BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-416-316-E023	Rev. No.	00	Prepared	Checked	Approved
TYPE OF DOC.	**TECHNICAL SPECIFICATION**		SIGN			
TITLE **CLAMPS AND CONNECTORS**			NAME	**MSP**	**NK**	**SKS**
			DATE	14.07.2023	14.07.2023	14.07.2023
			GROUP	**TBEM**	W.O. No	
OWNER	**NLC TAMILNADU POWER LIMITED (NTPL)**					
PROJECT	**2X500 MW FGD TUTICORIN PROJECT**					
SYSTEM	**Electrical**					

Section	Description	No of Sheets
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4	Section-4: Guaranteed Technical Particulars For Clamps, Connectors and Spacers	1
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Project:	**2X500 MW FGD TUTICORIN PROJECT**
Customer:	***NLC TAMILNADU POWER LIMITED (NTPL)***
Contractor:	**Bharat Heavy Electricals Limited**
Document No.	**TB-416-316-023, Rev.00**
Technical Specification:	**Clamps & Connectors**

SECTION 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS & QUANTITIES

1.0 SCOPE

This technical specification covers the requirements of design, engineering, manufacturing, testing at works, documentation, packing and loading at works, transportation to site of Clamps and Connectors and Spacers etc. along with their accessories and fixing hardware. The scope shall encompass and include all the activities listed above.

In case of variance in the requirements specified under Section-1 and other Sections of this specification, requirements of Section-1 shall prevail. In case of variance in the requirements specified in Section-2 & 3, Section-2 shall prevail.

Clamps and Connectors/Spacers are required for the following Project

Name of customer: *NLC TAMILNADU POWER LIMITED (NTPL)*

Name of Projects: 2X500 MW FGD TUTICORIN PROJECT

The fitment and equipments offered shall be of approved make of NTPL or its subsequent approval from NTPL shall be bidder's responsibility with no commercial implications to BHEL. If any of the make offered by the bidder is not acceptable to M/s NTPL, the bidder has to supply alternate NTPL approved make, meeting the specification, with no commercial implications to BHEL.

The specification comprise of following sections:

Section-1: Scope, Specific Technical Requirements and Quantities
Section-2: Equipment Specification
Section-3: Project Details & General Specification
Section-4: Guaranteed Technical particulars (GTP)
Section-5: Checklist

In case of any conflict between various sections, **order of precedence** shall be in the same order as listed above.

Note: The term 'Owner/Employer' appearing in this specification shall refer to NTPL, the term 'Purchaser' shall refer to BHEL and the term 'Contractor' shall refer to the successful Bidder.
Refer Section - 3 for Project Details and General Specifications.

1.1 BILL OF QUANTITIES:

Bidder shall supply the items along with all accessories as per the BOQ below:

Project:	**2X500 MW FGD TUTICORIN PROJECT**
Customer:	***NLC TAMILNADU POWER LIMITED (NTPL)***
Contractor:	**Bharat Heavy Electricals Limited**
Document No.	**TB-416-316-023, Rev.00**
Technical Specification:	**Clamps & Connectors**

S.No.	Clamp No.	Description	TOTAL (No.)	Reference Drawing of the equipment
1	201	SUPPLY-220kV, 2000A, 40kA for 3 second, GIS SF6 Bushing connector suitable for Twin ACSR Moose Conductor	03	For equipment as per Drawing No.NLC-H-LT-10N-A13-01 enclosed in Annexure-A
2	202	SUPPLY-220kV, 2000A, 40kA for 3 second, BPI connector suitable for Twin ACSR Moose Conductor	09	For equipment as per Drawing TB-DG-416-316-E010 enclosed in Annexure-A
3	204	220kV, 2000A, 40kA for 3 second, PG clamp suitable for Twin ACSR Moose to Single ACSR Moose Conductor	06	----
4	206	SUPPLY-220kV, 2000A, 40kA for 3 second, Rigid Spacer suitable for Twin ACSR Moose Conductor	30	----
5	207	SUPPLY-CLAMP SUITABLE FOR FIXING 75X12 or 50X6 Earthing flat on Pipe Structure	200	-----

Note:

1. The final quantity may vary at contract stage by ± 25%. However, quality of individual items can vary up to any extent during detailed engineering.
2. All hardware required for connecting clamps/spacers to equipment/conductor/Al Tube shall be in bidder's scope of supply.

The following points may be noted:

1.1.1 No deviations from specification shall be acceptable.

1.1.2 The exact terminal details will be furnished after placement of order.

1.1.3 Clamps shall be bolted type.

1.1.4 For summary of abbreviations in BOQ, please refer annexure 1.

1.2 Specific Technical Requirements:

1.2.1 Technical Particulars for Clamps & Connectors/Spacers

Sl. No.	Technical Particulars	Unit	System Ratings
			220kV
1	Nominal system voltage	kV	220
2	Highest system voltage	kV	245
3	Current Rating	A	2000
4	Short circuit current (for 3 sec)	kA	40
5	Frequency	Hz	50 Hz ± 5%

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Technical Specification:	**Clamps & Connectors**

6	Dry lightning impulse withstand voltage (for 1.2/50 μ sec.)	kVp	1050
7	Dry and wet one minute power frequency withstand voltage	kVrms	460
8	Minimum Visual Corona Extinction Voltage	kVrms	156
9	Maximum RIV Voltage(at 266 kV at frequency range 0.5 to 2 MHz[rms])	μV	1000
10	**Material**		
a	For connecting ACSR Conductors	Aluminum alloy casting, conforming to designation A6 of IS:617 and shall be tested for all tests as per IS:617	
b	For connecting equipment terminals made of copper with ACSR Conductor	Bimetallic connectors made from aluminum alloy casting, conforming to designation A6 of IS 617 with 2mm thick Bimetallic liner and shall be tested as per IS:617.	
c	For connecting G.I. shield wire	Galvanized mild steel	
d	Bolts, nuts and plain washers	Electro galvanized for size below M12, for other hot dip galvanized	
e	Spring washers for items 'a' to 'c'	Electro - galvanized mild steel suitable for at least service conditions-3 as per IS:1573	

1.2.2 Type Tests

a) Clamps and Connectors and spacers to be supplied shall be of type tested design. During detail engineering, the Bidder shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out not earlier than five years prior to the date of techno-commercial bid opening i.e., 21-May-2019. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a Client.

b) However if Bidder is not able to submit report of the type test(s) conducted not earlier than ten years prior to the date of techno-commercial bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Bidder shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/ owners representative and submit the reports for approval.

c) All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

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Technical Specification:	**Clamps & Connectors**

The clamps and connectors shall be subject to type tests as per IS-5561-1970. Type tests shall be carried out on three clamps and connectors of each type and design. All clamps and connectors shall also be type tested as per applicable clause no. as indicated against each test for the following in addition to the other tests indicated in IS-5561.

i) Temperature Rise test (Clause 12)

ii) Short time current test (Cl.No.13)

iii) Resistance test (Cl.No. 11)

iv) Tensile test (Cl. No. 10)

v) Dimensional Check (Cl. No. 14)

vi) Galvanization Test (Where applicable) (Cl. 15)

vii) Visual Corona & RIV test – (for 400kV & 220kV system)- Refer Annexure-1

Each type of spacer shall be subjected to at least the following type tests in addition to all other tests specified in IS 10162:

i. **Clamp slip tests**

In this test the sample shall be installed on test span of twin/quad bundle string at a tension of 44.2 kN (4500 kg). One of the clamps when subjected to a longitudinal pull of 2.5 kN (250 kg) parallel to the axis of conductor shall not slip, i.e. permanent displacement between conductor and clamp after the test shall not exceed 1.0 mm. This test should have been performed on all other clamps of the sample.

ii. Fault current test as per Cl 5.14.2 of IS : 10162

iii. Corona Extinction Voltage test (Dry)- Refer Annexure-1

Minimum corona extinction voltage shall be 320kV (rms) line to ground for 400 kV/220kV spacers respectively.

iv. RIV Test (Dry)- Refer Annexure-1

This test shall be performed as per procedure mentioned at Annexure-B, Section-3. Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 266kV rms between phase to ground for 400kV system (1000 micro volts).

v. Resilience test (where applicable)

vi. Log decrement test (applicable only for spacer dampers)

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vii. Compression test.

viii. Galvanising test.

ix. Movement test

x. Clamp bolt torque test

xi. Assembly torque test

xii. Tensile load test

xiii. Compression and pull off test.

xiv. Vibration test

xv. Magnetic power loss test

1.2.3 Quality Plan

Bidder to follow valid UPPTCL approved quality plan at contract stage. In case the bidder does not have NTPL approved QP, it will be the bidder's responsibility to get its QP approved directly from NTPL.

1.2.4 Special Tools & Tackles

The bidder shall include in his proposal the deployment of all special tools and tackles required for erection, testing, commissioning and maintenance of the equipment. The Special tools and tackles shall only cover items which are specifically required for the equipment offered and are proprietary in nature. A list of all such devices shall be furnished.

1.3 DEVIATIONS

The bidder shall list all the deviation from the specification separately. Offers without specific deviation will be deemed to be totally in compliance with the specification and NO DEVIATION on any account will be entertained at a later date.

1.4 PACKING

1.4.1 All equipment shall be suitably protected, coated, covered and boxed and crated to prevent damage or deterioration during transit, handling and outdoor storage (for a minimum period of 6 months) at site till the time of erection. While packing all the materials, the limitations from the point of view of availability of transportation facilities in India should be taken into account. The Bidder shall be responsible for any loss or damage during transportation, handling and storage.

1.4.2 The Bidder shall include and provide for security, protection and packing the equipment so as to avoid loss or damage during transport by any mode.

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1.4.3 All packing shall allow for easy removal and checking at site. Wherever necessary, proper arrangement for attaching slings for lifting shall be provided. All packages shall be clearly marked for with signs showing 'UP' and 'DOWN' side of boxes, and handling and unpacking instructions as considered necessary. Special precautions shall be taken to prevent rusting of steel and iron parts during transit and storage. Gas seals or other methods proposed to be adopted for protection against moisture during transit shall be to the satisfaction of the purchaser.

1.4.4 The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbols i.e. FRAGILE, HANDLE WITH CARE, USE NO HOOKS etc.

1.4.5 Each package delivered under the contract shall be marked by the Bidder at his expense and such marking must be distinct (all previous irrelevant marking being carefully obliterated). Such marking shall show the description and quantity of contents, the name of consignee and address, the gross and net weights of the package, the name of Bidder with a distinctive number of mark sufficient for purpose of identification. All markings shall be carried out with such materials as to ensure quickness of drying, fastness and legibility.

1.4.6 Each Package shall contain a note quoting specifically the name of the Bidder, the number and date of contract or order and the name of office placing the contract, nomenclature of the stores and include a schedule of parts for each complete equipment giving the parts number with reference to the General Arrangement/ Assembly drawing and the quantity of each part, drawing number and tag numbers.

1.4.7 All equipment/ material shall be suitably packed for transport, carriage at site and outdoor storage during transit. The Bidder shall be responsible for any damage to the equipment during transit. The contents of each package shall bear marking that can be readily identified from the package list and packing shall provide complete protection from moisture, termites and mechanical shocks etc.

1.4.8 Any material found short inside the packing cases shall be supplied by the Bidder without any extra cost.

1.4.9 Notwithstanding anything stated in this clause the Bidder shall be entirely responsible for any loss, damage or depreciation to the stores.

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1.5 TECHNICAL QUALIFYING REQUIREMENT

<table>
<tr><th>Sr. No</th><th>Description</th><th>Supporting Document to be attached</th><th>Reference of attached documents</th></tr>
<tr><td>01</td><td>The bidder must have designed, manufactured, tested and supplied similar type of Clamps and Connectors of 132kV class or higher in last 5 years as on date of bid opening.</td><td>1. Bidder to Provide Compliance/Confirmation of fulfilling SL No.1 Technical Requirement.
2. PO Copy / PO list in following format

<table>
<tr><th>Sr. No</th><th>ITEMS SUPPLIED TO</th><th>ORDER REFERENCE No. & DATE</th><th>ITEMS</th><th>QUANTITY</th><th>ORDER FULLY EXECUTED.</th><th>STATUS, IF ORDER UNDER</th><th>REMARK</th></tr>
</table>

3. Dispatch instructions/ Tax invoice/ Material receipt at site/ lorry receipt details etc</td><td></td></tr>
</table>

1604864/2023/TBG-TB_HVDC

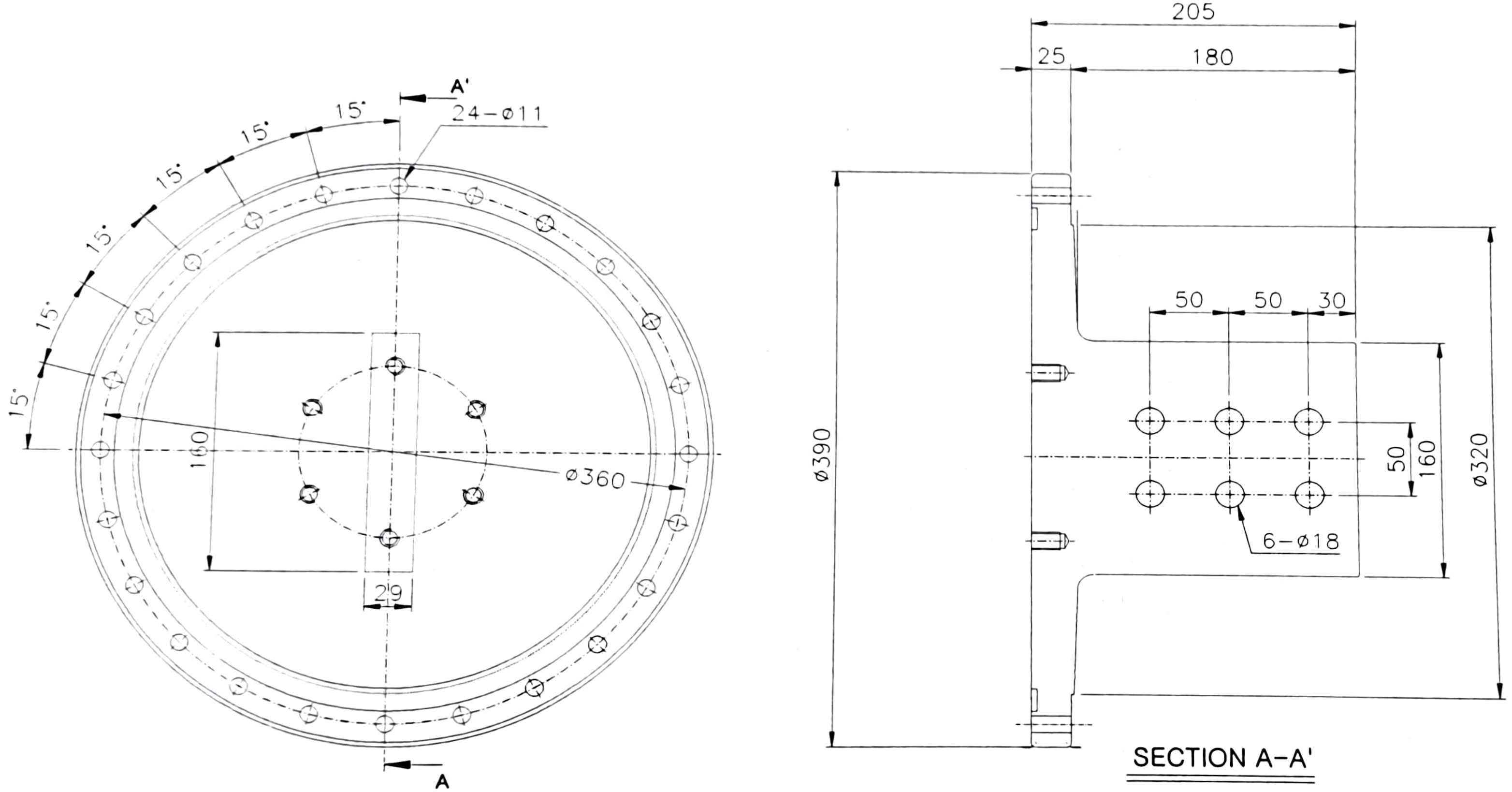
ANNEXURE-A

NOTE

1. ALL DIMENSIONS ARE IN MILLIMETERS.

REFERENCE DRAWINGS

SINGLE LINE	SINGLE LINE DIAGRAM WITH CT/VT DATA : NLC-H-LT-10N-A01-01
LAYOUT	LAYOUT FOR GIS IN BUILDING : NLC-H-LT-10N-A02-01
FOUNDATION	FOUNDATION FOR GIS IN BUILDING : NLC-H-LT-10N-A03-01 FOUNDATION FOR BUS DUCT WITH SUPPORT : NLC-H-LT-10N-A03-02
PLATFORM	PLATFORM ARRANGEMENT : NLC-H-LT-10N-A05-01
GAS SYSTEM	GAS SYSTEM DIAGRAM : NLC-H-LT-10N-A06-01 GAS SECTION MARKS : NLC-H-LT-10N-A07-01



SECTION A-A'

A	FOR INFORMATION	RHO DEC.21.11	LEE DEC.21.11	RHO DEC.21.11	JUN DEC.21.11
REV.NO.	DESCRIPTION	DESIGNED	DRAWN	CHECKED	APPROVED

REVISIONS

CUSTOMER	NLC-TAMILNADU POWER LIMITED
CONSULTANT	मेकान लिमिटेड MECON LIMITED
CONTRACTOR	LARSEN & TOUBRO LIMITED ECC Division - EDRC
PROJECT	NLC-TAMILNADU POWER LIMITED 2x500 MW-TUTICORIN THERMAL POWER PROJECT

PACKAGE CODE-TA8
INDOOR 400kV GIS AND INDOOR 220kV GIS SWITCHYARD

L&T DRG NO. NLC-H-LT-10N-A13-02 | SHEET 1 OF 1 | SIZE A1 | REV. A

JOB No. :

	NAME	SIGN	DATE
DSGN	T.S.RHO	T.S.RHO	DEC.21.11
DRWN	S.J.RYU	D.J.LEE	DEC.21.11
CHKD	T.S.RHO	T.S.RHO	DEC.21.11
APPD	B.K.JUN	B.K.JUN	DEC.21.11

TITLE: 400/220kV GIS SUBSTATION
220kV DETAIL TERMINAL CONNECTOR

SCALE N/A

PROJECTION

1. Ratings

✓ Type	:	Composite
✓ Rated voltage	:	245 kV
✓ Lightning impulse withstand voltage	:	1050 kV peak
✓ Power-frequency withstand voltage	:	460 kV rms, 1min
✓ Minimum creepage distance	:	31/mm/kV
✓ Application standard	:	IEC 60137

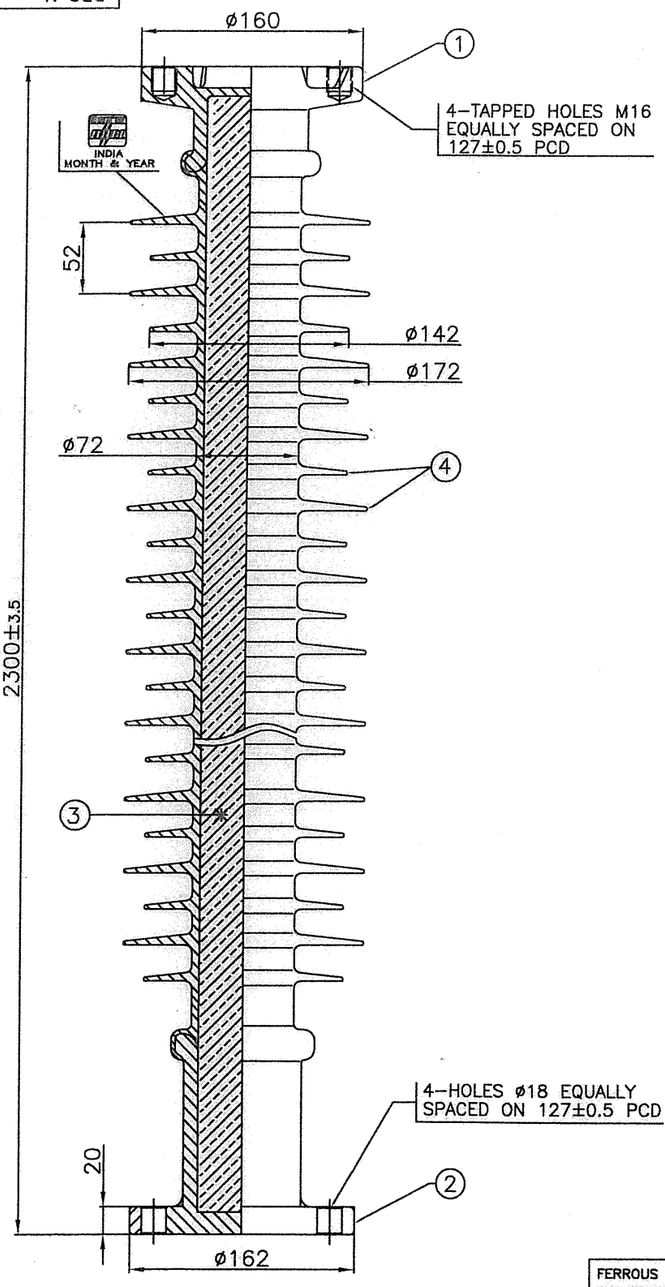
ANNEXURE-A

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN mm.

DRG No. EL DG 3 987 13 70100 | REV 02

SIGN AND DATE | REF. DRG. No.



TECHNICAL PARTICULARS

I DIMENSIONS	UNIT	VALUES
1. CREEPAGE DISTANCE (MINIMUM)	mm	7600
2. ARCING DISTANCE (NOMINAL)	mm	2050
II MECHANICAL VALUES		
1. SPECIFIED MECHANICAL LOAD (CANTILEVER/BENDING)	kN	8
2. TENSILE TEST LOAD	kN	110
3. TORSION STRENGTH	kN	3.4
4. COMPRESSION STRENGTH	kN	11
5. MAXIMUM DEFLECTION DISTANCE AT 145 kgs LOAD	mm	170
III ELECTRICAL VALUES		
1. POWER FREQUENCY WITHSTAND VOLTAGE (WET)	kV	460
2. DRY LIGHTNING IMPULSE WITHSTAND VOLTAGE	kVp	1050
3. VISIBLE DISCHARGE VOLTAGE	kV	154
4. MAXIMUM RIV AT TEST VOLTAGE 154kV(rms)	µv	500

NOTE:

1. STANDARD TEST SPECIFICATION IEC-62231

ITEM No.	DESCRIPTION	MATERIAL	QTY.	WT.KG (APPROX.)
4	WEATHER SHEDS	SILICONE RUBBER	1	14.3
3	CORE ROD (ø63)	FIBREGLASS	1	15.5
2	BOTTOM FLANGE	SGI CASTING	1	5.8
1	TOP FLANGE	SGI CASTING	1	4.0

FERROUS PARTS ARE HOT-DIP GALVANIZED (EXCEPT FEMALE THREADS) AS PER IS:2629 & TESTS CONFORM TO IS:2633/IEC-383

PROJECT: 2X5000MW THERMAL POWER PLANT AT TUTICORIN

CUSTOMER: NTPL NLC TAMILNADU POWER LIMITED

BHARAT HEAVY ELECTRICALS LTD;
SOLAR BUSINESS DIVISION
BANGALORE 560 012

	NAME	SIGN	DATE
DRN	C MADAIAH		18.06.2022
CHD	P SAHOO	Psahoo	18.06.2022
APPD	P R V		18.06.2022

DEPT / CODE	GRADE OF TOL DIM C/M/F	SCALE	WEIGHT (kg)	REF TO ASSY.DRG	ITEM No.	No.OF ITEMS
		N T S	39.6 (Approx)			

TITLE: COMPOSITE STATION POST INSULATOR FOR 220 kV, 8 kN RATING

CARD CODE

DRAWING No. EL DG 3 987 13 70100 | REV. 02

SUB No.01 | No.OF SHEETS

SUPERSEDES DRG. No.

SHT.24 SIZE A3 420 x 297

INVENTORY No.

REV	DATE	ALTERED / CHECKED

REV	DATE	ALTERED / CHECKED
02	14.6.23	Reference for IEC standard is changed REF. PH No. 6111

REV	DATE	ALTERED / CHECKED
01	18.06.22	1. PROJECT NAME, CUSTOMER NAME & LOGO ADDED 2. DRAWING REPREPARED & REVISED REF. PH No.6067

Project:	**2X500 MW FGD TUTICORIN PROJECT**
Customer:	***NLC TAMILNADU POWER LIMITED (NTPL)***
Contractor:	**Bharat Heavy Electricals Limited**
Document No.	**TB-416-316-023, Rev.00**
Technical Specification:	**Clamps & Connectors**

SECTION-2

Equipment Specification

2.1 GENERAL

This section covers the general technical requirements of spacers and clamps & connectors. In case of any discrepancies between the requirements mentioned in this section and those specified in other section of this specification, the latter shall prevail and shall be treated as binding requirements.

2.1.1 Technical Particulars for spacers and Clamp & Connectors

Sl. No.	Technical Particulars	Unit	System Ratings
			220kV
1	Nominal system voltage	kV	220
2	Highest system voltage	kV	245
3	Current Rating	A	2000
4	Short circuit current (for 3 sec)	kA	40
5	Frequency		50 Hz ± 5%
6	Dry lightning impulse withstand voltage (for 1.2/50 μ sec.)	kVp	1050
7	Dry and wet one minute power frequency withstand voltage	kVrms	460
8	Minimum Visual Corona Extinction Voltage	kVrms	156
9	Maximum RIV Voltage(at 266 kV at frequency range 0.5 to 2 MHz[rms])	μV	1000

System Earthing : Effectively earthed

Spacing between sub-conductors of the bus : 450mm

Maximum working tension:

a) Twin Conductor (Kg): 6000
b) Quad Conductor (Kg): 6000

Visual Corona withstand V: 320 kV

a) The material of clamps and connectors shall be Aluminium alloy casting conforming to designation A6 of IS: 617 for connecting to equipment terminals and conductors of aluminium. In case equipment terminals are of copper, the same clamps/connectors shall be used with 2mm thick bimetal.

Project:	2X500 MW FGD TUTICORIN PROJECT
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b) The material of clamps and connectors shall be Galvanised mild steel for connecting to G.S. shield wire.

c) Bolts, nuts and plain washers shall be hot dip galvanised mild steel for sizes M12 and above. For sizes below M12, they shall be electro-galvanised mild steel. The spring washers shall be electro-galvanised mild steel.

d) All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be rounded off to meet specified corona and radio interference requirements.

e) They shall have same current rating as that of the connected equipment. All current carrying parts shall be at least 10 mm thick. The connectors shall be manufactured to have minimum contact resistance.

f) Flexible connectors, braids or laminated strips shall be made up of copper/aluminium.

g) Current rating and size of terminal/conductor for which connector is suitable shall be put on a suitable sticker on each component which should last atleast till erection time.

2.2 Applicable Standards

The spacers and clamps & connectors shall strictly conform to the following Indian and International standards as appropriate:

List of Standards:

IS 617:1994	Aluminium and aluminium alloy ingots and castings for general engineering purposes.
IS 1363 (All Parts):2002	Hexagon head bolts, screws and nuts of product grade C
IS 1364 (All Parts):2002	Hexagon head bolts, screws and nuts of product grades A and B
IS 1367 (Part I):2002	Technical Supply Conditions for threaded fasteners.
IS 1367 (Part 2):2002	Technical Supply Conditions for threaded fasteners.
IS 1367 (Part 3):2002	Technical Supply Conditions for threaded fasteners.
IS 1367 (Part 13):1983	Technical Supply Conditions for threaded fasteners.

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IS 2121:1981 (Part -1 & 2)	Specification for conductors and earth wire accessories for overhead power lines
IS 2121:1992 (Part -3)	Specification for conductors and earthwire accessories for overhead power lines.
IS 2121:1991 (Part -4)	Specification for conductors and earth wire accessories for overhead power lines
IS 5561:1970	Electric power connectors.
IS 2633:1986	Methods for testing uniformity of coating of zinc coated articles.
IS 1573:1986	Electroplated coating of Zinc on Iron and Steel
IS 3138:1966	Hexagonal Bolts & Nuts (M42 to M150)
IS 4218 (Parts 1,2 & 4) 2001	Metric Screw Threads
IS 4218:(Part 3):1999	Metric Screw Threads
IS 4218:(Part 6):1978	Metric Screw Threads
IS 10162:1982	Spacers & spacer dampers for twin horizontal bundle conductors
ISO 272	Fasteners: Hexagonal Products -Width across Flats.
ISO 898	Fasteners, Screws & Studs
NEMA CC1	Electric power connectors for sub-station
NEMA CC3	Connectors for use between Aluminium or Aluminium-Copper Overhead Conductors.
IS 816:1969	Code of practice for use of metal arc welding for general construction in mild steel.
IS 4759:1996	Hot dip zinc coatings on structural steel and other allied products.

IS 2629:1985	Recommended practice for hot dip galvanising of iron and steel.

2.3 **Clamps and Connectors**

2.3.1 All the current carrying parts shall be designed and manufactured to have minimum resistance. Maximum tension per conductor is expected to be 3000kg in case of 400kV. Clamps and fittings shall be so designed that the equipment shall not be subject to any abnormal stresses due to thermal changes in conductor. All the clamps and fittings shall enable the connection to be as short as possible. Wherever possible they shall be in two separate halves. No U bolts shall be used. Corona control ring shall be of such design and shape that they will prevent visual discharge forming on the hardware assemblies. They shall have minimum thickness of 2.5mm. All similar parts, particularly the removable one shall be interchangeable with one another.

2.3.2 The clamps and connectors shall be made of materials listed below:

a) For connecting ACSR conductor material designation A6 of IS 617:1994 for bolted type.

b) For connecting equipment terminals made of copper or brass to ACSR/AAC conductor, Bimetallic connector made from aluminium alloy casting conforming to designation A6 of IS 617:1994, with 2mm thick cast copper liner shall be provided. Alternatively, equivalent bimetallic strip can be provided.

c) For connecting GI shield wire: Forged steel.

d) Bolts, nuts, plan washers shall be hot dip galvanized & spring washers of spring steel (E.G.)

e) Wherever crimping is involved, such clamps shall be forged /extruded.

f) For copper to copper and copper to brass or brass connectors- copper alloy of the following composition shall be used:

Zinc	2 to 3%
Lead	2 to 2.5%
Tin	0.6 to 1.5%
Iron	0.5 to 1.0%
Copper	92% to 94%

The impurities if present shall not exceed the limits as indicated, below:

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Technical Specification:	**Clamps & Connectors**

Nickel	0.03%
Antimony	0.03%
Manganese	0.04%
Silicon	0.04%
Phosphorous	0,04%

g) All casting shall be free from below holes' surface blisters and shall be rounded off.

h) All sharp edges and corners hall be blurred and rounded off.

i) Thickness of the clamps and connectors shall not be less than 10mm.

j) Bolts and nuts shall have hexagonal heads and threads as per Indian standard.
Rated torque of the nuts shall be indicated on drawing.

k) For bimetallic clamps or connectors copper alloy liner of minimum thickness 2mm shall be cast integral with the aluminium alloy body. Equivalent bimetallic sleeve/ strips can also be provided.

k) For flexible connectors, braids or laminated straps shall be made from tinned copper strips or aluminium laminates depending upon the clamp. All Aluminium
conductors of adequate current, mechanical stability & flexibility can also be provided.

l) Each clamp/ connector shall be identified with respective BOM & Drawing number.

m) The clamp shall be designed to carry out the same current as that of the connected equipment as specified in the specification. The temperature rises when carrying full load current shall not exceed 75°C for site ambient temperature.

n) Clamps and connectors shall be designed to be corona controlled. Corona extinction voltage for 400KV class clamps shall not be less than 320KV (rms) and R.I.V. level shall not be more than 1000 micro volts at the test voltage specified in respective sections.

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p) There should not be any significant change in Radio interference of associated conductor with & without clamps & fittings.

q) **Designs**:

Responsibility of satisfactory design of the clamps/connectors to safely withstand the specified mechanical stresses and carry the rated current without exceeding the temperature rise specified, shall solely rest with the bidder.

2.3.3 **Clamps and Connectors-Tests**

A. Type Tests

The clamps and connectors shall be subject to type tests as per IS-5561-1970. Type tests shall be carried out on three clamps and connectors of each type and design. All clamps and connectors shall also be type tested as per applicable clause no. as indicated against each test for the following in addition to the other tests indicated in IS-5561.

i) Temperature Rise test (Clause 12)

ii) Short time current test (Cl.No.13)

iii) Resistance test (Cl. No. 11)

iv) Tensile test (Cl. No. 10)

v) Dimensional Check (Cl. No. 14)

vi) Galvanization Test (Where applicable) (Cl. 15)

vii) Visual Corona & RIV test (for 400 & 220 kV systems)

B. Acceptance Test

Following acceptance tests shall be carried out as per applicable clause no. of IS: 5561:1970 indicated against each test:

i) Resistance test (Cl. No. 11)

ii) Tensile test (Cl. No. 10)

iii) Dimensional Check (Cl. No. 14)

iv) Galvanization Test (Where applicable) (Cl.15)

C. Routine Test

Following Routine tests shall be carried out as per applicable clause no. of IS:5561:1970 indicated against each test :

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i) Visual Check

ii) Dimensional Check (Cl.No.14)

2.4 **SPACERS**

2.4.1 **General** :

Spacer shall conform to IS : 10162. The spacers are to be located at a suitable spacing to limit the short circuit forces and also to avoid snapping of sub conductors during short circuit conditions. Necessary spacer span calculation shall be provided by the contractor during engineering for the approval

2.4.2 Constructional Features

a) Spacers shall be of non-magnetic material except nuts and bolts, which shall be of hot dip galvanised mild steel.

b) Spacers shall generally meet the requirements of clamps and connectors specified above. Spacer design shall be made to take care of fixing and removing during installation and maintenance

c) The design of the spacers shall be such that the conductor does not come in contact with any sharp edge.

2.4.3 **Tests**

Each type of spacer shall be subjected to at least the following type tests in addition to all other tests specified in IS 10162:

A. **Type Tests**

i. **Clamp slip tests**

Clamp slip test should have been conducted. In this test the sample shall be installed on test span of twin/quad bundle string at a tension of 44.2 kN (4500 kg). One of the clamps when subjected to a longitudinal pull of 2.5 kN (250 kg) parallel to the axis of conductor shall not slip, i.e. permanent displacement between conductor and clamp after the test shall not exceed 1.0 mm. This test should have been performed on all other clamps of the sample.

ii. Fault current test as per Cl 5.14.2 of IS: 10162

iii. Corona Extinction Voltage test (Dry)

This test shall be performed as per procedure mentioned at Annexure-B section –3. Minimum corona extinction voltage shall be 320kV (rms) line to ground for 400 kV spacers.

iv. RIV Test (Dry)

This test shall be performed as per procedure mentioned at Annexure-B, Section-3. Max. radio interference voltage for frequency between 0.5 MHz and 2 MHz at 266kV rms between phase to ground for 400kV system (1000 micro volts).

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v. Resilience test (where applicable)
vi. Log decrement test (applicable only for spacer dampers)
vii. Compression test.
viii. Galvanising test.
ix. Movement test
x. Clamp bolt torque test
xi. Assembly torque test
xii. Tensile load test
xiii. Compression and pull off test.
xiv. Vibration test
xv. Magnetic power loss test

B. Acceptance Test (As per IS : 10162 (Latest Version)

a) Visual examination
b) Dimensional verification
c) Movement test
d) Clamp slip test
e) Clamp bolt torque test (if applicable)
f) Assembly torque test
g) Compression test
h) Tension test
i) Galvanising test
j) Hardness test for neoprene (if applicable)
The shore hardness of different points on the elastomer surface of cushion grip clamp shall be measured by shore hardness meter. It shall be between 65 to 80.
k) Ultimate Tensile Strength Test (where applicable)
The UTS of the retaining rods shall be measured. It shall not be less than 35 kg/Sq. Mm.

C Routine test

a) Visual examination
b) Dimensional verification

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ANNEXURE - B
GALVANIZING PROCEDURE

If the steel surfaces are contaminated with marking paint, or welding slag, these must first be removed by mechanical means such as abrasive blasting or grinding.

Molding sand on the surfaces of cast goods is removed by means of sand/shot blasting.

Grease and oil is usually removed in an alkaline degreasing solution. After washing in water, rust and mill scale are removed from the steel surfaces by pickling in diluted hydrochloric/ sulphuric acid.

When dipping into the molten zinc, a fluxing agent must be used. The purpose of the fluxing agent is to dissolve oxides on both the steel and zinc to make pure metallic contact with each other.
In dry galvanizing the steel components are first pickled and then washed with water. They are then dipped in a flux solution of zinc-ammonium chloride in water and then dried at a temperature not greater than 120 deg. C. A thin layer of flux salts remains on the surfaces of the components. Dipping in molten zinc can therefore take place without further addition of fluxing agent.

Before the components are dipped into and withdrawn from the bath, the surface of the molten zinc is skimmed to remove oxides and flux residue. After withdrawal from the zinc bath, the components are cooled in water or air. They are then ready for touching-up, inspection and dispatch.

HOT-DIP GALVANIZING OF SMALL COMPONENTS-CENTRIFUGING

Small components such as nails, nuts, bolts, washers and fittings are cleaned as described above and placed in perforated baskets, which are then dipped into the molten zinc. Upon withdrawal from the zinc bath, the basket is placed in a centrifuge. Rotation has the effect of throwing some of the zinc off the coated surfaces, leaving the components free from drop concentration and uneven deposits of zinc. As a result, the zinc layer is somewhat thinner, with a more matt- like surface, compared with individual dipping (which would in any case be far too expensive for small objects). Individual dipping also makes it difficult to avoid obtaining uneven deposits of zinc on certain sensitive areas, such as threads.

WIRE AND TUBE GALVANIZING

Wire, strip material and tubing are hot-dip galvanized according to the dry or wet methods-or a combination of both-in continuously operating production lines. Immediately after withdrawal from the zinc bath excess zinc is wiped from wire (or blown off tubes) to give a smooth and uniform coating. The thickness of the zinc coating can be varied to some extent during the wiping or air blowing procedures.

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SHEET GALVANIZING:

Sheet metal is hot-dip galvanized on continuous production lines in which all the processes are linked together. The base material consists of cold-rolled sheet in coils. One coil welded to another to form an endless strip.

After degreasing the strip is pickled or oxidized. Oxides are then removed from the surfaces by reduction at 9500 C. At the same time the strip is soft-annealed. The surfaces of the strip, now chemically clean, are moved through a protective gas atmosphere and directly down into the zinc bath.

The strip is withdrawn from the bath vertically and passed through "air knives". Fine jets of air or steam are blown through the knives, wiping the zinc coating to the desired thickness.

After cooling, straightening and treatment against wet storage stain, the strip is cut into suitably sized sheets or rolled into coils for delivery or subsequent plastic coating, painting and/or profiling.

Thin sheet is galvanized with microlloyed, low-alloyed or high-alloyed zinc. The most important alloy additive is in all cases aluminum.

INSPECTION AND TEST

Presence of any defect noticed on inspection shall render the material liable for testing or rejection. The supplier shall supply all samples and equipment and carry out the tests without any extra cost.
Sharp edges with radii less than 2.5 mm shall be able to withstand four immersions of the standard Preece test. All other coatings shall withstand six immersions. The following galvanizing tests can be performed.

- Coating thickness as per IS 2633-1986
- Uniformity of zinc as per IS 2633-1986
- Adhesion test as per IS 2629-1985
- Mass of zinc coating as per IS 6745-1972

Galvanized material must be transported properly to ensure that galvanized surfaces are not damaged during transit. Application of zinc rich paint at site shall be subject to approval of BHEL, Transmission Projects.

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SECTION - 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.0 GENERAL

This section stipulates the General Technical Requirements under the contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections and is not exclusive. However, in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 SITE INFORMATION

SL.NO.	DESCRIPTION	
3.1	**PROJECT INFORMATION**	
	a) Customer	***NLC TAMILNADU POWER LIMITED (NTPL)***
	b) Project	**2X500 MW FGD TUTICORIN PROJECT**
	c) Project location	TAMILNADU
	d) Transport facilities Nearest Railway Station/Gauge Distance from Railway Station	Port Trust Railway Yard
	e) Access roads	National Highway No. 7A
3.2	**SITE CONDITIONS**	
3.2.1	Ambient Temp.	36.5 ºC maximum 20.8 ºC minimum
	a) Maximum Design Ambient air temp. (Max.) ˚C	50
	b) Minimum Design Ambient air temp. (Max.) ˚C	
3.2.2	Relative humidity	Max- 80% Min.-35% Average- 57 to 68%
3.2.3	Height above mean sea level	1.46 M above MSL
3.2.4	Earth quake data	
	a) Seismic zone as per IS 1893:84	**Zone II as per IS: 1893 latest edition.**
3.2.5	Wind data	
	a) Wind velocity m/sec.	In accordance with IS-875, Part-3
3.2.6	Average annual rainfall	437 mm

3.2 INSTRUCTION TO BIDDERS

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification.

It is recognised that the Manufacturer may have standardised on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are

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acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously.

3.3 STANDARDS

The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

The equipment to be furnished under this specification shall conform to latest issue (with all amendments) of specified standards.

In addition to meeting the specific requirement called for in Sections 1 and 2 of the Technical Specification, the equipment shall also conform to the general requirement of the applicable standards, which shall form an integral part of the specification.

The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other.

When the specific requirements stipulated in the specifications exceed or differ from those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards, which ensure equivalent or better performance than that specified in the standards referred, shall also be accepted. The bidder shall submit copies of such standards.

In case governing standard for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in the offer along with English language version of standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's / owner's approval.

The bidder shall clearly indicate in his bid the specific standards in accordance with which the works will be carried out.

SURGE ARRESTERS:

SL. No.	STANDARD	DESCIRPTION
1	IS-3070 (PART2)	Lightning arresters for alternating current systems : Metal oxide lightning arrestors without gaps
2	IEC-60099-4	Metal oxide surge arrestors without gaps
3	IEC-60099-5	Selection and application recommendation
4	ANSI-C62.1	IEE Standards for S A for AC Power Circuits
5	NEMA-LA 1	Surge Arresters

3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc for the equipment.

3.5 ENGINEERING DATA

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3.5.1 Drawings

The contactor shall necessarily submit all the drawings/ documents unless anything is waived. The contactor shall submit 6 (six) sets of drawings/ design documents/ data/ test reports as may be required for the approval of the purchaser. All drawings submitted by the Manufacturer including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required. the dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnections between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the Manufacturer shall be clearly marked with the name of the Purchaser, the unit designation, the specifications title, the specification number and the name of the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Manufacturer shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser, if so required.

The review of these data by the Owner will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. Owner may not indicate a thorough review of all dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. This review and /or approval by the Owner shall not be considered by the Manufacturer, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Manufacturer's risk. The Manufacturer may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Manufacturer’s drawing or work by the Purchaser shall not relieve the manufacturer of any of his responsibilities and liabilities under the Contract

All engineering data submitted by the Manufacturer after final process including review and approval by the Owner shall form part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Owner in Writing.

The title block of drawings shall contain the following information incorporated in all contract drawings

Title block for 2X500 MW FGD TUTICORIN PROJECT:

1. **Customer : NLC TAMILNADU POWER LIMITED (NTPL)**
2. **Project : 2X500 MW FGD TUTICORIN PROJECT**
3. **Contract No./LOA No. : CO CONTS/009H/NTPL/FGD/2019 dtd 09.08.2019**
4. **Main Contractor : Bharat Heavy Electricals Limited**
5. **BHEL Order No. & Date :**

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3.5.2 Approval Procedure

The scheduled dates for the submission of these as well as for, any data/ information to be furnished by the Purchaser would be discussed and finalised at the time of award.

NOTES:

a) The manufacturer may note that all re-submissions must incorporate all comments given in the prior submission by the Purchaser. Adequate justification for not incorporating the same must be submitted, failing which the submitted documents may be returned.

3.6 QUALITY ASSURANCE PROGRAMME

To ensure that the equipment and services under the scope of this Contract, whether manufactured or performed within the Manufacturer's Works or at his Sub-manufacturer's premises or at the Purchaser's site or at any other place of Work, are in accordance with the specifications, the Manufacturer shall adopt a suitable quality assurance programme to control such activities at all points, as necessary. Such programme shall be outlined by the Manufacturer and shall be finally accepted by the Purchaser after discussions before the award of Contract. A quality assurance programme of the manufacturer shall generally cover the following:

(a) Manufacturer's organisation structure for the management and implementation of the proposed quality assurance programme:
(b) Documentation control system;
(c) Qualification data of bidder's key personnel;
(d) The procedure for purchases of materials, parts components and selection of sub-Manufacturer's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
(e) System for shop manufacturing and site erection controls including process controls and fabrication and assembly control;
(f) Control of non-conforming items and system for corrective actions;
(g) Inspection and test procedure both for manufacture and field activities;
(h) Control of calibration and testing of measuring instruments and field activities;
(i) System for indication and appraisal of inspection status;
(j) System for quality audits;
(k) System for authorising release of manufactured product to the Purchaser
(1) System for maintenance of records;
(m) System for handling storage and delivery; and
(n) A quality plan detailing out the specific quality control measures and Procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered.

The Purchaser or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and Procedure of the Manufacturer/'his vendors quality management and control activities.

3.7 Quality Assurance Documents

The Manufacturer shall be required to submit the following all Quality Assurance Documents as stipulated in the quality plan at the time of purchasers inspection of equipment/ material.

3.8 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

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All equipment being supplied shall conform to type tests and shall be subject to routine and acceptance tests in accordance with requirements stipulated under respective sections. Purchaser reserves the right to witness any or all the tests. The Manufacturer shall intimate the Purchaser the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies. Purchaser reserves the option for getting any or all the type tests repeated on the equipment. The Manufacturer shall also submit type test procedure for approval of the Purchaser.

The reports for all type tests and additional type tests as per technical specification and shall be furnished by the Contractor along with equipment/material drawings. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited based on ISO/IEC Guide 25/17025 or EN 45001 by the national accredition body of the country where laboratory is located) or witnessed by the representative(s) of Utility. The test-reports submitted shall be of the tests conducted within last 5 (five) years prior to the date of bid opening. In case the test reports are of the test conducted earlier than 5 (five) years prior to the date of bid opening, the contractor shall repeat these test(s) at no extra cost to the purchaser.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the technical specification or any/all additional type tests not carried out without any additional cost implication to the Purchaser.

The purchaser intends to repeat the type tests and additional type tests on cable glands for which test charges shall be payable as per provision of contract.

The Purchaser, his duly authorised representative and/or outside inspection agency acting on behalf of the Purchaser shall have at all reasonable times free access to the Contractors premises or Works and shall have the power, at all reasonable times to inspect and examine the materials and workmanship of the Works during its manufacture or erection if pert of the Works is being manufactured or assembled at other premises or works, the Manufacturer shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Manufacturer’s own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

The Manufacturer shall give the Purchaser/inspector thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Manufacturer's account except for the expenses of the inspector. Unless witnessing of the tests is virtually waived, the Purchaser/ inspector will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/ inspection, failing which the Manufacturer may proceed with the test which shall be deemed to have been made in the Inspector's presence and the Manufacturer shall forthwith forward duly certified copies of test reports in triplicate to the Inspector.

The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein, give notice in writing to the Manufacturer, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Manufacturer shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Purchaser/ inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

When the factory tests have been completed at the Manufacturer's works, the Purchaser/ inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser/inspector, the certificate shall be issued within fifteen (15) days of

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receipt of the Manufacturer's Test certificate by the Engineer/ Inspector. Failure of the Purchaser/inspector to issue such a certificate shall not prevent the Manufacturer from proceeding with the Works. The completion of these tests or the issue of the certificate shall not bind the Purchaser to accept the equipment should it, on further tests/ after erection, be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of MICC by the Purchaser.

In all cases where the Contract provides for tests whether at the premises or at the works of the Manufacturer or of any Sub-Contractor, the Manufacturer except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Purchaser /Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Purchaser Inspector or to his authorised representative to accomplish testing.

The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Manufacturer in respect of the agreed quality assurance programme forming a part of the Contract.

The Purchaser will have the right of having at his own expenses any other test(s) of reasonable nature carded out at Manufacturer's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.

The Purchaser reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment for these tests shall be provided by the Purchaser

3.9 MATERIAL/ WORKMANSHIP

General Requirement

Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended.

Incase where the equipment, materials or components are indicated in the specification as 'similar' to any special standard, the Purchaser shall decide upon the question of similarity. When required by the specification or when required by the Purchaser the Contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Contractor.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Purchaser.

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

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All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be considered as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, levelling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances, instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacturer's limits suitable guards shall be provided for the protection of personnel on all exposed rotating and/ or moving machine parts and shall be designed for easy installation and removal for maintenance purposes. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.

All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. In such is the case he shall declare in the proposal, where such oil or grease is available. He shall help Purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

A cast iron or welded steel base plate shall be provided for all rotating equipment which are to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base plate shall support the unit and its drive assembly, shall be of design with pads for anchoring the units, shall have a raised up all around and shall have threaded in air connections, if so required.

Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipments located in non-air-conditioned areas shall also be of same type.

3.10 PACKING AND STORAGE

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. On request of the purchaser, the manufacturer shall also submit packing details/ associated drawing for any equipment/ material at a later date, in case the need arises.

All coated surfaces shall be protected against abrasions, impact, discolouration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device.

Supplier shall ensure that equipment shall be properly packed, blocked, padded, coated and protected so that it is not damaged due to possible mishandling. Storage requirements shall be clearly defined by the supplier. Packing shall be such that if required, long time storage at site should not deteriorate the performance of the equipment.

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Technical Specification:	**Clamps & Connectors**

SECTION-4

Guaranteed Technical Particulars For Clamps, Connectors and Spacers

As per NTPL Format – To be Submitted during Contract Execution Stage

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SECTION-5

CHECK LIST FOR INFORMATION TO BE FURNISHED WITH OFFER RETURN THIS CHECKLIST AS PART OF THE OFFER DULY SIGNED

The offer may not be considered if the following information and this Checklist are not enclosed with the Offer.

BHEL ENQUIRY. NO:
BIDDER OFFER REFERENCE:

(1)	(2)	(3)	(4)	(5)
S.No.	**Parameter/ Requirement**	**400kV**	**Yes / No**	**Remarks in case reply in Col (4) is NO**
1.	Applicable IS	5561 & 10162	Yes	
2.	Type of connectors	Bolted	Yes	
3.	Material of Clamps/Fittings	As per Section 2	Yes	
4.	Continuous current rating of the clamps/fittings	As per BOQ	Yes	
5.	Short circuit current rating of the clamps/fittings	As per BOQ	Yes	
6.	Minimum thickness of any part of clamps and connector	10mm	Yes	
7.	Bimetallic Sleeves /liner thickness	2mm	Yes	
8.	Hardware for connecting clamp to equipment/ conductor/ tube	Included in scope of bidder supply	Yes	
9.	Sub-conductor spacing for 400kV conductor	450mm	Yes	

2. TYPE TESTS

(1)	(2)/(3)	(4)	(5)
S.No.	**Parameter/ Requirement**	**Yes / No**	**Remarks in case reply in Col (4) is *NO***
1	Please confirm that there are no deviations from the technical specifications.	Yes/ No, Deviations are enclosed.	
2	Whether similar items offered have been supplied?	Yes similar clamps have been supplied earlier/ No	
3	Whether reports of Corona & RIV	Yes available	

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	tests are as per procedure mentioned in Section-1, Annexure-1.		
4	Valid Type Test Reports (of identical Clamps & Connectors/ spacers) for all offered Clamps & connectors/ spacers as per spec are available i.e, not older than 07-09-2013. (List as mentioned below).	Yes available.	
	The onus is on vendor to check the applicability of Type test reports vis-à-vis the clamps offered.	Yes	
	In case the type test reports are not found valid at detailed engineering stage, the same will have to be conducted without any price and delivery implication to BHEL	Yes	

FOR CLAMPS & CONNECTORS

Sl. No.	TESTS	YES/NO
A	Type tests	
1.	Temperature rise test	
2.	Short time current test	
3.	Resistance test	
4.	Tensile test	
5.	Galvanization test	
6.	Measurement of RIV (dry) and Corona extinction voltage test (dry). – as per UPPTCL procedure	

FOR SPACERS

Sl. No.	TESTS	YES/NO
A	Type tests	
1	Movement test	
2	Clamp slip test	
3	Resilience test.	
4	Clamp bolt torque test	
5	Assembly torque test	

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6	Tensile load test	
7	Compression and pull off test	
8	Vibration test	
9	Short circuit current test	
10	Galvanization test	
12	Log decrement test (for spacer damper)	
13	Magnetic Power Loss test	
14	Measurement of RIV (dry) and Corona extinction voltage test (dry) - as per procedure	