

**TECHNICAL SPECIFICATION  
OF  
ELECTRICAL  
MATERIALS**

**Insulators**

**“GROUP – B”**

Tender Notice No. NESCO Utility / O&M Materials/58 / 8267, dtd.17.7.15

## GROUP – B

### Insulator

Sl. No.	Item Description	Unit	Qty.
1	33KV Post Insulator	No	150
2	11KV Post Insulator	No	300
3	33KV Pin Insulator	No	3000
4	11 KV Pin Insulator	No	7000
5	33KV Disc Insulator(B&S)90KN	No	300
6	11 KV Disc Insulator (B&S)70KN	No	600

**NB: 1. Bidders should put their authorized signature with office seal on each page of the documents.**

**2. Bidders should put their offer in the Guaranteed particulars column furnished in the tender documents.**

**3. Purchaser may ask to the bidder who will qualify in Techno- Commercial evaluation of the tenders for submission of Samples for verification , if required.**

**4. Purchaser reserves the right to increase or decrease the above quantities during placement of purchase order or may cancel any item/items without assigning any reason thereof .**

**Dy. General Manager (C&P)**  
NESCO Utility, Balasore, Odisha

## **TECHNICAL SPECIFICATION OF INSULATORS**

### **TECHNICAL SPECIFICATIONS OF 33 KV POST TYPE INSULATOR**

**1.Scope of Work:** This Specification covers design, engineering, manufacture, assembly, stage testing, inspection & testing before supply and delivery at site of the 33 KV post type insulator

## **2.0 INSULATORS**

### **2.1 General Requirements**

2.1.1 The Porcelain shall be sound, free from defects, thoroughly vitrified and smoothly glazed.

2.1.2 Unless otherwise specified, the glaze shall be brown in colour. The glaze shall cover all the porcelain parts of the insulator except those areas which serve as supports during firing or are left unglazed for the purpose of assembly.

2.1.3 The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. The porcelain shall not engage directly with hard metal.

2.1.4 Cement used in the construction of the insulator shall not cause fracture by expansion or loosening by contraction and proper care shall be taken to locate the individual parts correctly during cementing. The cement shall not give rise to chemical reaction with metal fittings, and its thickness shall be as uniform as possible.

**3.0 Tests:** The insulators shall comply with the following tests as per IS:2544-1973 & IS: 5350(PT – III)-1971.

### **3.1 Type tests**

- a) Visual examination
- b) Verification of dimensions
- c) Visible discharge test
- d) Impulse voltage withstand test.
- e) Wet power-frequency voltage withstand test.
- f) Temperature cycle test.
- g) Electro-mechanical failing load test.
- h) Mechanical failing load test (for those of type B string insulator units to which electro mechanical failing load test (g) is not applicable.
- i) Twenty four hours mechanical strength test (for string insulators only when specified by the purchaser).
- j) Puncture test
- k) Porosity test and
- l) Galvanising test.

### 3.2 **Acceptance Tests**

The test samples after having withstood the routine tests shall be subjected to the following acceptance test in the order indicated below:

- a) Verification of dimensions.
- b) Temperature cycle test.
- c) Twenty four hours mechanical strength test(for string insulator units only when specified by the purchaser)
- d) Electro-Mechanical failing load test.
- e) Puncture test
- f) Porosity test and
- g) Galvanising test.

### 3.3 **Routine Test**

- a) Visual examination.
- b) Mechanical routine test(for string insulator units only) and
- c) Electrical routine test(for string insulator units only)

### 3.4 **Marking**

#### 3.4.1 **Each Insulator shall be legibly and indelibly marked to show the following.**

- a) Name and trade mark of the manufacturer.
- b) Month and year of manufacture
- c) Minimum failing load in Newtons
- d) Country of the manufacturer and e) ISI Certification mark, if any.
- f) Specific Parameters & Layout Conditions.

3.4.2 Marking on porcelain shall be printed and shall be applied before firing.

### 3.5 **Packing**

All insulators (without fittings) shall be packed in wooden crates suitable for easy but rough handling and acceptable for rail transport. Where more than one insulator are packed in a crate, wooden separators shall be fixed between the insulators to keep individual insulators in position without movement within the crate.

**GUARANTEED TECHNICAL PARTICULARS FOR 33 KV POST INSULATOR**

Slno.	Description	Unit	Specified		Bidder's Offer
			UNIT	STACK	
1	Manufacture Name		To be Submitted by Bidder		
2	Address of Manufacture		To be Submitted by Bidder		
3	Reference Standard (s) of Insulator		IS: 2544-1973 & IS:5350(PT-III)-1971		
4	Height	mm	254	508	
5	Insulating Part Diameter	mm	192	192	
6	Pitch Circle Diameter				
a)	Top Metal Fitting	mm	76	76	
b)	Bottom Metal Fitting	mm	76	76	
7	Minimum creepage Distance	mm	450	900	
8	Cantilever Strength				
a)	Upright	Kgf	900	459	
b)	Inverted	Kgf	700	340	
9	Tensile Strength	Kgf	3060	3060	
10	Torsional Strength	Kgfm	70	70	
10	Compression Strength	Kgf	4600	4600	
11	Nominal System Voltage	KV(rms)	22	33	
12	Highest System Voltage	KV(rms)	24	36	
13	Power frequency withstand voltage (Dry)	KV(rms)	75	140	
14	Power frequency withstand voltage (Wet)	KV(rms)	55	90	
15	Impulse-withstand test voltage(1.2x50 microsecond wave)		Caps Padestal		
a)	Positive	KVP	125	190	
b)	Negative	KVP	125	190	
16	Material of Cap		Aluminium Alloy Cap		
17	Drawing & Sample		To be submitted by bidder		

**NB- Every insulator should bear the marking of manufacturer's name & Purchaser's name and ISI mark.**

**Name & Signature of Bidder with seal**

## **TECHNICAL SPECIFICATION 11 KV POST INSULATOR**

1. **Scope**- This specification covers the manufacture, testing and works supply and delivery of 11KV post insulators. The Porcelain insulators shall conform to IS: 731-1971 ammended upto date. Small fittings like spring washers, nuts etc may be electro-galvanised.

- Frequency : ( 50 ± 3%)Hz
- Nominal System Voltage : 11 K V
- Maximum System Voltage : 12 KV
- No. of phases : 3
- Power frequency one minute withstand(Dry) : 75 KV
- Neutral Earthing arrangement System : Effectively Earthed

### **3. Requirements:**

The post type insulators shall be suitable for outdoor use and cap & base type. Caps & base shall have plain machined faces & zigs shall be used for drilling bolt holes on the cap & in the base for easy & perfect assembly. Regarding Test for Mechanical strength for post Insulators, all the necessary tests are as per 9.6.5.1, 9.6.5.2, & 9.6.5.3 of IS:2544-1973 with latest amendments are to be carried out at the manufacturer"s premises.

For each of the Post Insulators / Insulator sets Bolts, Nuts, Set Screws & Washers shall be supplied as follows :

- i. Requisite numbers of set Screws & Spring Washers for assembling the Post Insulator unit.
- ii. Requisite numbers of set screws & spring washers for fixing bus-bar Support to the cap in the top Post Insulator.
- iii. One set of Bolts, Nuts & Washers or Lock nuts & plain washers for mounting the Insulators on the support steel structures of bus support.
- iv. 5% spare Nuts & Bolts with washers shall have to be supplied of no extra cost by the purchaser with each consignment.

### **4. Creepage Distances :**

The minimum creepage distance shall 30 mm/KV.

### **5. Tests:**

Suitable number of individual units shall be subject to the following tests in accordance with IS:731/1971 with its latest amendments

### **6. Test Certificate :**

The Bidder shall furnish detailed type test reports of the offered post Insulators at the NABL approved laboratories to prove that the Disc Insulators offered meet the requirements of the specification. These Type Tests should have been carried out within five years prior to the date of opening of this tender.

- iii) Their offered Insulators are already fully type tested at approved Laboratory within five years prior to the date of opening of this tender.
- iv) There is no change in the design of type tested Insulators and those offers against this tender.

7. **Testing Facilities :**

The Bidder must clearly indicate what testing facilities are available in the works of the manufacturer and whether facilities are adequate to carry out all Routine & acceptance Tests. These facilities should be available to Purchaser'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.

8. **Drawings :**

The tender shall be accompanied with the detailed drawings showing the dimensions of the individual insulator, giving all the design dimensions of various component parts. Generally it shall be as per IS.

9. **Markings :**

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

- a) Name or trade mark of the manufacturer.
- b) Voltage Type
- c) Month and year of manufacturing.
- d) Country of Manufacturer
- e) ISI certificate mark

10. **Packing :**

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

**GUARANTEED TECHNICAL PARTICULARS FOR 11 KV POST INSULATOR**

<b>Slno.</b>	<b>Description</b>	<b>Specified</b>	<b>Bidder's Offer</b>
1	Name of Manufacturer. & Address	To be specified by the bidder	
2	Location of type testing	To be specified by the bidder	
3	Applicable standard	IS-731/1971 with latest amendment	
4	Nominal System Voltage	11 KV	
5	Highest System voltage	12 KV	
6	Visible discharge Test voltage (Minimum)	9 KV	
7	Impulse withstand voltage +(1.2/50 microsecond wave)	90 KVp (+ve) and 105 KVp(-ve)	
8	Impulse flashover voltage+(1.2/50 microsecond wave)	95 KVp (+ve) and 120 KVp (-ve)	
9	1min. power frequency flashover Voltage kV. (Dry)	70 KV	
10	1min. power frequency flashover Voltage kV.(Wet)	45 KV	
11	Cantilever strength		
	a. Upright	65 Kg(Min)	
	b. Inverted	400 Kg(Min)	
12	Tensile strength	2050 Kg	
13	Torsion strength	34 m-Kg	
14	Compression strength	3600 Kg	
15	Conforming standard	As per IS	
16	Drawing & Sample	To be submitted by Bidder	

**NB- Every insulator should bear the marking of manufacturer's name & Purchaser's name and ISI mark.**

**Name & Signature of Bidder with seal**

## TECHNICAL SPECIFICATIONS OF 33 KV PIN INSULATOR

### 1.0 Scope of Work:

This Specification covers design, engineering, manufacture, assembly, stage testing, inspection & testing before supply and delivery at site of the 33KV Pin Insulator.

### 2.0 APPLICABLE STANDARDS

Unless otherwise stipulated in this specification, the insulators shall comply with the Indian standard specification IS:731-1971 and the insulator fittings with IS:2486(Pt . I )-1971 and IS:2486(Pt . II)-1974 or the latest version thereof.

### 3.0 INSULATORS

#### 3.1 General Requirements

3.1.1 The Porcelain shall be sound, free from defects, thoroughly vitrified and smoothly glazed.

3.1.2 Unless otherwise specified, the glaze shall be brown in colour. The glaze shall cover all the porcelain parts of the insulator except those areas which serve as supports during firing or are left unglazed for the purpose of assembly.

3.1.3 The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. The porcelain shall not engage directly with hard metal.

3.1.4 Cement used in the construction of the insulator shall not cause fracture by expansion or loosening by contraction and proper care shall be taken to locate the individual parts correctly during cementing. The cement shall not give rise to chemical reaction with metal fittings, and its thickness shall be as uniform as possible.

#### 3.2 Creepage Distance

The minimum creepage distance shall be as under:

Highest System Voltage	Normal and Moderately Polluted Atmospheres(total)	Heavily polluted Atmospheres(Total)
(1)	(2)	(3)
36 KV	580 mm	840 mm

**Note:** For insulator used in an approximately vertical position the values given in col.(2) or (3) shall apply. For insulators used in an approximately horizontal position, the value given in col. (2) shall apply but the value in Col.(3) may be reduced by as much as 20%.

#### 3.3 Tests:

The insulators shall comply with the following tests as per IS:731-1971.

##### 3.3.1 Type tests

- a) Visual examination
- b) Verification of dimensions

- c) Visible discharge test
- d) Impulse voltage withstand test.
- e) Wet power-frequency voltage withstand test.
- f) Temperature cycle test.
- g) Electro-mechanical failing load test.
- h) Mechanical failing load test (for those of type B string insulator units to which electro mechanical failing load test (g) is not applicable.
- i) Twenty four hours mechanical strength test (for string insulators only when specified by the purchaser).
- j) Puncture test
- k) Porosity test and
- l) Galvanising test.

### 3.3.2 **Acceptance Tests**

The test samples after having withstood the routine tests shall be subjected to the following acceptance test in the order indicated below:

- a) Verification of dimensions.
- b) Temperature cycle test.
- c) Twenty four hours mechanical strength test (for string insulator units only when specified by the purchaser)
- d) Electro-Mechanical failing load test.
- e) Puncture test
- f) Porosity test and
- g) Galvanising test.

### 3.3.3 **Routine Test**

- a) Visual examination.
- b) Mechanical routine test (for string insulator units only) and
- c) Electrical routine test (for string insulator units only)

## 3.4 **Marking**

### 3.4.1 **Each Insulator shall be legibly and indelibly marked to show the following.**

- a) Name and trade mark of the manufacturer.
- b) Month and year of manufacture
- c) Minimum failing load in Newtons
- d) Country of the manufacturer and
- e) ISI Certification mark, if any.
- f) Specific Parameters & Layout Conditions.

### 3.4.2 **Marking on porcelain shall be printed and shall be applied before firing.**

## 3.5 **Packing**

All insulators (without fittings) shall be packed in wooden crates suitable for easy but rough handling and acceptable for rail transport. Where more than one insulator are packed in a crate, wooden separators shall be fixed between the insulators to keep individual insulators in position without movement within the crate.

<b>GURANTEED TECHNICAL PARTICULARS OF 33KV PIN INSULATOR</b>			
<b>Sl.No.</b>	<b>Description</b>	<b>Specified</b>	<b>Bidder's offer</b>
1	Manufacture Name		
2	Address of Manufacture		
3	Normal working voltage	33KV(rms)	
4	High system voltage	36KV(rms)	
5	Visible Discharge Voltage dry PF	27KV(rms)	
6	Dry Power frequency 1 Minute withstand voltage	95KV(rms)	
7	Wet Power frequency 1 Minute withstand voltage	75KV(rms)	
8	PF puncture withstand voltage	180KV(rms)	
9	Impulse withstand voltage	170 KV	
11	Minimum failing load	10KN	
12	Minimum creepage distance	580mm	
13	Colour of glaze	Brown	
14	Weight per unit	To be submitted by bidder	
15	Size of Insulator		
a)	Height	To be submitted by bidder	
b)	Diameter	To be submitted by bidder	
16	Material of thimble	Lead	
17	Steel head	Large	
18	Standard	IS: 731/1971	
19	Tolerance	Tolerance will be allowed as per IS:731/1971 or latest	
20	Drawing & Sample	To be submitted by bidder	
<p><b>PACKING:</b> All insulators shall be packed in wooden crates suitable for easy but rough handling &amp; acceptable for road transport. Where more than one insulator are packed in a crate, Separator shall be fixed between the insulators to keep individual insulator in position without movement in the crate.</p>			

**NB- Every insulator should bear the marking of manufacturer's name & Purchaser's name and ISI mark.**

**Name & Signature of Bidder with seal**

## **11 KV PIN INSULATOR**

### **1.SCOPE :**

The specification cover the manufacture, testing at works supply and delivery of Porcelain insulators for overhead power lines with a nominal voltage below 12KV . Both Pin and Shackle type insulators are covered.

### **2.APPLICABLE STANDARDS:**

Except when they conflict with the specific requirements of this specification, the insulators shall comply with IS : IS:731 & IS: 3188 or the latest version thereof.

### **3.GENERAL REQUIREMENTS:**

The porcelain shall be sound, free from defects, thoroughly vitrified and smoothly glazed. The design of the insulators shall be such that the stresses due to expansion and contraction in any part of the insulator shall not lead to its deterioration. The glaze shall be brown in color for insulators. The glaze shall cover the entire porcelain surface parts except those areas that serve as supports during firing. The insulators shall be suitable for use with all Aluminum Conductor or Copper conductor or ACSR upto 100 sq.mm. The insulators should withstand the conductor tension the reversible wind load as well as the high frequency vibrations set due to wind.

### **4.SYSTEM CONDITIONS:**

Frequency	: 50 Hz
Nominal System Voltage	: 11KV
Maximum System Voltage LT System	: 12 KV
Minimum LT Voltage	: 11KV
Power frequency one minute withstand Voltage(wet):	35KV

### **5. TYPE OF INSULATORS:**

The standard Pin insulators shall be of designation Type –B of IS : 731 or its latest revision.

### **6. TESTS:**

#### **6.1 Type tests:**

- a) Visual examination
- b) Verification of dimensions
- c) Temperature cycle test
- d) Dry one minute power frequency withstand test
- e) Wet one minute power frequency withstand test
- f) Mechanical strength test
- g) Porosity test

## 6.2 Acceptance test:

The insulators, after having withstood the routine test shall be subjected to the following acceptance tests in the order given below:

- a) Verification of Dimensions.
- b) Temperature cycle test
- c) Mechanical strength test
- d) Porosity test

## 6.3 Routine tests:

- ii) Visual examination

## 7. TESTING FACILITIES:

a. The Bidder must clearly indicate what testing facilities are available in the works of the manufacturer and whether the facilities, are adequate to carry out all the routine as well as type tests. These facilities should be made available to Purchaser's Engineers if deputed to carry out or witness the tests. If any tests cannot be carried out at the manufacturer's works, the reasons should be clearly stated in the tender.

b. The Bidder shall furnish detailed type test reports of the offered 11KV Pine insulator as per clause 6.1 of this specification. All the above Type Tests shall be carried out at laboratories, which are accredited, by the National Accreditation Board of Testing and Calibration Laboratories (NABL) of Government of India to prove that the insulators offered meet the requirements of the specification. These Type Tests should have been carried out within five years prior to the date of opening of this tender.

c. There offered L.T. shackle Insulators & pin insulators are already fully Type Tested at Laboratories accredited by the National Accreditation Board of Testing and Calibration Laboratories (NABL) within five years prior to the date of opening of the tender.

There is no change in the design of Type tested L.T. shackle Insulators and those offers against this tender.

## 8. Drawings :

The tender shall be accompanied with the detailed drawings showing the dimensions of the individual insulator, giving all the design dimensions of various component parts. Generally it shall be as per IS.

9. **MARKING:**

a. Each insulator shall be legibly and indelibly marked to show the following:

i) Name of Purchaser- NESCO

ii) Name or trade mark of the manufacturer

iii) Year of manufacturer

iv) ISI certificate, mark, if any.

b. Marking on porcelain shall be applied before firing.

10. **Packing :**

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

**GUARANTEED TECHNICAL PARTICULARS 11 KV PIN INSULATOR**

<b>Sl. No.</b>	<b>Description</b>	<b>Specific Requirement</b>	<b>Bidders offer</b>
	Name of Manufacturer. & Address	To be specified by the bidder	
	Location of type testing	To be specified by the bidder	
	Applicable standard	IS: 731,IS 3188 or the latest version	
1	Normal working voltage	11 Kv (rms)	
2	High system voltage.	12 Kv (rms)	
3	Visible Discharge voltage dry PF.	9 Kv (rms)	
4	1 Minute withstand voltage wet PF.	65 Kv (rms)	
5	1 Minute withstand voltage.....	35 Kv (rms)	
6	PF puncture withstand voltage.	110 Kv (rms)	
7	Impulse withstand voltage :		
	(+ ve)	80 Kv peak	
	(- ve)	80 Kv peak	
8	Impulse flashover voltage :		
	(+ ve)	90 Kv peak	
	(- ve)	120 Kv peak	
9	Minimum failing load.	5 KN.	
10	Minimum creepage distance.	240 mm.	
11	Colour of glaze.	Brown.	
12	Weight per unit.	1.4 Kg. (Apprx.)	
13	Size of insulator. (Height)	125 mm.	
	(Diameter	125 mm.	
14	Material of thimble.	Lead.	
15	Steel head.	Small head.	
16	Standard.	IS : 731/1971.	
17	Tolerance.	Tolerance will be allowed as per IS : 731/1971 or latest amendments if any.	
18	Drawing	To be submitted	
19	Conforming standard	As per IS	

**NB- Every insulator should bear the marking of manufacturer's name & Purchaser's name and ISI mark.**

**Name & Signature of Bidder with seal**

## TECHNICAL SPECIFICATION OF 70KN (B&S) DISC INSULATOR TECHNICAL SPECIFICATION OF 90KN (B&S) DISC INSULATOR

**SCOPE:** This specification provides for design, manufacture, engineering, inspection and testing before dispatch packing and delivery FOR (destination) for Indian manufacturers of disc. Insulators as per technical requirements furnished in this specification.

These insulators are to be used in suspension and tension insulators strings for the suspension and anchoring of the bus-bar conductors.

Following is the list of documents constituting this package.

- (i) Technical specification.
- (ii) Technical data sheet.
- (iii) Drawings of insulators

All the above volumes along with amendments there of shall be read and interpreted together. However, in case of a contradiction between the -Technical Specification and any other volume, the provisions of this volume will prevail.

The insulators shall conform in all respects to high standards of engineering, design workmanship and latest revisions of relevant standards at the time of offer and purchaser shall have the power to reject any work or material which in his judgment, is not in full accordance therewith.

### **STANDARDS:**

Except as modified in this specification, the disc insulators shall conform to the following Indian Standards, which shall mean latest revisions and amendments. Equivalent International and Internally recognized standards to which some of these standards generally correspond are also listed below.

Sl. No.	Indian Standard	Title.	International Standard
1.	IS: 206	Method for Chemical Analysis of Slab Zinc.	
2.	IS: 209	Specification for Zinc.	BS: 3436
3.	IS: 731	Porcelain insulators for overhead power lines with a normal voltage greater than 1000V	BS: 137(I&II); IEC 274 IEC 383
4.	IS: 2071 Part-(I) Part-(II)	Method of High Voltage Testing.	

5.	IS: 2121  (Part-I)	Specification of Conductors and Earth wire Accessories for Overhead Power lines. Armour Rods, Binding wires and tapes for conductor.	
6.	IS: 2486	Specification for Insulator fittings for overhead power lines with	
		1000V.	
	Part – I	General Requirement and Tests.	BS: 3288
	Part – II	Dimensional Requirements.	IEC: 120
	Part – III	Locking devices.	IEC: 372
7.	IS: 2629	Recommended practice for Hot Dip Galvanisation for iron and steel.	
8.	IS: 2633	Testing for Uniformity of Coating of Zinc coated articles.	
9.	IS: 3138	Hexagonal Bolts & Nuts.	ISO/R 947 & ISO/R272
10.	IS: 3188	Dimensions for Disc Insulators.	IEC: 305
11.	IS: 4218	Metric Screw Threads	ISO/R 681969  R 261963,  R 262-1969 & R965-1969
12.	IS: 6745	Determination of weight of zinc coating on zinc coated iron and steel articles.	
13.	IS: 8263	Methods of RIV Test of HV insulators.	IEC 437 NEMA  Publication No.107/1964  CISPR
14.	IS: 8269	Methods for switching impulse test on HV insulators.	IEC: 506
15.		Thermal mechanical performance test and mechanical performance test on string insulator units.	IEC: 575
16.	IEC	Long Rod Insulators	IEC-433

The standards mentioned above are available from:

Reference.	Abbreviation.	Name & Address:
BS		British Standards, British Standards Institution, 101, Pentonville Road, N-19

IEC / CISPR		International Electro technical commission Electro Technique International. 1, Rue de verembe
IS		Bureau of Indian Standards, Manak Bhavan, 9 Bahadurshah Zafar Marg, New Delhi-
ISO		International Organisation for Standardization. Danish Board of Standardization Dansk Standardizing Sraat Aurehoegvej-12 DK-2900 Helleprup
NEMA		National Electric Manufacturers Association 1`55, East 44 <sup>th</sup> . Street New York, NY 10017

### PRINCIPAL PARAMETERS.

#### DETAILS OF DISC INSULATORS:

The Insulator strings shall consist of standard discs for use in three phases, 50 Hz 33/11KV S/S, 33 KV & 11KV Lines of NESCO Utility in a moderately polluted atmosphere. The discs shall be cap and pin, ball and socket type, radio interference and have characteristics as shown in Table-I and all ferrous parts shall be hot dip galvanized as per the latest edition of IS 2629. The zinc to be used for making sleeves shall be 99.95 % pure.

The size of disc insulator, minimum creepage distance the number to be used in different type of strings, their electromechanical strength and mechanical strength of insulator string along with hardware shall be as follows:

Sl. No	Type of String.	Size of disc. Insulator (mm)	Minimum creepage distance of each	No. of standard discs 33KV	Electro-mechanical strength of insulator string fittings (KN)
1.	Single	255x145	430	1x3	70KN/90KN Antifog Insulator
2.	Double	-do-	-do-	2x3	70KN/90KN Antifog Insulator
3.	Single Tension	280x170	320	1x4	70KN/90KN Normal Insulator
4.	Double Tension	-do-	-do-	2x4	70KN/90KN Normal Insulator

#### SPECIFICATION DRAWINGS:

The specification in respect of the disc insulators are described. These specification for information and guidance of the Bidder only. The drawings to be furnished by the supplier shall

be as per his own design and manufacture and in line with the specification.

#### **GENERAL TECHNICAL REQUIREMENTS:**

##### **Porcelain:**

The porcelain used in the manufacture of the shells shall be ivory white nonporous of high dielectric, mechanical and thermal strength, free from internal stresses blisters, laminations, voids, forgone matter imperfections or other defects which might render it in any way unusable for insulator shells. Porcelain shall remain unaffected by climatic conditions ozone, acid, alkalis, zinc or dust. The manufacturing shall be by the wet process and impervious character obtained by through verification.

The insulator shall be made of highest grade, dense, homogeneous, wet-process porcelain, completely and uniformly vitrified throughout to produce uniform mechanical and electrical strength and long life service. The porcelain shall be free from warping, roughness, cracks, blisters, laminations, projecting points foreign particles and other defects, except those within the limits of standard accepted practice. Surfaces and grooves shall be shaped for easy cleaning. Shells shall be substantially symmetrical.

##### **Porcelain glaze:**

Surface to come in contact with cement shall be made rough by sand glazing. All other exposed surfaces shall be glazed with ceramic materials having the same temperature coefficient of expansion as that of the insulator shell. The thickness of the glaze shall be uniform throughout and the colour of the glaze shall be brown. The Glaze shall have a visible luster and smooth on surface and be capable of satisfactory performance under extreme tropical climatic weather conditions and prevent ageing of the porcelain. The glaze shall remain under compression on the porcelain body throughout the working temperature range.

#### **METAL PARTS:**

##### **(i) Cap and Ball Pins:**

Ball pins shall be made with drop forged steel caps with malleable cast iron. They shall be in one single piece and duly hot dip galvanized. They shall not contain parts or pieces joined together welded, shrink fitted or by any other process from more than one piece of materials. The pins shall be of high tensile steel, drop forged and heat-treated. The caps shall be cast with good quality black heart malleable cast iron and annealed. Galvanizing shall be by the hot dip process with a heavy coating of zinc of very high purity. The bidder shall specify the grade composition and mechanical properties of steel used for caps and pins. The cap and pin shall be of such design that it will not yield or distort under the specified mechanical load in such a manner as to change the relative spacing of the insulators or add other stresses to the shells. The insulator caps shall be of the socket type provided with nonferrous metal or stainless steel cotter pins and shall provide positive locking of the coupling.

##### **(ii) Security Clips:**

The security clips shall be made of phosphor bronze or of stainless steel.

#### **FILLER MATERIAL:**

Cement to be used, as a filler material be quick setting, fast curing Portland cement. It shall not cause fracture by expansion or loosening by contraction. Cement shall not react chemically

with metal parts in contact with it and its thickness shall be as small and as uniform as possible.

#### **MATERIALS DESIGN AND WORKMANSHIP:**

##### **GENERAL:**

All raw materials to be used in the manufacture of these insulators shall be subject to strict raw material quality control and to stage testing/ quality control during manufacturing stage to ensure the quality of the final end product. Manufacturing shall conform to the best engineering practices adopted in the field of extra high voltage transmission. Bidders shall therefore offer insulators as are guaranteed by them for satisfactory performance on Transmission lines.

The design, manufacturing process and material control at various stages be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish elimination of sharp edges and corners to limit corona and radio interference voltages.

##### **INSULATOR SHELL:**

The design of the insulator shells shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. Shells with cracks shall be eliminated by temperature cycle test followed by mallet test. Shells shall be dried under controlled conditions of humidity and temperature.

##### **METAL PARTS:**

- i. The twin ball pin and cap shall be designed to transmit the mechanical stress to the shell by compression and develop uniform mechanical strength in the insulator. The cap shall be circular with the inner and outer surfaces concentric and of such design that it will not yield or distort under loaded conditions. The head portion of the pinball shall be suitably designed so that when the insulator is under tension the stresses are uniformly distributed over the pinhole portion of the shell. The pinball shall move freely in the cap socket either during assembly of a string or during erection of a string or when a string is placed in position.
- ii. Metal caps shall be free from cracks, seams, shrinks, air holes, blowholes and rough edges. All metal surfaces shall be perfectly smooth with no projecting part or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stress uniformly. Pins shall not show any microscopically visible cracks, inclusions and voids.

##### **GALVANIZING:**

All ferrous parts, shall be hot dip galvanized in accordance with IS: 2629. The zinc to be used for galvanizing shall conform to grade Zn 99.5 as per IS: 209. The zinc coating shall be uniform, smoothly adherent, reasonably light, continuous and free from impurities such as flux, ash, rust stains, bulky white deposits and blisters. Before ball fittings are galvanized, all die flashing on the shank and on the bearing surface of the ball shall be carefully removed without reducing the designed dimensional requirements.

##### **CEMENTING:**

The insulator design shall be such that the insulating medium shall not directly engaged with hard metal. The surface of porcelain and coated with resilient paint to offset the effect of difference in thermal expansions of these materials. High quality Portland cement shall be used for cementing the porcelain to the cap & pin.

**SECURITY CLIPS (LOCKING DEVICES)**

The security clips to be used as locking device for ball and socket coupling shall be ‘R’ shaped hump type to provide for positive locking of the coupling as per IS: 2486 (Part-IV). The legs of the security clips shall allow for spreading after installation to prevent complete withdrawal from the socket. The locking device shall resilient corrosion resistant and of sufficient mechanical strength. There shall be no possibility of the locking device to be displaced or be capable of rotation, which placed in position, and under no circumstances shall it allow separation of insulator units and fittings. ‘W’ type security clips are also acceptable. The hole for the security clip shall be counter sunk and the clip shall be of such design that the eye of the clip may be engaged by a hot line clip puller to provide for disengagement under energized conditions. The force required for pulling the clip into its unlocked positions shall not be less than 50 N (5 kg.) or more than 500 N (50 kgs.).

**MARKING:**

Each insulator shall have the rated combined mechanical and electrical strength marked clearly on the porcelain surface. Each insulator shall also bear symbols identifying the manufacturer, month, and year of manufacture. Marking on porcelain shall be printed, not impressed, and shall be applied before firing.

**BALL AND SOCKET DESIGNATION:**

The dimensions of the ball and sockets for 70 and 90 KN discs shall be of 16 mm and for 120

KN and 160 KN discs shall be of 20 mm designation in accordance with the standard dimensions stated in IS: 2486 (Part-II).

**DIMENSIONAL TOLERANCE OF INSULATOR DISCS:**

It shall be ensured that the dimensions of the disc insulators are within the limits specified below:

a) Diameter of Disc (mm)

	Standard	Maximum	Minimum
70 KN Disc	255	266	244
90 KN Disc	255	266	244

b) Ball to Ball spacing Between Discs (mm)

	Standard	Maximum	Minimum
70 KN Disc	145	149	141
90 KN Disc	145	149	141

**INTERCHANGEABILITY:**

The insulators inclusive of the ball and socket fittings shall be of standard design suitable for use with hardware fittings of any make conforming to relevant Indian Standards.

**FREEDOM FROM DEFECTS:**

Insulators shall have none of the following defects:

- 1) Ball pin shake.
- 2) Cementing defects near the pin like small blow holes, small hair cracks lumps etc.
- 3) Sand fall defects on the surface of the insulator.

**INSULATOR STRINGS:****TYPE AND RATING:**

The insulator strings shall be formed with standard discs described in this specification for use on 3 phases 33 KV 50 Hz effectively earthed systems in an atmosphere with pollution level as indicated in project synopsis. Suspension insulator strings for use with suspension/tangent supports are to be fitted with discs 70 KN EMS rating while tension insulator strings for use with Anchor / Tension towers are to be fitted with discs of 90 KN EMS level rating.

**STRING SIZE:**

The sizes of the disc insulator, the number to be used in different types of strings, their electro-mechanical strength and minimum nominal creep age distance shall be as given in this specification

Insulator units after assembly shall be concentric and coaxial within limits as permitted by Indian Standards.

The strings design shall be such that when units are coupled together there shall be contact between the shell of one unit and metal of the adjacent unit.

**DIMENSIONAL TOLERANCE OF INSULATORS DISCS**

It shall be ensured that the dimensions of the long rod insulators are within the limits as per relevant IEC/ISS.

**TESTS (FOR DISC INSULATORS) :**

The following tests shall be carried out on the insulator string and disc insulators.

**TYPE TEST:**

This shall mean those tests, which are to be carried out to prove the design, process of manufacture and general conformity of the material and product with the intents of this

specification. These tests shall be conducted on a representative number of samples prior to commencement of commercial production. The Bidder shall indicate his schedule for carrying out these tests.

**ACCEPTANCE TESTS:**

This shall mean these tests, which are to be carried out on samples taken from each lot offered for pre-dispatch inspection for the purpose of acceptance of the lot.

**ROUTINE TESTS:**

This shall mean those tests, which are to be carried out on each insulator to check the requirements, which are likely to vary during production.

**TESTS DURING MANUFACTURE:**

Stage tests during manufacture shall mean those tests, which are to be carried out during the process of manufacture to ensure quality control such that the end product is of the designed quality conforming to the intent of this specification.

**TEST VALUE:**

For all type and acceptance tests the acceptance values shall be the value guaranteed by the bidder in the guaranteed technical particulars of the acceptance value specified in this specification of the relevant standard whichever is more stringent for that particular test.

**TEST PROCEDURE AND SAMPLING NORMS:**

The norms and procedure of sampling for the above tests shall be as per the relevant Indian Standard or the internationally accepted standards. This will be discussed and mutually agreed to between the supplier and purchaser before placement of order. The standards and normal according to which these tests are to be carried out are listed against each test. Where a particular test is a specific requirement of this specification, the norms and procedure for the same shall be as mutually agreed between the supplier and the purchaser in the quality assurance programme.

**TYPE, ROUTINE & ACCEPTANCE TESTS:**

The following type test shall be conducted on a suitable number of individual unit components, materials or complete strings.

**1. On complete insulator string with hardware fittings Standards BS:137(Part-I) IEC: 383**

- a) Power frequency voltage withstand test with corona control rings and under wet condition.
- b) Impulse voltage withstand test under dry condition.
- c) Mechanical strength test. As per this specification.

## **2. On Insulators:**

- a) Verification of dimensions. :IS: 731
- b) Thermal mechanical performance test: : IEC:575
- c) Power frequency voltage withstand and flashover
  - i) dry ii) wet :BS:173
- d) Impulse voltage withstand flashover test (dry) : IEC: 383
- e) Visible discharge test (dry) : IS:731

All the type tests given under clause No.5.14 above shall be conducted on single suspension and Double Tension insulator string along with hardware fittings.

## **3. ACCEPTANCE TESTS: For insulator:**

- a) Visual examination : IS:731
- b) Verification of dimensions. : IS:731
- c) Temperature cycle test. : IS:731
- d) Galvanizing test. : IS:731
- e) Mechanical performance test. : IEC:575
- f) Test on locking device for ball and socket coupling. :IEC-372
- g) Eccentricity test.
- h) Electro-mechanical strength test : As per this specification.
- i) Puncture test. : IS:731
- j) Porosity test. : IS:731

## **4. ROUTINE TESTS: For insulators:**

- a) Visual inspection. : IS:731
- b) Mechanical routine test.
- c) Electrical routine test. : IEC:383

### **ADDITIONAL TESTS:**

The purchaser reserves the right for carrying out any other tests of a reasonable nature at the works of the supplier/ laboratory or at any other recognized laboratory/ research institute in addition to the above mentioned type, acceptance and routine tests at the cost of the purchaser to satisfy that the material complies with the intent of this specification.

**CO-ORDINATION FOR TESTING:**

For insulator strings, the supplier shall arrange to conduct testing of their disc insulators with the hardware fittings to be supplied to the purchaser by other suppliers. The supplier is also required to guarantee overall satisfactory performance of the disc insulator with the hardware fittings.

**NOTE:**

In respect of electrical tests on a complete string consisting of insulators and hardware guarantee of values of responsibility of testing shall be with hardware manufacturer of RIV corona and voltage distribution test and with insulator manufacturer for all other tests.

**TEST CHARGES AND TEST SCHEDULE:****TYPE TEST:**

The insulator offered shall be fully type tested as per this specification. In case the equipment of the type and design offered, has already been type tested in an independent test laboratory. The bidder shall furnish four sets of type test reports along with the offer. These tests must not have been conducted earlier than five years. The purchaser reserves the right to demand repetition of some or all type tests in the presence of purchasers' carrying representative. For this purpose the bidder may quote unit rates for carrying out each type test. These prices shall be taken into consideration for bid evaluation. For any change in the design/type already type tested and the design/type offered against this specification, purchaser reserves the right to demand repetition of tests without any extra cost.

**ACCEPTANCE AND ROUTINE TEST:**

All acceptance and routine tests as stipulated herein shall be carried out by the supplier in the presence of purchaser's representative.

Immediately after finalization of the programme of type/ acceptance/ routine testing, the supplier shall give sufficient advance intimation to the purchaser to enable him to depute his representative for witnessing the tests.

For type tests involving tests on a complete insulator string with hardware fittings, the purchaser will advise the supplier of the hardware fittings to provide the necessary fittings to the place of the test.

In case of failure of the complete string in any type tests, the supplier whose product has failed in the tests shall get the tests repeated at his cost. In case of any dispute, assessment of the purchaser as to the items that has caused the failure in any of the type tests shall be final and binding.

**VOLTAGE DISTRIBUTION TEST:**

- a) The voltage across each insulator unit shall be measured by sphere gap method. The result obtained shall be converted into percentage and proportionate correction be applied as to give a total of 100% distribution.
- b) The complete insulator string along with its hardware fitting excluding arcing horn corona controlling/grading ring and suspension assembly/dead end assembly shall be subject to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be

increased already rate to 68% of the minimum UTS specified. The load shall be held for five minutes and then removed. After removal of the load, the string components shall not show any visual deformation and it shall be possible to disassemble them by hand,. Hand tools may be used to remove cotter pins and loosen the nuts initially. The string shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing loads reached and the value recorded.

**VIBRATION TEST:**

The suspension string shall be tested in suspension mode, and tension string in tension mode

itself in laboratory span of minimum 30 meters. In the case of suspensions string a load equal to 600 Kg. shall be applied along with the axis of the suspensions string by means of turn buckle. The insulators string along with hardware fittings and two sub conductors throughout the duration of the test vibration dampers shall not be used on the test span. Both the sub-conductors shall be vertically vibrated simultaneously at one of the resonance frequencies of the insulator string (more than 10Hz) by means of vibration inducing equipment. The amplitude of vibration at the antipode point nearest to the string shall be measured and the same shall not be less than 120.4 being the frequency of vibration. The insulator strings shall be vibrated for five million cycles then rotated by 90 deg and again vibrated for 5 million cycles without any failure, after the test, the disc insulators shall be examined for looseness of pins and cap or any crack in the cement. The hardware fittings shall be examined to fatigue fatter and mechanical strength test. There shall be no deterioration of properties of hardware components and disc insulators after the vibration test. The disc insulators shall be subjected to the following tests as per relevant standards.

Test.	Percentage of disc to be tested
a)Temperature cycle test followed by Mechanical performance test.	60
b)Puncture test (for porcelain insulator only)	40

**INSPECTION:**

- i. Purchaser and its representative shall at all times be entitled to have access to the works and to all places of manufacturer where insulators are manufactured and the supplier shall afford all facilities to them for unrestricted inspection of the works, inspection of materials, inspection of manufacturing process of insulators and for conducting necessary tests as specified herein.
- ii. The supplier shall keep the purchaser informed in advance of the time of starting and of progress of manufacture of insulators in its various stages so that arrangements could be made for inspection.
- iii.No material shall be dispatched from its point of manufacture unless the materials has been satisfactorily inspected and tested.

- iv. The acceptance of any quantity of insulators shall in no way relieve the supplier of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection, if such insulators are later found to be defective.

**IDENTIFICATION MARKING:**

- a) Each unit of insulator shall be legibly and indelibly marked with the trade mark of the supplier, the year of manufacture, the guaranteed combined mechanical and electrical strength in kilo-Newton abbreviated by ‘\_KN’ to facilitate easy identification and proper use.
- b) The marking shall be on porcelain for porcelain insulators. The marking shall be printed and not impressed and the same shall be applied before firing.

**QUALITY ASSURANCE PLAN:**

The bidder hereunder shall invariably furnish following information along with his offer, failing which the offer shall be liable for rejection.

- a. Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested, list of tests normally carried out on raw materials in presence of bidder's representative, copies of test certificates.
- b. Information and copies of test certificates as in (i) above in respect of bought out materials.
- c. List of manufacturing facilities available.
- d. Level of automation achieved and lists of area where manual processing exists.
- e. List of areas in manufacturing process, where stage inspections are normally carried out in quality control and details of such tests and inspection.
- f. Special features provided in the equipment to make it maintenance free.
- g. List of testing equipment available with the bidder for final testing of equipment specified and test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in schedule of deviations from specified test requirements.

The supplier shall within 15 days of placement of order submit the following information to the owner.

List of raw material and the names of sub-suppliers selected from those furnished along with the offer.

**CHEMICAL ANALYSIS OF ZINC USED FOR GALVANIZING.**

Samples taken from the zinc ingot shall be chemically analyzed as per IS: 209. The purity of zinc shall not be less than 99.95%.

**TESTS FOR FORGINGS:**

The chemical analysis hardness tests and magnetic particle inspection for forgings will be as per the internationally recognized procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the supplier and purchaser in quality assurance programme.

**TESTS ON CASTING:**

The chemical analysis mechanical and metallographic tests and magnetic particle inspection for castings will be as per the internationally recognized procedures for these tests. The samplings will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the supplier and purchaser in quality assurance programme.

**HYDRAULIC INTERNAL PRESSURE TEST ON SHELLS:**

The test shall be carried out on 100% shells before assembly. The details regarding test will be as discussed and mutually agreed to by the suppliers and purchaser in Quality Assurance Programme.

**THERMAL MECHANICAL PERFORMANCE TEST:**

The thermal mechanical performance test shall be carried out on minimum 15 number of disc insulators units as per the procedure given in IEC 575. The performance of the insulator unit shall be determined by the same standard.

**ECCENTRICITY TEST:**

The insulator shall be vertically mounted on a fixture using dummy pin and socket. A vertical scale with horizontal slider shall be used for the axial run out. The pointer shall be positioned in contact with the bottom of the outermost petticoat of the disc. The disc insulators shall be rotated with reference to the fixture and the slider shall be allowed to move up and down on the scale but always maintaining contact with the bottom of the outer most petticoats. After one full rotation of the disc the maximum and minimum position the slider has reached on the scale can be found out. Difference between the above two readings shall satisfy the guaranteed value for axial run out.

Similarly using a horizontal scale with vertical slider the radial run out shall be measured. The slider shall be positioned on the scale to establish contact with the circumference of the disc insulator and disc insulator rotated on its fixture always maintaining the contact. After one full rotation of the disc the maximum and minimum position the slider has reached on the scale can be found out. Difference between the above two readings shall satisfy the guaranteed value for axial run out.

**CRACK DETECTION TEST:**

Crack detection test shall be carried out on each ball and pin before assembly of disc unit. The supplier shall maintain complete record of having conducted such tests on each and every piece of ball pin. The bidder shall furnish full details of the equipment available with him for crack test and also indicate the test procedure in detail.

### DISC INSULATOR (B&S) Type:

Bidder should offer 11KV/33 KV Disc Insulator (B & S type) suitable for overhead power line Conforming to IS:731/1971 (2<sup>nd</sup> Revision), (Amendments - 6), Reaffirmed – 1991 & Guaranteed Technical Particulars. Type test certificates from CPRI or accredited NABL laboratory should be furnished

#### GUARANTEED TECHNICAL PARTICULARS

##### DISC INSULATOR B & S TYPE

Sl. No.	Description	Unit	70KN.	90 KN	Bidder's Offer
1.	Manufacture's Name & Address		To be specified by bidder	To be specified by bidder	
2.	Type of Insulator		Ball T Socket	Ball T Socket	
3	Size of Ball & Socket		16B	16B	
4	Dimensions				
a)	Disc Diameter	mm	255	255	
b)	Unit spacing	mm	145	145	
c)	Creepage distance of single insulator	mm	430	430	
5	Electromechanical strength of single insulator	KN	70	90	
6	Materials of Shell		Porcelain	Porcelain	
7	Dry one minute power frequency	Kv(rms)	80	80	
6	Wet one minute power frequency	Kv(rms)	45	45	
7	Dry power frequency flashover.	Kv(rms)	85	85	
8	Wet power frequency flashover.	Kv(rms)	50	50	
9	Dry impulse withstand positive & negative.	Kv (Peak)	170	170	
10	Impulse flashover 1.2 x 50 microsecond (Positive)	Kv (Peak)	125	125	
11	Impulse flashover 1 x 50 microsecond (Negative)	Kv (Peak)	125	125	
12	Power frequency puncture voltage	Kv	1.3 times the actual drive flashover voltage of the unit.	1.3 times the actual drive flashover voltage of the	
13	High system voltage.	Kv	36	36	
14	Visible Discharge voltage.	Kv	27	27	
15	Weight/Unit.	Kg.	To be specified by bidder	To be specified by bidder	
16	Marking :--	Each insulator will be legibly marked to show the following :			

		(a) Name of the Purchaser :-- NESCO	
		(b) Name or trademark :--	
		(c) Month & year of manufacturing :--	
		(d) Minimum failing load.	
	PACKING: -- All insulators shall be packed suitably for easy but rough handling & acceptable for road transport. Where more than one insulator is packed in a crate, separator shall be fixed between the insulators to keep individual insulator in position without movement in the crate.		

**NB- Every insulator should bear the marking of manufacturer's name & Purchaser's name and ISI mark.**

**Name & Signature of Bidder with seal**

