TECHNICAL QUALIFICATION REQUIREMENT

Name of Project : - RMU of Chilla HEP

Name of Customer : - UJVNL

Name of Item : - CLAMPS & CONNECTORS.

TECHNICAL QUALIFICATION REQUIREMENT
The bidder should have supplied 132kV or above class clamps & connectors in last 10 years from original scheduled date of technical bid opening of this tender enquiry.

SUPPORTING DOCUMENTS TO BE SUBMITTED BY BIDDER ALONGWITH TECHNICAL BID		
Sr	**Required Criteria**	**Supporting Documents**
1	Supply	PO and Dispatch clearance/ LR/ Material Receipt certificate at site etc. establishing bidder as proven supplier of offered item.

PREPARED BY	REVIEWED BY	APPROVED BY
08/04/25	08/04/25	8.4.25
Debashis Mandal	D K Shukla	Vivek Kapil
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BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION PROJECTS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-414-316-014	Rev. No.	00		Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION			NAME	DM	DKS	VK
TITLE				SIGN			
CLAMPS & CONNECTORS				DATE	02/04/25		
				GROUP	TBEM		

CUSTOMER	UTTARAKHAND JAL VIDYUT NIGAM LIMITED (UJVNL)
PROJECTS	RMU of Chilla HEP

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Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS			
				Distribution	TBMM	TBQM	TBCM	TBTS
				Copies	1	-	-	-

SECTION-1

Scope, Bill of Quantities and Specific Technical Requirement

1.1 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 to following project sites. The scope shall encompass and include all the activities listed above.

1.2 The equipment is required for the following Projects.

Name of Customer : UTTARAKHAND JAL VIDYUT NIGAM LIMITED (UJVNL)

Name of the Project : RMU of Chilla HEP

Sites name :Chilla

Refer Section - 3 for Project Details and General Specifications.

In case of any conflict among the various sections of this specification, the order of precedence shall be section 1, section 2 & the section 3.

1.3 BILL OF QUANTITIES

Refer **ANNEXURE-BOQ.**

Note:

1. Quantity variation as per NIT terms & condition.
2. The Equipment terminal details will be furnished after placement of order.
3. Quantity Variation: +/- 30% on overall contract value.

1.4 SPECIFIC TECHNICAL REQUIREMENTS

All power clamps and connector/spacers and their accessories shall conform to IS 5561 and IS 10162 respectively and other relevant standards as mentioned in clause 2.2 of this specification, except to the extent explicitly modified in the Section -2 of this Specification. EKD drawing is attached for refence. Few items are not shown in EKD and required for in-process RMU of 132kV Switchyard.

1.4.1 Technical Particulars for Clamps & Connectors/Spacers

Sl. No.	Technical Particulars	Unit	System Ratings
1	Nominal system voltage	kV	**132**
2	Highest system voltage	kV	145
3	Current Rating	A	As per clamp & connector Description #
4	Short circuit current (for 3 sec)	kA	40
5	Dry lightning impulse withstand voltage (for 1.2/50 μ sec.)	kV_p	650
6	Switching surge withstand voltage (wet)	kV_p	650
7	Dry and wet one minute power frequency withstand voltage	kV_{rms}	275
8	**Material**		
a	For connecting ACSR conductors/AAC conductors	Aluminum alloy casting, conforming to designation 4600 of IS:617 and all test shall conform to IS:617.	
b	For connecting equipment terminals made of copper with ACSR conductors/ AAC conductors	Bimetallic connectors made from aluminum alloy casting, conforming to designation 4600 of IS:617 with 2mm thick bimetallic liner/strip and all test shall conform to IS:617.	
c	For connecting G.I.	Galvanised mild steel shield wire.	
d	Bolts, nuts and plain washers	Electro galvanised for size below M12, for others hot dip galvanised.	
e	Spring washers	Electro - galvanised mild steel suitable for at least service conditions-3 as per IS:1573	

Current rating is subject to maximum current carrying capacity of the conductor.

1.4.2 Technical Qualifying Requirement

As per Annexure-TQR.

1.4.3 Type Tests

Bidder shall submit valid type test reports (as per relevant IEC/IS standard) for the tests carried out within 10 years from the date of technical bid opening of this enquiry. The reports should have been conducted on identical or similar equipment/components to those offered. if any type report is found to be technically unacceptable, such type test(s) shall be conducted by the bidder free of cost without any cost and delivery implication to BHEL/UJVNL.

1.4.4 Quality Plan

Bidder to follow BHEL/customer approved quality plan at contract stage.

1.4.5 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.

1.4.6 Deviations

The bidder shall list all the deviation from the specification separately only in the deviation schedule provided with the NIT. 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.

ANNEXURE-BOQ

Sl. No.	Sub-Equipment	Qty. (Nos.)
1	SUPPLY- CLAMPS & CONNECTORS : 145KV, 1250A, CB CONNECTOR SUITABLE SINGLE ZEBRA	47
2	SUPPLY- CLAMPS & CONNECTORS : 145KV, 1250A, CB CONNECTOR SUITABLE SINGLE ZEBRA FOR ST BAY	7
3	SUPPLY- CLAMPS & CONNECTORS : 145KV, 1250A, CB CONNECTOR SUITABLE TWIN ZEBRA	7
4	SUPPLY- CLAMPS & CONNECTORS : 145KV, 1600A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR SINGLE ZEBRA	126
5	SUPPLY- CLAMPS & CONNECTORS : 145KV, 1600A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR TWIN ZEBRA	14
6	SUPPLY- CLAMPS & CONNECTORS : 145KV, 1600A CT CONNECTOR SUITABLE FOR SINGLE ZEBRA	53
7	SUPPLY- CLAMPS & CONNECTORS : 145KV, 1600A CT CONNECTOR SUITABLE FOR TWIN ZEBRA	7
8	SUPPLY- CLAMPS & CONNECTORS : 145KV CVT CONNECTOR SUITABLE FOR SINGLE ZEBRA	10
9	SUPPLY- CLAMPS & CONNECTORS : 145KV IVT CONNECTOR SUITABLE FOR SINGLE ZEBRA	24
10	SUPPLY- CLAMPS & CONNECTORS : 145KV, LA CONNECTOR SUITABLE FOR SINGLE ZEBRA	3
11	SUPPLY- CLAMPS & CONNECTORS : 145KV, 1250A WT CONNECTOR SUITABLE FOR SINGLE ZEBRA	14
12	SUPPLY- CLAMPS & CONNECTORS : 145KV, 1250A WT CONNECTOR SUITABLE FOR SINGLE PANTHER	9
13	SUPPLY- CLAMPS & CONNECTORS : 145KV, 1250A WT CONNECTOR SUITABLE FOR SINGLE TARANTULA	5
14	SUPPLY- CLAMPS & CONNECTORS : 145KV, 800A, ST BUSHING CONNECTOR SUITABLE FOR SINGLE ZEBRA	4
15	SUPPLY- CLAMPS & CONNECTORS : 145KV, 800A, GT BUSHING CONNECTOR SUITABLE FOR SINGLE ZEBRA	14
16	SUPPLY- CLAMPS & CONNECTORS : 145KV TEE CONNECTOR SUITABLE FOR TWIN ZEBRA TO TWIN CONDUCTOR.	27
17	SUPPLY- CLAMPS & CONNECTORS : 145KV TEE CONNECTOR SUITABLE FOR TWIN ZEBRA TO SINGLE ZEBRA	47
18	SUPPLY- CLAMPS & CONNECTORS : 145KV TEE CONNECTOR SUITABLE FOR SINGLE ZEBRA TO SINGLE ZEBRA	80
19	SUPPLY-145kV PG CLAMP SUITABLE FOR SINGLE ZEBRA TO SINGLE ZEBRA	63
20	SUPPLY- CLAMPS & CONNECTORS : 145KV TEE CONNECTOR SUITABLE FOR SINGLE PANTHER TO SINGLE ZEBRA	25
21	SUPPLY- CLAMPS & CONNECTORS : 145KV TEE CONNECTOR SUITABLE FOR SINGLE TARANTULA TO SINGLE ZEBRA	30

22	SUPPLY- CLAMPS & CONNECTORS : 145KV TEE CONNECTOR SUITABLE FOR SINGLE MOOSE TO SINGLE ZEBRA	48
23	SUPPLY- CLAMPS & CONNECTORS : 145KV TEE CONNECTOR SUITABLE FOR SINGLE DEER TO SINGLE ZEBRA	12
24	SUPPLY- CLAMPS & CONNECTORS : 132kV FLEXIBLE SPACER SUITABLE FOR TWIN ZEBRA	304
25	SUPPLY- CLAMPS & CONNECTORS : 132KV, RIGID SPACER SUITABLE FOR TWIN ZEBRA,	765
26	SUPPLY- CLAMPS & CONNECTORS : STRAIN/ TENSION CLAMPS (BOLTED TYPE) FOR EARTHWIRE WITH D-SHACKLE ASSEMBLY	43
27	SUPPLY- CLAMPS & CONNECTORS : STRAIN PLATE TO BE FIXED ON BUILDING COLUMN AND SUITABLE FOR 10.98MM DIA GS SHIELD WIRE STRAIN/ TENSION CLAMPS (BOLTED TYPE) WITH D SHACKLE ASSEMBLY	12
28	CLAMPS & CONNECTORS PG CLAMP FOR SHIELD WIRES OF DIA 10.98MM	61
29	SUPPLY- CLAMPS & CONNECTORS : LUG TYPE CLAMP FOR CONNECTING 10.98MM DIA GS SHIELD WIRE ON LIGHTNING MAST/ SPIKE	10
30	SUPPLY- CLAMPS & CONNECTORS : PAD TYPE CLAMP SUITABLE FOR CLAMPING GS EARTHING FLAT WITH SHIELD WIRE/BONDING CABLE	26
31	CLAMPS & CONNECTORS CLAMP FOR 10.98MM DIA SHIELD WIRE ON LATTICE / PIPE STRUCTURE	132
32	SUPPLY- CLAMPS & CONNECTORS : CLAMP FOR GS SHIELD WIRE SUITABLE FOR FIXING ON BUILDING	138
33	SUPPLY- CLAMPS & CONNECTORS : CLEAT TYPE CLAMPS FOR 75 X 12MM G.S. FLAT FOR EQUIPMENT LATTICE STRUCTURE	743

SECTION-2

Equipment Specification

2.1. General

This section covers the general technical requirements of Clamps & Connectors/Spacers. In case of any discrepancies between the requirements mentioned in this section and those specified in other sections of this specification, this shall prevail after section-1 and shall be treated as binding requirements.

2.2 Applicable Standards

The spacers and clamps & connectors, unless otherwise specified, shall strictly conform to the latest revision of the following Indian and International standards as appropriate:

2.3 Clamps and Connectors

2.3.1 *All power clamps and connectors shall conform to IS:5561 or other equivalent international standard and shall be made of materials listed below:*

Sl. No.	Description	Materials
1	For connecting ACSR conductors/AAC conductors	Aluminum alloy casting, conforming to designation 4600 of IS:617 and all test shall conform to IS:617
2	For connecting equipment terminals made of copper with ACSR conductors/AAC conductors	Bimetallic connectors made from aluminum alloy casting, conforming to designation 4600 of IS:617 with 2mm thick bimetallic liner/strip and all test shall conform to IS:617
3	For connecting G.I	Galvanised mild steel shield wire
4	Bolts, nuts & plain washers	Electro-galvanised for sizes below M12, for others hot dip galvanised.
5	Spring washers	Electro-galvanised mild steel suitable for atleast service condition-3 as per IS:1573

2.3.2 Necessary clamps and connectors shall be supplied for all equipment and connections. If corona rings are required to meet these requirements they shall be considered as part of that equipment and included in the scope of work.

2.3.3 Where copper to aluminum connections are required, bi-metallic clamps shall be used, which shall be properly designed to ensure that any deterioration of the connection is kept to a minimum and restricted to parts which are not current carrying or subjected to stress.

2.3.4 Low voltage connectors, grounding connectors and accessories for grounding all equipment as specified in each particular case, are also included in the scope of Work.

2.3.5 No current carrying part of any clamp shall be less than 10 mm thick. All ferrous parts shall be hot dip galvanised. Copper alloy liner/strip of minimum 2 mm thickness shall be cast integral with aluminum body or 2 mm thick bi-metallic liner/strips shall be provided for Bi-metallic clamps.

2.3.6 All casting shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

2.3.7 Flexible connectors, braids or laminated straps made for the terminal clamps for bus posts shall be suitable for both expansion or through (fixed/sliding) type connection of IPS AL tube as required. In both the cases the clamp height (top of the mounting pad to centre line of the tube) should be same.

2.3.8 Current carrying parts (500A and above) of the clamp/connector shall be provided with minimum four numbers of bolts preferably for 132kV and above.

2.3.9 All current carrying parts shall be designed and manufactured to have minimum contact resistance.

2.3.10 Power Clamps and connectors shall be designed to control corona as per requirement.

2.4 Spacers

Spacer shall conform to IS - 10162.
No magnetic material shall be used in the fabrication of spacers except for GI bolts and Nuts.
Spacer design shall be made to take care of fixing and removing during installation and maintenance.
The design of the spacers shall be such that the conductor does not come in contact with any sharp edge.

2.5 Type Tests

2.5.1 Tests for Clamps and Connectors

Clamps and connectors should be type tested as per IS:5561 and shall also be subjected to routine tests as per IS:5561. Following type test reports shall be submitted for approval. Type test once conducted shall hold good.

i) Temperature rise test (maximum temperature rise allowed is 35°C over 50°C ambient).
ii) Short time current test.
iii) Corona (dry) and RIV (dry) test [for 132kV and above voltage level clamps].
iv) Resistance test and Pullout strength test.
v) Cantilever Strength test on bus support clamps & connectors.

2.5.2 Tests for Spacers

The spacers shall be subjected to the type tests, acceptance tests and routine tests in accordance with IS: 10162.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

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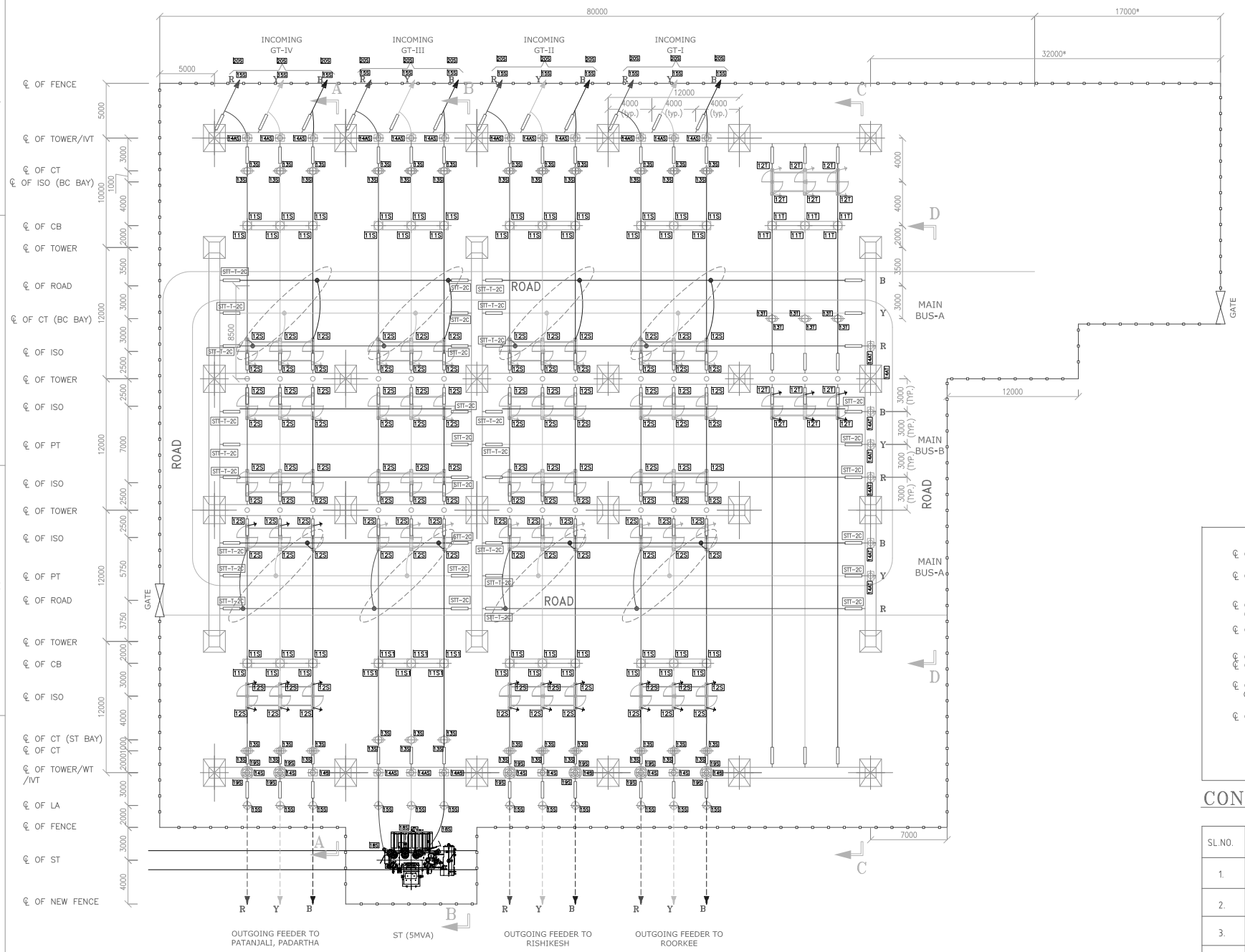
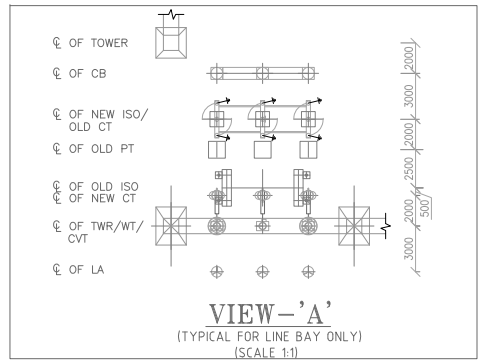


(For tendering purpose)

CONNECTORS FOR 132 kV EQUIPMENTS

SN	SYMBOL	EQUIPMENT	EQUP.QTY.	GT BAY ID NO. QTY(NOS)	ST BAY ID NO. QTY(NOS)	LINE BAY ID NO. QTY(NOS)	B/C BAY ID NO. QTY(NOS)	MAIN BUS ID NO. QTY(NOS)
1		145kV, 1250A, 40kA FOR 3 SEC, 3-Ph, SF-6 CIRCUIT BREAKER	09	11S (24)	11S1 (06)	11S (18)	11T (06)	–
2		145 kV, 1600A, 3-PH, HDB MOTORIZED ISOLATOR (MECHANICALLY GANGED)	21	12S (48)	12S (12)	12S (54)	12T (12)	–
3		145 kV, 40kA FOR 3 SEC, 1-PH CURRENT TRANSFORMER	27	13S (24)	13S (06)	13S (18)	13T (06)	–
4		145 kV, 40kA FOR 3 SEC, 1-PH INDUCTIVE VOLTAGE TRANSFORMER FOUR SECONDARY CORES	21	14AS (12)	14AS (03)	–	–	14AS (06)
5		145 kV, 13200pF, 40kA FOR 3 SEC, 1-PH CAPACITOR VOLTAGE TRANSFORMER THREE SECONDARY CORES - (FOR LINE BAYS)	09	–	–	14S (09)	–	–
6		120kV, 10kA, 40kA FOR 3 SEC, DISCHARGE CLASS-3, 1-Ph SURGE ARRESTER	24	15S (12)	15S (03)	15S (09)	–	–
7		145kV, 1250A, 1mH, 40kA for 1sec. (SUSPENSION TYPE) WAVE TRAP	6+6*	–	–	19S+19S1* (12+12*)	–	–
8		HT BUSHING OF GT	03	–	–	20S (12)	–	–
9		HT BUSING OF ST	03	–	–	18S (03)	–	–

NOTE: * – 06 NOS. WT TO BE SUPPLIED LOOSE FOR REMOTE END.



VIEW–'A'
(TYPICAL FOR LINE BAY ONLY)
(SCALE 1:1)

SYSTEM PARAMETERS

Sl.No.	DESCRIPTION OF PARAMETER	VALUE
1	SYSTEM OPERATING VOLTAGE	132kV
2	MAX. OPERATING VOLTAGE (rms)	145kV
3	RATED FREQUENCY	50Hz
4	NO. OF PHASES	3
5	RATED INSULATION LEVELS i) LIGHTNING IMPULSE WITHSTAND VOLTAGE (1.2/50microsec.) ii) ONE MINUTE POWER FREQUENCY WITHSTAND VOLTAGE (rms)	650kVp 275kV (rms)
6	MIN. CREEPAGE DISTANCE	25mm/kV (3625 mm)
7	MIN. CLEARANCE i) PHASE TO PHASE ii) PHASE TO EARTH iii) SECTIONAL CLEARANCE	1300mm 1300mm 3800mm
8	RATED SHORT CIRCUIT CURRENT	40kA FOR 3 SEC.
9	SYSTEM NEUTRAL EARTHING	SOLIDLY EARTHED

CONDUCTOR DETAILS :–

SL.NO.	DESCRIPTION	CONDUCTOR DETAIL	CONNECTION HEIGHT (ABOVE PLINTH LEVEL)
1.	EQUIPMENT INTERCONNECTION	SINGLE ACSR ZEBRA CONDUCTOR TWIN ACSR ZEBRA CONDUCTOR AT BC	5 mtr.
2.	MAIN BUS	TWIN ACSR ZEBRA CONDUCTOR	8 mtr.
3.	JACK BUS	SINGLE ACSR ZEBRA CONDUCTOR TWIN ACSR ZEBRA CONDUCTOR AT BC	11.5 mtr.
4.	EARTHWIRE	7/9 SWG (3.66mm) SHIELD WIRE	14.5 mtr.

NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. ALL STRUCTURE/CONDUCTOR HEIGHTS ARE ABOVE PLINTH LEVEL. PLINTH LEVEL IS RL 306 MM ABOVE F.G.L.
3. EXISTING STRUCTURE & FOUNDATION OF TOWER SHALL BE RETAINED AS PER MOM DATED 06–11–2020 BETWEEN UJVNL & BHEL.
4. ALL FLEXIBLE CONNECTIONS ARE WITH SINGLE ACSR MOOSE CONDUCTOR IN LINE WITH EXISTING SWITCHYARD.
5. TENTATIVE LOCATION OF STATION TRANSFORMER IS SHOWN IN THE LAYOUT.HOWEVER EXACT LOCATION SHALL BE FINALIZED AFTER RECEIPT OF APPROVED GA FROM BHEL JHANSI.
6. PHASE SEQUENCE TO BE CONFIRMED & MATCHED WITH EXISTING BAYS PHASE SEQUENCE DURING SITE EXECUTION IN CONSULTATION WITH SITE–INCHARGE.
7. EXISTING STRUCTURE & FOUNDATION OF EQUIPMENT SHALL BE RETAINED & IF REQUIRED WILL BE REPLACED. HOWEVER ST BAY IS COMPLETELY NEW BAY
8. HEIGHT OF THE EQUIPMENTS SHALL BE AS PER GA.
9. CIRCUIT BREAKER OF ST BAY IS IN THE SCOPE OF TBG. REMAINING CBs ARE EXISTING/UJVNL SCOPE AS PER CONTRACT.
10. THE DIMENSIONS OF THE BUILDING IN THE SWITCHYARD ARE TENTATIVE AND NO CIVIL WORK IS ENVISAGED IN THE BUILDING AREA.
11. THE MEASUREMENTS SHOWN ARE BASED ON THE OLD DRAWINGS TO ACCOMODATE THE EXSITING STRUCTURES.
12. SOME MEASUREMENTS ARE TO BE CONFIRMED BY UJVNL

LEGEND

	TOWER WITH PEAK
	TOWER WITHOUT PEAK
	SINGLE SUSPENSION INSULATOR STRING
	SINGLE TENSION INSULATOR STRING
	ACSR MOOSE CONDUCTOR R–PHASE Y–PHASE B–PHASE
	7/9 SWG (3.66mm) SHIELD WIRE

REFERENCE DRGS.

SN	Drg. No.	DESCRIPTION
1	TB–414–386–510–1	SINGLE LINE DIAGRAM OF 132kV SUBSTATION
2	TB–1–414–316–002	PLAN LAYOUT 132KV SUB STATION CHILLA

PROJECT: CHILLA HYDRO ELECTRIC PROJECT (4X36MW)

OWNER: UJVN Limited

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

	NAME	SIGN.	DATE
DRN.	DM	–sd–	20.03.2025
CHD.	DK	–sd–	20.03.2025
APPD.	VK	–sd–	20.03.2025

REV.	DATE	ALTERED	CHD/APPD
	27.12.16		

ZONE

DEPT. TBEM CODE 411 | UNTOL. DIMS. GR. ¢/M/F | SCALE N.T.S | WEIGHT (KG) N.A. | REF. TO ASSY. DRG. N.A. | ITEM NO. N.A. | NO.OF ITEMS N.A.

TITLE
132kV SWITCHYARD– ERECTION KEY DIAGRAM

DRAWING/ DOCUMENT NO. TB–1–414–316–004 | REV. 00

SHT. No 01 | NO. OF SHT. 02

COMPUTER FILE NAME | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

SIZE–A1

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

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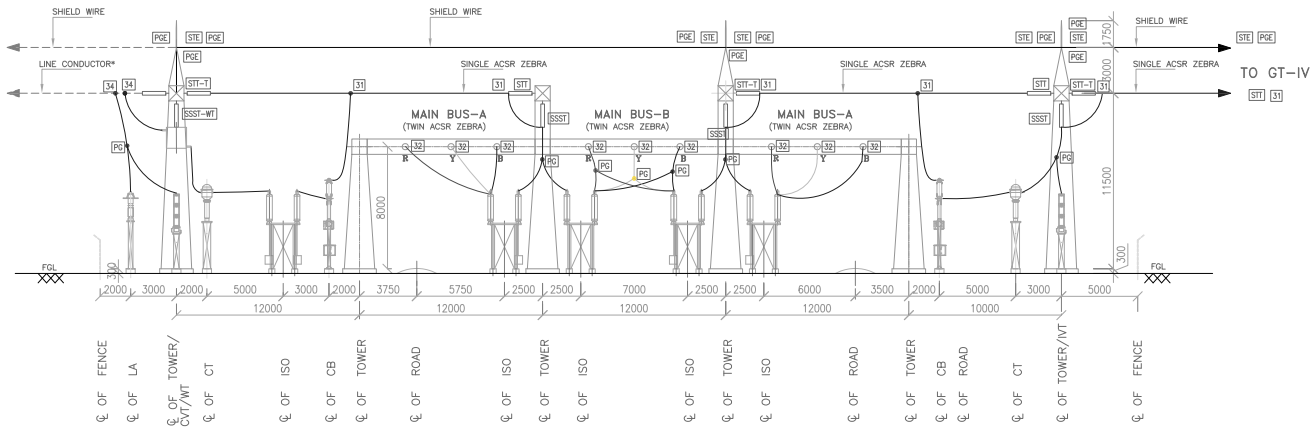
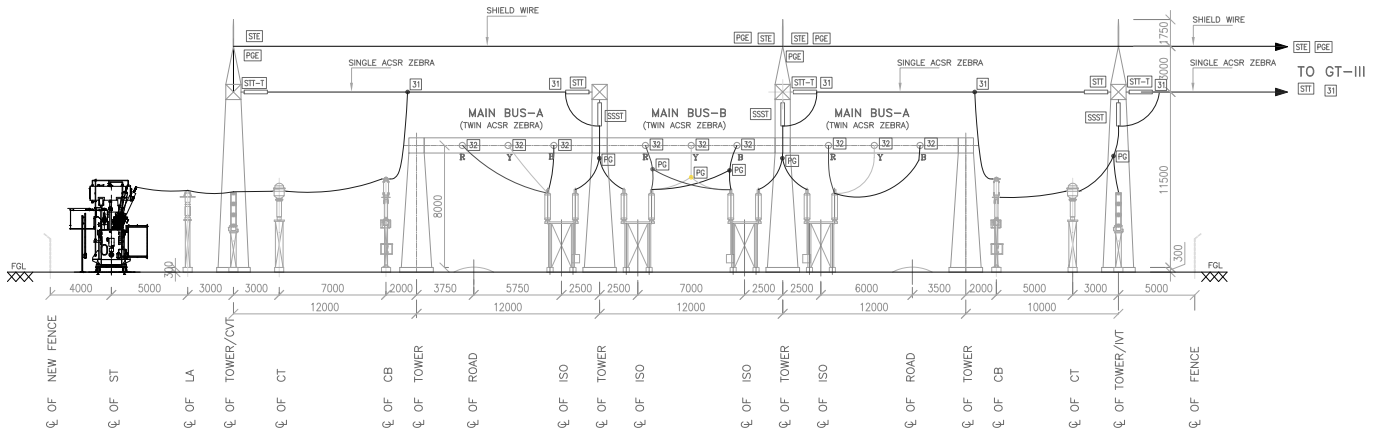


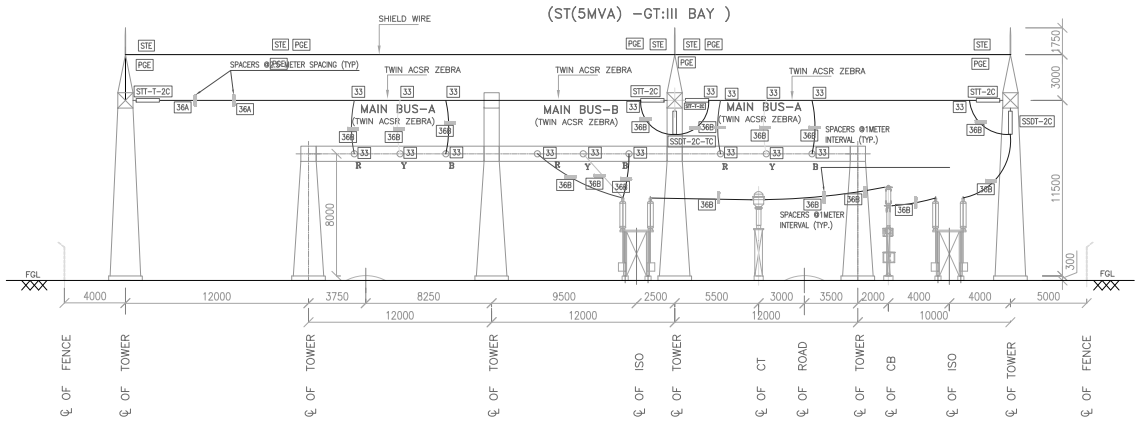
SECTION:A-A

(NAJIBABAD LINE-GT:IV BAY)



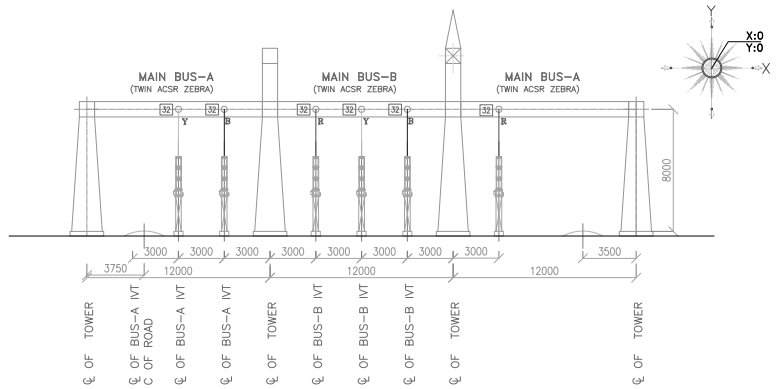
SECTION:B-B

(ST(5MVA) -GT:III BAY)



SECTION:C-C

(BUS COUPLER BAY)



SECTION:D-D

(BUS IVT)

CONNECTORS FOR CONDUCTORS

SN.	ID NO.	CONNECTOR	SEC-A LINE & GT BAY	SEC-B ST & GT BAY	SEC-C BC BAY	BUS A & B	TOTAL (NOS.)
1	33	TEE CONNECTOR (132 KV S/S) TWIN ACSR ZEBRA TO TWIN ACSR ZEBRA	–	–	18	–	18
2	32	TEE CONNECTOR (132 KV S/S) TWIN ACSR ZEBRA TO SINGLE ACSR ZEBRA	27	09	–	06	42
3	31	TEE CONNECTOR (132 KV S/S) SINGLE ACSR ZEBRA TO SINGLE ACSR ZEBRA	54	18	–	–	72
4	PG	PG-CLAMP FOR DROPPER CONNECTION	45	12	–	–	57
5	36A	FLEXIBLE (FOR MAIN STRINGING) SPACERS FOR TWIN ACSR ZEBRA WITH 250MM SUB-CONDUCTOR SPACING	–	–	69	207	276
6	36B	RIGID (FOR JUMPERS) SPACERS FOR TWIN ACSR ZEBRA WITH 250MM SUB-CONDUCTOR SPACING	–	–	155	540	695
7	STT	SINGLE TENSION STRING INSULATOR FOR SINGLE ZEBRA CONDUCTOR W/O TURN BUCKLE	27	09	–	–	36
8	STT-T	SINGLE TENSION STRING INSULATOR FOR SINGLE ZEBRA CONDUCTOR WITH TURN BUCKLE	27	09	–	–	36
9	STT-2C	SINGLE TENSION STRING INSULATOR FOR TWIN ZEBRA CONDUCTOR W/O TURN BUCKLE	–	–	06	18	24
10	STT-T-2C	SINGLE TENSION STRING INSULATOR FOR TWIN ZEBRA CONDUCTOR WITH TURN BUCKLE	–	–	06	18	24
11	SSST	SINGLE SUSPENSION STRING INSULATOR FOR SINGLE ZEBRA CONDUCTOR WITH DC CLAMP	27	09	–	–	36
12	SSS-WT	SINGLE SUSPENSION STRING INSULATOR WITH ALL HARDWARE ACCESSORIES FOR WAVE TARP	18+18*	–	–	–	–
13	SSDT-2C	SINGLE SUSPENSION STRING INSULATOR FOR TWIN ZEBRA CONDUCTOR WITH DROP CLAMP	–	–	03	–	03
14	SSDT-2C-TC	SINGLE SUSPENSION STRING INSULATOR FOR TWIN ZEBRA CONDUCTOR WITH THROUGH CLAMP	–	–	03	–	03
15	34	TEE CONNECTOR (132 KV S/S) SINGLE ACSR PANTHAR TO SINGLE ACSR ZEBRA	15+06*	–	–	–	15+06*
				–	–	–	–

NOTE: * – FOR REMOTE END

SN.	ID NO.	CLAMP	SEC-A LINE & GT BAY (NOS.)	SEC-B ST & GT BAY (NOS.)	BC BAY (NOS.)	BUS IVT (NOS.)	TOTAL (NOS.)
1	PC	PAD TYPE CLAMP FOR CONNECTING 10.98mm DIA. G.I WIRE ON ONE SIDE AND 75X12mm GS STIRIPS ON OTHER SIDE.	12+5	3	3		23
2	CC1	CLEAT TYPE CLAMP FOR EARTHING DOWN CONDUCTOR (10.98mm DIA).	72	24	24		120
3	CC2	CLEAT TYPE CLAMP FOR EARTHING DOWN CONDUCTOR (10.98mm DIA) ON BUILDING	125	–	–		125
4	CC4	CLEAT TYPE CLAMP FOR 75X10mm G.S. FAT FOR LATTICE STUCTURE	468	138	51	18	675
5	STE	EARTHWIRE STARIN/TENSION CLAMP 9BOLTED TYPE) WITH D SHACKLE ASSEMBLY	23	12	4		39
6	PGE	PG-CLAMP FOR GS EARTH WIRE 10.98MM	32	18	5		55

(For tendering purpose)

PROJECT:	CHILLA HYDRO ELECTRIC PROJECT (4X36MW)
OWNER:	UJVN Limited

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP
NOIDA

	NAME	SIGN.	DATE
DRN.	DM	–sd–	20.03.2025
CHD.	DK	–sd–	20.03.2025
APPD.	VK	–sd–	20.03.2025

DEPT.	UNTOL. DIMS.	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
TBEM CODE 411	GR. G/M/F	N.T.S	N.A.	N.A.	N.A.	N.A.

TITLE: 132kV SWITCHYARD- ERECTION KEY DIAGRAM

DRAWING/ DOCUMENT NO. TB-1-414-316-004 REV. 00

SHT. No 02 NO. OF SHT. 02

REV.	DATE	ALTERED	CHD/APPD
	27.12.16		

ZONE

COMPUTER FILE NAME | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

SIZE-A1

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No TB-382-316-010.

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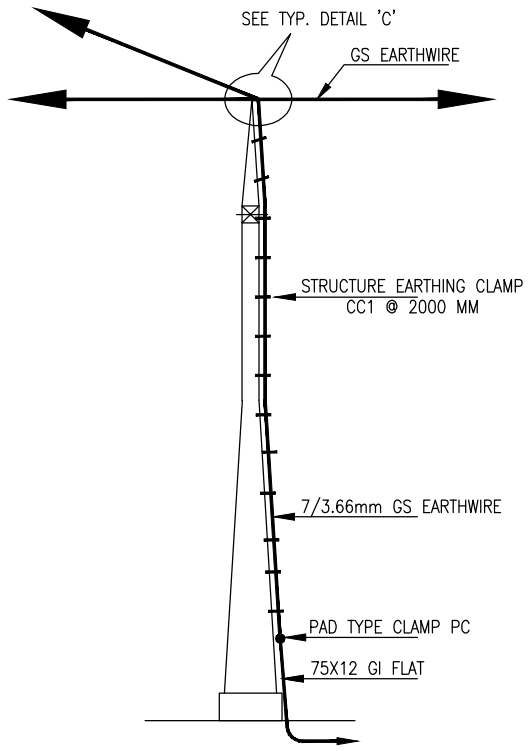
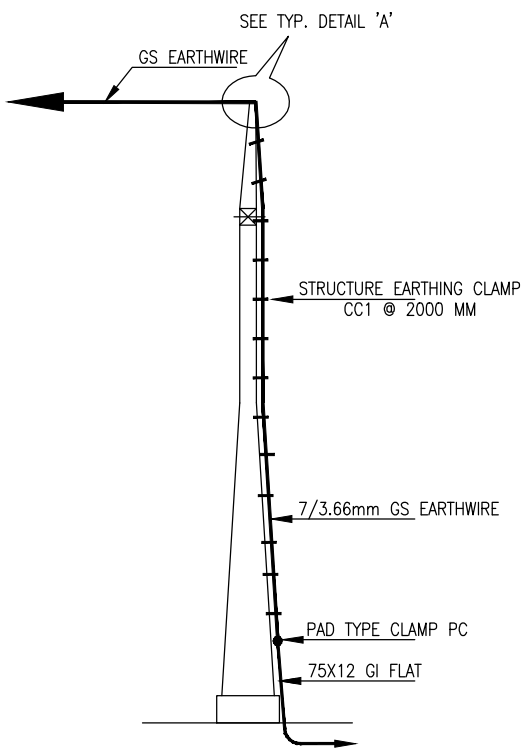
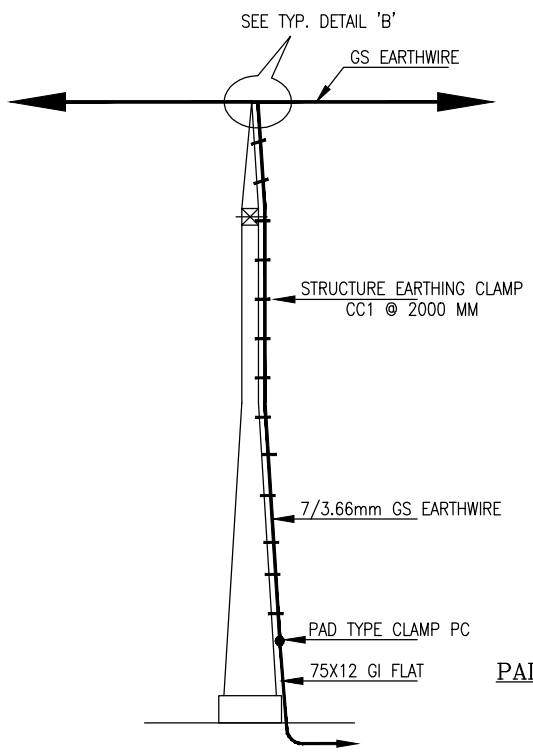


SHIELDING OF TOWER WITH PEAK
THREE SHIELD WIRE TERMINATION

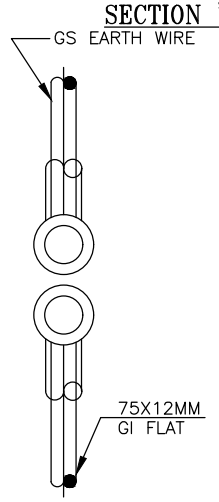


SHIELDING OF TOWER WITH PEAK
ONE SHIELD WIRE TERMINATION

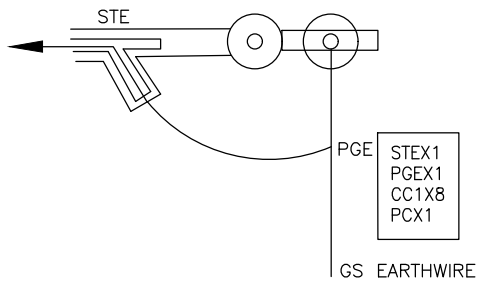


SHIELDING OF TOWER WITH PEAK
TWO SHIELD WIRE TERMINATION

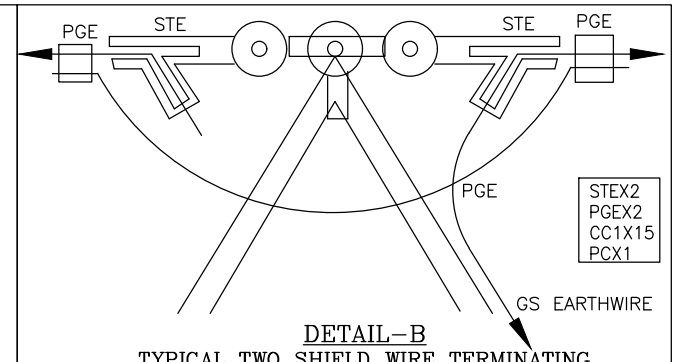
SECTION "C-C"



PAD TYPE FIXING SHIELD WIRE WITH
75X12mm GI FLAT



DETAIL-A
TYPICAL ONE SHIELD WIRE TERMINATING
AT TOWER



DETAIL-B
TYPICAL TWO SHIELD WIRE TERMINATING
AT TOWER

NOTE:-

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
2. ALL THE JUMPERS SHALL BE ALLOWED TO TAKE NATURAL CATENARY WITHOUT ANY ADDITIONAL PULL. JUMPERS SHALL BE SHORTEST POSSIBLE SO THAT PHASE TO EARTH CLEARANCE SHALL BE MAINTAINED FOR ALL THE JUMPERS CONNECTION.

ADDITIONAL INFORMATION
W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम
NAME OF CUSTOMER/PROJECT

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
पारेषण व्यापार समूह
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

	नाम /NAME	हस्ता./SIGN.	दि./DATE
बनाया DRAWN	BY	-SD-	30.01.23
जाँचा CHECKED	DKS	-SD-	30.01.23
स्वीकृत APPROVED	VK	-SD-	30.01.23

REV.	DATE	ALTERED / CHECKED / APPROVED
ZONE		

REV.	DATE	ALTERED / CHECKED / APPROVED
01	24.02.23	
ZONE	As per customer comments dtd. 23.02.23.	

विभाग DEPT. TBEM
कोड CODE 422
अनुपात / SCALE
कार्ड कोड CARD CODE

शीर्षक/TITLE
ERECTION KEY DIAGRAM FOR POTHEAD YARD

ड्राईंग क्र./DRAWING NO.
TB-382-316-010

पुनः/REV. 01

पृष्ठ क्र./SHEET No. 03 | अगला पृष्ठ/NEXT SHEET 03

COMPUTER DRG. PATH NAME :
REF. DRG. No.
SIGN. & DATE
INVENTORY No.

A3 SIZE

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, equipments and services covered under other respective sections and are 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 PROJECT INFORMATION AND SYSTEM PARAMETERS:

a)	Customer/ Purchaser/ Owner	UJVN Limited
b)	Project Title	132kV Switchyard for 4 X 36 MW Chilla HEP
c)	Location	5km downstream of Rishikesh Chilla Colony, District: Pauri (Gharwal), 9kms from the city of Haridwar, Uttrakhand
d)	Maximum Pond Level	El.337 m above MSL
e)	Normal Pond Level	El.333 m above MSL
f)	Latitude & Longitude	North 30º04’27” N East 78º17’18” E
g)	Transport Facilities	Nearest Airport at Dehradun (40kms), Nearest Railway station at Haridwar (9kms) Accessible by Road from National Highway NH-334 via Haridwar.
SITE CONDITIONS		
a)	Max. temp.	46.9°C
b)	Min. temp.	2°C
c)	Annual Mean Rainfall (Project Area)	2136.7mm
d)	Maximum Relative humidity	86 %
e)	Minimum Relative humidity	46%
f)	Pollution Severity	Less Polluted
g)	Basic Wind Speed in area	39 m/s
h)	Seismic acceleration	0.36g for maximum Credible Earthquake (MCE) and 0.18g for Design basis Earthquake (DBE)
i)	Seismic zone	Zone-IV

SYSTEM PARAMETERS:

Nominal system voltage	**132 kV**
Highest system voltage	145 kV
Rated continuous current per Ø	1250 A for each bus
Lightning impulse voltage	650 kV (peak)
Switching impulse voltage	650 kV (peak)
Power frequency withstand voltage	275 kV (rms)
Frequency	50 Hz ± 5%
Rated short circuit withstand current	40 kA (rms) for 3 sec
Minimum creepage distance Ø-ground and between circuit breaker terminals	3625mm
System Earthing	Solidly Grounded
Fault Level (DC) both 220V & 48V	15 kA

Note: -

Seismicity: -The project is situated in a seismic zone and falls within Zone IV of the seismic zoning Map of India. Value of peak ground acceleration has been recommended as 0.36g for maximum Credible Earthquake (MCE) and 0.18g for Design Basis Earthquake (DBE).

Wind Load: - The basic wind load as per IS875 (part-3) shall be applied on the vertical projected area, multiplied with the applicable factor for different type of structures.

AUXILIARY POWER SUPPLY:

A.C power supply	415V, 50 Hz, 3-phase 4 wire, neutral earthed with variation in frequency of +/-5% and variation in voltage +/-10%.
D.C. power supply	220V (variation under worst condition from of + 10% to -15%) , 2-wire ungrounded system, 24V, 48V (+10% to -15%), 2 Wire, positive grounded (for communication)

TRANSPORTATION LIMITATIONS:

For shipments, the Manufacturer shall pack the items to meet size and weight restrictions of the Indian railways and road systems. Shipments from Manufacturer's work (in case of foreign manufacturer) shall travel to the Port of entry in India, from where these will be transported, after necessary port clearances etc., by the Contractor to Haridwar, which shall be the nearest rail head for the Project, and further transported to site. However, in certain cases the Contractor may be required to transport the materials from Port of entry to Haridwar and further to Chilla HEP site directly by road transport. However, Indian contractors shall be responsible in all respects for transportation of all materials and equipment up to the project site.

Manufacturers shall consult with the concerned authorities of railways and highways to ensure that their packaging will be such as to permit them to transport the plant and equipment within such imposed limits. Manufacturers shall arrange to deliver the maximum size subassemblies consistent with safe and convenient transport. All materials and equipment etc. arrived at Haridwar will be unloaded from rail wagons and reloaded on to road transport for shipment to project site by the Contractor. The roads and bridges enroute shall be made suitable for 70R loading capacity. The Contractor is required to carry out survey for obtaining the transportation limitation data on its own.

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 recognized that the bidders may have standardized 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 acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously. All deviations from the specification shall be clearly brought out in the respective schedule of deviations. Any discrepancy between the specification and the catalogues or the bid, if not clearly brought out in the schedule, will not be considered as valid deviation.

Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes, though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment under supply shall be inter-changeable with one another.

'Make' of brought-out items are subject to Owner/Purchaser's approval.

The bidder shall furnish relevant details to the Owner/Purchaser for his concurrence before procurement. Makes approved by owner shall only be acceptable.

The bidder shall supply type tested (including special tests as per tech. specification) equipment and materials. The test reports shall be furnished by the bidder along with equipment/ material drawings. In the event of any discrepancy in the test reports, (i.e., if any test report is not acceptable due to any design/ manufacturing changes or due to non-compliance with the Technical Specification and/ or applicable standard), the tests shall be carried out without any additional cost implication to the BHEL. BHEL reserves the right to get any or all type/tests conducted/repeated.

3.3 CODES AND STANDARDS

The Design, manufacture, erection, testing and performance of items and services provided under this specification shall comply with the latest edition including all applicable official amendments and revisions as on date of award of the following standards. In case of conflict between this specification and code (IS Code, standards, etc.) referred herein, the more stringent of both shall prevail. All work shall be carried out as per the codes and standards listed out in the description of each equipment/item. Indian Electricity Act and Indian Electricity Rules can be obtained from bureau of Indian Standards. Equipment complying with other internationally accepted standards such as IEC, BS, USA, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision amendments and revision in force on date of opening of bid and shall clearly bring out the salient features for comparison.
The supplier is required to follow local statutory regulations stipulated in the latest amended Electricity Supply Act 1948 and Indian Electricity Rules 1956 (latest), and other local rules and regulations.

3.4 MATERIAL/WORKMANSHIP

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood 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 and shall ensure satisfactory performance throughout the service life. All design calculations, materials, works, manufacturing and testing shall conform to the latest applicable standards.
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 and shall be used throughout the design. 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 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 be interchangeable with, 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.
The equipment offered in the bid only shall be accepted for supply, with the minimum modifications as agreed/accepted.
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 modem practices will be accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, 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 and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. 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.

In case 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

3.5 TROPICAL PROTECTION

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

All electrical equipment, accessories and wiring shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

Fine mesh screen of corrosion resistant material shall be furnished on all ventilating openings to prevent entry of insects.

3.6 SPACE HEATERS

The space heaters shall be suitable for single phase 50 Hz AC supply from an independent source, which should automatically switch off before starting of unit. However, once the dehumidification unit is switched ON, it shall be controlled automatically with a thermostat. The dehumidification unit shall be designed to avoid hot spot. The heater shall be suitable for continuous operation at 240 V AC supply voltage and shall be provided with on – off switch and fuse shall be provided for heater.

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent

condensation in any compartment. The heater shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heater to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and air and shall consist of coiled resistance wire centered in metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of a resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and air. Alternatively, they shall consist of resistance wire mounted into a tubular ceramic body built into an envelope of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in vitreous glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

3.7 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistance varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

3.8 VENTILATION OPENING

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

3.9 DEGREE OF PROTECTION

The supplier shall propose the Degree of protection to BHEL/UJVNL for those equipment/Items for which the degree of protection has not been specified in the specification for the approval. The decision of BHEL/UJVNL shall be final. The degree of protection shall be in accordance with IS: 13947 (Part –I) / IEC-947 (Part-I) / IS 12063/1987, IEC 2147, IS 2063, IEC/ANSI-60529

Type test report for degree of protection test, on each type of the box shall be submitted for approval. The enclosures of the Control Cabinet, Junction boxes and Marshalling boxes panels etc. to be installed shall be provided with degree of protection as detailed here under:

a) Outdoor kiosks and marshalling boxes: IP55
b) MLDB, Sub-distribution boards: IP42
c) Residual current circuit breakers, Socket outlets: IP20
d) The protection class for the luminaries shall generally be as follows:
   For office control room etc.: IP 20 or better
   For all other indoor area: IP 22 or better

For all other indoor area: IP 22 or better

For Switchyard /street light Minimum: IP-65 for Luminaire at 60W or below and IP-66 for Wattage above 60Wprotection and safety as per IEC 60598/IS 10322

e) Protection class of Relay enclosure: IP54
f) Protection class of Protection panel: IP52 minimum
g) 220V DC, UPS switchboards: IP53
h) Installed outdoor: IP-55
i) Installed indoor in air conditioned area: IP-42
j) Installed in covered area IP:52
k) For LT switchgear (AC & DC distribution Boards): IP-54

The degree of protection shall be in accordance with IS:13947, (Part-1)/IEC-947(Part-1). Type test report/or degree of protection test on each type of the box shall be submitted for approval. If necessary, the cubicles shall be equipped with automatically controlled heating elements for protection against internal condensation and moisture. All panels/cubicles shall have approximately 20% space for mounting of future devices. Door operated interior illuminating lamps, power socket for 240V, 5/15A and communication socket shall be provided in all panels.

3.10 ELECTRICAL EQUIPMENT ENCLOSURES

All electrical equipment, apparatus and devices shall be of suitable design for satisfactory operation under the conditions prevailing at the Site. The equipment shall operate satisfactorily under normal load and voltage variations in accordance with IEC Publications.

The design shall also include all necessary provisions ensuring the safety of the operating and maintenance personnel. All electrical connections and contacts shall be of ample cross section and capacity for carrying continuously the specified currents without undue heating and shall be secured by bolts or setscrews of ample size, fitted with locknuts or lock-washers of approved types.

Unless otherwise expressly stated conductors and all other current carrying parts shall be made from electrolytic grade copper in accordance with approved applicable standards.

Cubicles and other enclosures containing electrical equipment shall be especially treated to prevent corrosion. All cubicles shall be provided with a door switched lighting fixture and a single-phase socket for power outlet.

All interior surfaces of electrical apparatus, enclosures etc. including contactors, relays, and coils, etc., shall be treated in an approved manner to prevent mold growth. Such treatment shall in no way interfere with the proper operation of the equipment either electrically or mechanically.

Bigger assemblies such as switchboards, etc., shall be designed to present suitable transportation devices adapted to the local conditions within the plant.

Unless otherwise specifically called for or described in these Contract Documents all electrical appliances shall conform to the applicable IEC Publications.

CONSTRUCTION REQUIREMENTS

All cubicles and enclosures shall be of good quality standard production subject to approval by the Engineer. Cubicles shall be free floor standing type, of rigid frame covered with removable steel sheets. The frame shall be bolted to the floor. Cubicles mounted in rooms with computer floors shall have their own supporting structures made of steel profiles, being fixed to the concrete floor. There shall be provision and enough space for entrance of cables from above or below as necessary. The cubicles shall be ventilated if needed; in this case, removable filter inserts shall be fitted to the air entrance openings. Provision for cable fastening shall be inside the cubicles and enclosures, and sufficient space from cable fastenings to nearest terminal.

All control and indicating devices such as contactors, circuit breakers, auxiliary relays, indicating instruments, switches etc., shall be functionally displayed in appropriate location. All indicating devices shall be visible with the door closed. The layout is subject to the approval of the Engineer.

If required, flush mounted hinged steel doors with latches shall be available: doors shall be with approved locks. The locks shall be of the same type throughout the plant. All panels and cubicles shall have a uniform appearance.
The indoor cubicles and enclosures shall be of protection class IP42 or higher according to their location. For outside installation, the ingress protection class of cubicles shall be IP65. Cubicles housing electronic cards/ modules such as of unit control boards, control & protection panels, digital governor etc. shall be of protection IP 5X except static excitation equipment (SEE) cubicles shall be IP31. If necessary the cubicles shall be equipped with automatically controlled heating elements for protection against internal condensation and moisture especially in the outdoor cubicles such as circuit breaker mechanism & other ODMKs.
All panels/cubicles shall have approximately 20% space for mounting of future devices.
Door operated interior illuminating lamps, power socket for 240V 5 / 15A and communication socket shall be provided in all panels.

WIRING

Unless and otherwise specifically called for or described in these contract documents all electrical appliances shall conform to the applicable IEC standards.
Wiring within cubicles and equipment enclosures shall conform to requirements of this section unless otherwise specified. Control wiring shall be stranded copper and shall be not smaller than 1.52 mm , except as otherwise agreed by the Engineer.
Larger size wiring shall be used where needed for the current carrying capacity requirements.
LT Cables shall have at least 1100 V grade PVC insulation except for 110V DC and telemetering or communication system equipment for which 650V and 300 V ratings respectively are acceptable. Cables shall conform to IEC 60331/ IEC 60332/ IS 1554/ IS 7098 as per applicability. LT power cables single or multicore (2/3/3.5 cores) shall be 1100V grade, heavy duty, FRLS, stranded Aluminum/ Copper conductor, cross linked polyethylene (XLPE) insulated and PVC inter sheathed. Cables for DC system shall be copper only. The control & instrumentation cables shall be multi core, FRLS, colour coded/ numbered, Annealed stranded high

conductivity Copper, insulated with PVC & PVC sheathed. The outer sheath shall be specially formulated PVC compound. For current and potential transformer secondary circuits the minimum cross section of the conductors shall not be less than 2.52mm .
Wiring shall terminate at terminal blocks at one side only. Where tap connections are required, they shall be made on terminal blocks. Wiring shall be neatly arranged and laid in plastic conduits accessible from the front door. The conduits shall not be filled more than 70 %.
Each cubicle shall be provided with an earthing bar (PE) of sufficient cross section carrying any possible fault current without undue heating. All metallic parts of the cubicle not forming part of the live circuits, all instrument transformer terminals to be earthed and other earthing terminals as well as all cable screens and PE wires shall be connected to the earthing bar.
All internal equipment and wiring shall be neatly and clearly marked as indicated on the schematic and wiring diagrams. Internal wiring and cables shall be marked with sleeve type engraved marking. Marking system and marking material shall be subject to approval by Employer. Identification of the respective conductors shall be in accordance with the requirements of IEC publication 60204. In cables having five conductors or more the individual conductors shall be numbered throughout the entire length. In cables having less than five conductors colour coding in accordance with IEC 60204 shall be applicable.

TERMINAL BLOCKS

Control circuits & power circuits shall be completely separated by use of divided or separate Terminal Blocks (TB). The screw type modular Terminal block should be manufactured as per IEC-60947-7-1. The insulating material of terminal block should be of polyamide 6.6 meeting V0/V2 flammability Class as per UL94. All metal parts including screws should be of copper alloy. The terminal block should be suitable for mounting on both "DIN" as well as "G" type rail . All metal parts shall be captive & touch proof. The TB shall have screw locking design so that it can withstand vibration level up to 5g and also prevent accidental, loosening of conductors. The terminal blocks shall also have necessary accessories like end clamp, separation plates etc. Unless otherwise specified terminal blocks shall be suitable for connecting following conductors on each side:-

1	All circuits except CT/PT circuits	Minimum of two of 2.5 mm^2 copper flexible
2	All CT/PT circuits	Minimum of two of 2.5 mm^2 copper flexible

The terminal blocks shall be located to allow a neat and easy connection work and shall be safely accessible while the equipment is in service. Control circuits and power circuits shall be completely separated by use of divided or separate terminal blocks. Power terminal blocks shall be rated in accordance with applicable standards, and shall be provided with covers.
Control wiring terminal shall be equipped with facilities for opening the circuit. It shall be possible to interchange a single terminal block for a new one without dismantling a whole row. Current transformer terminal blocks shall have provisions for short-circuiting and disconnecting. Not more than two wires shall be connected to any one terminal. Terminal blocks using screws acting directly on the wire will not be accepted. At least 20% spare terminals shall be provided on each panel/ cubicle/ box and these spare terminals shall be uniformly distributed on all terminals rows. Terminals shall be marked with printed labels.

GROUNDING

In addition to the grounding through cable screens, all equipment such as cubicles, motors, etc. shall be connected directly to the grounding system using copper wire of area not less than 50 mm^2 at two different points. In general, all iron parts such as supports, covers, railing, etc. shall be connected to the grounding system. Each conductor shall have its own separate connection point. Pressed on closed shoes shall be used for connections to bars.

PROTECTION DEVICES

For short circuit and overload protection of power and control circuits, moulded case circuit breakers or MCBs shall be used. Outlets from AC (and DC) distribution panels are protected in their respective panels. Power supply system shall be provided with three stage of surge protection (First stage with class A type, Second stage with class B type and third stage with class D type of lightning arrestors) to protect electrical & electronic devices.

MARKING OF EQUIPMENT AND WIRING

All internal equipment and wiring shall be neatly and clearly marked as indicated on the schematic and wiring diagrams. Internal wiring and cables shall be marked with sleeve type engraved marking. Marking system and marking material shall be subject to approval by Engineer. Identification of the respective conductors shall be in accordance with the requirements of IEC publication 60204. In cable, having five conductors or more the individual conductors shall be numbered throughout the entire length. In cables having less than five conductors colour coding in accordance with IEC Recommendations 60204 shall be used.

i) Colour Coding For Electrical Connections Live parts of electrical connections shall be colour coded as follows:

Conductor Designation	**Coding Alphanumeric**	**Symbol**	**Colour**
A.C. network 3 phase	Phase 1	R	Red
	Phase 2	Y	Yellow
	Phase 3	B	Blue
	Neutral	N	Black
A.C. single phase	Phase	P	Red
	Neutral	N	Black
	Earth	E	Green-Yellow
D.C. Network	Positive	a	Red
	Negative	b	Black

ii) Colour Coding for Mimic Diagrams
Mimic diagrams to be arranged on switchgear cubicles, control panels/desks, etc., shall be colour coded as follows:

S. No.	**Voltage Level**	**Colour**	**Colour Code**
1	HVDC	Crimson Red	No. 540 as per IS - 5
2	400 kV	Signal Red	RAL 3001/ No. 537 as per IS - 5
3	220 kV	Yellow Orange/ Light Orange	RAL 2000/ No. 557 as per IS - 5
4	132 kV & 110 kV	Lemon Yellow	RAL 1012/ No. 355 as per IS - 5

5	66 kV	Golden Brown	No. 414 as per IS - 5
6	33 kV	Olive Green	RAL 6003/ No. 220 as per IS - 5
7	11 kV	Sea Green	RAL 6017/ No. 217 as per IS - 5
8	6.6 kV	Aircraft Blue	No. 108 as per IS - 5
9	3.3 kV	Sky Blue	RAL 5015/ No. 101 as per IS - 5
10	415V & 220V AC	Dark Violet	No. 796 as per IS - 5
11	220V & 110V DC	Graphite Black	RAL 9011

Note: Above colours shall be finally agreed upon during detailed design.

3.11 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications, into operation, shall be furnished by the Bidder unless specifically excluded under the exclusions in these specifications and documents

3.12 RATING PLATES, NAME PLATES AND LABELS

Rating plates and other technical data/informative plates shall either be of the enameled type or be of stainless steel suitably protected after engraving with a transparent paint resistant to aggressive atmosphere and solar radiation.

The switchyard equipment shall have a rating plate with the information required by relevant IEC i.e. at least the following:

- Manufacturer’s name
- Type number
- Serial number
- Rated Voltage
- Rated impulse withstand voltage
- Rated power frequency withstand voltage
- Rated frequency
- Rated current

- Rated short circuit breaking current
- Rated short time current (r.m.s), & duration Each instrument transformer must have its own rating plate with the information as required in IEC 600441 and IEC 60186.

3.13 DRAWINGS

All drawings submitted by the supplier 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 Contractor (including those of sub-vendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. 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.

After the approval of the drawings, further work by the Contractor 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 purchaser will cover only general conformance of the data to the specification and documents, interfaces with the equipment provided under specification, external connections and of the dimensions which might affect plan layout. This review by the purchaser may not indicate a thorough review of the 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 purchaser shall not be considered by the contractor, 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 Contractor's risk. The Contractor 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 Contractor’s drawing or work by the Purchaser shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

All engineering data submitted by the contractor after final process including review and approval by the purchaser shall form part of the contract document and the entire work performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the purchaser in writing.

3.14.1 QUALIFYING REQUIREMENT

As per section-1 of item Specific QR

3.14.2 TYPE TESTS

The offered equipment must have been fully type tested as per relevant IS and/ or other specified International Standards carried out after **30.05.2014**. The type test certificate of prototype manufactured and tested by foreign collaborators of the Bidders at their works shall not be acceptable for indigenously manufactured equipment.

In case the equipment is being, manufactured in India under foreign collaboration, the collaborator's equipment shall have minimum two years' satisfactory operating experience under tropical climate. The offered indigenously manufactured equipment should have been type tested and test report submitted with the tender.

Type tests to be done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off.

In case Contractor is not able to submit report of type test(s) conducted in carried out after **30.05.2014**, or in case type test report(s) are not found to be meeting the specification/relevant standard requirements, then all such tests shall be conducted under this contract by the Bidder free of cost to Employer/Purchaser, and reports shall be submitted for approval. No charges shall be paid under this contract. All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bid price.

3.15. COLOUR SCHEDULE

Colour Standard references to major equipment/ system shall be as per the details given below: -

S. No.	Equipment	Colour	Colour Code
1	Governor Cubicles	Oyster White	RAL 1013
2	Local Control Cubicle for Governor	Oyster White	RAL 1013
3	Generator Cover Plates	Oyster White	RAL 1013
4	Braking Control Cubicle	Oyster White with blue band	RAL 1013 & RAL 5012 for band
5	LAVT/NGT/Transformers including Marshalling Box	Light Grey	RAL 7035

6	Bus Duct	Light Grey	RAL 7035
7	HS Oil Unit	Light Grey	RAL 7035
8	Oil Sump Tank	Light Grey	RAL 7035
9	Oil centrifuging & purification system	Light Grey	RAL 7035
10	Turbine (top cover & other equipment in the turbine pit)	Pebble Grey	RAL 7032
11	HS Oil Unit	Light Grey	RAL 7035
12	Oil Pressure Tank	Yellow Orange	RAL 2000
13	Cooling water pumps, cooling water filters & strainers.	Mint Green	RAL 6029
14	Cooling water, conveniences water & drinking water pipelines	Mint Green	RAL 6029
15	Local Control Cubicle for cooling water system, Drainage & dewatering system and emergency flood dewatering pumps	Oyster White with green band	RAL 1013 & RAL 6029 band
16	compressed air pipelines	Light Blue	RAL 5012
17	Air Compressors	Sky Blue	RAL 5015
18	Fire Fighting water Pipelines	Traffic Red	RAL 3020
19	Pressure oil & lubrication oil Pipelines	Yellow Orange	RAL 2000
20	Transformers	Pebble Grey	RAL 7032
21	Outdoor switchyard equipment, junction box, Outdoor Marshalling Kiosk (ODMK) etc.	Pebble Grey	RAL 7032

22	Unit Control Board/ Local Control Boards/ Excitation Panel/ Protection & Control Panels/ indoor marshalling boxes etc.	Oyster White	RAL 1013
23	Power Auxiliary Boards, Distribution Low Voltage Boards	Oyster White with Melon Yellow band	RAL 1013 & RAL 1028 band

The interior of all the cubicles & panels shall preferably have a matt finish unless specified otherwise. The colour scheme shall however be got reconfirmed & approved by the Employer during detailed engineering

3.16 ELECTRICAL EQUIPMENT ENCLOSURES

GENERAL

All electrical equipment, apparatus and devices shall be of suitable design for satisfactory operation under the conditions prevailing at the Site. The equipment shall operate satisfactorily under normal load and voltage variations in accordance with IEC Publications.
The design shall also include all necessary provisions ensuring the safety of the operating and maintenance personnel.
All electrical connections and contacts shall be of ample cross section and capacity for carrying continuously the specified currents without undue heating and shall be secured by bolts or setscrews of ample size, fitted with locknuts or lock-washers of approved types.

Unless otherwise expressly stated conductors and all other current carrying parts shall be made from electrolytic grade copper in accordance with approved applicable standards.

Cubicles and other enclosures containing electrical equipment shall be especially treated to prevent corrosion. All cubicles shall be provided with a door switched lighting fixture and a single-phase socket for power outlet.

All interior surfaces of electrical apparatus, enclosures etc. including contactors, relays, and coils, etc., shall be treated in an approved manner to prevent mold growth. Such treatment shall in no way interfere with the proper operation of the equipment either electrically or mechanically.

Bigger assemblies such as switchboards, etc., shall be designed to present suitable transportation devices adapted to the local conditions within the plant.

Unless otherwise specifically called for or described in these Contract Documents all electrical appliances shall conform to the applicable IEC Publications.

CONSTRUCTION REQUIREMENTS

All cubicles and enclosures shall be of good quality standard production subject to approval by the Engineer. Cubicles shall be free floor standing type, of rigid frame covered with removable steel sheets. The frame shall be bolted to the floor. Cubicles mounted in rooms with computer floors shall have their own supporting structures made of steel profiles, being fixed to the concrete floor. There shall be provision and enough space for entrance of cables from above or below as necessary. The cubicles shall be ventilated if needed; in this case, removable filter inserts shall be fitted to the air entrance openings. Provision for cable fastening shall be inside the cubicles and enclosures, and sufficient space from cable fastenings to nearest terminal.

All control and indicating devices such as contactors, circuit breakers, auxiliary relays, indicating instruments, switches etc., shall be functionally displayed in appropriate location. All indicating devices shall be visible with the door closed. The layout is subject to the approval of the Engineer.
If required, flush mounted hinged steel doors with latches shall be available: doors shall be with approved locks. The locks shall be of the same type throughout the plant. All panels and cubicles shall have a uniform appearance.

The indoor cubicles and enclosures shall be of protection class IP42 or higher according to their location. For outside installation, the ingress protection class of cubicles shall be IP65. Cubicles housing electronic cards/ modules such as of unit control boards, control & protection panels, digital governor etc. shall be of protection IP 5X except static excitation equipment (SEE) cubicles shall be IP31. If necessary the cubicles shall be equipped with automatically controlled heating elements for protection against internal condensation and moisture especially in the outdoor cubicles such as circuit breaker mechanism & other ODMKs. All panels/cubicles shall have approximately 20% space for mounting of future devices.
Door operated interior illuminating lamps, power socket for 240V 5 / 15A and communication socket shall be provided in all panels.

WIRING

Unless and otherwise specifically called for or described in these contract documents all electrical appliances shall conform to the applicable IEC standards.

Wiring within cubicles and equipment enclosures shall conform to requirements of this section unless otherwise specified. Control wiring shall be stranded copper and shall be not smaller than 1.5 mm^2 , except as otherwise agreed by the Engineer.

Larger size wiring shall be used where needed for the current carrying capacity requirements.

LT Cables shall have at least 1100 V grade PVC insulation except for 110V DC and telemetering or communication system equipment for which 650V and 300 V ratings respectively are acceptable. Cables shall conform to IEC 60331/ IEC 60332/ IS 1554/ IS 7098 as per applicability. LT power cables single or multicore (2/3/3.5 cores) shall be 1100V grade, heavy duty, FRLS, stranded Aluminium/ Copper

conductor, cross linked polyethylene (XLPE) insulated and PVC inter sheathed. Cables for DC system shall be copper only. The control & instrumentation cables shall be multi core, FRLS, colour coded/ numbered, Annealed stranded high conductivity Copper, insulated with PVC & PVC sheathed. The outer sheath shall be specially formulated PVC compound.

For current and potential transformer secondary circuits the minimum cross section of the conductors shall not be less than 2.5 mm^2 .
Wiring shall terminate at terminal blocks at one side only. Where tap connections are required, they shall be made on terminal blocks. Wiring shall be neatly arranged and laid in plastic conduits accessible from the front door. The conduits shall not be filled more than 70 %.
Each cubicle shall be provided with an earthing bar (PE) of sufficient cross section carrying any possible fault current without undue heating. All metallic parts of the cubicle not forming part of the live circuits, all instrument transformer terminals to be earthed and other earthing terminals as well as all cable screens and PE wires shall be connected to the earthing bar.

All internal equipment and wiring shall be neatly and clearly marked as indicated on the schematic and wiring diagrams. Internal wiring and cables shall be marked with sleeve type engraved marking. Marking system and marking material shall be subject to approval by Employer. Identification of the respective conductors shall be in accordance with the requirements of IEC publication 60204. In cables having five conductors or more the individual conductors shall be numbered throughout the entire length. In cables having less than five conductors colour coding in accordance with IEC 60204 shall be applicable.

TERMINAL BLOCKS

Control circuits & power circuits shall be completely separated by use of divided or separate Terminal Blocks (TB).

The screw type modular Terminal block should be manufactured as per IEC-60947-7-1. The insulating material of terminal block should be of polyamide 6.6 meeting V0/V2 flammability Class as per UL94. All metal parts including screws should be of copper alloy. The terminal block should be suitable for mounting on both “DIN” as well as “G” type rail . All metal parts shall be captive & touch proof. The TB shall have screw locking design so that it can withstand vibration level up to 5g and also prevent accidental, loosening of conductors. The terminal blocks shall also have necessary accessories like end clamp, separation plates etc. Unlewss otherwise specified terminal blocks shall be suitable for connecting following conductors on each side:-

1	All circuits except CT/PT circuits	Minimum of two of 2.5 mm2 copper flexible
2	All CT/PT circuits	Minimum of two of 2.5 mm2 copper flexible

The terminal blocks shall be located to allow a neat and easy connection work and shall be safely accessible while the equipment is in service. Control circuits and power circuits shall be completely

separated by use of divided or separate terminal blocks. Power terminal blocks shall be rated in accordance with applicable standards, and shall be provided with covers.

Control wiring terminal shall be equipped with facilities for opening the circuit. It shall be possible to interchange a single terminal block for a new one without dismantling a whole row. Current transformer terminal blocks shall have provisions for short-circuiting and disconnecting. Not more than two wires shall be connected to any one terminal. Terminal blocks using screws acting directly on the wire will not be accepted. At least 20% spare terminals shall be provided on each panel/ cubicle/ box and these spare terminals shall be uniformly distributed on all terminals rows. Terminals shall be marked with printed labels.

GROUNDING

The Contractor shall connect all equipment included in the scope of delivery to the grounding system as described in chapter on Grounding System.

In addition to the grounding through cable screens, all equipment such as cubicles, motors, etc. shall be connected directly to the grounding system using copper wire of area not less than 50 mm2 at two different points. In general, all iron parts such as supports, covers, railing, etc. shall be connected to the grounding system. Each conductor shall have its own separate connection point. Pressed on closed shoes shall be used for connections to bars.

MARKING OF EQUIPMENT AND WIRING

All internal equipment and wiring shall be neatly and clearly marked as indicated on the schematic and wiring diagrams. Internal wiring and cables shall be marked with sleeve type engraved marking. Marking system and marking material shall be subject to approval by Engineer. Identification of the respective conductors shall be in accordance with the requirements of IEC publication 60204. In cable, having five conductors or more the individual conductors shall be numbered throughout the entire length. In cables having less than five conductors colour coding in accordance with IEC Recommendations 60204 shall be used.

i) Colour Coding For Electrical Connections

Live parts of electrical connections shall be colour coded as follows:

Conductor Designation	Coding Alphanumeric	Symbol	Colour
A.C. network 3 phase	Phase 1	R	Red
	Phase 2	Y	Yellow
	Phase 3	B	Blue
	Neutral	N	Black
A.C. single phase	Phase	P	Red

	Neutral	N	Black
	Earth	E	Green-Yellow
D.C. Network	Positive	a	Red
	Negative	b	Black

ii) Colour Coding for Mimic Diagrams

Mimic diagrams to be arranged on switchgear cubicles, control panels/desks, etc., shall be colour coded as follows:

S. No.	Voltage Level	Colour	Colour Code
1	HVDC	Crimson Red	No. 540 as per IS - 5
2	400 kV	Signal Red	RAL 3001/ No. 537 as per IS - 5
3	220 kV	Yellow Orange/ Light Orange	RAL 2000/ No. 557 as per IS - 5
4	132 kV & 110 kV	Lemon Yellow	RAL 1012/ No. 355 as per IS - 5
5	66 kV	Golden Brown	No. 414 as per IS - 5
6	33 kV	Olive Green	RAL 6003/ No. 220 as per IS - 5
7	11 kV	Sea Green	RAL 6017/ No. 217 as per IS - 5
8	6.6 kV	Aircraft Blue	No. 108 as per IS - 5
9	3.3 kV	Sky Blue	RAL 5015/ No. 101 as per IS - 5
10	415V & 220V AC	Dark Violet	No. 796 as per IS - 5
11	220V & 110V DC	Graphite Black	RAL 9011

3.17 PACKING

The Contractor shall provide such packing of the Goods as is required to prevent damage or deterioration during transit to their final destination i.e. Chilla HEP site as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit

and exposure to extreme temperatures, salt and precipitation during transit and open storage. Packing case size and weights shall be taken into consideration, where appropriate, the remoteness of the Good's final destination and the absence of heavy handling facilities at all points in transit.
Suitable lifting lugs should be provided in heavy consignments and clear instructions be marked on the package for handling.

All electrical parts shall be carefully packed in high-pressure polyethylene foils where parts may be affected by vibration, they shall be carefully protected and packed to ensure that no damage will occur while they are being transported and handled.

All bright parts shall be thoroughly protected from rust during transit. Each package shall contain a packing list in polythene cover and six copies shall be sent to the Employer. All points shall be marked to facilitate erection.

Large articles, which are not packed in cases, shall have all screwed holes, plugged suitably and machined surfaces properly protected. Weight and size limitation for transport shall be ensured by the Contractor.

The Contractor will be required to make separate packages for each consignment and shall mark all containers with the implementing document number pertinent to the shipment. Each shipping container shall also be clearly marked on at least two sides as follows:
a. Consignee :
b. Contract No. :
c. Package number :
d. Description :
e. Item number (if applicable) :
f. Net and gross weight :
g. Volume :
h. Country of Origin :
i. Port of entry :

3.18 DELIVERY, INSTALLATION AND COMMISSIONING

TRANSPORTATION LIMITATIONS:
For shipments, the Manufacturer shall pack the items to meet size and weight restrictions of the Indian railways and road systems. Shipments from Manufacturer's work (in case of foreign manufacturer) shall travel to the Port of entry in India, from where these will be transported, after necessary port clearances etc., by the Contractor to Haridwar , which shall be the nearest rail head for the Project, and further transported to site. However, in certain cases the Contractor may be required to transport the materials from Port of entry to Haridwar and further to Chilla HE Project site directly by road transport. However, Indian contractors shall be responsible in all respects for transportation of all materials and equipment up to the project site. The contractor shall consult with the concerned authorities of railways and highways to ensure that their packaging will be such

as to permit them to transport the plant and equipment within such imposed limits. Manufacturers shall arrange to deliver the maximum size sub-assemblies consistent with safe and convenient transport. All materials and equipment etc. arrived at Haridwar will be unloaded from rail wagons and reloaded on to road transport for shipment to project site by the Contractor. The roads and bridges en-route shall be made suitable for loading capacity.

All components shall be so designed and constructed as would enable easy assembly of components at works and at the same time permit easy transportation. The weights and sizes of the components/packages shall be within the permissible transport limits for the project site.

PACKAGING, HANDLING AND SITE STORAGE:
The Contractor shall pack all the consignment in sea worthy packaging, wherever required, strong enough to withstand rough handling during transit. Machine surface shall be suitably protected against scratches, corrosion, shocks, impact etc. Packages shall be suitably and distinctly identified for type of handling and kind of storage. The packaging and storage of electronic equipment shall be strictly in accordance with internationally accepted standards. Electronic equipment shall be packaged, shipped and stored in anti-static packing. All packages shall be stored indoor. Packages containing electronic equipment shall be stored in humidity controlled environment.

INSTALLATION PROCEDURE:
The contractor shall submit six copies of all detailed programs and the procedures to be adopted for disassembly, erection/installation, testing and commissioning well in advance, before start of erection activates/installation, for approval of the Employer. The installation procedure shall also have a section “site quality assurance plan” containing erection data sheets for various components. These sheets should specify site measurements/inspection required to be made for ensuring proper installation.

SPECIAL TOOLS AND TACKLES
The bidder shall supply all special tools and tackles required for Operation and maintenance of equipment. The special tools and tackles shall only cover items which are specifically required for the equipment offered and are proprietary in nature. The list of special tools and tackles, if any, shall be finalized during detail engineering and the same shall be supplied without any additional cost implication to the Employer.

INSTALLATION & FIELD TESTING

The Contractor has to do all the work related to disassembly, assembly, erection, testing and commissioning complete in all respects. All necessary tools, plants, labour, materials including consumable for performing installation, testing and pre_commissioning shall be proved by the Contractor. The Contractor shall submit the necessary data/information, layout and foundation/support drawings well in advance. The Contractor shall provide and install the concrete inserts/embedment; support steels and/or components such as discharge ring, draft tube cone etc. and coordinate between both E&M as well as civil activities within the scope of the tender,

keeping both the activities synchronised. All installation for foundation shall be verified and accepted by the Employer.

The Contractor shall use anchor fasteners for installation of piping, fixtures, mountains, conduits, cabling, panels etc. Chipping of concrete and, or taking support from reinforcement bars shall not be allowed. Casting of new concrete blocks if required shall be in the scope of the contractor.
The design, location and approval tests of anchoring rings for the fixing of lifting apparatus necessary for assembly and dismantling or equipment and plant accessories shall be the responsibility of the Contractor. The supply of all type of consumables and other materials required for installation etc. for all equipment shall be in the scope of contractor. The contractor shall furnish a complete outline of the proposed methods and field procedures to be followed for all the equipment testing including a list of equipment and instruments to be used, to the Engineer for review not later than 60 days prior to the date of testing of each equipment.
The contractor shall provide all necessary materials and labour for preparing all the field tests on the equipment. All test equipment and instruments shall be furnished by the contractor and will remain the contractor's property after the fulfilment of all field tests.
The contractor shall furnish a complete report of the field tests carried out on all equipment.

3.18.1 HANDLING, STORING AND INSTALLATION

Manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.
Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.
Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning.
The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.
The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

3.19 QUALITY ASSURANCE PALN

BHEL quality plan to be followed subject to TBEM / customer's approval.

3.20 GUARANTEE:

The supplier shall guarantee that the goods under the Contract are new, unused of the most recent or current models and incorporated all recent improvements in design and materials unless provided otherwise in the Contract. The supplier shall further guarantee that the goods supplied under this Contract shall have no defects arising from design, materials or workmanship, installation and erection, if that may develop under normal use of the supplied goods. The supplier shall also guarantee the performance of the works executed by him including the performance of all the materials/goods supplied by him.

BHEL shall promptly notify supplier in writing of any claims arising under guarantee in respect of goods. Upon receipt of such notice, the supplier shall, with all reasonable speed, repair or replace the defective works or parts thereof, free of cost at site. All the expenses towards transportation of defective parts to supplier's works and of repaired/replaced parts to site shall be borne by the Supplier.

If the Supplier, having been notified, fails to remedy the defects within 14 days, the BHEL will proceed to take such remedial action as may be necessary, at the supplier's risk and expenses. All expenses in this regard will be recovered from Supplier.

3.21 DOCUMENTATION

3.20.1 LIST OF DOCUMENTS

The bidder shall submit a detailed list of drawings / documents along with the bid proposal which he intends to submit to the Employer after award of the contract.
The supplier shall necessarily submit all the drawings / documents unless anything is waived.
All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under this specification shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

3.20.2 DRAWINGS

All drawings submitted by the Contractor 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's and materials, clearances and spaces required for installation and interconnection between various portions of equipment's and any other information specifically requested in the specifications.

Vendor to provide calculation of power requirement for operating mechanism of breakers and other switches like **isolators.**

Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, name of consultant, the unit designation, contract no., 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 Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Employer if so required.
All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Contractor's risk. The Contractor 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 Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

3.21.1 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalized at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

	Approval/comments/by employer on Initial submission	Within 2 weeks of receipt
	Resubmission	Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time.
	Approval or comments	Within 3 weeks of receipt of resubmission
	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

3.21.2 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

Drawings
Guaranteed Technical Particulars
Type Test Reports
Manufacturing Quality Plan

DOCUMENTATION SCHEDULE

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1	Drawings and Data Sheets	1	11	13	05
2	Drawings "As Built "	-	-	13	
5	Type Test Reports	1	11	13	
7	Erection Manuals	-	11	13	
9	Operation and Maintenance Manuals	-	11	13	
13	Manufacturing Quality Plan	1	11	13	
15	Field Quality Plan	1	11	13	
17.	Inspection Test Reports	-	-	13	

Drawings will also be submitted in in AUTOCAD or any other CAD package along with conversion files for all major items.
Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top .

3.22 : Please refer attached document- **VOLUME III-A GENERAL TECHNICAL SPECIFICATIONS (GTS)**

SECTION 4: ANNEXURES

ANNEXURE-A: COMPLIANCE CERTIFICATE OF TECHNICAL SPECIFICATION

The bidder shall confirm compliance to the following by signing and stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.

2. There are no deviation(s) with respect to specification other than those furnished in the schedule of deviations.

3. Only those technical submittals which are specifically asked for in Notice Inviting Tender (NIT) to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of technical offer.

4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.

5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

Date: Bidder's Stamp & Signature

SECTION 4: ANNEXURES

ANNEXURE-B: DEVIATION/ CHANGE REQUEST OF TECHNICAL SPECIFICATION

Bidder shall list out all technical potential deviation/ change request (s) along with clause with respect to technical specifications.

Sl. No.	Page No.	Clause No.	Deviation	Reason/ Justification(s)

Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date: Bidder's Stamp & Signature

SECTION 4: ANNEXURES
ANNEXURE-D: TECHNICAL CHECKLIST

Clamps & Connectors

Sl. No.	Parameters/ Particulars	Confirmation (Yes/No)	Remarks in case of "No"
1	Material of Clamps/Fittings		
	Clamp body (Designation 4600 of IS 617 :1994)	Yes/ No	
	Bolts, nuts and plain washers (Hot dip galvanized)	Yes/ No	
	Spring washers (Spring steel -E.G)	Yes/ No	
	Liners for terminals which are of copper alloy liner of minimum thickness 2mm shall be cast integral with the aluminium alloy body (For Bimetallic connectors)	Yes/ No	
2	Continuous current rating of the clamps/fittings (Is it compatible with the conductor rating/ equipment rating)	Yes/ No	
3	Maximum temperature rise (------°C) of the clamps/ fittings over ambient temperature (50°C) when carrying estimated fault current of ------ kA for ------ sec	Yes/ No	
4	Rated terminal load (Suitable for ------ mtrs. conductors)	Yes/ No	
5	Nominal Breaking load of conductor is minimum 1100kg and tensile load is 55kg	Yes/ No	

Spacers

Sl. No.	Parameters/ Particulars	Confirmation (Yes/No)	Remarks in case of "No"
1	Spacing between sub-conductors 250 mm	Yes/ No	
2	Ultimate strength		
	Compressive load of 1500 kg for 40 kA fault current	Yes/ No	
	Tensile load of 750 kg for 40 kA fault current	Yes/ No	
3	Movement which can be accommodated by the unit		
	Longitudinal movement parallel to the conductor ± 50 mm	Yes/ No	
	Vertical movement in a vertical direction at right angle to the conductor ± 25 mm	Yes/ No	
	Torsional movement /angular movement in a vertical plane parallel to the conductor ± 5°		

2. Compliance to clause 1.4.3 (TYPE TEST) of section-1 YES / NO

Date: Bidder's Stamp & Signature