TECHNICAL SPECIFICATION OF 33KV & 11 KV GI PIN FOR PIN INSULATOR

The 33KV & 11KV hot-dipped galvanized Pin shall confirming to IS: 2486 (Part-I) 1971 & (Part: II) / 1989, IS: 1363 / 1984, IS: 3063 / 1972 & IS: 2633 / 1972.

1. SCOPE:-

11 KV & 33KV G.I. Pin for power conductor suitable for use in 11 KV & 33KV Over-head transmission lines and sub-stations. The materials/equipment offered, shall be complete with all components, which are necessary or usual for the efficient performance and satisfactory maintenance. Such part shall be deemed to be within the scope of contract

2. MATERIALS & DESIGN:-

The pins shall be of single piece obtained by the process of forging. They will not be made by any process using more than one piece of material. The pin will have good finish, free from flaws and other defects. The finish of the collar shall be such that a sharp angle between the collar and the shank is avoided. All ferrous pins, nuts and washers, except those made of stainless steel shall be galvanized by hot dip process. Other fittings, i.,e flat washers and spring washers may be electro-galvalised as per IS:2486. The threads of nuts, and toped holes, when cut after galvanization shall be well oiled or greased.

The pins shall be as per relevant figure indicated in IS 2486 (part II) having stalk length of 300mm for 33KV & 165 mm for 11KV GI Pin and shank length of 150 mm with minimum failing load of 10kN for 33KV & 5kN for 11KV GI Pin with small heads and shall match with the pin type insulators with cemented zinc thimble having similar threads.

3. TESTS :-

The hardware fittings and pins shall be tested as per IS: 2486 (part-1):1993

3.1 Type Test:

The bidder has to enclose the reports of the following type tests carried out in any govt. recognized laboratory along with the bid documents.

a) Checking of Threads on Heads
b) Galvanizing Test
c) Visual Examination
d) Mechanical Test.

3.2 Acceptance Tests:

Following tests shall be carried out at the works of the manufacturer before dispatch.

a) Checking of Threads on Heads
b) Galvanizing Test
c) Visual Examination
d) Mechanical Test.

Guaranteed Technical Particulars of 33KV & 11KV GI Pin

Sl. No.	General Technical Particulars	Bidder's Offer	
		33KV GI Pin	11KV GI Pin
1.	Manufacturer's name & Address		
2.	Standard applicable specification		
3.	Minimum failing load		
4.	Dimensions (mm)		
(a)	Total length		
(b)	Shank length		
(c)	Stalk length		
5.	Type of threads		
6.	Threads per Inch		
7.	Type of galvanization of pin & nuts		
8.	Mass of zinc (minimum)		
9.	No. of Nuts with each pin & its size		
10.	No. of spring washer with each pin & its size		
11.	Packing details		
a	Type of packing		
b	Weight of each pin approx, (with nut & washers)		
c	No. of Pins in each packing (Kg)		
12.	Tolerance in weight / dimensions, if any		
13.	Any other relevant information the bidder would like to indicate		
14.	Whether drawing has been submitted by the bidder		

TECHNICAL SPECIFICATION OF 33KV & 11KV B&S TYPE HARDWARE FITTING

1. SCOPE:-

11 KV & 33KV B&S Hardware fitting for power conductor and hardware fittings for string insulators suitable for use in 11 KV & 33KV Over-head transmission lines and sub-stations. Hardwares to be supplied shall be as per approved drawings. The materials/equipment offered, shall be complete with all components, which are necessary or usual for the efficient performance and satisfactory maintenance. Such part shall be deemed to be within the scope of contract.

2. STANDARD:-

The materials covered under this Specification shall comply with the requirement of the latest version of the following standards as amended up to date, except where specified otherwise.

IS: 2486 (Part-II & III)	: Insulator fitting for overhead power lines with a nominal voltage greater than 1,000 volts
IS: 2121 (Part I & II)	: Conductor & earth wire accessories for overhead Power lines
IS: 9708	: Stock Bridge Vibration Dampers on overhead Power lines
IS: 2633	: Method of testing of uniformity of coating on zinc Coated articles
IS: 209	: Specification for Zinc
BS: 916	: Specification for Hexagonal bolts and nuts

3. MATERIALS AND DESIGN:

Aluminium and aluminium alloys, malleable iron and forged steel having required mechanical strength, corrosion resistance and machinability depending on the types of application for which accessories / fittings are needed. In the accessories / fittings, the composition of the aluminium alloys used shall be made available to purchaser if required for verification. The materials offered shall be of first class quality, workmanship, well finished and approved design. All castings shall be free from blow-holes, flaws, cracks of other defects and shall be smooth, close grained and true forms and dimensions. All machined surfaces should be free, smooth and well finished.

Metal fittings of specified material for conductor and earth wire accessories and string insulator fittings are required to have excellent mechanical properties such as strength, toughness and high resistance against corrosion. All current carrying parts shall be so designed and manufactured that contact resistance is reduced to the minimum. All bolts, nuts, bolt-heads shall be the white worth's standard thread. Bolt heads and nuts shall be hexagonal. Nuts shall be locked in an approved manner. The treads in nuts and tapped holes shall be cut after galvanizing an shall be well fabricated and greased. All other treads shall be cut before galvanizing. The bolt treads shall be undercut to take care of increase in diameter due to galvanizing. All nuts shall be made of materials to Clause: 4.8 of IS: 1367 (latest edition) with regard to its mechanical properties. The general design conductor and earth wire accessories and insulator fittings shall be such as to ensure uniformity, high strength, free from corona formation and high resistance against corrosion even in case of high level of atmosphere pollution. All hooks, eyes, pins, bolts, suspension clamps and other fittings for attaching to the tower or to the line conductor or to the earth wire shall be so designed that the effects of vibration, both on the conductor and the fittings itself, are minimized. Special attention must be given to ensure smooth finished surface throughout. Adequate bearing area between fittings shall be provided and point or line contacts shall be avoided. All accessories and hardwares shall be free from cracks, shrinks, slender air holes, burrs or rough edges. The design of the accessories and hardwares shall be such as to avoid local corona formation or discharge likely to cause interference to tele-transmission signals of any kind.

4. Galvanisation:

All ferrous parts of conductor and ground wire accessories and insulator hardwares shall be galvanized in accordance with IS: 2629-Recommended Practice for hot dip galvanizing of iron and steel or any other equivalent standards. The weight of zinc coating shall be determined as per method stipulated in IS: 2633 for testing weights, thickness and uniformity of coating of hot dip galvanized articles or as per any other equivalent authoritative standards. The zinc used or galvanization shall conform to grade Zn

98 of IS: 209. The galvanized parts shall withstand four (4) dips of 1 minute each time while testing uniformity of zinc coating as per IS: 2633. Spring washers shall be electro galvanized.

5. INSULATOR HARDWARES:

The insulator disc hardware and string assemblies to be offered by the bidder shall be suitable to meet the requirement given in the specific technical particulars as detailed hereinafter. Hardware for suspension and tension insulator shall be suitable for insulator with normal pin shank diameter of 20 mm. in case of tension string unit and 16mm. for suspension string unit.

Each insulator string shall generally include the following hardware components.

Single Suspension Set	**Double Suspension Set**
a) Ball Hook.	(i) Ball Hook.
b) tower side arching horn	(ii) Socket clevis with R-Type security clip-3 Nos.
c) Socket Eye with R-Type security clip.	(iii) Yoke Plate-2 Nos.
d) Line side arcing horn.	(iv)Tower side arcing horns-2Nos.
e) Suspension clamps	(v)Ball clevis – 2 Nos.
	(vi) Line side arcing homs-2 Nos.
	(vii)Clevis Eye.
	(viii) Suspension Clamp
Single Tension Set :	**Double Tension Set :**
a) Anchor Shackle	a) Anchor Shackle.
b) Ball Eye.	b) Chain Link.
c) Tower side arcing horn.	c) Yoke Plate – 2 Nos.
d) Socket Clevis with R-Type security clip.	d) Tower side arching horn.
e) Line side arcing horn	e) Ball Clevis – 2 Nos.
f) Bolted type dead end clamp.	f) Socket Clevis with R-Type security clip – 2Nos
	g) Line side arcing horns.
	h) Bolted type dead end clamps.

6. SUSPENSION CLAMPS

This clamp will be envelope type made out of aluminum alloy suitable for accommodating preformed armored rod.

7. TENSION CLAMPS

The Tension Clamps shall be made out of aluminum alloy and of 4 **pair** bolted **(M-16)** type suitable for 232 mm² AAAC –up conductor **(In case of lines it will be suitable for 80mm²100 mm² 150 mm²)** The tension clamps shall not permit slipping or damage to failure of the complete conductor or any part thereof at a load less than 90% of the ultimate strength of conductor. The mechanical efficiency of tension / clamps shall not be affected by method of erection involving come / along or similar clamps or tension stringing operation during or after assembly and erection of tension clamp itself. The tension clamp shall be of a design that will ensure unrestricted flow of current without use of parallel groove clamps. The clamps shall be as light as possible.

8. ARCING HORNS

Each hardware assembly shall have provision for attaching arcing horns of both adjustable and non/adjustable type across the suspension and tension strings or tower side. However each hardware assembly shall be provided with arching horn of fixed type on line side only.

9. TESTS, TEST CERTIFICATE AND PERFORMANCE REPORTS

The fittings and accessories for the power conductor, insulator and hardware shall be tested in accordance with IS:2121, IS:2486, BS:916 for hexagonal bolts and nuts or any other

authoritative equivalent standards. Six sets of type and routine test certificates and performance reports are to be submitted by the bidder.

The Employer however, reserves the right to get all the tests performed in accordance with the relevant I.S. Specification as Acceptance Test in presence of Employer-s representatives.

The bidder shall clearly state the testing facilities available in the laboratory at his Works and his ability to carry out the tests in accordance with this Specification. All the specified tests shall be carried out without any extra cost.

Acceptance Test for power conductor accessories.

a) Visual examination
b) Dimensional verification
c) Failing load test
d) Slip strength test (for clamps)
e) Electrical resistance test
f) Fatigue test (for vibration dampers)
g) Mass pull off test (for vibration dampers)
h) Galvanizing test.

10. <u>ACCEPTANCE TEST FOR HARDWARES</u>

i) Dimensional Verification
ii) Ultimate tensile test.
iii) Slip strength test
iv) Electrical Resistance test
v) Heating cycle test
vi) Breaking strength of full string assembly
vii) Galvanizing test

11.

a) material	:	Flexible copper bond (37/7/0.417 mm. tinned copper flexible stranded cable).
b) Length	:	Not less than 750 mm.
c) Bolt size	:	16mm x 40 mm.
d) Copper area.	:	34 sq.mm.
e) Thickness of long	:	6 mm.
f) Material for connecting socket	:	Tinned Brass

12. <u>FASTENERS</u>: Bolts, Nuts & Washers

1. All bolts and nuts shall conform to IS-6639 – 1972. All bolts and nuts shall be galvanized. All bolts and nuts shall have hexagonal heads, the heads being truly concentric, and square with the shank, which must be perfectly straight.

2. Bolts up-to M16 and having length up-to ten times the diameter of the bolt should be manufactured by cold forging and thread rolling process to obtain good and reliable mechanical properties and effective dimensional control. The shear strength of bolt for 5.6 grades should be 310 Mpa minimum as per IS-12427. Bolts should be provided with washer face in accordance with IS-1363 Part-I to ensure proper bearing.

3. Fully threaded bolts shall not be used. The length of the bolt shall be such that the threaded portion shall not extend into the place of contact of the component parts.

4. All bolts shall be threaded to take the full depth of the nuts and threaded enough to permit the firm gripping of the component parts but not further. It shall be ensured that the threaded

portion of the bolt protrudes not less than 3 mm and not more than 8 mm when fully tightened. All nuts shall fit and be tight to the point where shank of the bolt connects to the head.

5. Flat washers and spring washers shall be provided wherever necessary and shall be of positive lock type. Spring washers shall be electro-galvanized. The thickness of washers shall conform to IS-2016-1967.
6. The bidder shall furnish bolt schedules giving thickness of components connected, the nut and the washer and the length of shank and the threaded portion of the bolts and size of holes and any other special details of this nature.
7. To obviate bending stress in bolt, it shall not connect aggregate thickness more than three time its diameter.
8. Bolts at the joints shall be so staggered that nuts may be tightened with spanners without fouling.
9. Fasteners of grade higher than 8.8 are not to be used and minimum grade for bolts shall be 5.6.

13. <u>GENERAL</u>:

1. All ferrous parts including fasteners shall be hot dip galvanized, after all machining has been completed. Nuts may however be tapped (threaded) after galvanizing and the threads oiled. Spring washers shall be electro-galvanized. The bolt threads shall be undercut to take care of the increase in diameter due to galvanizing. Galvanizing shall be done in accordance with IS-2629-1985 and shall satisfy the tests mentioned in IS: 2633-1986. Fasteners shall withstand four dips while spring washers shall withstand three dips of one-minute duration in the standard Preece test. Other galvanized materials shall be guaranteed to withstand at least six successive dips each lasting one minute under the Standard Preece test for galvanizing.
2. The zinc coating shall be perfectly adherent of uniform thickness, smooth, reasonably bright, continuous and free from imperfections such as flux, ash, rust stains, bulky white deposits and blisters. The zinc used for galvanizing shall be of grade Zn 99.95 as per IS 209-1979.
3. Pin balls shall be checked with the applicable –G‖ gauges in at least two directions, one of which shall be across the line of die flashing and the other 90 deg. to this line. ‗NO GO' gauges shall not pass in any direction.
4. Socket ends, before galvanizing shall be of uniform contour. The bearing surface of socket ends shall be uniform about the entire circumference without depressions or high spots. The internal contours of socket ends shall be concentric with the axis of the fittings as per IS 2486/IEC-120. The axis of the bearing surfaces of socket ends shall be coaxial with the axis of the fittings. There shall be no noticeable tilting of the bearing surfaces with the axis of the fittings.
5. All current carrying parts shall be so designed and manufactured that contact resistance is reduced to minimum.
6. Welding of aluminum shall be by inert gas shielded tungsten are or inert gas, shielded metal arc process. Welds shall be clean, sound, smooth, and uniform without overlaps, properly fused and completely sealed. There shall be no cracks, voids incomplete penetration, incomplete fusion, under-cutting or inclusions Porosity shall be minimized so that mechanical properties of the aluminum alloys are not affected. All welds shall be properly finished as per good engineering practices.

14. <u>Electrical Design</u>:

The normal duty and heavy duty suspension, light duty, normal duty and heavy duty tension insulator sets shall all comply with the technical requirements and satisfy the test requirements

15. Mechanical Design:

The mechanical strength of the insulators and corresponding insulator fittings must match .The design shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to the development of defects.

Insulating material shall not engage directly with hard metal. All fixing materials shall be of approved quality, shall be applied in an approved manner and shall not enter into chemical action with the metal parts or cause fracture by expansion in service. Where cement is used as a fixing medium, cement thickness shall be as small and even as possible and proper care shall be taken to correctly centre and locate the individual parts during cementing.

16. Technical Specification for Design, Supply and Testing of Hard ware fittings:-

16.1 Type tests:-

The following type tests shall be conducted on hardware fittings.

A. On suspension hardware fittings only.

(i) Magnetic power loss test.
(ii) Clamp slip strength Vs torque
(iii) Mechanical strength test.
(iv) On one test on elastomer.

B. On Tension hard ware fittings only.

(i) Electrical resistance test for dead end assembly : IS 2486 (Part-I) 1971
(ii) Heating cycle test for dead end assembly : -do-
(iii) Slip strength test for dead end assembly : IS 2486 (Part-I)
(iv) Mechanical strength test.

C. On both suspension and tension hardware fittings.

(i) Visual examination. : IS-2486 (Part-I) 1971
(ii) Verification of dimension. : -do-
(iii) Galvanizing / electroplating test. : -do-
(iv) Mechanical strength test of each component (Including corona control ring/grading ring and arcing horn)
(v) Mechanical strength test of welded joint.
(vi) Mechanical strength test for corona control ring/ grading ring and arcing horn. BS-3288 (Part-I)
(vii) Test on locking device for ball and socket coupling. IEC – 3721984
(viii) Chemical analysis, hardness tests, grain size, Inclusion rating and magnetic particle inspection for forging/casting.

D. On suspension hardware fittings only.

i) Clamp ship strength ver as torque test for suspension clamp
ii) Shore hardness test of elastomer cushion for AG suspension clamp.
iii) Bend test for armour rod set : IS-2121 (Part-I)
iv) Resilience test for armour rod set. : –do-
v) Conductivity test for armour rod set. : –do-

All the acceptance tests stated at clause shall also be carried out on composite insulator unit, except the eccentricity test at clause. In addition to these, all the acceptance tests indicated

in IEC 1109 shall also be carried out without any extra cost to the employer.

E. <u>For hardware fittings</u>

a) Visual examination. : IS-2121 (Part-I)

b) Proof & test.

F. Tests on conductor accessories.

G. Type Test

H. Mid span compression joint for conductor and earth wire.

a) Chemical analysis of materials.

b) Electrical resistance tests. : IS-2121 (Part-II) 1981 clause 6.5 & 6.6

(c) Heating cycle test. : –do-

(d) Slip strength test. : –do-

GUARANTEED TECHNICAL PARTICULARS OF 33KV & 11KV B&S TYPE HARDWARE FITTING

Sl. No.	Description	Bidder's Offer	
		33KV HW	11KV HW
1	Name & Address of Manufacturer		
2	Applicable standard		
3	Type of insulator (Porcelain or toughened glass)		
4	Dry impulse withstand voltage		
5	Wet power frequency, 1 minute, withstand voltage		
6	Dry, Critical Impulse Flashover Voltage		
7	Dry, power frequency Critical Flashover Voltage		
8	Wet, power frequency Critical Flashover Voltage		
9	Power frequency Puncture Voltage		
10	Mechanical Routine Test Load		
11	Mechanical Impact Strength		
12	Shattered Strength (Glass)		
13	Electromechanical Failing Load		
14	Safe Working Load		
15	Minimum Failing Load		
16	Creepage Distance		
17	Protected Creepage Distance		
18	Type and Grade of Materials: Insulator		
19	Type and Grade of Materials: Cap		
20	Type and Grade of Materials: Pin		
21	Type and Grade of Materials: Locking Pin		
22	Type and Grade of Materials: Cement		
23	Type of semi conducting Glaze		
24	Colour of Insulator		
25	Weight of Insulator		
26	Number of insulator per crate		
27	Gross Weight of Loaded Crate		
28	Whether drawing showing dimensional details have been furnished along with Bid		

TECHNICAL SPECIFICATION OF 11 KV T&C TYPE HARDWARE FITTING

The hardware fittings required for T & C Strain Disc Insulator. For use in 11 KV Overhead power lines shall comply IS: 2486 (Part-I) 1971 & 2486 (Part-II) / 1974, IS: 2486 (Part-III) 1974 & IS: 12048 / 1987 or the latest revision thereof. All Forging and Casting shall be good finish and free from flows and other defects. The edges on the outside of fittings such as at the Eye, Cleaves and Holes shall be rounded.

All parts of different fittings, which provide for Inter-connection shall be made such that sufficient clearance is provided at the Connection Point to ensure free movement & suspension of the Insulator string Assembly. All eye and cleaves shall be free in this manner but care shall be taken that too much clearance between Eye & Tongs of the cleaves is avoided.

All ferrous fittings and parts other than those of Stainless steel shall be hot dip galvanized as per ISS: 26331964.Small fittings like spring washer, Nuts etc. may be Electro-galvanized as per IS-6745 / 72.The threads of nuts and topped holes when cut after Galvanizing shall be well cited & grassed. The Hardware fittings (Tongue & Clevis type) shall be suitable for fixing on 75 mm x 40 mm Channel Cross Arm and can accommodate upto 80mm² Conductors.

The set shall comply the following components:

Cross arms straps (Dead & Straps) with Bolt (16 mm) Nut and Spring Washer. Two Nos. forged cotter pints and spring washer to suit the tongue and the clevics. Formed helical fittings should be of suitable materials, i.e., all alloy aluminum steel suitable upto 80mm² ACSR/AAAC.

Strain clamps shall be suitable for the above ACSR conductor or AAAC. The ultimate strength of the clamp should not be less than 3000 Kg and slipping strength shall not be less than 90% of this figure. The clamp should be malleable cast iron/All alloy A-6.

TESTS:- String insulator fittings shall comply with the following tests as per IS: 2486 (Part: I).

A) Type Tests:

a) Visual examination test
b) Verification of dimensions
c) Slip strength test
d) Mechanical test
e) Electrical resistance test
f) Heating cycle test
g) Galvanizing test

B) Acceptance/ Routine Test:

a) Verification of dimensions
b) Mechanical test
c) Galvanizing test
d) Visual examination test
e) Routine mechanical test

Guaranteed Technical Particulars of 11KV T&C Hard Wire Fittings

Sl. No.	Description	Bidder's Offer
1)	Manufacturer’s Name & Address	
2)	Standard Specification to which Hard ware Fittings shall confirm	
3)	Ultimate strength	
4)	Dimension in accordance with	
5)	Type of washer thickness	
a)	Spring	
b)	Flat	
6)	Type of Clamp size	
7)	Galvanisation confirms to	
8)	Weight of fittings	
9)	Tolerance in dimension if any	
10)	Manufacturer trade mark to be embossed on the sets	
11)	Specific drawing to be enclosed	