Insulators i.e. 11kV, 22kV & 33kV. The Bidder shall furnish full description and illustration of the material offered.

The tenderer shall furnish the 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 requirements shall be termed as

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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) Min. Failing Load in kN
- v) MSEDCL marking
- vi) Country of manufacture

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

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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

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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. | Methods of Random Samplings | IS 731-1971 |
| 5. | Method of High Voltage Testing | IS 2071 (Part -1, 2 & 3) |

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GUARANTEED TECHNICAL PARTICULARS REQUIREMENTS

| Sr. No. | Particulars | Porcelain Pin Insulators | | |
|---------|---|--------------------------|---------------|---------------|
| | | 11 kV | 22 kV | 33 kV |
| 1. | Working Voltage | 11 kV | 22 kV | 33 kV |
| 2. | Highest System Voltage | 12 kV | 24 kV | 36 kV |
| 3. | Impulse Withstand Voltage kV (Peak) | 75 kV (Peak) | 125 kV (Peak) | 170 kV (Peak) |
| 4. | Wet 1 min. power frequency withstand Voltage kV (rms) | 35 kV (rms) | 55 kV (rms) | 75 kV (rms) |
| 5. | Puncture withstand Voltage kV (rms) | 105 kV (rms) | 140 kV(rms) | 180 kV (rms) |
| 6. | Minimum Failing Load (kN) | 5 kN | 10 kN | 10 kN |
| 7. | Min. Creepage Distance (mm) | 320 mm | 560 mm | 840 mm |
| 8. | Colour of Disc Insulator | Brown | Brown | Brown |

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SCHEDULE – ‘A’

**GUARANTEED TECHNICAL PARTICULARS
11KV PORCELAIN PIN INSULATOR**

| 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. | Standard according to which the Insulators manufactured & tested | IS 731-1971 amended upto date | Text |
| 5. | Name of material used in manufacture of the Insulator with grade | Highest grade Porcelain material | Text |
| 6. | Colour of Pin Insulator | Brown | Text |
| 7. | Diameter of first outer shell (mm) | Mfg. to give details | Text |
| 8. | Diameter of second middle shell (mm) | Mfg. to give details | Text |
| 9. | Diameter of third lower shell (mm) | Mfg. to give details | Text |
| 10. | Height of Insulator (mm) | Mfg. to give details | Text |
| 11. | Minimum Failing Load (kN) | 5 kN | Text |
| 12. | Min. creepage distance (mm) | 320 mm (min.) | Text |
| 13. | Suitable for shank diameter (mm) | 20 mm | Text |
| 14. | Net weight of Single Pin Insulator | Mfg. to give details | Text |
| 15. | Nominal System Voltage (kV) | 11 kV | Text |
| 16. | Highest System Voltage in kV | 12 kV | Text |
| 17. | Dry 1 min. power frequency withstand Voltage kV (rms) | Mfg. to give details | Text |
| 18. | Wet 1 min. power frequency withstand Voltage kV (rms) | 35 kV rms | Text |
| 19. | Dry flashover Voltage kV (rms) | Mfg. to give details | Text |
| 20. | Wet flashover Voltage kV (rms) | Mfg. to give details | Text |
| 21. | Dry lighting Impulse Withstand Voltage (Positive) kV (Peak) | 75 kV (Peak) | Text |
| 22. | Dry lighting Impulse Withstand Voltage (Negative) kV (Peak) | 75 kV (Peak) | Text |
| 23. | Dry lighting Impulse flashover Voltage (Positive) kV (Peak) | Mfg. to give details | Text |
| 24. | Dry lighting Impulse flashover Voltage (Negative) kV (Peak) | Mfg. to give details | Text |
| 25. | Puncture Withstand Voltage | 105 kV (rms) | Text |

SCHEDULE – ‘A’

**GUARANTEED TECHNICAL PARTICULARS
22KV PORCELAIN PIN INSULATOR**

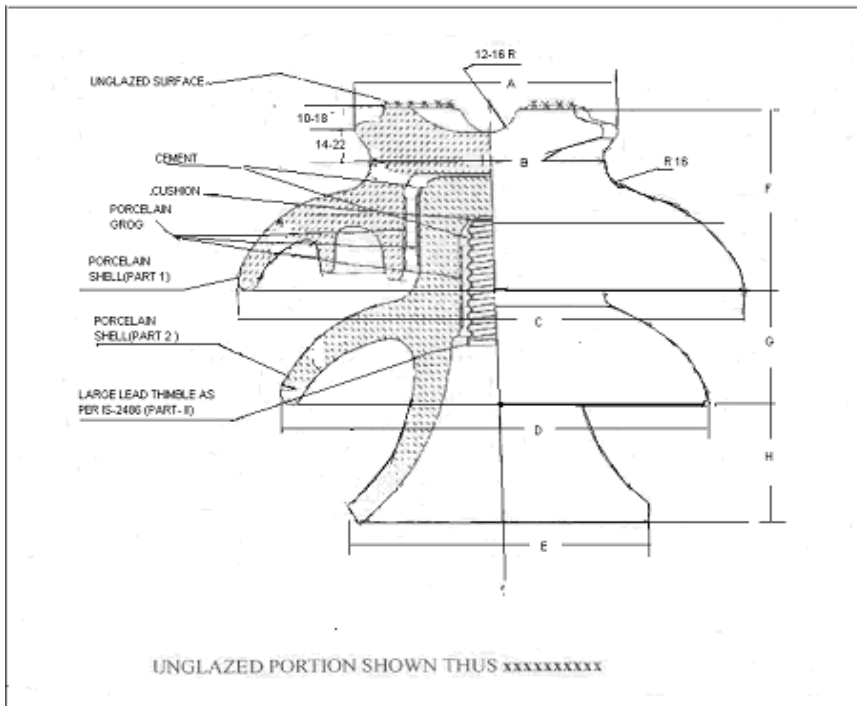
| Sr. No. | Particulars | MSEDCL Requirement | To be offered by Bidder |
|---------|---|----------------------------------|-------------------------|
| 1. | Name of Manufacturer | Mfg. to give details | Text |
| 2. | Works address | Mfg. to give details | |
| 3. | Type of Insulator | Type B | Text |
| 4. | Standard according to which the Insulators manufactured & tested. | IS 731-1971 amended up to date | Text |
| 5. | Name of material used in manufacture of the Insulator with grade | Highest grade Porcelain material | Text |
| 6. | Colour of Pin Insulator | Brown | Text |
| 7. | Diameter of first outer shell (mm) | Mfg. to give details | Text |
| 8. | Diameter of second middle shell (mm) | Mfg. to give details | Text |
| 9. | Diameter of third lower shell (mm) | Mfg. to give details | Text |
| 10. | Height of Insulator (mm) | Mfg. to give details | Text |
| 11. | Minimum Failing Load (kN) | 10 kN | Text |
| 12. | Min. creepage distance (mm) | 560 mm (min.) | Text |
| 13. | Suitable for shank diameter (mm) | 24 mm | Text |
| 14. | Net weight of Single Pin Insulator | Mfg. to give details | Text |
| 15. | Nominal System Voltage (kV) | 22 kV | Text |
| 16. | Highest System Voltage in kV | 24 kV | Text |
| 17. | Dry 1 min. power frequency withstand Voltage kV (rms) | Mfg. to give details | Text |
| 18. | Wet 1 min. power frequency withstand Voltage kV (rms) | 55 kV rms | Text |
| 19. | Dry flashover Voltage kV (rms) | Mfg. to give details | Text |
| 20. | Wet flashover Voltage kV (rms) | Mfg. to give details | Text |
| 21. | Dry lighting Impulse Withstand Voltage (Positive) kV (Peak) | 125 kV (Peak) | Text |
| 22. | Dry lighting Impulse Withstand Voltage (Negative) kV (Peak) | 125 kV (Peak) | Text |
| 23. | Dry lighting Impulse flashover Voltage (Positive) kV (Peak) | Mfg. to give details | Text |
| 24. | Dry lighting Impulse flashover Voltage (Negative) kV (Peak) | Mfg. to give details | Text |
| 25. | Puncture Withstand Voltage | 140 kV (rms) | Text |

SCHEDULE – ‘A’

**GUARANTEED TECHNICAL PARTICULARS
33KV PORCELAIN PIN INSULATOR**

| 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 | |
| 3. | Type of Insulator | Type B | Text |
| 4. | Standard according to which the Insulators manufactured & tested. | IS 731-1971 amended upto date | Text |
| 5. | Name of material used in manufacture of the Insulator with grade | Highest grade Porcelain material | Text |
| 6. | Colour of Pin Insulator | Brown | |
| 7. | Diameter of first outer shell (mm) | Mfg. to give details | Text |
| 8. | Diameter of second middle shell (mm) | Mfg. to give details | Text |
| 9. | Diameter of third lower shell (mm) | Mfg. to give details | Text |
| 10. | Height of Insulator (mm) | Mfg. to give details | Text |
| 11. | Minimum Failing Load (kN) | 10 kN | Text |
| 12. | Min. creepage distance (mm) | 840 mm (min.) | Text |
| 13. | Suitable for shank diameter (mm) | 24 mm | Text |
| 14. | Net weight of Single Pin Insulator | Mfg. to give details | Text |
| 15. | Nominal System Voltage (kV) | 33 kV | Text |
| 16. | Highest System Voltage in kV | 36 kV | Text |
| 17. | Dry 1 min. power frequency withstand Voltage kV (rms) | Mfg. to give details | Text |
| 18. | Wet 1 min. power frequency withstand Voltage kV (rms) | 75 kV rms | Text |
| 19. | Dry flashover Voltage kV (rms) | Mfg. to give details | Text |
| 20. | Wet flashover Voltage kV (rms) | Mfg. to give details | Text |
| 21. | Dry lighting Impulse Withstand Voltage (Positive) kV (Peak) | 170 kV (Peak) | Text |
| 22. | Dry lighting Impulse Withstand Voltage (Negative) kV (Peak) | 170 kV (Peak) | Text |
| 23. | Dry lighting Impulse flashover Voltage (Positive) kV (Peak) | Mfg. to give details | Text |
| 24. | Dry lighting Impulse flashover Voltage (Negative) kV (Peak) | Mfg. to give details | Text |
| 25. | Puncture Withstand Voltage | 180 kV (rms) | Text |

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| Sr. No. | Dimensions | PIN INSULATORS (All Dimensions are in mm) | | |
|---------|------------|--|------------------------------|------------------------------|
| | | 11 kV min. Creepage 320mm | 22 kV min. Creepage 560mm | 33 kV min Creepage 840 mm |
| 1. | A | | | |
| 2. | B | | | |
| 3. | C | | | |
| 4. | D | | | |
| 5. | E | | | |
| 6. | F | | | |
| 7. | G | | | |
| 8. | H | | | |

Note: Dimensions A to H to be specified by the Bidder along with the offer.

| | |
|---|---|
| MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD. | |
| NAME OF DRAWING | GENERAL ARRANGEMENT DRAWING FOR 11KV/22KV/33KV PIN INSULATORS |
| DRAWING NO. | 11KV/ 22KV/ 33 KV PIN INS - PORCELAIN |