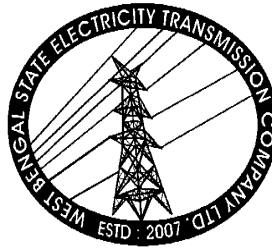


CLAMPS CONNECTORS & EQUIPOTENTIAL RING



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Engineering Department

WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED

পশ্চিমবঙ্গ রাজ্য বিদ্যুৎ সংবহন কোম্পানি লিমিটেড
(পশ্চিমবঙ্গ সরকারের একটি উদ্যোগ)

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TECHNICAL SPECIFICATION FOR CLAMPS CONNECTORS AND EQUIPOTENTIAL RING

1. SCOPE:

This specification cover, design, manufacture, testing, supply delivery at site of the terminal Connectors, Clamps and Equipotential . All clamps, connectors and Equipotential rings shall be suitable as per application of Al. Pipe bus of different sizes suitable for different voltage class, ACSR Moose Conductor, ACSR Panther Conductor, ACSR ZEBRA Conductor etc.

2. STANDARD :

Clamp and Connector shall conform to the latest revision of the following IS

- | | | | |
|-------|---------------------|---|---|
| (i) | IS – 5561 | : | Electric Power Connectors |
| (ii) | IS-2121 Part I & II | : | Conductor and earth wire accessories for overhead line. |
| (iii) | IS-2633 | : | Method for testing weight, thickness and uniformity of coating on hot dipped galvanized articles. |
| (iv) | IS-5082 | : | Wrought Aluminium and Aluminium Alloy section for electrical purpose. |
| (v) | IS-1285 | : | Wrought Aluminium and Aluminium Alloy Round Tube and hollow sections. |
| (vi) | IS-617 | : | Aluminium and aluminium alloy ingots and casting for general engineering purpose. |

3. I) DEVIATION :

Normally the offer should be as per Technical Specification without any deviation.

II) MODIFICATION :

If any modification felt necessary to improve performance, efficiency and utility of equipment, the same must be mentioned in the 'Modification schedule' with reasons duly supported by documentary evidences and advantages. Such modifications suggested may or may not be accepted, but the same must be submitted along with Pre-Bid Queries. The modifications not mentioned in Schedule will not be considered.

4. DESIGN CRITERIA OF CLAMPS & CONNECTORS FOR 220KV, 132KV & 33KV SWITCHYARD PORTION:

- (a) Clamps and connectors shall be made from cold forged Aluminum Alloy plate i.e. Extruded Aluminum Clamps and Connectors shall be processed through Cold forging of Aluminum Alloy.
- (b) The Nuts and Bolts associated with equipment of Connector pieces shall be of MS Hot dip Galvanized, Quality of nuts and bolts shall conform to relevant IS of latest edition.
- (c) Minimum thickness at any point of current carrying part of any clamp and connector shall not be less than 12 mm. However bidder has to submit detail calculation in support of withstanding of continuous current rating of connector as well as short circuit current withstand for specified duration as mentioned under general specification without increase of temperature beyond allowable limit as per relevant IS.
- (d) The clamps and connectors shall be of best quality and workmanship, free from blowholes, cracks, cavities, surface blisters, claws and any other defect which may effect the performance of the clamp.
- (e) Wherever connector will bridge Aluminum & Copper for bimetallic clamps, pure copper with tin coated liner having minimum thickness of 2 mm. shall be used.
- (f) The connectors shall be designed Corona free. The voltage gradient at any corner surface shall be at a level that will not cause any resultant radio interference.
- (g) Flexible connectors shall be made from all aluminium conductors having suitable current rating.
- (h) All connectors or its components to be connected with ACSR conductor shall be of compression type having Aluminum purity not less than 99.0%.
- (i) All clamps and connectors shall be made from cold forged Aluminum plate i.e. extruded Aluminum having purity of Aluminum not less than 97.5%.
- (j) From outermost hole edge to nearest edge of any clamps and connectors the distance shall not be less than 10 mm.
- (k) Sharp Corners and edges shall be rounded off.
- (l) The connectors are to be designed to prevent accumulation of moisture and can withstand the corrosive atmosphere condition.
- (m) The connector shall be mechanically strong so that it can withstand loads imposed during erection, normal service, electro-mechanical force due to temperature variation and short circuit condition.
- (n) The bolts shall be so located that pressure is properly distributed from the bolts over the entire contact surface.
- (o) The current density of Aluminum / copper shall be considered as 0.75 / 1.75 A / sq. mm.
- (p) The normal rated continuous current of clamps and connectors shall be selected as per point of application, use of type of conductors/Aluminum tube and also the stipulation of Clause No. 12.1 (a), (b) & (c) of IS : 5561 which are stated below :
 - (i) Equipment Connectors – The values of current shall be selected on the basis of the rating of the equipment to which the connector is connected or on the basis of the rating of the conductor for which the opening is designed, whichever is smaller.
 - (ii) Junction Connectors – The values of current shall be selected on the basis of the conductor which has the lower current carrying value where the openings are of two

sizes and on the basis of the conductor which is common to both openings where the openings are of the same size.

(iii) 'T' Connectors – The values of current shall be selected on the basis of the full rated current in the tap conductor only.

(q) **The rated frequency of connector shall be 50 HZ.**

(r) Rated short time current shall be as laid in the general specification for different voltage classes.

(s) The temperature rise of connector above an ambient temp. of 50°C when carrying rated continuous current shall not exceed 35°C.

(t) Power connector shall be so designed and proportioned that they are capable of safely withstanding stresses to which they may be subjected (including those due to short-circuit and climatic condition) and that the effect of vibration both on the conductor and the connector itself are minimized. They shall be designed, manufactured and finished so as to avoid sharp radii of curvature, ridges and excrescences which might lead to localised pressure on or damage to the conductor in service.

(u) Sufficient contact pressure should be maintained at the joint by the provision of the required number of bolts or other fixing arrangement. But the contact pressure should not be so great as to cause relaxation of the joint. The joint should be such that the pressure is maintained within the range under all conditions of service. To avoid excessive local pressure, the contact pressure should be evenly distributed by the use of pressure plates, washers or suitable saddles of adequate area and thickness.

(v) All connector should be so designed and manufactured so as to offer ease of installation, as these are to be in overhead installation.

The connectors shall be indelibly marked with rated current or any identifying mark to enable full particulars of the connector to be obtained.

The electric power connector may also be marked with the ISI Certification Mark.

(w) All the clamps and connectors to be supplied along with all equipment i.e. Breaker, C.T., P.T. Earthing Transformer., L.A., CVT, Isolator, Stn. Service Transformer etc. shall be guided by this technical specification.

5. DESIGN CRITERIA FOR 400KV CLAMPS AND CONNECTORS.

(i) All aluminium and aluminium alloys used in the manufacture of clamps and connectors shall conform to designation 4600 of IS : 617 and to be manufactured by Casting process, Clamps and connectors shall be free from cavities, blow holes, surface blisters and any other defects which may effect the performance of the clamps.

(ii) General radius shall be provided on all outer surfaces to keep voltage stress to a minimum.

(iii) The thermal rating of connection shall be such that the joint runs cooler than the associated bus bar.

(iv) The current density shall be considered as 0.75A/sq. mm. in case of aluminium ally/forged aluminium and that for copper shall be 1.75 A/Sq. mm.

(v) Sl. No. (b), (c), (f), (g), (h), (k), (l), (m), (n), (o), (q), (r), (s), (t), (u), (v) and (w) of Cl. No. 4 are also applicable.

(vi) All clamps and connectors shall be bolted type.

6. EQUIPOTENTIAL RING FOR 400KV EQUIPMENTS :

Design Criteria :

Equipotential grading rings shall be provided and installed by the contractor on all live parts of 400KV equipment, connections, fittings, where the shape of external surface present sharp corner of any other irregularities resulting from design, manufacture, assembly, erection. They shall also be provided and installed wherever else, such rings are necessary to reduce the dielectric stress on the line surfaces in order to obviate radio interference and Corona effect. All clamp and connectors shall be bolted type.

The sharp and finish of such rings shall be such that the external line surface of the associated equipment is entirely surrounded and that the form of the dielectric field in the immediate vicinities of the line rings is smooth enough to reduce the voltage gradient within safe limits even under the most severe operating and climatic conditions. The rings shall be constituted by aluminium alloy pipes of adequate diameter. They shall be as light as possible and present the minimum possible moment of inertia. Provisions shall be made in order :

- a) To prevent ingress and accumulation of moisture and impurities inside the ring.
- b) To fasten the ring to the associated equipment, in such a way as to prevent loosening under any circumstances.
- c) To avoid vibrations or resonance effects during operation.

The design of the ring assemblies shall permit their easy partial or total installation, dismantling and replacement, without disturbing the associated equipment within the limits of an effecting design. The types of rings shall be standardized as much as possible in order to minimize their variety. All rings of the same type shall be fully interchangeable, without adjustment.

Particular care shall be taken during manufacture and erection in order to obtain a perfectly smooth surface on the whole pipe. Rings not in perfect conditions shall be rejected. The design and arrangement of the equipotential rings shall be subject to the approval of WBSETCL.

7. GUARANTEE :

Electrical characteristics shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, WBSETCL shall have right to reject the material. Guaranteed Technical Particulars are to be submitted by successful bidder during detailed engineering alongwith submitted drawings/documents. However format for submission of GTP shall be handed over to intending bidders at the time of sale of tender documents.

8. TEST REPORTS AND TYPE TESTS :

Only type tested Clamps and Connectors as well as Equipotential grading rings are to be offered conforming to our technical specification, and relevant IS and IEC. Clamps and Connectors as well as Equipotential grading rings offered should be similar with ones on which type testing has been carried out as per relevant IS and IEC. Three sets of complete type test

reports carried out in Govt. recognized Test House or Laboratory /NABL accredited laboratory shall have to be submitted by successful bidder positively alongwith submission of drawings during detailed Engineering. The submitted type test report shall proof that the type test have been carried out within five years from the date of submission of bid. Successful bidder may require to produce original copies of type test reports at the time of detail Engineering if asked by WBSETCL.

Each type test report shall comply the following information with test result

- i) Complete identification, date and serial no.
- ii) Method of application, where applied, duration and interpretation of each test.
- iii) Relevant drawings as documented with test report.

9. TESTS AT MANUFACTURER'S WORKS AND TEST CERTIFICATES :

Bidders shall have adequate testing facilities at their works to conduct all acceptance and routine tests as stipulated below as per relevant IS in presence of engineers of WBSETCL.

Acceptance Test for Clamps &Connectors :

- (a) Tensile test
- (b) Resistance test
- (c) Dimensional check
- (d) Galvanizing test, where applicable.

Routine Test for Clamps &Connectors :

All routine tests at manufacturer's works shall be carried out for each clamp & connectors as per stipulation of relevant IS and test reports are to be submitted.

All routine tests at manufacturer's works shall be carried out for each equipotential Ring as per stipulation of relevant IS and test reports are to be submitted.

All acceptance tests are to be carried out in presence of representatives of WBSETCL on equipotential Ring as well as for clamps & connectors at manufacturer's works on every lot offered for inspection.

Three (3) copies of routine and acceptance test results shall be submitted to the Chief Engineer, Engg. Deptt.,VidyutBhawan (9th floor), Salt Lake, Kolkata - 700 091 for approval & distribution. The contractor shall give at least 15 (fifteen) days advance notice to the Chief Engineer, Engg. Deptt., intimating the actual date of inspection and details of all tests that are to be carried out. The entire cost of acceptance and routine tests that are to be carried out as per relevant IS shall be treated as included in the quoted price of Clamps and Connectors and Equi-potential Ring.

10. CONTRACT DRAWINGS, MANUALS

In the event of placement of Letter of Award, contractor shall submit drawings and manuals in six (6) copies to the Chief Engineer, Engg. Deptt.,VidyutBhawan (9th floor), Salt Lake, Kolkata - 700 091 for approval.

After approval ten (10) sets of approved drawings, relevant manuals for each sub-station shall be submitted by the contractor to the Chief Engineer, Engg. Deptt.,VidyutBhawan (9th floor), Salt Lake, Kolkata - 700 091 for our record and distribution to site.

SPECIFIC TECHNICAL PARAMETERS OF CLAMP AND CONNECTORS

SNO	DESCRIPTION	TECHNICAL PARAMETERS			
(i)	Rated voltage of the system (KV)	400	220	132	33
(ii)	Rated Short time current (KA for 3 Secs.)	50 for one sec	40 for 3 sec	31.5 for 3 sec	25 for 3 sec
(iii)	Rated Current (Amp)	Depending upon point of application & Cl. No. 4(q) of technical specification			
(iv)	Current density of Al./Copper (A/Sq. mm.)	NA	0.75 / 1.75		
(v)	Type of Clamps & connectors	Made from al. alloy by casting process.	Made from cold forged Al. Alloy plate i.e. Extruded Al. Compression / Bolted or both as per technical specification and requirement		
(vi)	Minimum thickness of bimetal in bimetallic connections	2 mm.			2 mm.
(vii)	Current density of Al. alloy / copper (A/sq. mm.)	0.75 / 1.75	NA		

GUARANTEED TECHNICAL PARTICULARS FOR CLAMPS & CONNECTORS

(To be filled in and signed by the Bidder)

SL	DESCRIPTION	FOR 400 KV	FOR 220KV	FOR 132 KV	FOR 33 KV
1	General				
1.01	Name of Manufacturer				
1.02	Location of Factory				
1.03	Conforming Standard				
1.04	Material				
1.05	Type of clamps and connector (conventional or compression or both)				
1.06	Thickness of Connectors (mm)				
1.07	Minimum thickness of bimetallic element (mm)				
1.08	Temperature rise at full load and above 50°C ambient (°C)				
1.09	Tensile strength (Kgf)				
2	Electrical Parameters				
2.01	Designed rated current (A)				
2.02	Designed short time current (KArms for 3 sec.)				
2.03	Composition of aluminium alloy in percentage				
2.04	Current density (A/Sq.mm)				
2.05	Aluminium				
2.06	Copper				
2.07	Corona Extinction voltage (KVrms)				
2.08	Electrical conductivity				
2.09	Magnetic power loss				
2.10	Radio Interference voltage (microV)				