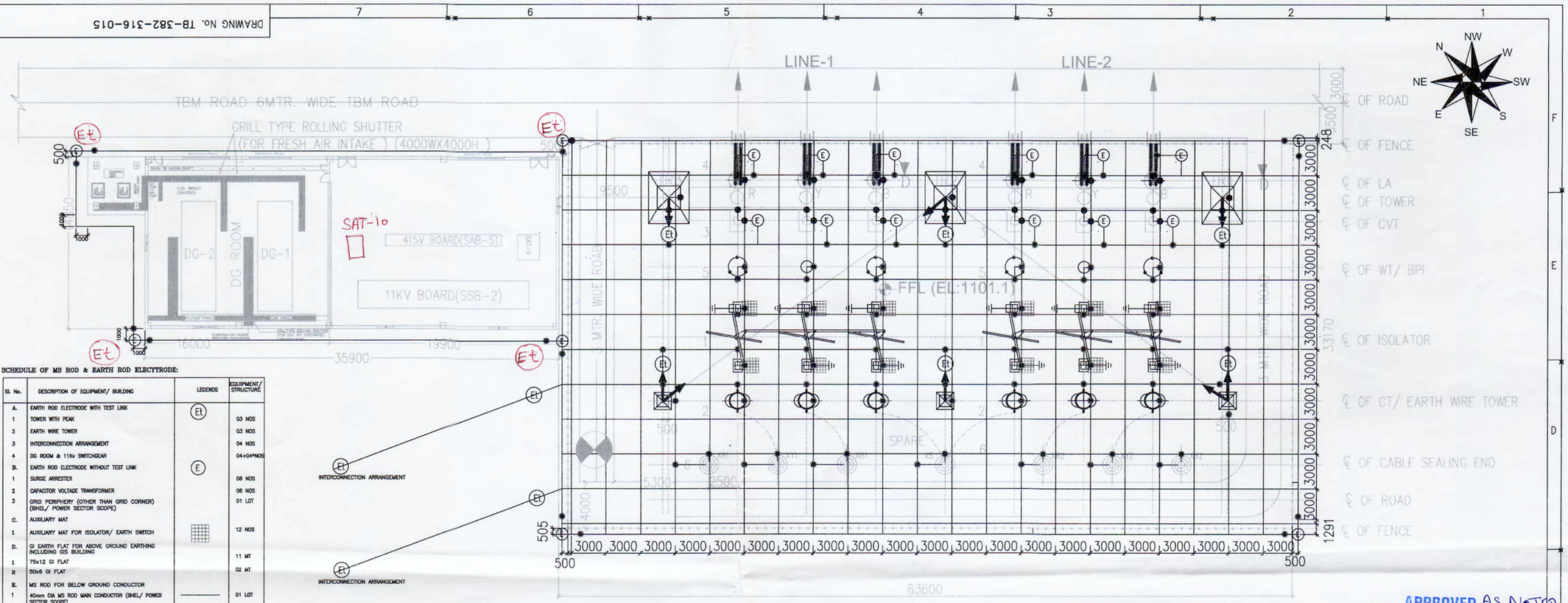
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No. TB-382-316-015



SCHEDULE OF MS ROD & EARTH ROD ELECTTRODE:

Sl. No.	DESCRIPTION OF EQUIPMENT/ BUILDING	LEGENDS	EQUIPMENT/ STRUCTURE
A.	EARTH ROD ELECTRODE WITH TEST LINK	Et	
1	TOWER WITH PEAK		03 NOS
2	EARTH WIRE TOWER		03 NOS
3	INTERCONNECTION ARRANGEMENT		04 NOS
4	DG ROOM & 11Kv SWITCHGEAR		04+04*NOS
B.	EARTH ROD ELECTRODE WITHOUT TEST LINK	E	
1	SURGE ARRESTER		08 NOS
2	CAPACITOR VOLTAGE TRANSFORMER		06 NOS
3	GRID PERIPHERY (OTHER THAN GRID CORNER) (BHEL/ POWER SECTOR SCOPE)		01 LOT
C.	AUXILIARY MAT		
1	AUXILIARY MAT FOR ISOLATOR/ EARTH SWITCH		12 NOS
D.	GI EARTH FLAT FOR ABOVE GROUND EARTHING INCLUDING GIS BUILDING		11 MT
1	75x12 GI FLAT		02 MT
2	50x6 GI FLAT		
E.	MS ROD FOR BELOW GROUND CONDUCTOR		
1	40mm DIA MS ROD MAIN CONDUCTOR (BHEL/ POWER SECTOR SCOPE)	———	01 LOT
2	40mm DIA MS ROD RISER	———	12 MT

*ADDITIONAL REQUIREMENT, IF ANY.

NOTES:

1. ● DENOTES POINT OF ORIGIN OF RISER.
2. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
3. THE EQUIPMENT EARTHING CONNECTIONS SHOWN ARE DIAGRAMMATIC ONLY. EXACT LOCATION OF EQUIPMENT EARTHING LEADS, EARTH ELECTRODES & TEST PITS SHALL BE INSTALLED TO SUIT SITE CONDITIONS.
4. ROUTING OF GROUNDING CONDUCTOR IS DIAGRAMMATIC ONLY AND HENCE, MARGINAL SHIFTING OF GROUNDING CONDUCTOR TO AVOID INTERFERENCES OF STRUCTURE/FOUNDATION. CABLE TRENCHES, BUILDING ETC. SHALL BE DONE AT SITE TO SUIT SITE CONDITIONS.
5. ALL EQUIPMENT AND STRUCTURES SHALL, IN GENERAL, BE GROUNDED AT TWO POINTS AT OPPOSITE CORNERS WHETHER SHOWN IN DRAWING OR NOT AND THESE SHALL BE CONNECTED TO DIFFERENT PARTS OF THE GROUNDMAT WHEREVER POSSIBLE.
6. GROUNDING CONDUCTORS IN OUTDOOR AREAS SHALL BE BURIED 600MM BELOW FINISHED GROUND LEVEL.
7. CONNECTION BETWEEN EQUIPMENT GROUNDING LEADS AND MAIN GROUND CONDUCTORS SHALL BE WELDED TYPE FOR RUST PROTECTION, THE WELDS SHALL BE CLEANED WITH WIRE BRUSH, TREATED WITH RED LEAD PRIMER AND AFTERWARDS THICKLY COATED WITH TWO COATS BITUMEN COMPOUND TO PREVENT CORROSION.
8. ALL GROUND CONNECTIONS SHALL BE MADE BY ELECTRIC ARC WELDING. ALL WELDED JOINTS SHALL BE ALLOWED TO COOL DOWN GRADUALLY TO ATMOSPHERIC TEMPERATURE BEFORE PUTTING ANY LOAD ON THEM. ARTIFICIAL COOLING SHALL NOT BE ALLOWED.
9. BENDING OF LARGE EARTHING ROD SHALL BE DONE PREFERABLE BY GAS HEATING.
10. ALL ARC WELDING OF LARGE DIAMETER CONDUCTORS SHALL BE DONE BY LOW HYDROGEN CONTENT ELECTRODES.
11. LOCATION OF ROD ELECTRODE ARE SHOWN TENTATIVELY, AND HENCE, ELECTRODES SHALL BE LOCATED NEAREST TO RESPECTIVE EQUIPMENT, AS POSSIBLE.
12. 50x6MM GALVANISED STEEL FLAT SHALL BE USED FOR EARTHING OF CABLE TRENCHES & CONTROL PANELS. ALL TRENCHES SHALL BE EARTHED AT INTERVALS OF 20 MTRS. ALONG THE LENGTH OF THE TRENCH AND AT ALL ENDS OF THE TRENCHES. RISER SHALL BE PROVIDED FOR TRENCH EARTHING AT EVERY 20 MTRS.
13. FOR DETAILED EARHING/ GROUNDING DETAILS FOR EQUIPMENT, FENCE, GATE, ETC., REFER RESPECTIVE EQUIPMENT EARTHING DRAWING.
14. THE RISER CONNECTION TO EARTHMAT WILL BE 40mm DIA ROD. THE RISER TO EQUIPMENT CONNECTION WILL BE BY 75x12mm G.I. FLAT
15. EVERY ALTERNATE POST OF FENCE SHALL BE CONNECTED TO EARTHING GRID.
16. ALL EARTHING CONNECTIONS BETWEEN EARTHING LEAD AND EQUIPMENT EARTHING TERMINAL SHALL BE BOLTED AND OTHER CONNECTIONS SHALL BE WELDED TYPE.
17. JOINTS SHALL BE AVOIDED AS FAR AS POSSIBLE. JOINTS SHALL BE MINIMUM FOR TRANSFORMER/REACTOR NEUTRAL CONNECTION TO EARTHING PIT TO MINIMIZE EARTH IMPEDANCE.
18. WAVETRAP EARTHING SHAL BE AS PER OEM DRAWINGS.
19. MAIN MAT FOR SWITCHYARD SHALL BE CARRIED OUT BY BHEL/ POWER SECTOR.

APPROVED AS NOTED
यथा टिप्पणी अनुमोदित
11/12/2023
ए.के. घिल्डियाल
A.K. Ghildiyal
मुख्य महाप्रबन्धक (विद्युत-परिकल्प)
CGM (EM-Design)
टीएचडीसी इंडिया लिमिटेड, ऋषिकेश
THDC India Limited, Rishikesh

जाँची गई
CHECKED
11-12-23
माधवी कुमारी
Madhwi Kumari
वरि. प्रबन्धक (विद्युत-परिकल्प)
Sr. Manager (EM Design)
टीएचडीसी इंडिया लि., ऋषिकेश
THDC INDIA LTD., RISHIKESH

संस्तुत
RECOMMENDED
शैलेन्द्र सिंह पंवार
Shailendra Singh Panwar
उपमहाप्रबंधक (विद्युत यांत्रिक-परिकल्प)
Dy. General Manager (EM-Design)
टीएचडीसी इंडिया लिमिटेड, ऋषिकेश
THDC INDIA LTD., RISHIKESH

REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED BY / CHECKED DKS / APPROVED VK
ZONE			ZONE			ZONE			ZONE			ZONE			01	21.11.23	AS PER CUSTOMER COMMENTS DTD. 17.11.23.

ADDITIONAL INFORMATION
W.O.No.
STATUS OF DRAWING
DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम NAME OF CUSTOMER/PROJECT: THDC INDIA LTD. — 4X111MW VISHNUGAD PIPALKOTI H.E. PROJECT

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

	नाम/NAME	हस्ता-/SIGN.	दि-/DATE
बनाया DRAWN	BY	–SD–	15.11.23
जाँचा CHECKED	DKS	–SD–	
स्वीकृत APPROVED	VK	–SD–	

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

शीर्षक/TITLE: EARTHING LAYOUT OF 400KV POTHEAD YARD

ड्राईग.क./DRAWING NO. TB-382-316-015; पुनः/REV. 01

पृष्ठ क्र./SHEET No.; अगला पृष्ठ/NEXT SHEET

A3 SIZE

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

NOTE : Drawing is approved Subject to Following :

1. Any change in Layout of Potheadyard Shall be Suitably incorporated in this drawing.
2. SAT-1o is also Part of LTAC Switch gear in Potheadyard.

टीएचडीसी इंडिया लिमिटेड
THDC INDIA LIMITED

Letter No: THDCIL/RKSH/EMD/VPHEP/401-6/586 Date: 14-06-2023

To,

1. **Mr. Yogender Pal** Email: yogenderpal@bhel.in
General Manager (BHEL PMG-Hydro Business Group)
BHEL, PS-HBG(PMG),6th Floor, BHEL New Building,
Film City, Sector-16A, Noida
UP-201301.

2. **Mr. Vivek Kapil** **Email: vivekk@bhel.in**
AGM (BHEL -Transmission Business Group)
5th Floor, BHEL New Building,
Film City, Sector-16A, Noida, UP-201301.

Subject: Approval of "Erection Key Diagram For Pothead yard" for VPHEP (4X111)- Contract Agreement No. THDCIL/RKSH/CC-297/AG-1, AG-2 & AG-3 dated 18.11.2014.

Ref: BHEL's Letter No. TBEM/VISHNUGAD/ PIPALKOTI/THDC/DWG EKD/30 dated 13.06.2023.

Sir,

With reference to the above transmittal, please find enclosed following approved documents of VPHEP

1. Erection Key Diagram For Pothead yard, DWG No. TB-382-316-010 Rev 02.

This approval does not absolve M/s BHEL from its responsibility for correctness of the documents, manufacturing/supply of the equipment as per Employer's requirement & GTP for the achievement of the desired performance at site & completeness of the equipment.

This is for your kind information and necessary action please.

Yours Sincerly,

14/6

(A.K.Ghildiyal)
CGM (EM Design)

Encl.: As above

Copy to:

1. ED (Tech),THDCIL Rishikesh.
2. OSD (Project), THDCILVPHEP, Pipalkoti.
3. GM (EM), THDCILVPHEP, Pipalkoti.
4. AGM (QA),THDCIL Rishikesh
5. Mr. Dileep Shukla, Sr. Manager, (BHEL -Transmission Business Group) 5th Floor, BHEL New Building, Film City, Sector-16A, Noida, UP-201301.

टीएचडीसी इंडिया लिमिटेड
THDC INDIA LIMITED

पत्रांक : टीएचडीसीआईएल / आरकेएसएच / ईएमडी/ वीपीएचईपी/401-6/586 दिनांक:14-06-2023

सेवा में ,

1. श्री योगेन्द्र पाल
महाप्रबंधक, पी एस-हाइड्रो व्यापार समूह (पी.जी.एम.),
भारत हैवी इलेक्ट्रिकल्स लिमिटेड,
6 वी मंजिल, न्यू बिल्डिंग (6th Floor, New Building),
सेक्टर-16A, फिल्म सिटी, नोएडा- 201301, उत्तर प्रदेश
Email: yogenderpal@bhel.in

2. श्री विवेक कपिल
अपरमहाप्रबंधक (बीएचईएल- पारेषण व्यापार समूह प्लांट)
5 वी मंजिल, न्यू बिल्डिंग (5th Floor, New Building),
सेक्टर-16A, फिल्म सिटी, नोएडा- 201301, उत्तर प्रदेश
Email:vivekk@bhel.in

विषय: Approval of "Erection Key Diagram For Pothead yard" for VPHEP (4X111)- Contract Agreement No. THDCIL/RKSH/CC-297/AG-1, AG-2 & AG-3 dated 18.11.2014.

सन्दर्भ: BHEL's Letter No. TBEM/VISHNUGAD/ PIPALKOTI/THDC/DWG EKD/30 dated 13.06.2023.

Sir,

With reference to the above transmittal, please find enclosed following approved documents of VPHEP

1. Erection Key Diagram For Pothead yard, DWG No. TB-382-316-010 Rev 02.

This approval does not absolve M/s BHEL from its responsibility for correctness of the documents, manufacturing/supply of the equipment as per Employer's requirement & GTP for the achievement of the desired performance at site & completeness of the equipment.

This is for your kind information and necessary action please.

भवदीय ,

14/06/2023

(ए. के. घिल्डियाल)
मुख्य महाप्रबंधक (विद्युत् परिकल्प)

संलग्नक.: As above

प्रतिलिपि :

1. अधिशाषी निदेशक (तकनिकी), परिकल्प, ऋषिकेश
2. ओ एस डी, परियोजना,पीपलकोटी
3. महाप्रबंधक, इ एम ,पीपलकोटी
4. अपर महाप्रबंधक, क्यु ए, ऋषिकेश
5. श्री दिलीप शुक्ला , वरिष्ठप्रबंधक , (बीएचईएल- पारेषण व्यापार समूह प्लांट) 5 वी मंजिल, न्यू बिल्डिंग (5th Floor, New Building), सेक्टर-16A, फिल्म सिटी, नोएडा- 201301, उत्तर प्रदेश

Approval of this drawing/document does not absolve contractor of its responsibility for manufacturing of the equipment as per ER & GTP for the achievement of designed performance at site and completeness of the equipment.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

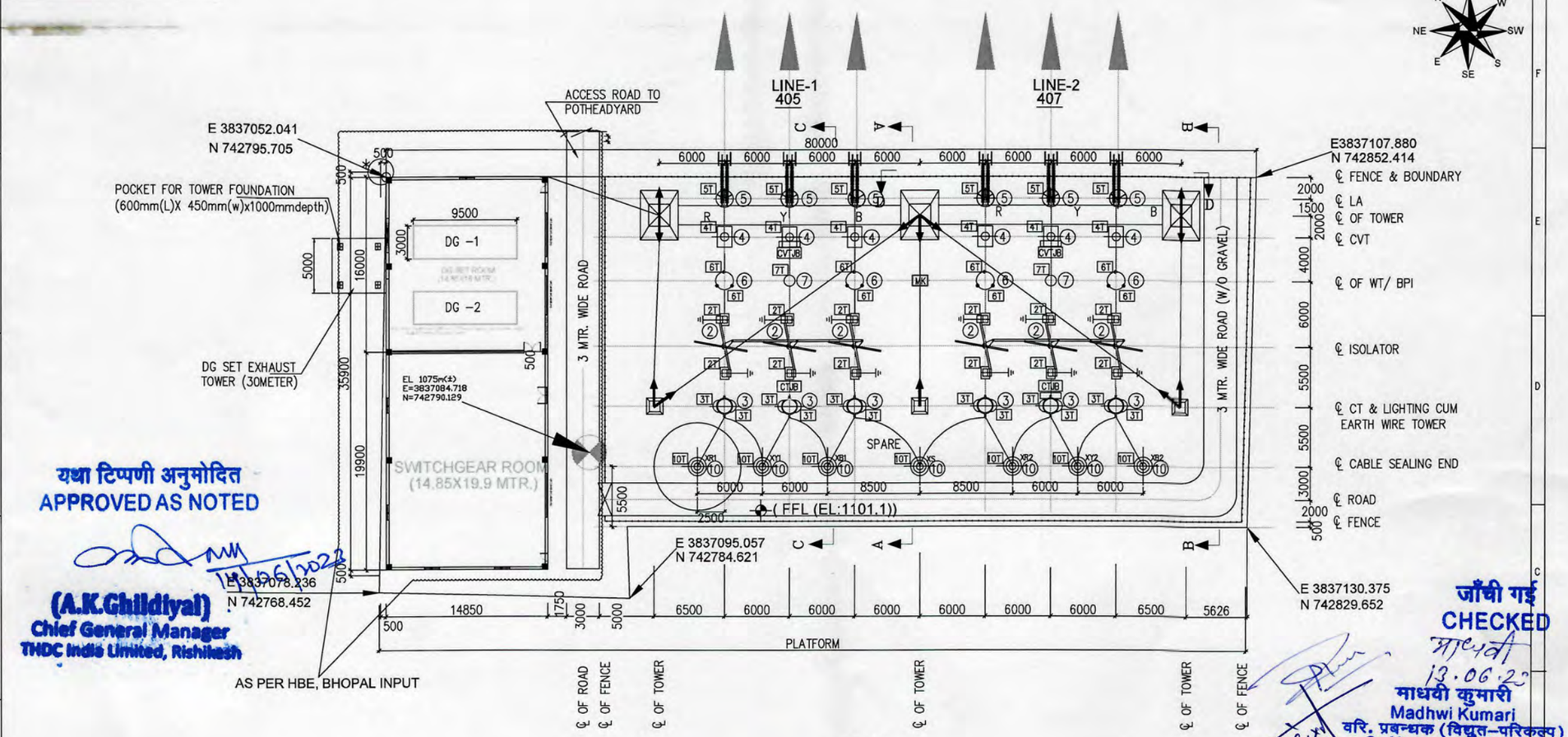
DRAWING No TB-382-316-010

COMPUTER DRG. PATH NAME :

REF. DRG. No.

SIGN. & DATE

INVENTORY No.



PLAN

INDEX:

SL.NO.	BAY NO.	DESCRIPTION	PAGE NO.
01	405	400kV LINE BAY#1	01, 02
02	407	400kV LINE BAY#2	01, 02

यथा टिप्पणी अनुमोदित
APPROVED AS NOTED
13/6/2023
(A.K.Ghildiyal)
Chief General Manager
THDC India Limited, Rishikesh

संस्तुत
RECOMMENDED
13/6/23
शैलेन्द्र सिंह पंवार
Shailendra Singh Panwar
उपमहाप्रबधक (विद्युत यांत्रिक–परिकल्प)
Dy. General Manager (EM-Design)
टीएचडीसी इंडिया लिमिटेड, ऋषिकेश
THDC INDIA LTD., RISHIKESH

जाँची गई
CHECKED
13.06.23
माधवी कुमारी
Madhwi Kumari
वरि. प्रबन्धक (विद्युत–परिकल्प)
Sr. Manager (EM Design)
टीएचडीसी इंडिया लि., ऋषिकेश
THDC INDIA LTD., RISHIKESH

REV.	DATE	ALTERED BY	REV.	DATE	ALTERED BY
01	13.06.23	CHECKED DKS	02	24.02.23	CHECKED DKS
		APPROVED VK			APPROVED VK
ZONE	As per customer comments dtd. 13.06.23.		ZONE	As per customer comments dtd. 23.02.23.	

ADDITIONAL INFORMATION W.O.No.
STATUS OF DRAWING
DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम
NAME OF CUSTOMER/PROJECT
टी.एच.डी.सी. इन्डिया लि.
T H D C INDIA Ltd.
4X111MW VISHNUGAD PIPALKOTI H.E. 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

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

शीर्षक/TITLE
ERECTION KEY DIAGRAM FOR POTHEAD YARD

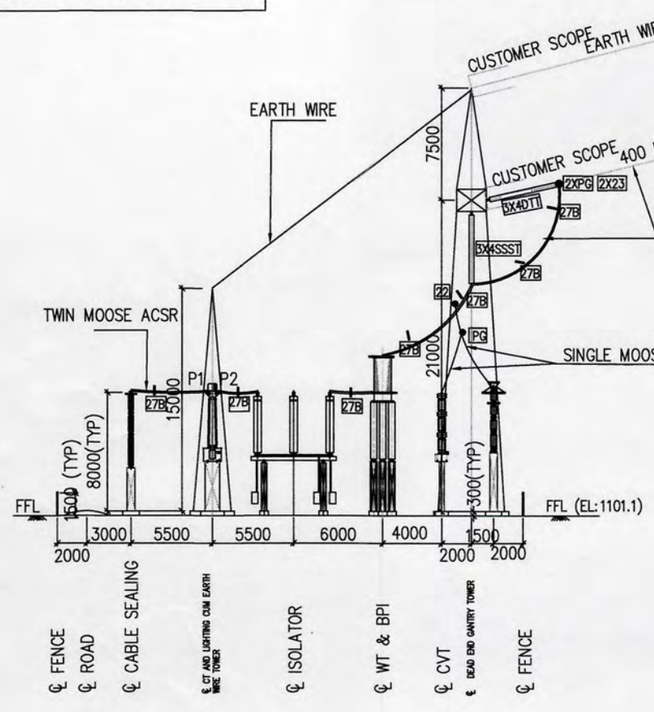
ड्राईंग क्र./DRAWING NO. TB-382-316-010
पुनः/REV. 01 02
पृष्ठ क्र./SHEET No. 01
उगला पृष्ठ/NEXT SHEET 03

A3 SIZE

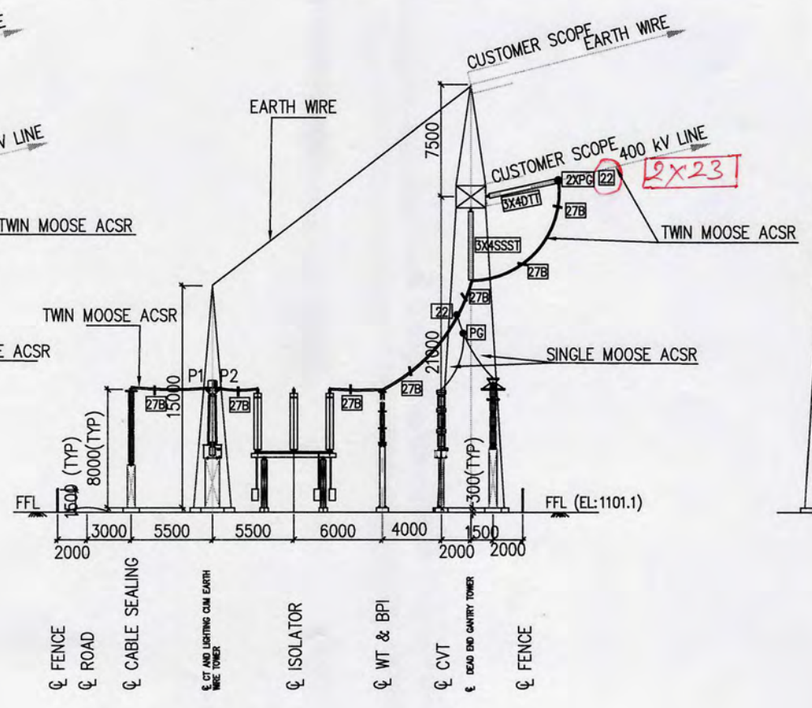
NOTE: Any item not mentioned in Annexure-1 (BOQ) or change in quantity of item is shall be in BHEL's scope.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

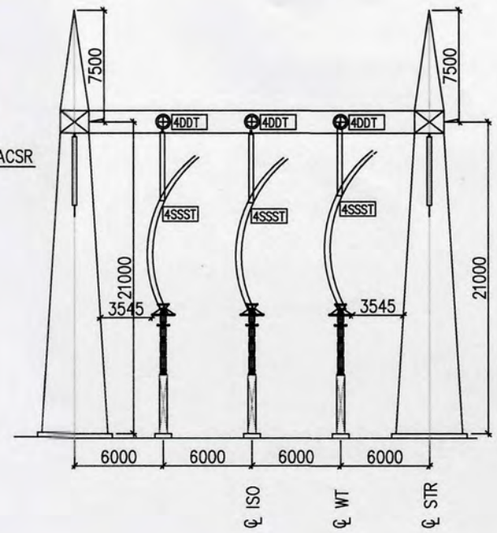
DRAWING No TB-382-316-010.



SECTION "A-A" & "B-B"



SECTION "C-C"



SECTION "D-D"

DETAILS OF CONDUCTOR

SECTION	CONDUCTOR	REMARKS
LINE BAY#1,2	TWIN ACSR MOOSE CONDUCTOR	
LINE JUMPER-LA/CVT	SINGLE ACSR MOOSE CONDCUTOR	

LEGEND TABLE

———	ACSR CONDUCTOR
———	EARTH WIRE

Madhu
13.06.23

REV.	DATE	ALTERED BY / CHECKED / APPROVED	ZONE
01	13.06.23	CHECKED DKS, APPROVED VK	As per customer comments dtd. 16.06.23.

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

ADDITIONAL INFORMATION
W.O.No.
STATUS OF DRAWING
DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम
NAME OF CUSTOMER/PROJECT
टी.एच.डी.सी. इण्डिया लि.
T H D C INDIA Ltd.
4X111MW VISHNUGAD PIPALKOTI H.E. 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
चेक्ड CHECKED	DKS	-SD-	30.01.23
स्वीकृत APPROVED	VK	-SD-	30.01.23

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

शीर्षक/TITLE
ERECTION KEY DIAGRAM FOR POTHEAD YARD

ड्रॉइंग क्र./DRAWING NO. TB-382-316-010
पुनः/REV. 01 02
पृष्ठ क्र./SHEET No. 02
अगला पृष्ठ/NEXT SHEET 03

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

A3 SIZE

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

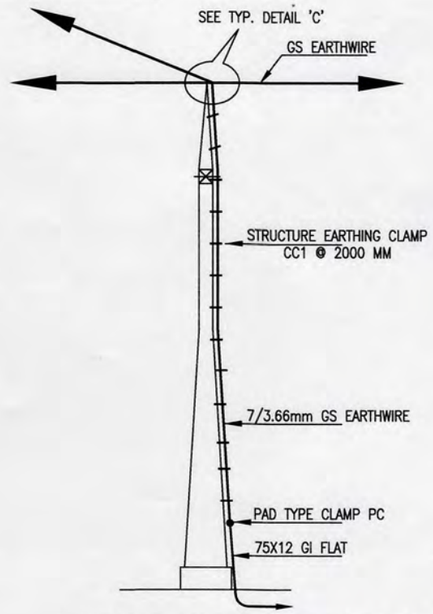
DRAWING No TB-382-316-010.

COMPUTER DRG. PATH NAME :

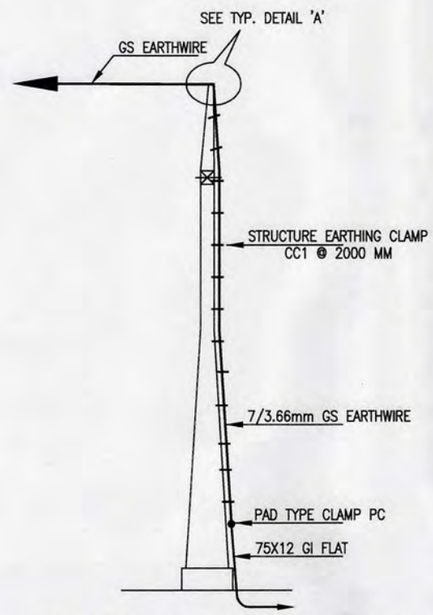
REF. DRG. No.

SIGN. & DATE

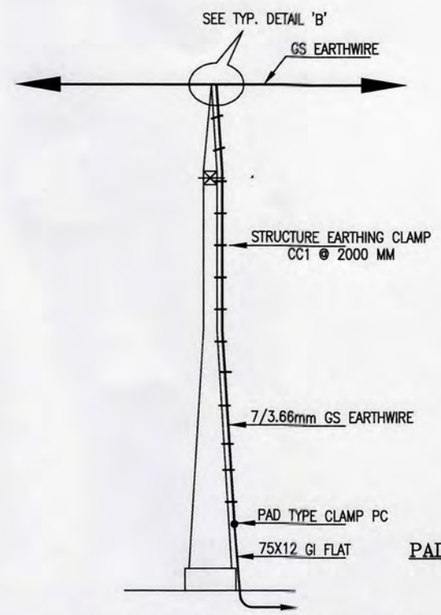
INVENTORY No.



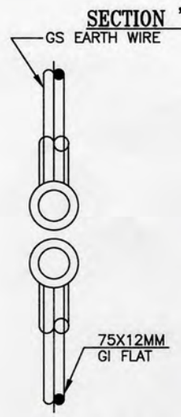
SHIELDING OF TOWER WITH PEAK
THREE SHIELD WIRE TERMINATION



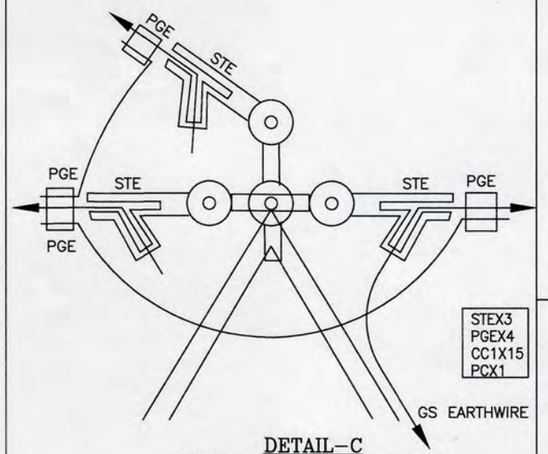
SHIELDING OF TOWER WITH PEAK
ONE SHIELD WIRE TERMINATION



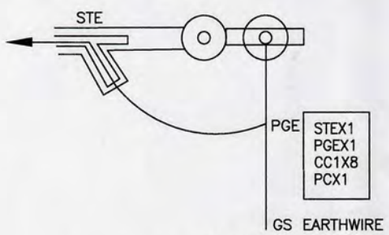
SHIELDING OF TOWER WITH PEAK
TWO SHIELD WIRE TERMINATION



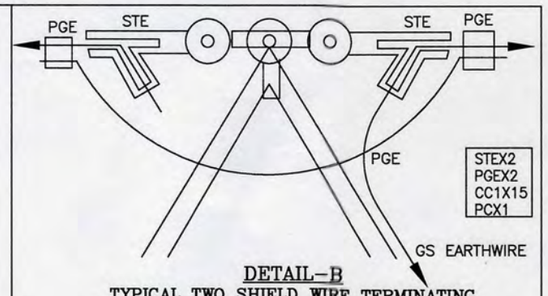
PAD TYPE FIXING SHIELD WIRE WITH
75X12mm GI FLAT



DETAIL–C
TYPICAL THREE SHIELD WIRE
TERMINATING AT TOWER



DETAIL–A
TYPICAL ONE SHIELD WIRE TERMINATING
AT TOWER



DETAIL–B
TYPICAL TWO SHIELD WIRE TERMINATING
AT TOWER

Madhu
13.06.23

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.

REV.	DATE	ALTERED BY
01	13.06.23	CHECKED DKS
		APPROVED VK
ZONE	As per customer comments dtd. 13.0623.	

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

ADDITIONAL INFORMATION
W.O.No.
STATUS OF DRAWING
DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम
NAME OF CUSTOMER/PROJECT

टी.एच.डी.सी. इन्डिया लि.
T H D C INDIA Ltd.
4X111MW VISHNUGAD PIPALKOTI H.E. 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
चेक्ड CHECKED	DKS	–SD–	30.01.23
स्वीकृत APPROVED	VK	–SD–	30.01.23

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

शीर्षक/TITLE
ERECTION KEY DIAGRAM FOR POTHEAD YARD

ड्रॉइंग क्र./DRAWING NO. TB-382-316-010
पुनः/REV. 01 02

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

A3 SIZE

Project: 400kV GIS at Vishnugad Pipalkoti Hydro Electric project (4X111MW)
Customer: THDC India Ltd., Rishikesh, Uttarakhand
Drawing No: TB-382-316-010
Drawing Title: Erection Key Diagram for Pothead Yard

ANNEXURE 1: BILL OF QUANTITY FOR 400KV CLAMPS AND CONNECTORS FOR POTHEAD YARD
REV. NO: 01

BOQ Item No.	CONNECTOR TYPE	Current rating (A)	Unit	Line-1	Line-2	Total without spare	Spare	Total Quantity including Spares
	BAY NO. ---------->			405	407			
	SECTION---------->			A-A/ C-C	B-B/ C-C			
2T	Connector for 400kV, 2000A, 40kA FOR 1s, HDB ISOLATORS, suitable for Twin ACSR Moose conductor (horizontal approach)	2000	Nos.	6	6	12	1	13
3T	Connector for 400kV, 2000A, 40kA FOR 1s, Current Transformer, suitable for Twin ACSR Moose conductor (horizontal approach)	2000	Nos.	6	6	12	2	14
4T	Connector for 400kV, 4400pF Capacitor Voltage Transformer, suitable for Single ACSR Moose conductor (universal approach)	NA	Nos.	3	3	6	1	7
5T	Connector for 390kV, 40kA FOR 1s, Surge Arrester, suitable for Single ACSR Moose conductor (universal approach)	NA	Nos.	3	3	6	1	7
6T	Connector for 400kV, 2000A, 1.0mH Wave Trap, suitable for Twin ACSR Moose conductor (horizontal/ universal approach)	2000	Nos.	4	4	8	1	9
7T	Connector for 400kV Buspost insulator, suitable for Twin ACSR Moose conductor (horizontal approach) THROUGH type	2000	Nos.	1	1	2	1	3
10T	Connector for 400kV Cable Sealing End (CSE), suitable for Twin ACSR Moose conductor (horizontal approach) THROUGH type	2000	Nos.	3	3	6	1	7
22	400kV TEE Connector, suitable for Twin ACSR Moose conductor to Single ACSR Moose conductor	1000	Nos.	(1)3	(1)3	(2)6	1	(3)7
23	400kV TEE Connector, suitable for Single ACSR Moose conductor to Single ACSR Moose conductor	1000	Nos.	6	6	12	2	14
27B	400kV Rigid Spacer, suitable for Twin ACSR Moose coductor with 450mm sub-conductor spacing	NA	Nos.	21	21	42	2	44
PG	PG clamp for Single ACSR Moose conductor to Single ACSR Moose conductor	1000	Nos.	9	9	18	2	20
	Composite long Insulator & Stringing Hardware							
(4DTT) 4DDT	400kV Double Tension Composite long insulator (120 kN per string) assembly of double anchoring points with 2 nos. polymer insulator along with all hardware accessories including Corona Ring and tension clamp suitable for Twin ACSR Moose conductor with 450mm sub conductor spacing with turn buckle.							
a	Polymer Insulator	NA	Nos.	6	6	12	1	13
b	Hardware	NA	Sets	3	3	6	1	7
4SSST	400kV Single Suspension Composite long insulator (120 kN) assembly of single anchoring point with 1 no. polymer insulator along with all hardware accessories including Corona Ring with drop/ straight clamp set suitable for Twin ACSR Moose Conductor with 450mm sub conductor spacing							
a	Polymer Insulator	NA	Nos.	3	3	6	1	7
b	Hardware	NA	Sets	3	3	6	1	7
2	400kV, 2000A, 40kA FOR 1s, 3-PH HDB ISOLATORS (ELECTRICALLY GANGED, MOTOR OPERATED) WITH 2 E/S (MECHANICALLY GANGED, MOTOR OPERATED) complete with operating mechanism	2000	Sets	1	1	2	0	2
	400kV Post insulators for above	NA	Nos.	9	9	18	0	18
3	400kV, 2000A, 40kA FOR 1s, 1-PH, 5-CORE CURRENT TRANSFORMER	2000	Nos.	3	3	6	0	6
	Junction boxes for above	NA	Nos.	1	1	2	0	2

Project: 400kV GIS at Vishnugad Pipalkoti Hydro Electric project (4X111MW)
Customer: THDC India Ltd., Rishikesh, Uttarakhand
Drawing No: TB-382-316-010
Drawing Title: Erection Key Diagram for Pothead Yard

ANNEXURE 1: BILL OF QUANTITY FOR 400KV CLAMPS AND CONNECTORS FOR POTHEAD YARD
REV. NO: 01

BOQ Item No.	CONNECTOR TYPE	Current rating (A)	Unit	Line-1	Line-2	Total without spare	Spare	Total Quantity including Spares
	BAY NO. ---------->			405	407			
	SECTION---------->			A-A/ C-C	B-B/ C-C			
4	400kV, 4400pF, 1-PH, 3-CORE CAPACITOR VOLTAGE TRANSFORMER	NA	Nos.	3	3	6	0	6
	Junction boxes for above	NA	Nos.	1	1	2	0	2
5	390kV, 20kA, 40kA FOR 1s, 1-PH SURGE ARRESTER (Gapless type) with surge monitors	NA	Nos.	3	3	6	0	6
6	400kV, 2000A, 0.5mH, 40kA FOR 1s, 1-PH WAVE TRAP	2000	Nos.	2	2	4	0	4
	400kV Post insulators for above	NA	Nos.	6	6	12	0	12
7	400 kV, 8kN Solid Core Bus Post Insulator	NA	Nos.	1	1	2	0	2
10	400kV Cable Sealing End (CSE)	2000	Nos.	3	3	6	1	7
MK	Marshalling kiosk - 180R	NA	Nos.	0	1	1	0	1
	Earthing clamps							
STE	Earthwire Strain/ tension clamps (Bolted type) with D-Shackle assembly	NA	Nos.	8	4	12	2	14
PGE	PG-clamp for GS earthwire of 10.98mm dia	NA	Nos.	9	4	13	2	15
CC1	Cleat type clamps for Earthing down conductor (10.98mm dia)	NA	Nos.	69		69	2	71
CC2	Cleat type clamps for 75x12mm G.S. flat for equipment pipe structure	NA	Nos.	188		188	2	190
CC3	Cleat type clamps for 75x12mm G.S. flat for equipment lattice structure	NA	Nos.	24		24	1	25
PC	Pad type clamp For connecting 10.98mm dia. GI wire on one side and 75x12mm GS strip on other side	NA	Nos.	4	2	6	1	7
	Bus Bar materials							
1	ACSR moose conductor	1000	Mtr	288	288	576	100	676
2	Earth wire	NA	Mtr	146	73	220	100	320

Madhi
13.06.23

SIEMENS energy

I&C Commissioning Tools_V13.0

No Sr.	Description	Image	Make	Model	Range	Quantity/ Set
1	Multi meter		FLUKE	FLUKE 179	1000V AC/DC; 10A AC/DC (with test leads and current jacks); resistance to 50 MΩ; capacitance to 10,000 µF, frequency to 100 kHz; temperature from -40 °C to 400 °C	1
2	CRM KIT		MEGGER	MOM 200A , MOM 600A	*Mains voltage* 115 / 230 V AC, 50 / 60 Hz *Temperature* *Operating* 0°C to +50°C (32°F to +122°F) **Resistance** *Range* 0 – 1999 µΩ 0 – 19.99 mΩ **Output** *Current* 0 – 200 A DC *Open circuit voltage* 4.7 VDC *Current shunt output* 10 mV / 100 A ±0.5%, max 20 mV out, max 10 V to protective earth (ground)	1
3	SF6 Multi-analyzer		DILO	Type no.: 3-038R- / 3-038-	<u>General data:</u> Input pressure: p_e 0.3 – 9bar Operating temperature: -10° - +40 °C Operating voltage: 90 – 264V /50 – 60Hz (L, N, PE) Interface: USB Mains fuse: 2 x 1.6 A/T (time delay) Measuring time (individual measurement): < 15 min. (automatically calculated) Limit value vol.-%: 0.0 – 99.9 vol.-% Limit value dew point: -60 °C – +20 °C	1

SIEMENS energy

I&C Commissioning Tools_V13.0

No Sr.	Description	Image	Make	Model	Range	Quantity/ Set
4	Megger insulation tester 5 kV MIT 520		MEGGER	MIT515DC	A.C. voltage (auto-ranging) MIT515, MIT525, MIT1025: 90-264 V rms, 47- 63 Hz 100 VA MIT1525 kV: 90-264 V rms, 47- 63 Hz 200 VA Battery charge time 2.5 hours deep discharge, 2 hours normal discharge Battery life 11.1 V, 5.2Ah Li-ion batteries, meet IEC 62133:2003, MIT1525 has 2 battery packs	1
5	CB Timing kit		MEGGER	CB Analyzer EGIL	**General** *Mains voltage* 115 / 230 V AC (switchable), 50 / 60 Hz *Power consumption* 100 VA (max) **Breaker operation** *Sequences* C, O, C-O, O-C, O-C-O *Continuous current* 5 A	1
6	DCRM kit (Optional)		SCOPE	HISAC ULTIMA	Trigger Options-O, C, C-O, O-C, O-C-O Power-230 V AC ± 15% , 50Hz ± 10% CRM Resistance Range-1000 / 2000 / 4000 / 8000 µΩ Selectable	1
7	CT , VT testing kit		OMICRON	CPC 100	**IAC/DC INPUT** Fuse-protected with a 10A very quick-acting fuse **2kV AC** High voltage output Mains power supply, 1 phase, 85V-264V AC **800A AC** (6.1-6.5V AC)	1

SIEMENS energy

I&C Commissioning Tools_V13.0

No Sr.	Description	Image	Make	Model	Range	Quantity/ Set
8	Leak detector		DILO	3-033-R002	Power Supply: Two (2) “C” cell alkaline batteries Sensitivity: 5 g SF6 / year Operating Temperature: 32 °F to 126 °F (-0 °C to 52 °C)	1
9	CT testing kit (optional)		OMICRON	CT Analyzer	Mains fuse: 2 x T6.3A / 250V, high breaking capacity **Output** Generator output, 120V/15A peak max. **Sec** Measurement input for secondary side of CT, 300VAC max., 500 kΩ input impedance **Prim** Measurement input for primary side of CT, 30VAC max., 150 kΩ input impedance	1
10	HV test kit Outdoor		HIGHVOLT	WRV 3.6/680 M	Main supply V 230/400 ±10% Output voltage V_{rms} 10 … 550 Rated output current A 70 Frequency range Hz 18 … 300 Duty cycle Continuous operation Rated voltage kV 680 Rated current[2)] A 3.6 Frequency range Hz (40[3)]…) 50 … 300	1

SIEMENS energy

I&C Commissioning Tools_V13.0

No Sr.	Description	Image	Make	Model	Range	Quantity/ Set
11	HV test Kit Indoor		HIGHVOLT	WRV 1.5/680	Power supply: 3ø PNE 50Hz, 400V, +/- 10%, 63 A. Rated power: 43 kVA (Control Panel), 1000kVA (Reactor) Rated voltage :680 kV, 1ø AC Rated current:1.5 A Rated inductivity:720 H Resonance frequency range: 50…300 Hz	1
12	Gas handling unit with accessories		DILO		**General** Main supply 420 V AC	1
13	PD test kit		QUALITROL	QUALITROL – QCM-PPDM	Power supply - 110 V 50/60 Hz Supply current- 200 mA Input - 3 UHF channels UHF bandwidth - 100 - 2000 MHz	1

GIS General Installation tools set V_14

Sr. No.	Tools Sr.No.	Description	Image	Quantity
1		ENERPAC Hydraulics pump P80 with hydralic pressure cylinder and High Pressure hose 3/8" 18 NPT 900mm high pressure hydraulic		4
2		Double open-end wrench 10-parts 4-11 ELECTRIC		1
3		Open Ring Spanner (22 to 32) +(10-32) set		1 set
4		Ratchet Spanner 10mm		2
5		Ratchet Spanner 13mm		2
6		Ratchet Spanner 17mm		2
7		Ratchet Spanner 19mm		2
8		Ratchet Spanner 24mm		2
9		Adaptor 1/2" to 3/8"		1

Sr. No.	Tools Sr.No.	Description	Image	Quantity
10		Adaptor 1/4" to 3/8"		1
11		Adaptor 1/4" to 1/2"		1
12		Torque wrench (4-20 NM)		1
13		Torque wrench 10-60 Nm plug in Adaptor		1
14		Torque wrench 40-200 Nm 730N/5 plug in adaptor		1
15		Torque wrench 60-320 Nm		1
16		Belt wrench		1
17		725 QR/S- 1PC Plug in ratchet 3/8" shank 9X12 size 5 735		2
18		Plug in ratchet 1/2" shank 14X18 size 20 735		2
19		10mm 731/10 open Slot Socket		1

Sr. No.	Tools Sr.No.	Description	Image	Quantity
20		13 mm 731/10 open Slot Socket		1
21		open-end wrench plug-in tool shank 9 x 12 mm 17 mm 733/10		1
22		open-end wrench plug-in tool shank 9 x 12 mm 19mm 731/10		1
23		Plug in tool 24mm SW jaw 14x18 square		2
24		Ring wrench plug-in tool shank 14 x18 mm 17 mm 732/40		2
25		Ring Wrench plug in tool shank 14x18mm 19mm 732/40		2
26		Ring Wrench plug in tool shank 14x18 mm 24mm 732/40		2
27		Hammer wooden handle1.5kg		1
28		Mallet with wooden handle 40		1
29		Soft face hammer 50mm		1

Sr. No.	Tools Sr.No.	Description	Image	Quantity
30		Chain pulley 750kg 1.5-meter stroke		2
31		Chain pulley 1500kg 1.5-meter stroke		2
32		Industrial Vacuum Cleaner (3000W)		1
34		Metal Spirit level 1000mm		1
35		Metal Spirit level 500 mm length		1
36		Metal Spirit level 400mm		1
37		Metal Spirit level(magnatic) 200mm		1
38		65mm Single open-end spanner		1
39		50mm=1pc Single open 55mm=1pc Single open		2
40		46 Single open		1

Sr. No.	Tools Sr.No.	Description	Image	Quantity
41		30 Single open		1
42		32 Single Open		1
43		Socket spanner 1/4 inch +1/2 inch 63-parts Hexagon and TORX		1
		Socket spanner 1/4 inch +1/2 inch 29-parts Hexagon		1
44		GEDORE Screwdriver insert 9-piece 1/2" 5-17mm		1
45		STAHLWILL 512		1
46		Combo Pliers 200mm		1
47		Water Pump Pliers,250mm, 300mm		2
48		Hexagon Allen key set 1.5-10 mm ball-end		1
49		Round Sling 2 Ton 2 Meter		4

Sr. No.	Tools Sr.No.	Description	Image	Quantity
50		Flat Sling 12Ton 2Meter		1
51		Round Sling 3 Ton 8Meter		2
52		Round Sling 2 Ton 10 Meter		2
53		Round Sling 2 Ton 4 Meter		2
54		Round Sling 5 Ton 3 Meter		2
55		Round Sling 3 Ton 4 Meter		2
56		Round Sling 8 Ton 6 Meter		2
57		Round Sling 2 Ton 1 Meter		4
58		Round Sling 5Ton 6Meter		2
59		Steel tape measure 10 M length		1

Sr. No.	Tools Sr.No.	Description	Image	Quantity
60		Steel tape measure 15M length		1
61		Plastic folding rule 2m		1
62		File Brush 115x40 mm		1
63		Cable drum steel sheet with 50 m rubber cable 3x1.5 mm2 (Optional for big project)		1
64		File Set (Dick)		1 Set
65		Plumb bob 300g with plumb line 50 m perlon white		3 Plumb + 1 Rop
66		13 long Hex Socket 1/2"		1
67		17 long hex socket 1/2"		1
68		19 long hex socket		1
69		24 long Hex Socket 1/2"		1

Sr. No.	Tools Sr.No.	Description	Image	Quantity
70		Plug in Adaptor 14x18 to 9x12 7370/10		2
71		Plug in adaptor 9x12 to 14x18 7370/40		2
72		8 Allen Long 1/2” 120mm		1
73		10 Allen 1/2” 140mm		1
74		12Allen 1/2” 140mm		1
75		5 Ball hex allen socket		1
76		6 Ball hex allen socket		1
77		8 Ball hex allen socket		1
78		10 Ball hex allen socket		1
79		Round Flat Nose Pliers 200mm curved 2 component grip		2

Sr. No.	Tools Sr.No.	Description	Image	Quantity
80		Side Cutter 180mm		1
81		Wire Stripping Tools 0.08-6mm2		1
82		Crimp Pliers PZ 16 for wire end sleeves		1
83		Crimp Pliers PZ 3 for wire end sleeves		1
84		Crimping lever pliers Preci Force for non-insulated Cable shoe and plug Conn		1
85		Harting Crimper plier		1
86		Crimping pliers 180mm self-adjusting		1
87		ATORN slot end screwdriver set		1 Set
88		Multipurpose Scissure 205mm non-rusting		1

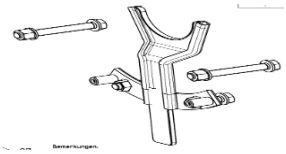
Sr. No.	Tools Sr.No.	Description	Image	Quantity
89		Eye bolt M12 (stud Length 75-100mm)		2
90		Eye bolt M16 (stud Length 75-100mm)		2
91		Shackle M20mm		4
92		Shackle 16mm		4
93		Multi-meter		1
94		Safety Goggle		2
95		Safety Helmet		2
96		Body Harness		2
97		Hook Wrench 80-90 (optional only for 8DN9)		2
98		Hook Wrench 95-100 (optional only for 8DN9)		2

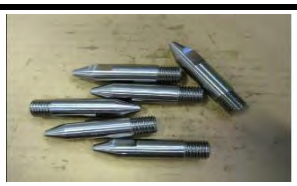
Sr. No.	Tools Sr.No.	Description	Image	Quantity
99		Leak Detector		1
100		Metal Box		1
101		Tools Trolly		1
I&C		**2024**		
Checked By: Shubham T.	**Verified By: Arjun J.**	**Approved By: Harsh Jain.**		
Sign:				
Date :-		**Site :**		

SIEMENS energy

DOC. No: - SE GP T SP EXE I&C/8DQ1 SPECIAL TOOL

8DQ1 SPECIAL TOOL FOR CENTERING _V14

Sr. No	Part Code	Installation Tools	Image	Qty
1	580-05661-005	8DQ1 Rod Head Contact Centering tool		1
2	580-05839-001	Contact Piece Setting Tool		1
3	580-07302-001	Bus Duct Conductor Holding Tool		2
4		Rollers for Busduct conductor		2
5		Centering Bush for Centering Device setting		2
6	459-02931-002	Guide Pin M12		4
7	580-05062-001	Guide Pin M16		6

8	459-02931-001	Guide Pins M12x75		6
9	459-02931-002	Fitting screws M12		6
10	580-05062-010	Guide Pins M16x75		6
11	459-02931-003	Fitting screws M12x75		6
12	580-050620-002	Fitting Screw M16x50		6
13	580-050620-003	Fitting Screw M16x90		6
14		M16 Long Guide pin		6

15	459-02931-004	Fitting screws M16×75		6
16	459-02931-005	Fitting Screw M12×45		6
Checked By : Shubham T.		Verified By : Arjun J.	Approved By : Sarvanan M	
Sign :				
Date :		**Site:**		

Remark: Any special testing other than approved FQP is requested, corrsponding kit shall be arranged by EPC on there own .

SIEMENS energy

TR 3001.1 High Voltage Switchgear Type 8D. 72,5 kV and above. Checklist on Before of Installation Activities

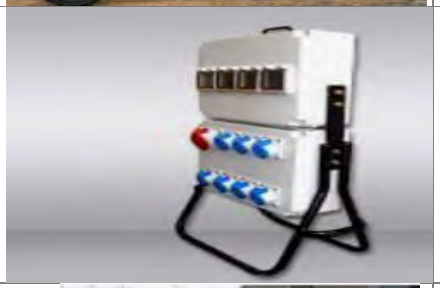
Site Name:		Contract No.:			
Customer:		Bay Serial Number	From		
Substation:			To		
Switchgear type:		Rated voltage:			kV

Sl. No.	Check Point - Indoor	Reference image	Qty	Yes	No
1.	Availability of Franna crane F-15 of 15Ton capacity along with material lifting slings. Slings Length - 5 meter & 3 meter (Qty- 4 no. of each) with valid calibration certificate.		1		
2.	Availability of Scaffolding with proper foot plate, intermediate guard rails, Toe board, working platform, ladder with anti-rust treatment		4 set		
3.	Availability of Aluminum scaffolding with proper foot plate, roller, intermediate guard rails, working platform, ladder with anti-rust treatment		2 set		
4.	Availability of Hydraulic plate truck with 2Ton capacity.		2 nos.		
5.	1.Provide midpoint of Circuit breaker, GIB wall cutout and both side GIB foundation. 2) Availability of Surveyor with total station for surveying along with line marking related materials 3) In case of any deviation joint acceptance document should be signed.		According to site condition.		

TR 3001.1 High Voltage Switchgear Type 8D. 72,5 kV and above. Checklist on Before of Installation Activities

6.	1. Availability of Uninterrupted Portable AC power source. 1 Phase 230V, 50Hz, with 32Amp MCB rating and 3 Phase, 415V, 50Hz with 63 Amp MCB rating. 2) Availability of single-phase extension board with long (20 M.) cables for vacuum cleaner		1 set		
7.	Arrangement hazardous waste disposal bins and a special place for disposal of waste.		4.Nos		
8.	Arrangement of all GIS cable housing female bushing dummy covers for the HV testing from manufactures of HV bushing. (if HV bushing under customer scope)		As per cable housing bays		
Sl. No	Check Point – Outdoor	Reference image	Quantity	Yes	No
1	As per Siemens standard we recommend Franna crane F-15 of 15Ton capacity along with material lifting slings. Slings Length - 5 meter & 3 meter (Qty- 4 no. of each) with valid calibration certificate.		1 No.		
2	Availability tarpaulin or dust proof covers. The surrounding area must be covered by suitable means of tarpaulin or dust proof covers		1 No.		
3	Temporary outdoor shed arrangements must be done with some protective dust proof covers/Tarpaulin for GIS assembly, and GIB cleaning requirements.		1 No.		

TR 3001.1 High Voltage Switchgear Type 8D. 72,5 kV and above. Checklist on Before of Installation Activities

4	1)Embedded plate positioning must be as per approved civil diagram. All the GIB foundation center must be as per drawing. 2). In case of any deviation joint acceptance document should be signed.		1 No.		
5	Scaffolding with proper foot plate, intermediate guardrails, Toe board, working platform, ladder and with anti-rust treatment is required.		6 feet – 2 quantity and as per site request		
6	Aluminum Scaffolding with proper foot plate, Roller, intermediate guardrails, Toe board, working platform, ladder is required		3 Set		
7	Availability of the man lifter throughout site erection, gas works and commissioning on time		1 No.		
8.	1. Availability of Uninterrupted Portable AC power source. 1 Phase 230V, 50Hz, with 32Amp MCB rating and 3 Phase, 415V, 50Hz with 63 Amp MCB rating. 2) Ensure the single-phase extension board with long (Approx.20 M.) cables for vacuum cleaner		1 set		
9.	Arrange hazardous waste disposal bins and a special place for disposal of these waste.		2 No's		

SIEMENS energy

TR 3001.1 High Voltage Switchgear Type 8D. 72,5 kV and above. Checklist on Before of Installation Activities

Tools Requirements Prior To Commencement of Material Unpacking Activities at Customer Premises					
Sr. No	Tools Requirements	Reference Photos	Quantity	Yes	No
1	Wooden Crate Opening Tools		1		
2	chisel		2		
3	Open & Ring spanner set 6-32mm		1 set		
4	Adjustable wrench Spanner		1		
5	Hammer		1		
6	Cutter Kinfe		1		
7	socket spanner set		1 set		
8	Flat Webbing Sling 5 Ton (8 mtr , 5 mtr & 3mtr)		4 No. each		

TR 3001.1 High Voltage Switchgear Type 8D. 72,5 kV and above. Checklist on Before of Installation Activities

9	D shackle Big		4		
10	D shackle Small		4		
11	Chain pulley block		2		
12	Wire Rope Sling		4		
13	Pliers and Screwdriver set		1		

REMARKS:

Responsible Person			
Name:		Designation	
Signature:		Mobile Number	

LIST OF TEST EQUIPMENTS &
TOOLS & TACKLES
TO BE ARRANGED BY CONTRACTOR

ANNEXURE- A		
(LIST OF TOOLS & TACKLES TO BE ARRANGED BY CONTRACTOR)		
Sl. No.	**PARTICULARS**	
1	Electrical Drilling Machine & Hand drilling Machine.	
2	Hydraulic Bending Machine for Aluminium pipes suitable upto 5" IPS Al tube	
3	Gas Welding Set & Gas Cutting Set.	
4	Hand Operated Winches.	
5	Electric Welding machine.	
6	Jack with axle for lifting Cable Drum. (Power cables/Control cables/HV & EHV cables, as required)	
7	Jointers Tool Box.	
8	Blow Lamps.	
9	Compression Tools suitable for all type of Cables	
10	Pull Lifts	
11	Pulley Blocks	
12	Hooks/ Chains	
13	Cable Rollers.	- For HV/EHV cable laying.
14	Hydraulic Jacks	
15	Aluminium Rollers	
16	D- Shackles	
17	Dynamometers	
18	TIG welding machine (for Aluminium welding).	
19	High Vacuum 1000 GPH **Oil Filtration Machine** for Transformer / Reactor oil suitable for 760mm Hg vacuum (In case 250 MVA/ 315/500 MVA transformer / Reactor, Oil filtration machine of 1500 GPH suitable for 760mm Hg Vacuum) equipped with fine filter of size 0.5 micron or less of oil to achieve the particle count of 10000 per liter of 4micron/as per OEM recommendation. and **50 kl or above capacity storage tank** for oil storage and processing of oil should be provided.	
20	Hydraulic cranes/Hydra crane/farana crane including accessories (20 tonne or more and boom height of 15mts. Vertical or more) suitable for erection of transformer bushings accessories and other equipments	
21	Hydraulic Crimping tools for conductor / Shield wire / Cables	
22	Crimping tools for cable termination.	
23	Torque wrenches of different ranges in sufficient numbers.	
24	All general-purpose hand tools in sufficient quantities.	
25	Shearing Machine for cutting of Earthing Flat.	

26	Tool Kits for fitters.
27	Tool Kits for Electrician.
28	Bench Vice.
29	'A' type collapsible Al. ladder height 8M
30	'H' type Al. ladder height 5M
31	Pressure Gauge 0-1kg/Sq.cm for measurement of N2 pressure.
32	Vacuum gauges for measuring fire vacuum of less than 1 torr in transformer.
33	Nylon slings for 4T capacity with different lengths in sufficient quantity.
34	Tarpaulin in sufficient quantity.
35	Angle meter for measurement of bushing angle during erection.
36	Nylon hammer.
37	Wedge for cutting of 'O' rings/ neoprene gaskets.
38	Die/ Drill tool for making holes in gland plates (All sizes in sufficient numbers)
39	Phoenix screw drivers for handling of Terminal Blocks.
40	Scaffolding/staging material for platform for working on heights.
41	Man-Lifter machine (with suitable boom length for providing working platform for switchyard equipments including Circuit Breaker, Isolator, Surge Arrester, Transformer etc. as per project requirement)
IMPORTANT NOTES:	
1.	The Contractor shall submit the copies of latest test certificate of lifting tackles, slings, pulleys etc. after mobilisation at site to the ENGINEER-IN-CHARGE.
2.	Above is indicative list only and any other tools & tackles as may be required by owner/BHEL at site during the execution of work shall have to be arranged by contractor.
3.	The status of tools, plants and instruments mentioned in annexure C of section - A does not relieve the subcontractor of his responsibility to make available all the test equipment and tools & tackles mentioned in the annexures of section B as per requirement of project.
4.	For GIS projects, some other general tool & tackles may be required as per OEM requirement and the same have to be arranged by contractor.

ANNEXURE- B

(LIST OF TEST EQUIPMENT TO BE ARRANGED BY CONTRACTOR)

All measuring and testing instrument shall be pre-calibrated through a certifying agency before use. The certificate of calibration shall be submitted to BHEL Site Engineer for records. **Also see clause E.5.0,E.6.0 & E.7.0 under** Section E of the tender specification for more details.

Sl. No.	TEST EQUIPMENT PARTICULARS	QTY
A	**GENERAL PURPOSE**	
1	Digital mustimeter - 4½ digits Accuracy ± 1% (Any reputed make - preferably Fluke - make)	4 Nos
2	Digital Insulation Resistance Meter 500V - 5kV, range 0.5 MΩ -10,000 MΩ (Any reputed make-preferably Megger make)	1 No.
~~3~~	~~Insulation Resistance Meter having voltage multiplier 0-500V-1000V, (Motorised / Electronic) Range 0.5 MΩ- 1000 MΩ (Any reputed make preferably Megger make)~~	~~1 No.~~
4	Single phase variac 8 A, 0-250V, 50 HZ	2 No
5	Three phase variac 15A, 0-440V, 50 HZ	1 No
6	Single phase transformer 220V / 4000V, 500VA, 50HZ	1 No
7	Stop watch	1 No
8	Contact Resistance meter (mV drop test kit) 0-200ADC, 0-2000 micro ohm with suitable calibrated cable leads for current injection and mV drop.	1 No
9	Phase sequence meter	1 No
10	Two-way intercom set with 50 to 100 M cables for checking of cable continuity	2 sets
11	Walkie - Talkie sets with battery charging sets Receiver + Transmitter, Type GP 300 - Motorola or any other reputed make	2 sets
12	Variable D.C. power supply 0-250V DC, 10 A	2 Nos
13	4 pole Miniature moulded case breaker (range 16A/5A)	3 No
14	Capacitance meter having range 20 PF- 100mfd ± 1%	1 No
15	Isolation Transformer 1KVA, 240V AC, 1 phase, 50Hz	2 Nos
~~16~~	~~Digital Clamp meter of reputed make rating 200A AC/DC~~	~~2 Nos~~
17	Digital Clamp on Meter of reputed make rating 0-100A DC	1 No.
18	Digital Clamp on Meter 0-3000A, 50 Hz (Any reputed make).	1 No
~~19~~	~~Digital Tongue tester 0-20A, 600V AC, 50 Hz (Any reputed make).~~	~~1 No~~
20	Leakage Current Measurement Kit, 0-1A, 50Hz (Any reputed make).	2 Nos
21	Earth resistance tester	1 No
B	**FOR TESTING OF CURRENT TRANSFORMER**	
1	Primary injection test kit, range 0-3000A with a pair of leads	1 No

	& C clamps for testing of CT's	
~~2~~	~~Secondary injection test kit suitable for 5A& 1A with banana plug cable leads~~	~~1 No~~
3	CT analyser kit of Megger, Omicron or any reputed make	1 No.
C	**FOR TESTING OF OIL COOLED TRANSFORMER AND REACTOR**	
1	Transformer winding resistance test kit (WRM) of reputed make	1 No.
2	Capacitance and tan Delta kit suitable for 12KV (Omicron, Doble, Megger or any other reputed make)	1 Set
3	Transformer turns ratio meter	1 No
4	PPM tester for transformer oil	1 No
5	BDV tester for transformer oil	1 No
6	Sweep Frequency resonance analyser, any reputed make	1 No
7	CT analyser kit of Megger, Omicron or any reputed make	1 No
8	Particle Count Meter	1 No
9	Dew point meter Vaishala any other reputed	1 No
10	MCleoud Vaccume gauge	1 No
D	**FOR TESTING OF RELAYS INCL. DISTANCE PROTECTION**	
1	Automatic Microprocessor based Relay Test Kit with Two current (upto 12.5 A) and at least one voltage source (3x110 V AC) (Any reputed make- Preferably Megger or Omicron Make)	1set
2	~~CFB kit or equivalent - of any reputed make~~	~~1 Set~~
3	~~ZFB kit or equivalent - of any reputed make~~	~~1 Set~~
E	**FOR TIME MEASUREMENT OF CIRCUIT BREAKER**	
1	Three Phase Breaker Analyser kit (Timing kit) with graphical representation facility (Scope/Megger/other reputed make)	1 No.
2	DCRM kit with suitable transducer- Scope/megger/other reputed make)	1 No.
F	**FOR TESTING OF CVT & CIRCUIT BREAKER**	
1	Capacitance and tan Delta kit suitable for 12KV (Omicron, Doble, Megger or any other reputed make)	1 Set
G	**SAFETY / PROTECTIVE MEANS**	
1	Protective earth rod suitable for 11/33/66/132/220/400/765 AC yard or 800/1200kV DC yard, as applicable, having leakage current meter, 70MM² copper cables and C clamps (Any reputed make).	2 Nos
2	Helmets, hand globes and Any other personal protective equipment as required	
H.	**FOR PLCC EQUIPMENT (if not covered in OEM scope)**	

1	Digital time interval meter and frequency counter, 8 digits with frequency range 10 Hz to 10MHz.	1 Set
2	200Hz to 620 KHz Selective level meter.	1 Set
3	200Hz to 620 KHz Selective level generator.	1 Set
I	**FOR TESTING SURGE ARRESTER**	
1	Kit for third harmonic measurement	1 Set
2	Testing kit for surge counter	1 Set
3	Capacitance and tan Delta kit suitable for 12KV (Omicron, Doble, Megger or any other reputed make)	1 Set
J.	**FOR GIS (if not covered in OEM scope)**	
1	SF6 Leakage Detector	1 No.
2	Dew Point meter with gas pushback facility	1 No.
3	SF6 Gas analyser for purity measurement with pushback facility	1 No.
NOTES:		
1	Any other test equipment (s), apart from above list, as may be required by Owner / BHEL at site during the execution of work will be arranged by the contractor well in time.	
2	Quantities mentioned above are the minimum requirement. If further, any requirement during testing, the same shall be arranged by contractor without any further charges.	
3	The status of tools, plants and instruments mentioned by subcontractor in tender does not relieve the subcontractor of his responsibility to make available all the test equipment and tools & tackles mentioned in Annexure A&B as per requirement of project.	
4	The above list of Testing kit/ instrument are general list for projects, however, for GIS projects, special tools and plant along with testing kits/ instrument shall be arranged by BHEL/ GIS OEM, which shall be part of tender document for information purpose.	

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NEW DELHI

DOCUMENT No.	TB-XXX-316-040	Rev. No.	02		Prepared	Checked	App.
TYPE OF DOC.	STANDARD TECHNICAL SPECIFICATION			NAME	NK	DS	SN
TITLE	GI PIPE & BENDS			SIGN	Sd/-	Sd/-	Sd/-
				DATE			
				GROUP	TBEM	W.O. No	
CUSTOMER							
CONSULTANT							
PROJECT	RATE CONTRACT (ONE YEAR)						

SCOPE AND SPECIFIC TECHNICAL REQUIREMENT

1.0 SCOPE

This technical specification covers design, manufacture, testing at works, packing and dispatch of 'GI pipe, its fittings and bends'. The material supplied shall fully comply with relevant Indian Standard given below and the product shall be BIS certified. The sizes and types of Pipes shall be as specified below. No Technical Deviations shall be acceptable in this regard.

1.1 SPECIFIC TECHNICAL REQUIREMENT

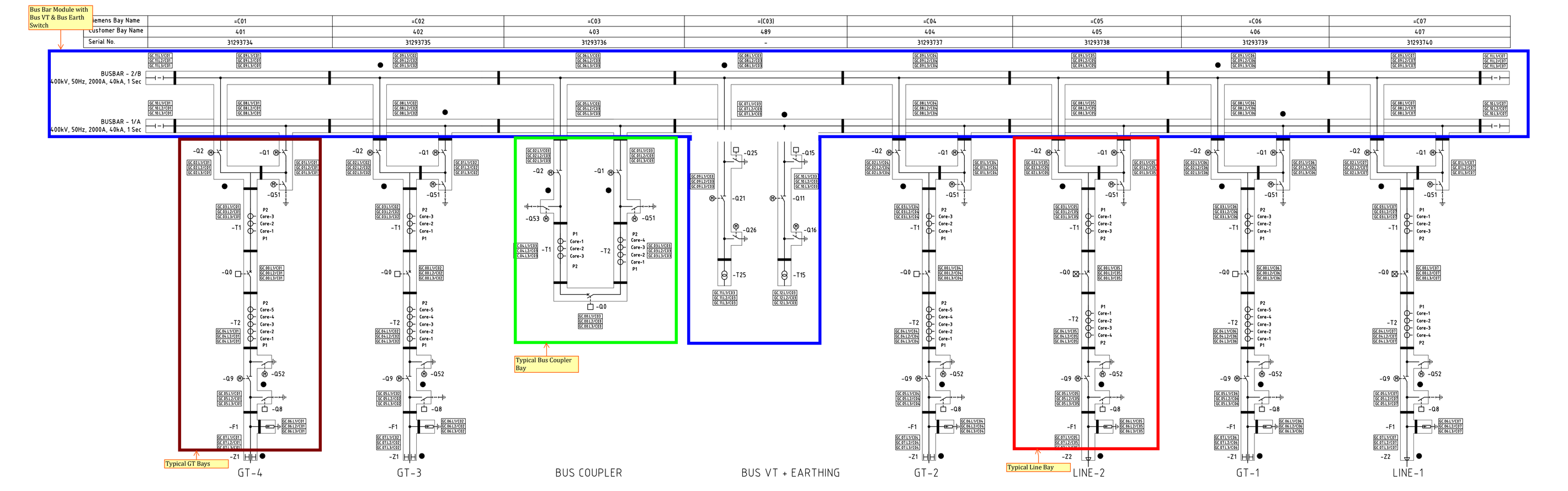
1.1.1 Galvanized Iron (GI) Pipe
The GI pipes shall be of nominal diameter 50 mm and/ or 100 mm, as per the indent. The pipe shall be of medium Grade as per IS 1239 and shall be of standard length of 6 meters. The pipe shall fully comply with specified standard and carry the BIS certification marking. The pipe shall have a socket at one end and threaded at both ends.

1.1.2 Sockets
The sockets shall fully comply with the requirements of IS 1239 (Part-2).

1.1.3 For Bends
The bends shall be of 90°, 112.5° and/ or Tee, as specified, for above mentioned pipes. The bends shall, in general, comply with the requirement of IS 1239 (part-2). The specific requirements and BIS certification marking of these bends shall be as per IS 1239 (Part-2). 90°, 112.5° and Tee bends shall have a socket at one end and threaded at all ends.

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS	
02	25.04.13				90° bends has been included.	
01	30.11.10	Sd/-	Sd/-	Sd/-	Document revised.	
Distribution				To	TBMM	OFFICE COPY
				Copies		

GAS SINGLE LINE DIAGRAM



Legend for Equipment

Equipment	Legend	Symbol
Circuit breaker(without CSD)	-Q0	
Circuit breaker (with CSD)	-Q0	
Disconnector	-Q1, -Q2,-Q9 -Q11, -Q21	
WIP Earthing switch (non-insulated)	-Q16, -Q26,-Q52	
WIP Earthing switch (Insulated)	-Q51,-Q53	
High speed earth switch (Insulated)	-Q8	
High speed earth switch (non-insulated)	-Q15, -Q25	
Current transformer	-T1,-T2	
Voltage transformer	-T15,-T25	
Surge Arrester	-F1	
Transformer termination module	-Z1	
Cable termination module	-Z2	
Gas tight bushing		
UHF PD Detection Sensor		
Manual Isolating Link		

System Rating

Rated voltage	420 kV
Rated frequency	50 Hz
Rated lightning impulse withstand voltage	1425 kV
Rated short-duration power frequency withstand voltage	650 kV
Rated switching impulse withstand voltage	1050 kV
Rated normal current Busbar @45 Deg.C.	2000 A
Rated normal current Bus Coupler @45 Deg.C.	2000 A
Rated normal current Feeder @45 Deg.C.	2000 A
Rated shorttime withstand current	1s 40kA
Rated shortcircuit breaking current	40 kA
Rated control voltage	220 V DC
Rated control voltage circuit breaker	220 V DC
Rated control voltage isolator/earthing switch	220 V DC
Auxiliary supply voltage	415/240 V AC

CURRENT TRANSFORMER DETAILS

Field Type	CT	Core No.	Application	Current Ratio	Accuracy Class as per IEC 61869	VA Burden	ISF	ALF	Knee point voltage Vk (V) (>=)	Rct in Ohm (<=)	Magnetizing current Im at Vk(mA) (<=)
C05 & C07	-T1	1	Protection	2000-1000-500/1	5P	10	-	20	-	-	-
		2	Protection	2000-1000-500/1	PX	-	-	-	2000-1000-500	30-60-120	10-5-2.5
		3	Protection	2000-1000-500/1	PX	-	-	-	2000-1000-500	30-60-120	10-5-2.5
C05 & C07	-T2	1	Metering	2000-1000-500/1	0.2S	20	±5 with choke coil	-	-	-	-
		2	Protection	2000-1000-500/1	PX	-	-	-	2000-1000-500	30-60-120	10-5-2.5
		3	Protection	2000-1000-500/1	PX	-	-	-	2000-1000-500	30-60-120	10-5-2.5
		4	Protection	2000-1000-500/1	PX	-	-	-	2000-1000-500	30-60-120	10-5-2.5
C01, C02, C04 & C06	-T1	1	Protection	500/1	5P	10	-	20	-	-	-
		2	Protection	500/1	PX	-	-	-	(160Rct+280)	120	2.5
		3	Protection	500/1	PX	-	-	-	(200Rct+470)	120	2.5
C01, C02, C04 & C06	-T2	1	Protection	2000-1000-500/1	PX	-	-	-	2000-1000-500	30-60-120	10-5-2.5
		2	Protection	2000-1000-500/1	PX	-	-	-	2000-1000-500	30-60-120	10-5-2.5
		3	Metering	500/1	0.2	20	±5 with choke coil	-	-	-	-
		4	Protection	500/1	PX	-	-	-	(160Rct+250)	120	2.5
		5	Protection	500/1	PX	-	-	-	(160Rct+280)	120	2.5
C03	-T1	1	Protection	2000-1000-500/1	5P	10	-	20	-	-	-
		2	Protection	2000-1000-500/1	PX	-	-	-	2000-1000-500	30-60-120	10-5-2.5
		3	Protection	2000-1000-500/1	PX	-	-	-	2000-1000-500	30-60-120	10-5-2.5
C03	-T2	1	Metering	2000-1000-500/1	0.2	20	<5 with choke coil	-	-	-	-
		2	Protection	2000-1000-500/1	PX	-	-	-	2000-1000-500	30-60-120	10-5-2.5
		3	Protection	2000-1000-500/1	PX	-	-	-	2000-1000-500	30-60-120	10-5-2.5
		4	Protection	2000-1000-500/1	PX	-	-	-	2000-1000-500	30-60-120	10-5-2.5

Extended primary current : 120 % at all taps

VOLTAGE TRANSFORMER DETAILS

Field Type	VT	Winding No.	Voltage Ratio	Accuracy Class as per IEC 61869	Burden (VA)	Application	Remarks
(C03) BBM	-T15, -T25	1	400kV/√3 : 110 V/√3	0.2	100	Metering	-
		2	400kV/√3 : 110 V/√3	3P	75	Protection	
		3	400kV/√3 : 110 V/√3	3P	75	Protection	

Rated Voltage Factor / Rated time : 1.2Un / Continuous , 1.5Un / 30 sec

GAS PRESSURE LEVELS

Gauge pressures @20°C)	Nominal pressure	Loss of SF6	CB block level	Minimum SF6 density
	bar	bar	bar	bar
Circuit breaker compartment	5.6	5.2	5.0	5.0

Density monitor shall be hybrid type with 6.5-20mA output to indicate SF6 gas pressure in HMI.

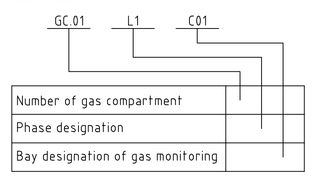
GAS PRESSURE LEVELS

Gauge pressures @20°C)	Nominal pressure	Loss of SF6	SF6 low level	Zone trip level
	bar	bar	bar	bar
Voltage transformer compartment	5.6	5.2	5.0	5.0
Switchgear compartments except CB and VT	5.2	4.9	4.7	4.7

Density monitor shall be hybrid type with 6.5-20mA output to indicate SF6 gas pressure in HMI.

Gas compartment designation

Each gas compartment is equipped with a separate gas monitoring system, consisting of density monitor indicating RED/GREEN



Number of gas compartment	
Phase designation	
Bay designation of gas monitoring	

EXTERIOR COLOUR SHADES

GIS COLOUR SHADE : RAL 7032
LCC COLOUR SHADE : RAL 7032

Device designation to DIN EN 81346 / IEC 81346 (2009)

Device designation according to DIN 40719 part 2 / IEC publication no. 750/(1983)

Phase assignment
Client designation

L1	=	C	=	R
L2	=	B	=	Y
L3	=	A	=	B

Environmental factors

Ambient Temperature (Indoor)	min.	-7°C
	max.	+40°C

Reference Drawing:

1	TB-3-382-510-001-REV-07	SINGLE LINE DIAGRAM OF 400kV GIS & POTHEAD

Notes:

1. Each gas compartments is equipped with Static Filter, Filling Valve with NRV, density monitors & safety diaphragm rupture discs.
2. The maximum leakage rate of SF6 gas shall not be exceeded by more than 0.5% per year.

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV.	DATE	ALTERED
		CHECKED			CHECKED	02	12.07.24	CHECKED GS	01	24.06.24	CHECKED GS	00	06.06.24	CHECKED GS
		APPROVED			APPROVED			APPROVED GQ			APPROVED GQ			APPROVED GQ
ZONE			ZONE			ZONE	AS PER CUSTOMER COMMENTS.		ZONE	AS PER CUSTOMER COMMENTS.		ZONE	AS PER TENDER DRAWINGS.	

GIS MANUFACTURER:SIEMENS LTD. AURANGABAD
DRAWING NO. : (0)-G71770-AC750-S005-01-01

SIEMENS
Energy Sector

ADDITIONAL INFORMATION
STATUS OF DRAWING
DISTRIBUTION OF PRINTS

	NAME	SIGN	DATE	NO. OF VAR
DRN	KG		06.06.24	
CKD	GS		06.06.24	
APPD	GQ		06.06.24	

SUB-SUPPLIER/VENDOR

PROJECT	4X111MW VISHNUGAD PIPALKOTI H.E. PROJECT
CUSTOMER	THDC INDIA LTD.
SUBSTATION	400kV GIS SUBSTATION AT VISHNUGAD PIPALKOTI
CONTRACTOR	BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP

ISSUED BY DEPT	UNTOL.DIMS. GR.	ANGLE	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEM
TBEM	–		NTS	–	TB-3-382-510-001	–	–
DEPT. CODE 316							

TITLE: **GIS GAS SINGLE LINE DIAGRAM (SLD) AND GAS SCHEMATICS**

DRAWING NO. TB-382-316-35-01 REV. 02

SHT. No. 1 NO. OF SHT. 1 OF 1

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

Annexure_Aluminium_Welding

PROCEDURE FOR WELDING OF ALUMINIUM BUSES

A. Recommended welding procedures to insure a sound weld are as follows:

Pure aluminum melts at 660 Deg. C while aluminum alloy melts in the range of 519 Deg. C depending on the alloy content of the particular metal involved. When aluminum alloy are heated there is no change in color. This makes it difficult, if not impossible; to tell metal is near the welding temperature.

The ever present surface oxide films on aluminum have a melting point of 1982 Deg. C. The parent aluminum or aluminum alloy can therefore be melted without fusing the surface oxides. Unless this film is removed, cleanliness of the molten filler metal and the parent metal cannot be completed and both strength and conductivity may be sacrificed. Therefore, it is of prime importance that aluminum oxides be removed from the aluminum alloys before welding is started. In the shielded arc welding method the shielding gas has a tendency to clean the material as welding progresses.

B. CLEANING OF BUSES & FITTINGS:

It is very important to remove all greases and oxides from the surfaces to be welded. This can be accomplished by using a mild alkaline solution or standard degreasing solution. The preferred method is to use a stainless steel wire brush and vigorously scrub the surfaces to be welded. The stainless steel brushes are specified because the stainless steel has fewer tendencies to pick up particles of aluminum.

C. WELDING METHODS

The following types of welding methods for welding aluminum fittings and buses are recommended.

1. TUNGESTEN-ARC WELDING (TIG)

The inert-gas shielded tungsten arc process is widely used for welding aluminum bus fittings. In this process the arc is established between a non-consumable tungsten electrode and the section to be welded. Inert gas envelopes the arc to prevent oxidation during welding.

Hence no flux is required. A bare filler rod supplies filler metal to the weld area. To initiate the arc the tungsten electrode is placed in contact with the component and then withdrawn to establish an arc length of approximately 3/16". The arc is given a circular motion until the base metal liquefies and the weld puddle is established. Filler metal is added by hand as required. In this process, if more than one pass is required for a sufficient weld, the weld should be wire brushed between passes, to remove any surface dirt or oxides which have accumulated from the previous pass. Since no flux is used the finished weld does not require cleaning. In this process the heat of the tungsten arc is concentrated in a smaller area and is much faster than the conventional type of welding and distortion of the weld is negligible since the heat is concentrated in a small area. In this process, if thickness is greater than 0.5" arc to be welded, pre-heating of parts will increase the arc speed.

2. METALLIC ARC INERT GAS SHIELDED WELDING

MIG welding process combines the advantages of tungsten arc welding with the increased welding speed. Welding can be done from any position and the process can be either manual or automatic, Manual welding techniques are somewhat different from other methods. However, a welder can be trained to use the MIG process with only a few days concentrated training. In the MIG process the bare filler rod is supplied as a coil of bare wire. In the commercially available equipment this wire is added to the weld at predetermined rate by a motor driven feed that can be adjusted to the magnitude of the welding current. In this process as well as the tungsten arc process, gas forms a shield around the arc to prevent oxidation during welding.

Either helium, argon or a mixture of helium and argon are suitable shielding gases. Pure argon is most widely used on the gas arc usually mixed to combine the hotter arc argon. If exceptionally hot arc characteristics are required pure helium can be substituted for the gas mixture. Precaution should be exercised if this substitution is made in that it is very easy to burn through the items that are to be welded with a pure helium atmosphere.

As it is readily apparent, the basic difference between the two types of welding apparatus is the automatic feeding mechanism for the filler wire. In both types of apparatuses the electrode holder and the welding gun can or cannot be cooled by water. If welding currents of more than 125 Amps are required, both methods will have to have water cooling apparatuses to the electrode holder and the welding gun.

D.WELDERS QUALIFICATIONS

No welding should be done until the operator has had experience with welding aluminum alloys by the methods described above, Men with previous experience with in metal welding should be selected for training in welding aluminum for a period of training of not less than one week after which time the man can be considered to be proficient in the use of the equipment and in the welding of aluminum joints. After this period there should be no difficulty experienced in welding aluminum alloys. It is suggested, if practical, that welders should practice on actual fittings or buses before proceeding with the welding of the required job.

The following is the recommended specification for the current fittings wire feeds, gas flows etc. These specifications are of a general nature to the extent that many factors have to be considered such as:

1. Type of equipment used, whether water cooled or not.
2. The size and mass of the piece to be welded.
3. The position of the weld.
4. And most important of all, the operator's skill
5. All persons in the welding area would wear the proper shields. The arc is approximately twice as strong as the standard AC welding arc. Extreme caution should be exercised for the protection of eyes.

ACCEPTANCE STANDARDS FOR NON-DESTRUCTIVE TESTING LIQUID PENETRANT EXAMINATION OF WELDED JOINTS

a) Evaluation of indications:
   - Relevant indications are those which result from mechanical discontinuities.
   - Linear indications are those indications in which the length is more than three times with width.
   - Rounded indications or indication, which are circular or elliptical with the length less than three times, the width.
   - Any questionable or doubtful indications shall be re-tested to verify whether or not actual defects are present.
   - Localised surface imperfections, such as may occur from machining marks, surface conditions, may produce similar indications, which are not relevant to detection of unacceptable discontinuities.

b) **Acceptance standards**:

- Linear indications
- Four or more rounded defects with any dimensions more than 1.6 mm in a line separated by 1/16 inch (1.6 mm) or less (edge to edge)

c) **Defect removal and repair:**

Unacceptable imperfections shall be removed and reexamination made to assure the complete removal. Whenever a defect is removed and subsequent repair by welding is not required, the excavated area shall be blended into the surrounding surface so as to avoid sharp notches, crevices or corners. Where welding is required after removal of a defect, the area shall be cleaned and welding performed in accordance with a qualified welding procedure, Completed repairs shall be re-examined by the method originally used for detection of the defection.

d) **Treatment of imperfections believed non-relevant.**

Any indication of an imperfection, which is believed to be non-relevant, shall be regarded as defect unless, on re-evaluation, it is shown by re-examination by the same method or by the use of other non-destructive methods and/ or by surface conditioning that no unacceptable defect is present.

e) **Examination of areas form which defects have been removed:**

After a defect is thought to have been removed and prior to making weld repairs, the area shall be examined by suitable methods to ensure the defect has been eliminated.

f) **Re-examination of repaired areas:**

After repairs are made, the repaired areas shall be blended.

ACCEOTANBCE STANDARDS FOR NON-DESTRUCTIVE TESTING RADIOGRAPHIC EXAMINATION OF WELDED JOINTS

Radiographic examination shall cover minimum 10% of weld seam and acceptance standard for visual examination and Radiography shall be as follows:

Any of the following imperfections shall not be acceptable.

1. Cracks

2. Zone of incomplete fusion or penetration, which exceed 10% of the weld length of the joint in longitudinal or transverse butt weld, where full penetration is intended by the weld procedure, some lack of penetration acceptable. The total length of weld with lack of penetration shall not exceed 10% of the overall weld length. At no place, shall weld penetration be less than 90% of the thickness of the material. Continuous occurrence of lack of penetration is permitted, but shall not exceed 50 mm in any 500 mm length of weld.

3. Inadequate weld dimensions, root cavity (shrinkage) and incompletely filled groove greater than 10% effective throat thickness.

4. Excess penetration shall be permitted provided it does not exceed 25% of the wall thickness or 4 mm whichever is smaller.

5. Weld reinforcement: Build up in excess of 25% of the effective throat thickness shall be dressed. Any reinforcement shall be substantially symmetrical about the center line of the weld and shall be of smooth contour blending smoothly at the toes with the parent material.

6. Undercutting and overlapping, greater than 10% effective throat thickness.

7. Elongated cavities and/or worm holes exceeding 3 mm dia or equivalent area in length provided the limitations on porosity are met with.

8. Copper, tungsten or oxide inclusions greater than t/1 or 3 mm whichever is smaller.

9. Crater pipes exceeding 2597o effective throat thickness or 3 mm whichever is smaller.

10. Porosity: Scattered porosity not exceeding 0.5% by volume is acceptable. In general, the size of the pores shall not exceed 0.8 mm dia, but occasional 1.6 mm dia pores may be acceptable, provided the following limits are not exceeded.
    a) Where pore size is 0.4 mm or less, up to 150 t pores may be permitted in 1000 mm sq. area of radiograph.
    b) Where pore size is 0.8 mm or less, up to 19 t pores may be permitted in 1000 mm. sq. area of radiograph.
    c) Where pore sizes are generally 0.8 mm dia or less, but occasional 1.6 mm dia/pores are present, up to 9t pores of 0.8 mm dia may be permitted in 1000 sq. mm area of radiograph, provided the number of pores up to 1.6 mm in dia does not exceed it.
    d) However, visible surface porosity> 1mm dia is not acceptable.

Note:

i. In all cases, t+ thickness of the thinnest section of the weld under examination.

ii. Unacceptable weld defects shall be repaired in accordance with the original welding procedure. All repairs shall be 100% inspected in accordance with original testing procedure.

ANNEXURE_INSULATING_ MAT

TECHNICAL SPECIFICATION
FOR INSULATING MAT

9.11 **Insulating mats**

9.11.1 The scope covers supply and laying of insulating mats of “class A” conforming to IS: 15652-2006.

9.11.2 These insulating mats shall be laid in front of all floor mounted AC and DC switchboards and control **& relay** panels located in control room building/ **Switchyard panel room**.

9.11.3 The insulating mats shall be made of elastomer material free from any insertions leading to deterioration of insulating properties. It shall be resistant to acid, oil and low temperature.

9.11.4 Upper surface of the insulating mats shall have small aberration (rough surface without edges) to avoid slippery effects while the lower surface shall be plain or could be finished slip resistant without affecting adversely the dielectric property of the mat.

9.11.5 Insulating mat **(wherever applicable)** shall be of pastable type, to be fixed permanently on the front and rear side of the panels except for the chequered plate area which shall not be pasted **as per requirement**. The insulating mats shall generally be fixed and joints shall be welded as per recommendations in Annexure-A of IS: 15652.

9.11.6 Width of insulating mats shall generally be of 1.5 meters or as per site requirements. Length shall be supplied as per site requirements.

9.11.7 The insulating mats offered shall conform to IS: 15652-2006.

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NEW DELHI

DOCUMENT No.	TB-XXX-316-041	Rev. No.	02		Prepared	Checked	App.
TYPE OF DOC.	STANDARD TECHNICAL SPECIFICATION			NAME	NK	MK	KK
TITLE	PVC PIPE & BENDS			SIGN	Sd/-	Sd/-	Sd/-
				DATE			
				GROUP	TBEM	W.O. No	

CUSTOMER	
CONSULTANT	
PROJECT	RATE CONTRACT

SCOPE AND SPECIFIC TECHNICAL REQUIREMENT

1.0 SCOPE

This technical specification covers design, manufacture, testing at works, packing and dispatch of 'PVC pipe, its fittings and bends'. The material supplied shall fully comply with relevant Indian Standard given below and the product shall be BIS certified. The sizes and types of Pipes shall be as specified below. No Technical Deviations shall be acceptable in this regard.

1.1 SPECIFIC TECHNICAL REQUIREMENT

1.1.1 UPVC Pipe

The UPVC pipes shall be of nominal diameter 50 mm and/ or 110 mm, as per the indent. The pipe shall be of Class-II & Class-IV Grade as per IS 4985: 2000 and shall be of standard length of 6 meters. The pipe shall fully comply with specified standard and carry the BIS certification marking.

1.1.2 Sockets

The sockets shall fully comply with the requirements of IS 7834 (Part-6)-1977.

1.1.3 For Bends

The bends shall be of 45°, 60°, 90° and Tee as specified, for above mentioned pipes. The bends shall, in general, comply with the requirement of IS 10124. The specific requirements and BIS certification marking of these bends shall be as per IS 10124 (Part-9) and IS 10124 (Part-10) respectively.

1.2 BILL OF MATERIAL

As per enclosed Annexure-1.

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS
02	06.09.13				90° Bends added.
01	30.11.10	-SD-	-SD-	-SD-	Document revised.

Distribution	To	TBMM	OFFICE COPY
	Copies	1	1

2.2.2 *Dimensions* — The dimensions of 45° bends shall comply with Table 1 read with Fig. 1.

2.2.3 The bends may either be plain at both ends or socketed either at one end or at both ends as agreed to between the manufacturer and the purchaser. In the case of socketed bends, the socket measurements shall comply with IS : 10124 (Part 1)-1988*.

NOTE 1 — For 0·25 MPa pressure class, fabricated bends should not be made from 0·25 MPa pressure class pipes. For this, bends made from 0·4 MPa pressure class pipe should be used.

NOTE 2 — The drawing is only intended to define the terms used in Table 1 and is not intended to illustrate specific design features.

3. MARKING

3.1 Each 45° bend fitting shall be marked with the following information:

a) Manufacturer's name or identification mark,

b) The size of the bend and the appropriate class (working pressure) of IS : 4985-1988* to which the pressure rating of the fitting corresponds,

c) The degree of bend, and

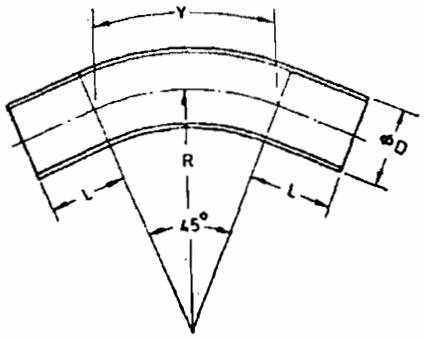


FIG. 1 45° BEND

*Specification for fabricated PVC fittings for potable water supplies: Part 1 General requirements.

*Specification for unplasticized PVC pipes for potable water supplies (*second revision*).

TABLE 1 DIMENSIONS OF 45° BENDS

(*Clauses* 2.2.2 and 2.2.3, and *Fig.* 1)

All dimensions in millimetres.

SIZE	Y* *Min*	L *Min* (Only for plain ends)	R† *Min*	MINIMUM WALL THICKNESS (*t*) FOR WORKING PRESSURE		
				0·4 MPa (Class 2)	0·6 MPa (Class 3)	1·0 MPa (Class 4)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
63	149	63	189	1·4	2·0	3·2
75	177	75	225	1·7	2·4	3·8
90	212	90	270	1·9	2·8	4·5
110	259	110	330	2·3	3·4	5·5
125	295	125	375	2·7	3·9	6·3
140	330	140	420	2·9	4·4	7·0
160	377	160	480	3·4	4·9	8·0
180	424	180	540	3·8	5·5	9·0
200	471	200	600	4·2	6·2	10·0
225	530	225	675	4·7	6·9	11·2
250	589	250	750	5·2	7·7	12·5
280	660	280	840	5·8	8·6	13·9
315	742	315	945	6·5	9·7	15·6
355	837	355	1 065	7·3	10·8	17·7
400	842	400	1 200	8·2	12·2	19·8
450	1 060	450	1 350	9·3	13·7	22·4
500	1 178	500	1 500	10·3	15·3	24·8
560	1 319	560	1 680	11·6	17·2	27·8
630	1 484	630	1 890	13·0	19·2	31·3

NOTE — Minimum wall thickness if calculated on the basis of 90 percent of the minimum wall thickness of the corresponding size and pressure class of pipe rounded off to the next higher 0·1 mm.

*Y is calculated from $\frac{45°}{360°} \times 2\pi R$.

†*R, radius of the bend, is equal to 3 times the nominal outside diameter (D).*

2.2.2 *Dimensions* — The dimensions of 90° bends shall comply with Table 1 read with Fig. 1.

2.2.3 The bends may either be plain at both ends or socketed either at one end or at both ends as agreed between the manufacturer and the purchaser. In the case of socketed bend, the socket measurements shall comply with IS : 10124 (Part 1)-1988*.

NOTE — For 0·25 MPa pressure class, fabricated bends should not be made from 0·25 MPa pressure class pipes. For this, bends made from 0·4 MPa pressure class pipe should be used.

NOTE — The drawing is only intended to define the terms used in Table 1 and is not intended to illustrate specific design features.

3. MARKING

3.1 Each 90° bend fitting shall be marked with the following information:

a) Manufacturer's name identification mark,

b) The size of the bend and the appropriate class (working pressure) of IS : 4985-1988* to which the pressure rating of the fitting corresponds,

c) The degree of bend, and

d) The bend shall be marked in colour as indicated below for different classes of fittings:

Class of Fitting	*Colour*
Class 2 (0·4 MPa)	Blue
Class 3 (0·6 MPa)	Green
Class 4 (1·0 MPa)	Yellow

*Specification for fabricated PVC fittings for potable water supplies: Part 1 General requirements (*first revision*).

*Specification for unplasticized PVC pipes for potable water supplies (*second revision*).

TABLE 1 DIMENSIONS OF 90° BENDS

(*Clauses* 2.2.2, 2.2.3 and *Fig.* 1)

All dimensions in millimetres.

SIZE	*Y** *Min*	*L* *Min* (Only for plain ends)	*R*† *Min*	MINIMUM WALL THICKNESS (*t*) FOR WORKING PRESSURE		
				0·4 MPa (Class 2)	0·6 MPa (Class 3)	1·0 MPa (Class 4)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
63	297	63	189	1·4	2·0	3·2
75	354	75	225	1·7	2·4	3·8
90	424	90	270	1·9	2·8	4·5
110	519	110	330	2·3	3·4	5·5
125	589	125	375	2·7	3·9	6·3
140	660	140	420	2·9	4·4	7·0
160	754	160	480	3·4	4·9	8·0
180	848	180	540	3·8	5·5	9·0
200	942	200	600	4·2	6·2	10·0
225	1 060	225	675	4·7	6·9	11·2
250	1 178	250	750	5·2	7·7	12·5
280	1 319	280	840	5·8	8·6	13·9
315	1 484	315	945	6·5	9·7	15·6
355	1 673	355	1065	7·3	10·8	17·7
400	1 884	400	1200	8·2	12·2	19·8
450	2 120	450	1350	9·3	13·7	22·4
500	2 355	500	1500	10·3	15·3	24·8
560	2 638	560	1680	11·6	17·2	27·8
630	2 968	630	1890	13·0	19·2	31·8

NOTE — Minimum wall thickness is calculated on the basis of 90 percent of the minimum wall thickness of the corresponding size and pressure class of pipe rounded off to the next higher 0·1 mm.

*Y is calculated from $\frac{90°}{360°} \times 2\pi R$.

†R, radius of the bend, is equal to 3 times the nominal outside diameter (D).

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

DOCUMENT No.	**TB xxx 618 002a**	Rev 04	Prepared	Checked	Appd
TYPE OF DOC.	**TECHNICAL SPECFICATION**	NAME	**BVG**	**PLK**	**RMS**
TITLE		SIGN	-SD-	-SD-	-SD-
	G I HARDWARES	DATE			
		GROUP	**TBEM**		
		W.O. No			
CUSTOMER/ CONSULTANT					
PROJECT					

Contents:

Rev	Date	Altered	Checked	Approved	
04	18.11.10	BVG	PLK	RMS	Unit wt of hardware added
02	13.4.06.	BVG	PLK	RMS	Eqpt mounting hardwares added.
Distribution				To	
				Copies	

SECTION - 1

SCOPE, SPECIFIC TECHNICAL REQUIREMENTS & QUANTITIES

1.1 SCOPE

The scope of this specification is to specify all details required by a supplier for supply of galvanized hardwares for projects being executed by BHEL on turnkey basis for NTPC, PGCIL, SEBs and other Customers.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

The specific technical requirements shall be as per Standard Technical Specification (Refer Section 2).

1.3 QUANTITIES

The quantities shall be as per attached BOQ.

SECTION - 2

2.0 GENERAL

This section covers the standard technical specification for GI Hardwares.

2.1 BOLTS:

M16 bolts shall be used in all types of structures except equipment mounting/ earthing bolts which shall be as per equipment requirement.

All bolts for member connections in towers, beams & equipment support structures shall conform to IS: 12427 - 2001 and for step bolts shall conform to IS: 10238 – 1982.

The mechanical properties shall conform to property class 5.6 of IS:1367 (part 3) - 1991.

All bolt heads shall have hexagonal shape, the heads being forged out of the solid material truly concentric and square with the shank, which must be perfectly straight.

Fully threaded bolts should not be used.

All bolts shall be threaded with metric standard thread to take the full depth of the nut and permit firm grip of the member.

All bolts shall be hot dip galvanized as per IS: 1367 (Part 13) – 1983.

2.2 NUTS:

All nuts shall conform to IS: 1363 (Part 3) –1992.

The mechanical properties shall conform to property class 5 of IS:1367 (part 6) – 1980.

The nuts shall be capable of being worked with fingers along the entire threaded portion of the bolt with a neat fit capable of developing the full strength of the bolt.

All nuts shall be hot dip galvanized as per IS: 1367 (Part 13) – 1983.

2.3 PLAIN WASHERS:

All plain washers shall be punched washers, A type conforming to IS: 2016-1967.

These shall be hot dip galvanized as per IS: 4759 – 1984.

2.4 SPRING WASHER:

All spring washers shall be of spring steel, positive lock type and conforming to type B of IS: 3063-1972. The thickness of spring washer shall be as specified under:

Bolt Diameter	Thickness of Spring washers
16 mm	3.5 mm
12 mm	2.5 mm

These shall be electro-galvanized as per IS: 1573 – 1986.

2.5 UNIT WEIGHT OF BOLTS I/C NUT, PLAIN AND SPRING WASHERS:

For purpose of payment, following unit weights as indicated below shall be considered.

A.) STANDARD BOLTS I/C ONE NUT UNIT WEIGHTS

S. NO.	TYPE	SIZE OF BOLTS	TOTAL WT (KG)
1	M16	16 ϕ X 35 LG	**0.117**
2	M16	16 ϕ X 40 LG	**0.125**
3	M16	16 ϕ X 45 LG	**0.133**
4	M16	16 ϕ X 50 LG	**0.141**
5	M16	16 ϕ X 55 LG	**0.149**
6	M16	16 ϕ X 60 LG	**0.157**
7	M16	16 ϕ X 65 LG	**0.164**
8	M16	16 ϕ X 70 LG	**0.172**
9	M16	16 ϕ X 75 LG	**0.180**
10	M16	16 ϕ X 80 LG	**0.188**
11	M16	16 ϕ X 85 LG	**0.196**
12	M16	16 ϕ X 90 LG	**0.204**
13	M16	16 ϕ X 95 LG	**0.212**
14	M16	16 ϕ X 100 LG	**0.220**
15	M12	12 ϕ X 35 LG	**0.0620**
16	M12	12 ϕ X 40 LG	**0.0664**
17	M12	12 ϕ X 45 LG	**0.0708**
18	M12	12 ϕ X 50 LG	**0.0753**
19	M12	12 ϕ X 55 LG	**0.0797**
20	M12	12 ϕ X 60 LG	**0.0842**

B.) SPRING WASHER

S. NO.	TYPE	TOTAL WT (KG)
1	3.5mm thk (M16 bolt)	**0.00891**
2	2.5mm thk (M12 bolt)	**0.00382**

C.) For supplies of bolts i/c nuts, plain washers and spring washer other than those listed above, payment shall be made based on unit weights worked out considering theoretical dimensions & density of steel as 7850kg/cum.

G.I EARTH WIRE

SECTION – II

TECHNICAL SPECIFICATION FOR G.I. GROUND WIRE.

(7/3.15 mm and 7/3.66mm)

1. **SCOPE** :

1.1 This specification provides for the manufacture, testing before despatch, supply and delivery of Ground wire for the purpose of earthing and protection of power transmission line, as per the particulars given in Appendix-I attached. The ground wire shall consist of standard galvanized steel wire.

2. **STANDARDS** :

2.1 The ground wire shall comply in all respect with the Indian Standard (IS) 2141-1979

3. **MATERIALS** :

3.1 The material offered shall be of best quality and workmanship. The steel wires (Strands) shall be manufactured from steel produced by any suitable process. The steel wire shall not contain sulphur and phosphorous exceeding 0.040 percent each as per IS : 2141-1971.

3.2 The steel wires shall be evenly and uniformity quoted with zinc complying with IS: 209-1965 specification for zinc (Retired). Only virgin zinc shall be used and reclaimed zinc is not permitted. The virgin zinc shall be of zn 99.95 percent quality.

3.3 The content of carbon shall not be more than 0.55 percent, manganese and silicon contents shall be 0.40 to 0.90 and 0.15 to 0.35 respectively.

4. **SIZE AND CONSTRUCTION** :

4.1 The size of ground wire shall be as given in Appendix-I. The physical properties have been given in the same Appendix. The lay of the strands shall be of lengths as given in the Appendices. The wires shall be so stranded together that when any evenly distributed pulls applied at the end of the completed strands each wire will take on equal share of the pull.

5. **LENGTH OF JOINING**:

5.1 The ground wire may be supplied in the standard length as per manufacturers standard practice and such length will be specifically indicated in the tender. However random length of ground wire upto a maximum of 10 (Ten) percent may be allowed.

5.2 The length of strand which may be supplied without joints in the individual wires comprising it depends on the length of wire which may be carried by the bobbin in a normal stranding machine. The normal lengths of strand which shall be supplied without joints in individual wires, excluding welds made in the rod before drawing shall be as given in Appendix – I.

5.3 Each coil shall be warranted to contain no weld joints or splice ether than in the rod before it is drawn and those permitted in 5.3 above. The wire shall be circular and shall be free from scale or irregularities, imperfections, flow spite and other defects. The zinc coating shall be smooth even and bright.

6. **TESTS AND TEST CERTIFICATES**:

6.1 Ground wire shall be subjected to the tests as specified in the IS:2141-1979 before despatch.

6.2 Al the coils of the galvanized strand shall be of the same grade, diameter and construction manufactured under similar condition shall be grounded to constitute one lot.

6.3 Samples from each lot shall be tested for ascertaining the conformity to the requirements of the ground wire specified herein. The coils selected shall be tested for length of the lay and joints. The lot shall be declared conforming to the requirements of these characteristics if all the coils are found satisfactory. One test specimen from each wire of the strand shall be drawn, from every selected coil and subjected to tensil tests, ductility test and coating test. One specimen of the completed strand from each coil shall be subjected to tensil strength. The lot shall be declared conforming to the requirements of these characteristics if the entire best specimen satisfy the relevant requirements.

6.4 **Chemical Analysis** : One sample shall be drawn from the lot for chemical analysis. Unless otherwise agreed to between the purchase and supplier the chemical analysis shall be carried out.

6.5 **Tensile Test** : The wire when tested in accordance with IS : 1521-1960 shall have minimum tensile strength specified in the Appendix – I. The tensile strength of the finished strand shall not be less than 95% of the aggregate of the single wires.

6.6 **Ductility test** : The wire shall be subjected to wrapping test in accordance with IS : 1755-1961. When wrapped eight times round its own diameter and on being subsequently straightened the wire shall not break or split.

6.7 **Coating test** : The uniformity of zinc coating shall be tested as per IS: 2633-1964. The wire shall withstand the number of dips specified in Appendix – I.

6.8 Three copies of manufacturers test certificate shall be submitted by the contractor to the purchaser for approval immediately after such tests have been conducted on the strands and the wire.

6.9 The purchaser reserves the right to inspect the material at Manufacturer's works before despatch.

7. **PACKING AND MARKING** :

7.1 The ground wire shall be supplied in non-returnable reals or drums of non-perishable or treated wood conforming to IS: 1778-1991 specification for Reals and Drums for Bare wire. Each coil shall be provided with a level fixed firmly on the inner part of the coil, bearing the following information.

(a) Trade name, if any.
(b) Name of manufacturer
(c) Type of wire, size and length of wire.
(d) Not weight of the wire.
(e) Total weight, and
(f) Number of lengths on the real or drum unless otherwise agreed to between the purchaser and the supplier, the stranded wire shall be supplied in 50 Kg. coil.

8. **SAG AND TENSION CHARTS AND SAG TEMPLATE** :

8.1 The successful tenderer shall be required to submit six copies of sag templates and strings charts for different temperatures and spans, One set of charts shall be ink on tracing cloth. The design date of the lines on which the ground wire will be used are given in Appendix – II

APPENDIX–I

TECHNICAL SPECIFICATION OF GROUND WIRE

(i)	Material	:	Steel
(ii)	Purity of material	:	Sulphur and phosphorous contents not exceeding 0.040 percent each. Carbon content not exceeding 0.55 percent. Total silicon contents shall be 0.15 to 0.35 and Manganese contents shall be 0.40 to 0.90 respectively.
(iii)	Standing and wire diameter	:	7/3.15 mm
(iv)	Weight	:	428 Kg / Km.
(v)	Single wire before stranding		
	Diameter of wire	:	3.15 mm
	Tolerance	:	+ 0.060 mm - 0.030 mm
	Minimum elongation in 100 mm.	:	4 mm.
	Minimum breaking strength	:	857 kg.
	Minimum tensile strength	:	85.7 kgf / mm2
(vi)	**Stranded wire length of lay**		
	Maximum	:	175 mm
	Minimum	:	145 mm
	Minimum breaking load	:	5810 kg
	Over all diameter	:	9.45 mm
	Modulus of elasticity	:	1.938 x 106 Kg/Cm2
	Co-efficient of linear expansion	:	11.50 x 10^{-6} per deg. C.
	D.C. resistance at 20^0C	:	3.375 Ohms/Km.
(vii)	**Zinc coating** :		
	Number of one minute dips	:	Three
	Number of half-minute dips	:	One
	Quality of zinc	:	Zn 98 IS:209/1966
	Weight of coating on wire process of galvanising	:	275 g/m^2
	Process of galvanising	:	Hot-dip.
(viii)	Joints	:	There shall be no joint in any of the wires constituting the ground wire.
(ix)	**Lengths** -		
	Standard length	:	1500 metres.
	Tolerance on standard length	:	± 5 percent
	Random lengths	:	Not more than 5 percent of the lengths ordered.
(x)	**Tests** : -	:	A sample of the finished ground wire when tested in tensile testing machine shall not fail at a stress less than 100% of UTS value of the ground wire. The length of the test sample shall be not less than 5 meters.
	Type tests Ultimate tensile strength test.		
	Electrical Tests	:	As per BS : 182/1972 and BS :

			3229/1960
	Routine Tests	:	As per clause No. 6 of IS: 2141 1968. In addition to these tests, the weight and adherence of Zinc coating tests shall be conducted as per clause 4 and 5 of IS : 4826/1968.
(xi)	Test Reports	:	Three copies of manufacturer test certificates shall be submitted by the Contracts to the purchaser for approve immediately after such test have been conducted on the galvanised steel strand and the wire.

9. Overhead earth conductors

General(7/3.66mm)

Where earth conductors are erected to provide the specified degree of lightning protection, they shall consist of stranded galvanised steel and shall comply with IEC 888 and IEC 1089 in so far as it applies to steel wires.

Galvanising shall comply with the requirements of IS 2141.

The arrangement of earth conductors shall be such that failure of a single conductor cannot predictably result in a fall across both bus bars in a duplicate bus bar substation.

Technical parameters

SI No.	Parameter		Value
1	Stranding and wire diameter		7/3.66mm
2	Number of strands		1/6
3	Total sectional area		73.65 mm^2
4	Overall diameter		10.98mm
5	Approximate weight		583 kg/km
6	Calculated DC resistance at 20C		2.5 ohms/m
7	Minimum ultimate tensile strength		68.4kN
8	Direction of outer lay		Right hand
9	Tolerances		
9a	Diameter	standard	3.66mm
		maximum	3.75mm
		minimum	3.57mm
9b	Lay length	standard	181mm
		maximum	198mm
		minimum	165mm
10	Steel composition	Carbon	≤ 0.55%
		Manganese	0.4 to 0.9%
		Phosphorous	≤ 0.04%
		Sulphur	≤ 0.04%
		Silicon	0.1 to 0.35%
11	Zinc for galvanising		Electrolytic high grade zinc of 99.95% purity to *209 1979*

Table for Technical parameters for earth wires

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No.

Document Name:– DIMENSIONAL and LAYOUT ARRANGEMENT IN CABLE TUNNEL/OTHER AREA FOR 400kV XLPE CABLE SYSTEM.

(Drawing NO.:–TB–382–316–36–33)

COMPUTER DRG. PATH NAME :

REF. DRG. No.	SIGN. & DATE	INVENTORY No.

REV.	DATE	ALTERED	T.K.	ZONE	REVISED AS PER CUSTOMER COMMENTS
04	17.10.25	CHECKED	V.K.	ZONE	
		APPROVED	P.H.		
03	08.08.25	CHECKED	V.K.	ZONE	REVISED AS PER CUSTOMER COMMENTS
		APPROVED	P.H.		
02	30.07.25	CHECKED	V.K.	ZONE	REVISED AS PER CUSTOMER COMMENTS
		APPROVED	P.H.		
01	07.06.25	CHECKED	V.K.	ZONE	REVISED AS PER CUSTOMER COMMENTS
		APPROVED	P.H.		

ADDITIONAL INFORMATION

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

	NAME	SIGN	DATE	NO. OF VAR
DRN	T.K.	–sd–	17.10.2025	
CKD	V.K.	–sd–	17.10.2025	
APPD	P.H.	–sd–	17.10.2025	

SUB–SUPPLIER/VENDOR

UNIVERSAL CABLES LTD.

MP BIRLA GROUP

PROJECT: 4X111MW VISHNUGAD PIPALKOTI H.E. PROJECT.

CUSTOMER: टीएचडीसी इंडिया लिमिटेड THDC INDIA LIMITED — THDC INDIA LTD. RISHIKESH, UTTARAKHAND.

CONTRACTOR: BHEL — BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP

ISSUED BY DEPT	UNTOL.DIMS. GR.	ANGLE	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEM
TBEM			NTS				
DEPT. CODE 316							

TITLE:–

DIMENSIONAL and LAYOUT ARRANGEMENT IN CABLE TUNNEL/OTHER AREA FOR 400kV XLPE CABLE SYSTEM.

DRAWING NO. TB–382–316–36–33 — REV. 04

SHT. No. 01 — NO. OF SHT. 05

UNIVERSAL CABLES LIMITED, SATNA (MP), INDIA

Comments Resolution Sheet

Document name: - Dimensional and Layout Arrangement in Cable Tunnel/ Other Area for 400kV XLPE Cable System.

Document No.: - TB-382-316-36-33 REV-03

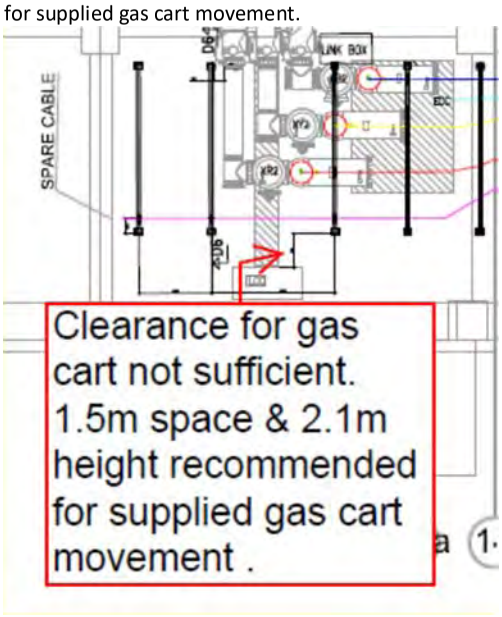
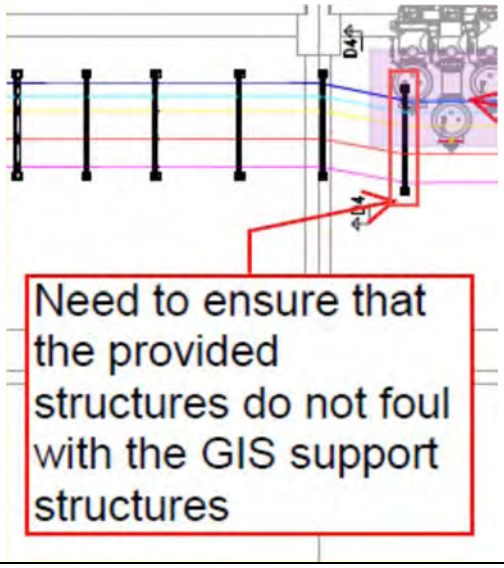
Sl.No.	BHEL Comment	Reply of Universal cables Ltd/Changes in Drawing
1	Cable laying arrangement in three racks	Amended as per the provided comments.
2	Section details shown differently	Revised in line with the Plan Drawing
3	Control Cable Rack Assembly Section (Tri-junction to Power House)	Shown as marked in Plan and Section (Sheet No. 1 & 3)
4	Culvert Section	Indicated in the Route Plan (Sheet No. 01)
5	Section Details in Pothead Yard	Incorporated as per Plan (Sheet No. 04).
6	Firefighting Pipe	Indicated in Sectional Drawings (Sheet No. 2 & 3).
7	EL Levels (marking)	Marked in all Sections and Plan Drawings
8	Circuit Marking in Culvert Section	Shown in Culvert Section (Sheet No. 03)

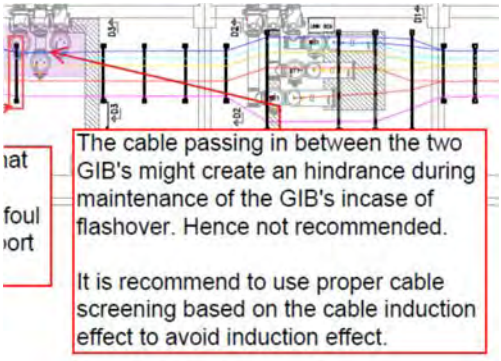
UNIVERSAL CABLES LIMITED, SATNA (MP), INDIA

Comments Resolution Sheet

Document name: - Dimensional and Layout Arrangement in Cable Tunnel/ Other Area for 400kV XLPE Cable System.

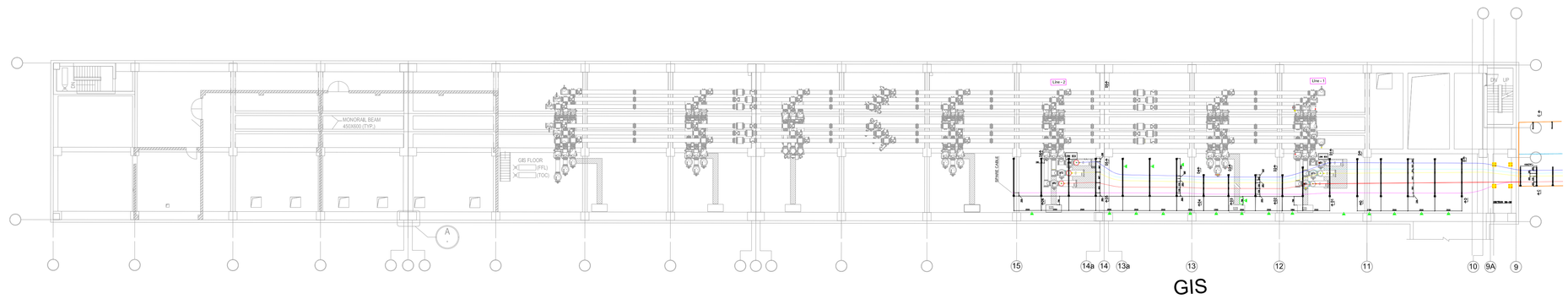
Document No.: - TB-382-316-36-33 REV-04 dated 17.10.2025

Sl. No.	BHEL/THDC Comment	Reply of Universal cables Ltd
1 (a)	In GIS hall, route of XLPE cable shall be reviewed and revised in line with comments received from OEM of GIS and shall be furnished to THDC for review.	**Noted and incorporated in the drawing.**
	Siemens Comments: Clearance for gas cart not sufficient. 1.5m space & 2.1m height recommended for supplied gas cart movement. 	**Noted and incorporated in the drawing.**
(b)	Siemens Comments: Need to ensure that the provided structures do not foul with the GIS support structures. 	**Noted and incorporated in the drawing.**

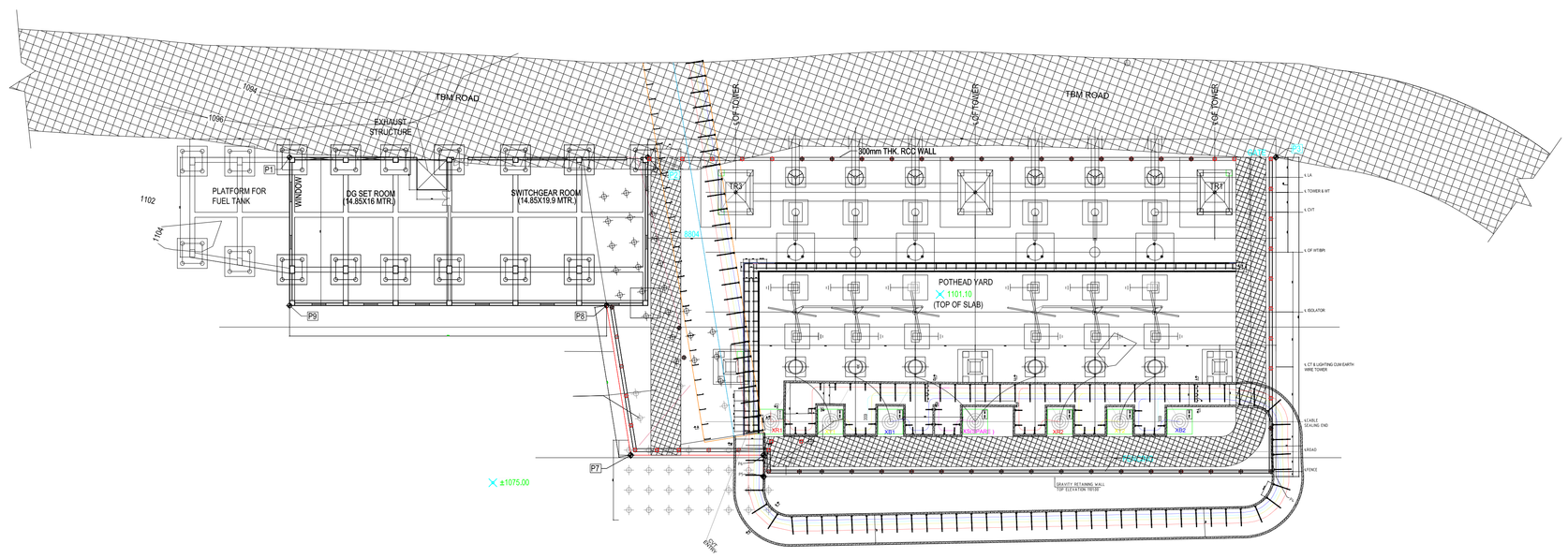
(c)	Siemens Comments: The cable passing in between the two GIB's might create a hindrance during maintenance of the GIB's in case of flashover. Hence not recommended. It is recommended to use proper cable screening based on the cable induction effect to avoid induction effect.  	**Noted and incorporated in the drawing.**
2	Correctness of route and length marked in this drawing is sole responsibility of BHEL	**Noted.**
3	In pothead yard area, cable loop shall be as per required bending radius and connections to CSE terminals shall be uniform.	**Noted.**
4	Refer Plan of GIS and Section D1/D1, D3/D3 & D/D, it is observed that space constraints at downstream side of GIS building. Space may be such any welding cart/ maintenance equipment and man movement during maintenance may be performed at downstream side near LCC panels. Please review.	**Noted and incorporated in the drawing. However, it may please be noted that due to space constraint due to double circuit of XLPE cable, provision could not be made for some restricted area.**
5	Refer Section B-B, suitable planning for access and cable handling in the culvert area during maintenance of the cables may be envisaged. Further, planning of firefighting, illumination, and ventilation in culvert area may be considered. Drawings may accordingly, be updated.	**Noted, it may be noted that in section B-B, only XLPE cables are passing. The other cables are passing through over hanging arrangement.**
6	Refer Section B-B, suitable planning for access and cable handling in the culvert area during maintenance of the cables may be envisaged. Further, planning of firefighting, illumination, and ventilation in culvert area may be considered. Drawings may accordingly, be updated.	**Noted, However, as per OEM recommendations and space constraint at that particular area, such requirements are not envisaged.**
7	The trench/ duct is open on both sides however, heat dissipation calculation and forced ventilation arrangement may be planned for maintenance personnel.	**Noted. The trench area is provisioned with precast covers, and in duct area, sufficient space is provisioned for man movement.**
8	Adequate firefighting and detection arrangement, illumination in trench may be considered.	**Noted, however, such requirements are not in scope.**
9	Proper drainage arrangement in complete trench and culvert/bund arrangement at CVT portal to divert the water from trench (normal drain water, storm water, cloud burst water), towards the river.	**Noted, however, it shall be the part of civil design as per site conditions. No specific recommendations from OEM.**
10	Please impose the structural details of XLPE cable in the plan of GIS where in GIS support structure plate mark	**Noted and incorporated.**

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No.



PLAN VIEW FOR GIS



PLAN VIEW FOR POTHEAD YARD

NOTES:
(1)ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE MENTIONED.
(2)THE ELEVATION LEVELS OF SWITCHYARD, GIS BUILDING ETC.SHALL BE AS PER ACTUAL REQUIREMENTS.
(3)STRUCTURAL DETAILS SHOWN ARE ONLY INDICATIVE, IT SHALL BE SUBJECT TO SIZING AND DETAILING, TO BE SUBMITTED IN SEPARATE DRAWING/ DOCUMENTS.

S. No.	REFRENCE DRG.	DESCRIPTION	DRAWING PROVIDED BY
1	TB-0-382-316-006 REV-02	OUTDOOR POTHEAD YARD TRENCH AND CABLE VENTILATION TUNNEL	BHEL
2	TB-382-316-35-02 REV-02	GIS LAYOUT, PLAN & SECTION & ISOMETRIC VIEW (OVERALL GIS)	BHEL
3	71.2754.10.001 REV-P2	POTHEAD YARD GENERAL ARRANGEMENT	BHEL
4	71.2754.10.302 REV-0	POTHEAD RETAINING WALL CONCRETE OUTLINE.	BHEL
5	3.76524-00 REV-0	GIS TERMINATION	UCL
6	3.75058-00 REV-0	OUTDOOR TERMINATION	UCL

REV.	DATE	ALTERED	T.K.	REV.	DATE	ALTERED	T.K.	REV.	DATE	ALTERED	T.K.	REV.	DATE	ALTERED	T.K.
04	17.10.25	CHECKED	V.K.	03	06.08.25	CHECKED	V.K.	02	30.07.25	CHECKED	V.K.	01	07.06.25	CHECKED	V.K.
		APPROVED	P.H.			APPROVED	P.H.			APPROVED	P.H.			APPROVED	P.H.
ZONE	REVISED AS PER CUSTOMER COMMENTS			ZONE	REVISED AS PER CUSTOMER COMMENTS			ZONE	REVISED AS PER CUSTOMER COMMENTS			ZONE	REVISED AS PER CUSTOMER COMMENTS		

ADDITIONAL INFORMATION

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

	NAME	SIGN	DATE	NO. OF VAR
DRN	T.K.	–sd–	17.10.2025	
CKD	V.K.	–sd–	17.10.2025	
APPD	P.H.	–sd–	17.10.2025	

SUB–SUPPLIER/VENDOR

UNIVERSAL CABLES LTD. NEW DELHI

PROJECT: 4X111MW VISHNUGAD PIPALKOTI H.E. PROJECT.

CUSTOMER: टीएचडीसी इंडिया लिमिटेड THDC INDIA LIMITED — THDC INDIA LTD. RISHIKESH, UTTARAKHAND.

CONTRACTOR: BHEL — BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP

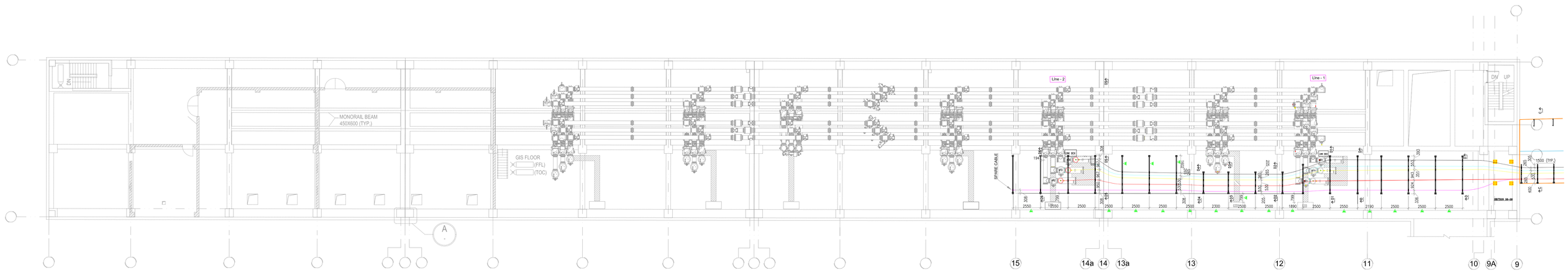
ISSUED BY DEPT TBEM
DEPT. CODE 316
UNTOL.DIMS. GR.
ANGLE
SCALE: NTS
WEIGHT (KG)
REF. TO ASSY. DRG.
ITEM NO.
NO. OF ITEM

TITLE:–
Dimensional and Layout Arrangement in Cable Tunnel/ Other Area for 400kV XLPE Cable System

DRAWING NO. TB–382–316–36–33
REV. 04
SHT. No.
NO. OF SHT. 01/05

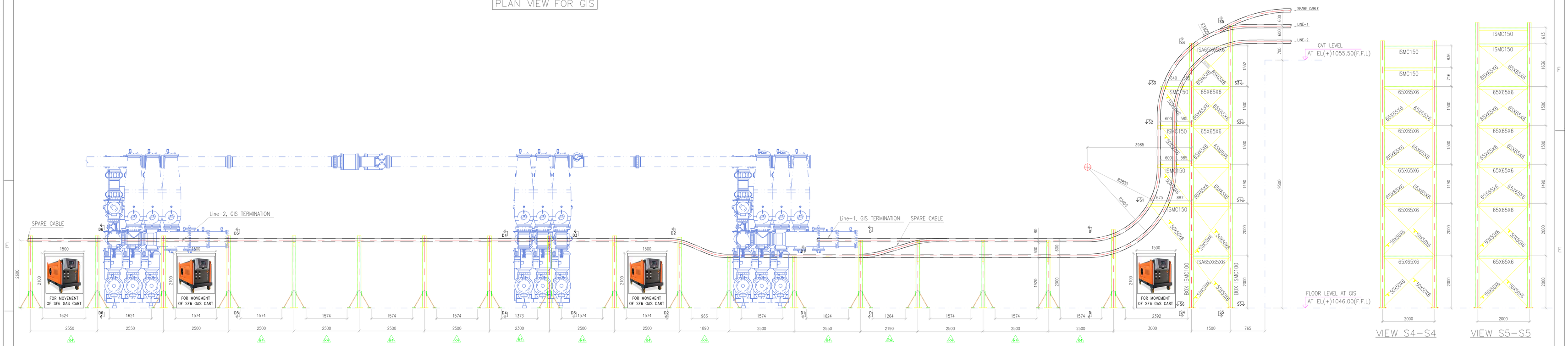
COMPUTER DRG. PATH NAME :
REF. DRG. No.
SIGN. & DATE
INVENTORY No.

DRAWING No.

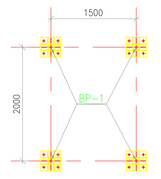


GIS

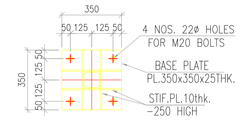
PLAN VIEW FOR GIS



ELEVATION VIEW AT GIS LOCATION



SECTION S6-S6



DETAIL OF BASE PL. MKD. BP1

FOR GIS AREA

Reference Drawing Provided by BHEI:-		
1	TB-0-382-316-006 REV-02	OUTDOOR POTHEAD YARD TRENCH AND CABLE VENTILATION TUNNEL
2	TB-382-316-35-02 REV-02	GIS LAYOUT, PLAN & SECTION & ISOMETRIC VIEW (OVERALL GIS)
3	71.2754.10.001 REV-P2	POTHEAD YARD GENERAL ARRANGEMENT
4	71.2754.10.302 REV-0	POTHEAD RETAINING WALL CONCRETE OUTLINE.

LEGEND:-

S. No.		DESCRIPTION	REFERENCE DRG.
1		CABLE CLAMP	DE-TBC22
2		400kV XLPE CABLE (Red,Yellow,Blue,Spare)	
3		300sqmm. Earth Continuity Cable.	

REV.	DATE	ALTERED	T.K.	REV.	DATE	ALTERED	T.K.	REV.	DATE	ALTERED	T.K.	REV.	DATE	ALTERED	T.K.
04	17.10.25	CHECKED	V.K.	03	25.09.25	CHECKED	V.K.	02	16.09.25	CHECKED	V.K.	01	21.08.25	CHECKED	V.K.
		APPROVED	P.H.			APPROVED	P.H.			APPROVED	P.H.			APPROVED	P.H.
ZONE	REVISED AS PER ROOD PLAN DWG.			ZONE	REVISED AS PER ROOD PLAN DWG.			ZONE	REVISED AS PER ROOD PLAN DWG.			ZONE	REVISED AS PER ROOD PLAN DWG.		

DISTRIBUTION OF PRINTS				
	NAME	SIGN	DATE	NO. OF VAR
DRN	T.K.	-sd-	06.08.2025	
CKD	V.K.	-sd-	06.08.2025	
APPD	P.H.	-sd-	06.08.2025	

SUB-SUPPLIER/VENDOR

UNIVERSAL CABLES LTD. NEW DELHI

MP BIRLA GROUP

ADDITIONAL INFORMATION

STATUS OF DRAWING

PROJECT: 4X111MW VISHNUGAD PIPALKOTI H.E. PROJECT.

CUSTOMER: टीएचडीसी इंडिया लिमिटेड THDC INDIA LIMITED — THDC INDIA LTD. RISHIKESH, UTTARAKHAND.

CONTRACTOR: BHEL — BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP

ISSUED BY	UNTOL.DIMS. GR.	ANGLE	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEM
DEPT TBEM			NTS				
DEPT. CODE 316							

TITLE:-

Dimensional and Layout Arrangement in Cable Tunnel / Other Area for 400kV XLPE Cable System.

DRAWING NO. TB-382-316-36-33 REV. 04

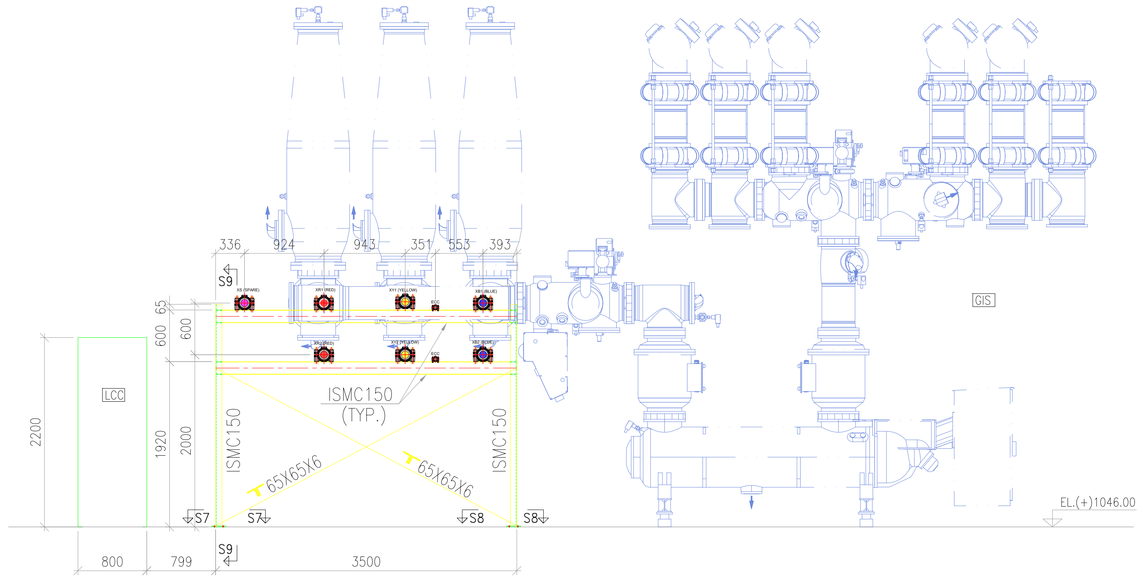
SHT. No. NO. OF SHT. 02/05

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

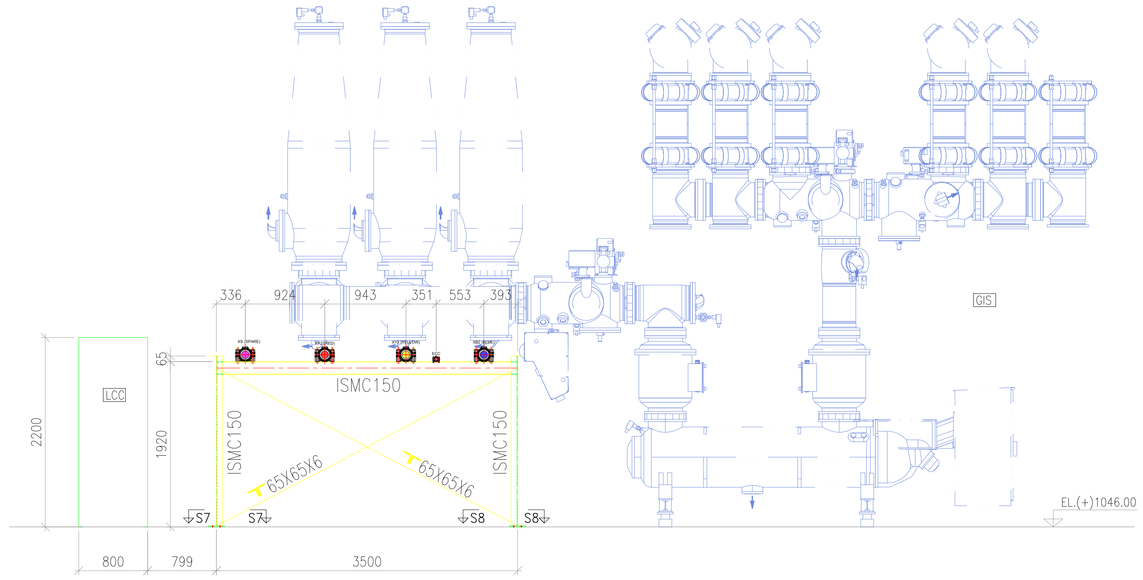
FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No.

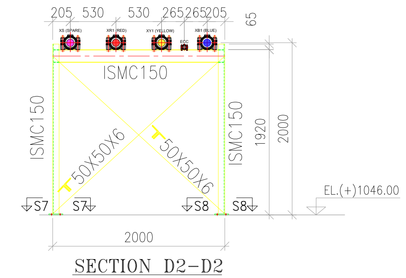
COMPUTER DRG. PATH NAME :



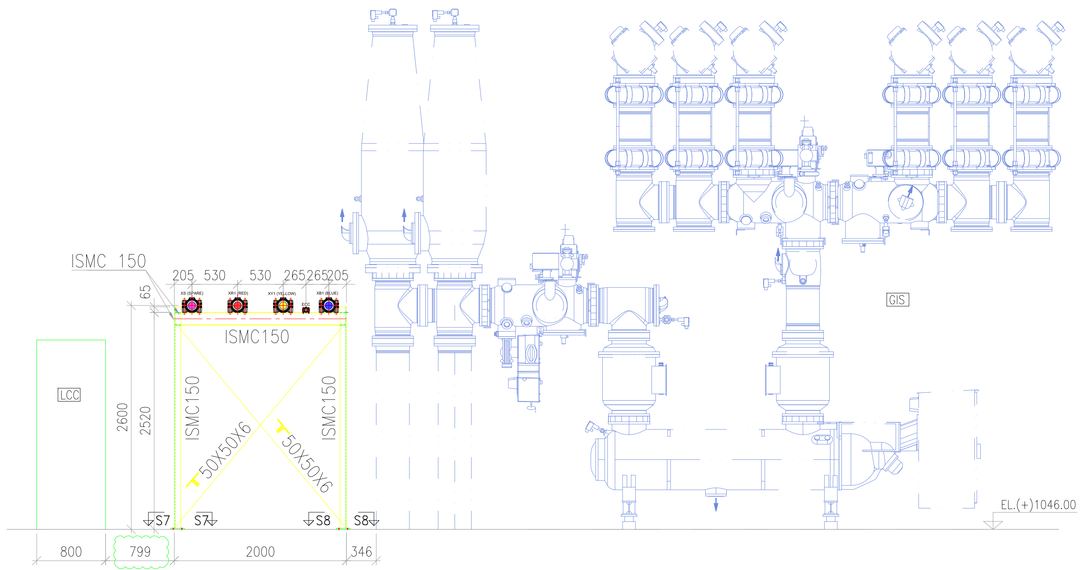
SECTION D-D
(CABLE SECTION AT GIS FLOOR)



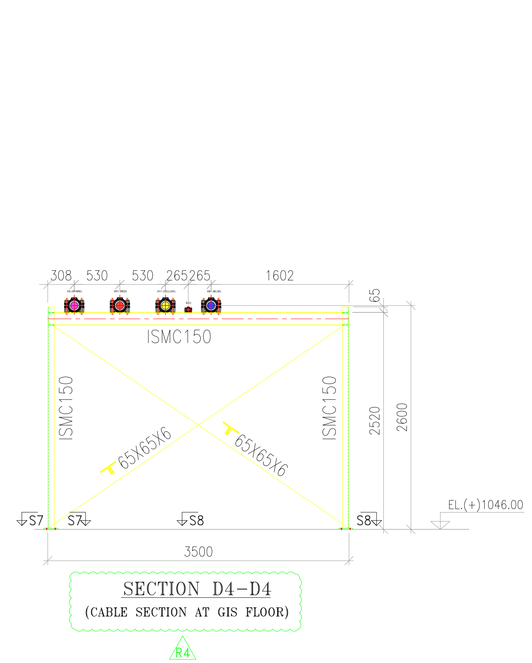
SECTION D1-D1
(CABLE SECTION AT GIS FLOOR)



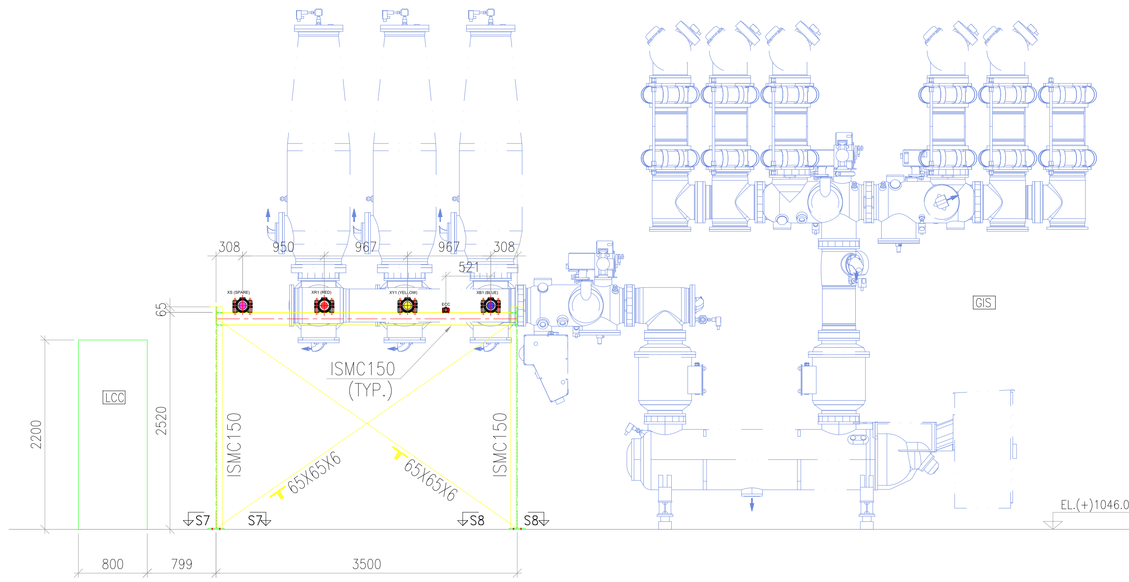
SECTION D2-D2
(CABLE SECTION AT GIS FLOOR)



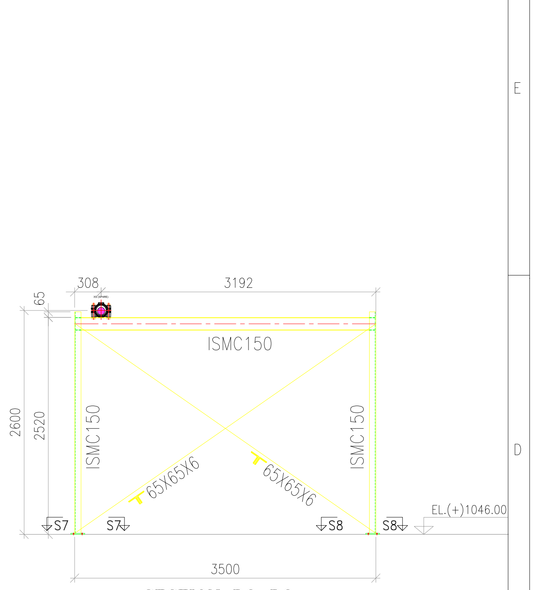
SECTION D3-D3
(CABLE SECTION AT GIS FLOOR)



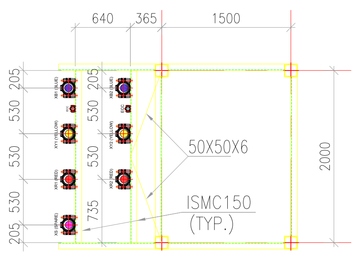
SECTION D4-D4
(CABLE SECTION AT GIS FLOOR)



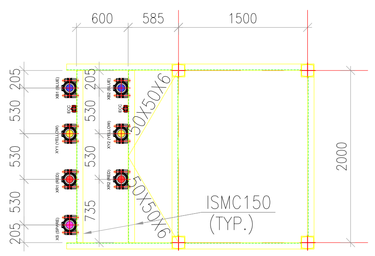
SECTION D5-D5
(CABLE SECTION AT GIS FLOOR)



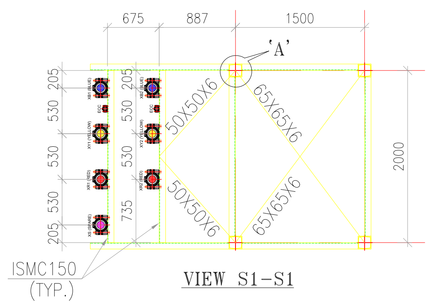
SECTION D6-D6
(CABLE SECTION AT GIS FLOOR)



VIEW S3-S3



VIEW S2-S2



VIEW S1-S1

FOR GIS AREA

Reference Drawing Provided by BHEL:-		
1	TB-0-382-316-006 REV-02	OUTDOOR POTHEAD YARD TRENCH AND CABLE VENTILATION TUNNEL
2	TB-382-316-35-02 REV-02	ISOMETRIC VIEW (OVERALL GIS)
3	71.2754.10.001 REV-P2	POTHEAD YARD GENERAL ARRANGEMENT
4	71.2754.10.302 REV-0	POTHEAD RETAINING WALL CONCRETE OUTLINE.

REV.	DATE	ALTERED	T.K.	REV.	DATE	ALTERED	T.K.	REV.	DATE	ALTERED	T.K.	REV.	DATE	ALTERED	T.K.
04	17.10.25	CHECKED	V.K.	03	25.09.25	CHECKED	V.K.	02	16.09.25	CHECKED	V.K.	01	21.08.25	CHECKED	V.K.
		APPROVED	P.H.			APPROVED	P.H.			APPROVED	P.H.			APPROVED	P.H.
ZONE	REVISED AS PER CUSTOMER COMMENTS			ZONE	REVISED AS PER CUSTOMER COMMENTS			ZONE	REVISED AS PER CUSTOMER COMMENTS			ZONE	REVISED AS PER CUSTOMER COMMENTS		

ADDITIONAL INFORMATION

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

	NAME	SIGN	DATE	NO. OF VAR
DRN	T.K.	-sd-	06.08.2025	
CKD	V.K.	-sd-	06.08.2025	
APPD	P.H.	-sd-	06.08.2025	

SUB-SUPPLIER/VENDOR

UNIVERSAL CABLES LTD. NEW DELHI

MP BIRLA GROUP

PROJECT: 4X111MW VISHNUGAD PIPALKOTI H.E. PROJECT.

CUSTOMER: टीएचडीसी इंडिया लिमिटेड THDC INDIA LIMITED — THDC INDIA LTD. RISHIKESH, UTTARAKHAND.

CONTRACTOR: भारत हेवी इलैक्ट्रिकल्स BHEL — BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP

ISSUED BY DEPT	UNTOL.DIMS. GR.	ANGLE	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEM
TBEM			NTS				

DEPT. CODE 316

TITLE:-

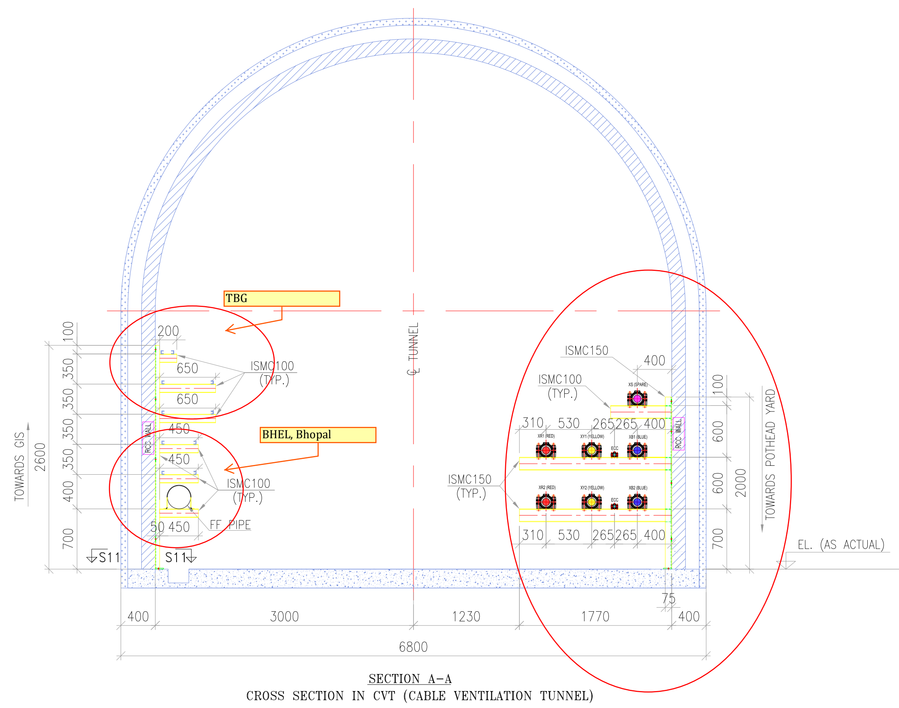
Dimensional and Layout Arrangement in Cable Tunnel / Other Area for 400kV XLPE Cable System.

DRAWING NO. TB-382-316-36-33 REV. 04

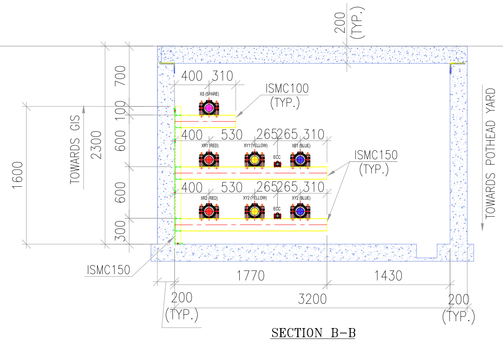
SHT. No. NO. OF SHT. 03/05

REF. DRG. No. | SIGN. & DATE | INVENTORY No.

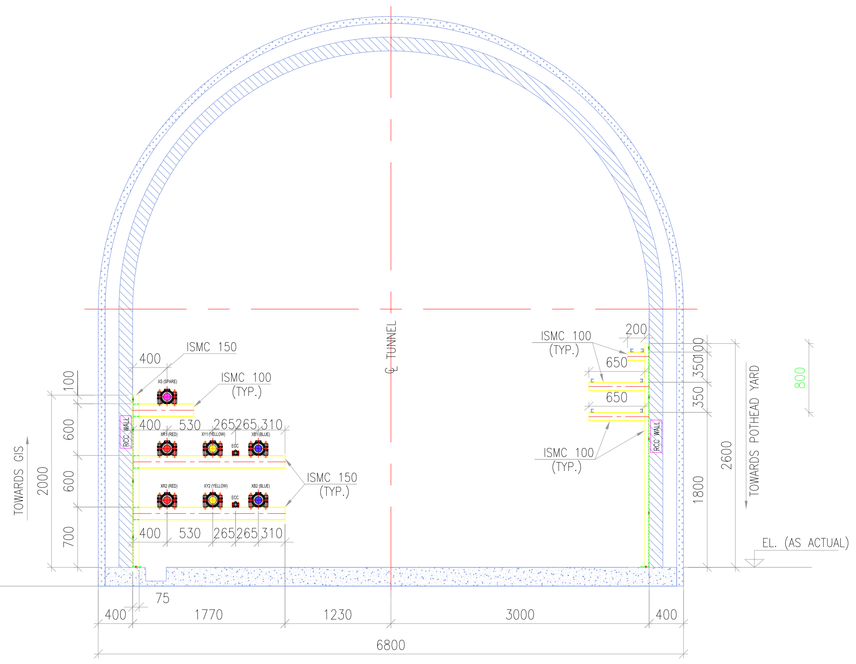
DRAWING No.



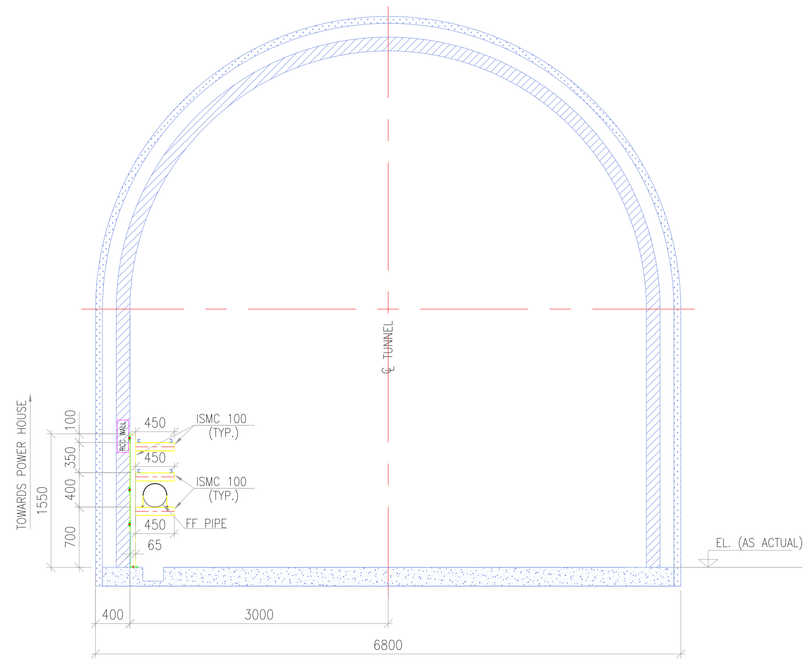
SECTION A–A
CROSS SECTION IN CVT (CABLE VENTILATION TUNNEL)



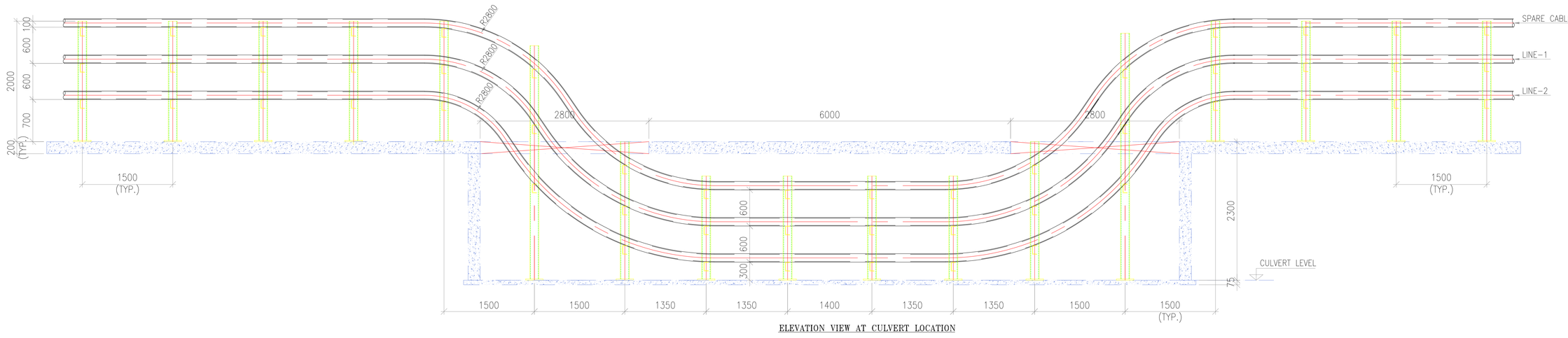
SECTION B–B
CABLE ARRANGEMENT IN CULVERT/CABLE TRENCH AT TRI–JUNCTION POINT IN CVT



SECTION C–C
CABLE ARRANGEMENT AFTER CROSSING CULVERT/ CABLE TRENCH AT TRI–JUNCTION POINT IN CVT



SECTION C1–C1



ELEVATION VIEW AT CULVERT LOCATION

FOR CVT AREA

LEGEND:–

S. No.		DESCRIPTION	REFERENCE DRG.
1		CABLE CLAMP	DE–TBC22
2		400kV XLPE CABLE (Red,Yellow,Blue,Spare)	
3		300sqmm. Earth Continuity Cable.	

Reference Drawing Provided by BHEL:–

1	TB–0–382–316–006 REV–02	OUTDOOR POTHEAD YARD TRENCH AND CABLE VENTILATION TUNNEL
2	TB–382–316–35–02 REV–02	ISOMETRIC VIEW (OVERALL GIS)
3	71.2754.10.001 REV–P2	POTHEAD YARD GENERAL ARRANGEMENT
4	71.2754.10.302 REV–0	POTHEAD RETAINING WALL CONCRETE OUTLINE.

REV.	DATE	ALTERED	T.K.	REV.	DATE	ALTERED	T.K.	REV.	DATE	ALTERED	T.K.
03	25.09.25	CHECKED	V.K.	02	16.09.25	CHECKED	V.K.	01	21.08.25	CHECKED	V.K.
		APPROVED	P.H.			APPROVED	P.H.			APPROVED	P.H.
ZONE	REVISED AS PER CUSTOMER COMMENTS			ZONE	REVISED AS PER CUSTOMER COMMENTS			ZONE	REVISED AS PER CUSTOMER COMMENTS		

DISTRIBUTION OF PRINTS

	NAME	SIGN	DATE	NO. OF VAR
DRN	T.K.	–sd–	06.08.2025	
CKD	V.K.	–sd–	06.08.2025	
APPD	P.H.	–sd–	06.08.2025	

SUB–SUPPLIER/VENDOR

UNIVERSAL CABLES LTD. NEW DELHI

MP BIRLA GROUP

ADDITIONAL INFORMATION

STATUS OF DRAWING

PROJECT: 4X111MW VISHNUGAD PIPALKOTI H.E. PROJECT.

CUSTOMER: टीएचडीसी इंडिया लिमिटेड THDC INDIA LIMITED — THDC INDIA LTD. RISHIKESH, UTTARAKHAND.

CONTRACTOR: BHEL — BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP

ISSUED BY DEPT TBEM	UNTOL.DIMS. GR.	ANGLE	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEM
DEPT. CODE 316			NTS				

TITLE:–
Dimensional and Layout Arrangement in Cable Tunnel / Other Area for 400kV XLPE Cable System.

DRAWING NO. TB–382–316–36–33 REV. 03

SHT. No. NO. OF SHT. 04/05

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

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

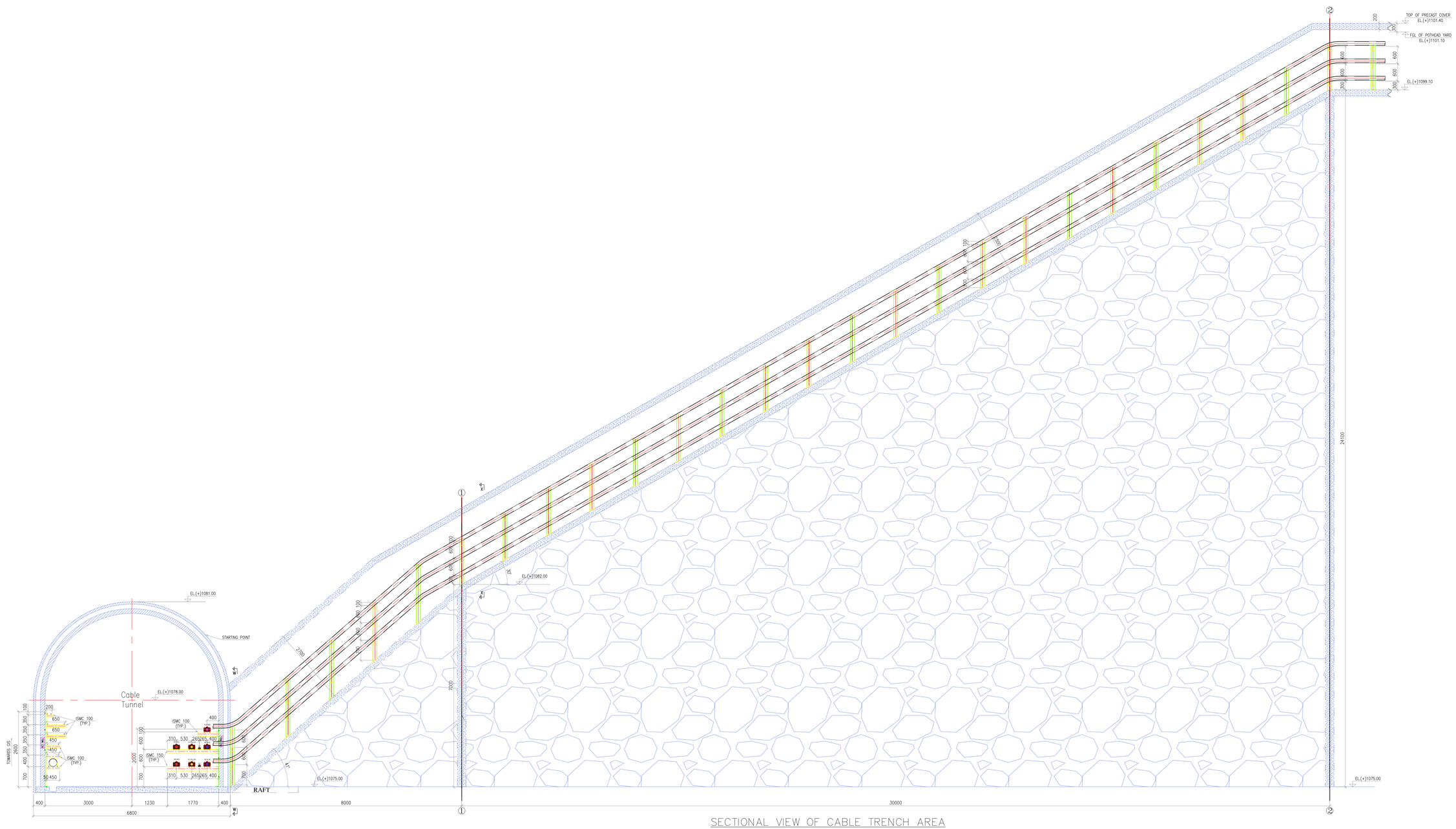
DRAWING No.

COMPUTER DRG. PATH NAME :

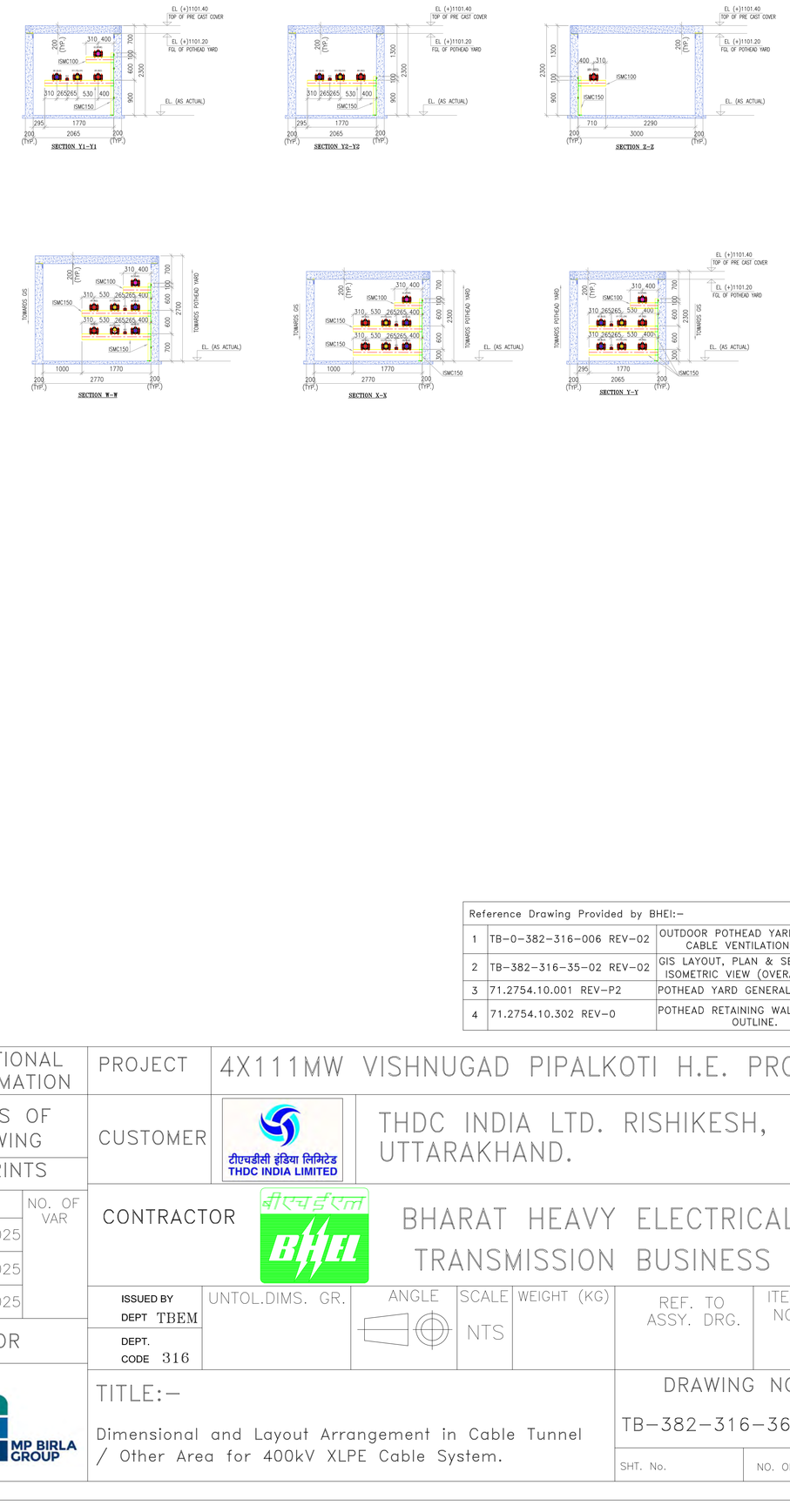
REF. DRG. No.

SIGN. & DATE

INVENTORY No.



SECTIONAL VIEW OF CABLE TRENCH AREA TOWARDS POTHEAD YARD



FOR POTHEAD YARD AREA

LEGEND:-

S. No.		DESCRIPTION	REFERENCE DRG.
1		CABLE CLAMP	DE-TBC22
2		400kV XLPE CABLE (Red,Yellow,Blue,Spare)	
3		300sqmm. Earth Continuity Cable.	

REV.	DATE	ALTERED	T.K.	REV.	DATE	ALTERED	T.K.	REV.	DATE	ALTERED	T.K.
03	25.09.25	CHECKED	V.K.	02	16.09.25	CHECKED	V.K.	01	21.08.25	CHECKED	V.K.
		APPROVED	P.H.			APPROVED	P.H.			APPROVED	P.H.
ZONE	REVISED AS PER ROOD PLAN DWG.			ZONE	REVISED AS PER ROOD PLAN DWG.			ZONE	REVISED AS PER ROOD PLAN DWG.		

Reference Drawing Provided by BHEI:-		
1	TB-0-382-316-006 REV-02	OUTDOOR POTHEAD YARD TRENCH AND CABLE VENTILATION TUNNEL
2	TB-382-316-35-02 REV-02	GIS LAYOUT, PLAN & SECTION & ISOMETRIC VIEW (OVERALL GIS)
3	71.2754.10.001 REV-P2	POTHEAD YARD GENERAL ARRANGEMENT
4	71.2754.10.302 REV-0	POTHEAD RETAINING WALL CONCRETE OUTLINE.

ADDITIONAL INFORMATION

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

	NAME	SIGN	DATE	NO. OF VAR
DRN	T.K.	-sd-	30.07.2025	
CKD	V.K.	-sd-	30.07.2025	
APPD	P.H.	-sd-	30.07.2025	

SUB-SUPPLIER/VENDOR

UNIVERSAL CABLES LTD. NEW DELHI

MP BIRLA GROUP

PROJECT: 4X111MW VISHNUGAD PIPALKOTI H.E. PROJECT.

CUSTOMER: टीएचडीसी इंडिया लिमिटेड THDC INDIA LIMITED — THDC INDIA LTD. RISHIKESH, UTTARAKHAND.

CONTRACTOR: भारत हेवी इलैक्ट्रिकल्स BHEL — BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP

ISSUED BY DEPT	UNTOL.DIMS. GR.	ANGLE	SCALE	WEIGHT (KG)	REF. TO ASSY. DRG.	ITEM NO.	NO. OF ITEM
TBEM			NTS				

DEPT. CODE 316

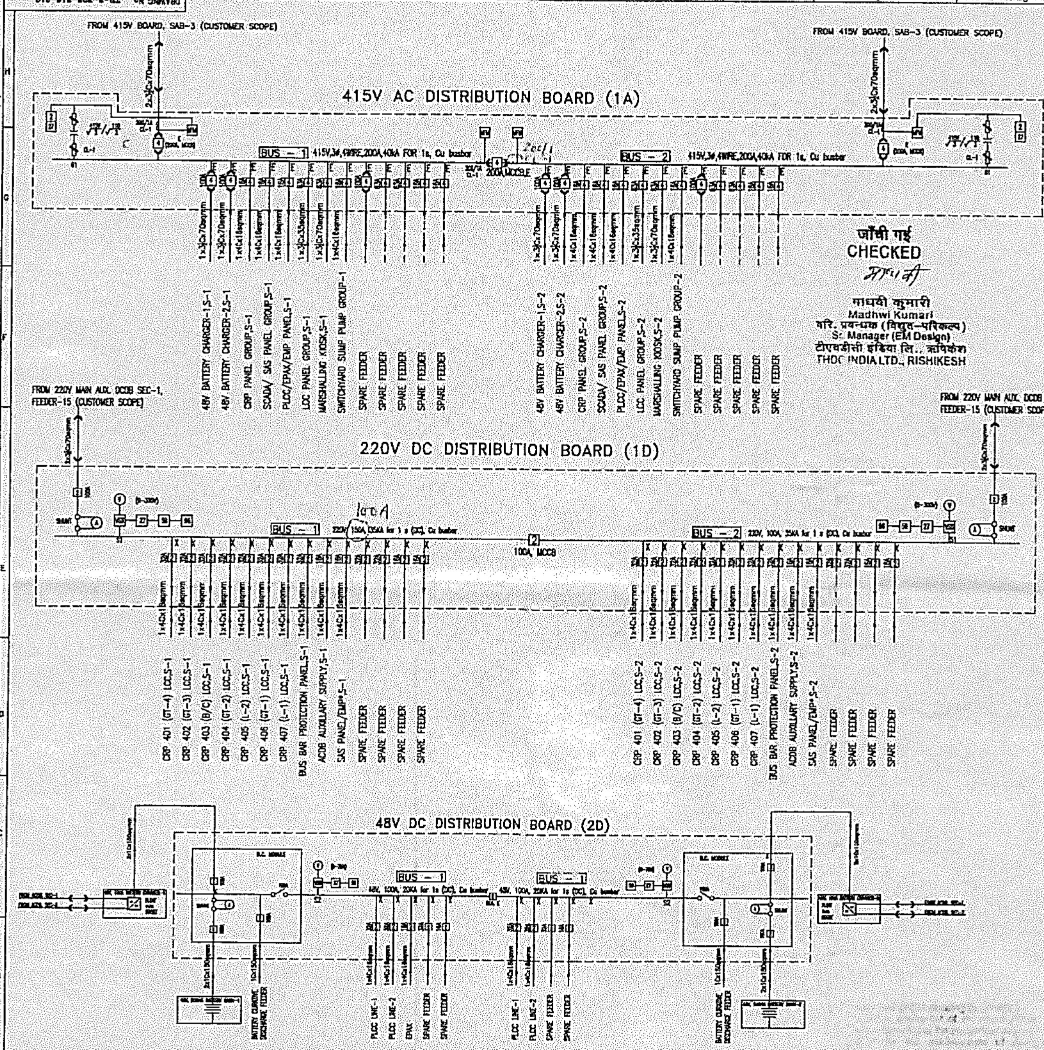
TITLE:-

Dimensional and Layout Arrangement in Cable Tunnel / Other Area for 400kV XLPE Cable System.

DRAWING NO. TB-382-316-36-33 REV. 03

SHT. No. NO. OF SHT. 05/05

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)



जाँची गई
CHECKED
माधवी कुमारी
Madhwi Kumari
वरि. प्रबन्धक (विद्युत–परिकल्प)
Sr. Manager (EM Design)
टीएचडीसी इंडिया लि., ऋषिकेश
THDC INDIA LTD., RISHIKESH

संस्तुत
RECOMMENDED
शैलेन्द्र सिंह पंवार
Shailendra Singh Panwar
उप महाप्रबन्धक (विद्युत परिकल्प)
Dy. General Manager (EM Design)
टीएचडीसी इंडिया लिमिटेड, ऋषिकेश
THDC INDIA LTD., RISHIKESH

यथा टिप्पणी अनुमोदित
APPROVED AS NOTED
03/01/2024
ए.के. घिल्डियाल
A.K. Ghildiyal
उप महाप्रबन्धक (विद्युत–परिकल्प)
DGM (EM-Design)
टीएचडीसी इंडिया लिमिटेड, ऋषिकेश
THDC India Limited, Rishikesh

NOTES:-

1. NO TWO AC SOURCE SHALL BE PARALLELED AT ANY STAGE.
2. CABLE SIZES SHOWN ARE TENTATIVE AND SHALL BE AS PER AUX. CABLE SIZING, IF REQUIRED.
3. INCOMING & OUTGOINGS CABLES SHALL HAVE BOTTOM ENTRY.
4. ALL THE FEEDERS SHOWN IN THE SLD INCLUDING SPARE AND OTHER ACCESSORIES ARE IN SCOPE OF SUPPLY.
5. ALL DIGITAL/ANALOG INPUTS/OUTPUTS REQUIRED FOR SAS/ SCADA SHALL BE CONSIDERED AND ACCORDINGLY, TRANSDUCERS/ AUX. CONTACTS REQUIRED FOR ANALOG AND DIGITAL INPUTS/ OUTPUT SHALL BE AN INTEGRAL PART OF INDIVIDUAL PANELS.
6. EACH MCCB SHALL BE PROVIDED WITH MINIMUM 1NO+1NC AUXILIARY CONTACT AND 1NO CONTACT FOR TRIPPING INDICATION/ALARM.
7. GLAND PLATE SHALL BE OF NON MAGNETIC WHEREVER SINGLE CORE POWER CABLE ARE USED.
8. SWITCHBOARDS SHALL BE CONTINUOUSLY RATED & DESIGNED FOR OPERATION AT AN AMBIENT TEMPERATURE OF 50 DEG C.
9. ELECTRICAL INTERLOCKING SHALL BE PROVIDED FOR INCOMER AND BUS COUPLER OF 415V ACDB, 220V DCDB, 48V DCDB.
10. SWITCBOARD SHALL BE SUITABLE FOR IP-41.
11. ON/OFF INDICATION SHALL BE PROVIDED IN SWITCHBAORD.
12. ALL OUTGOING FEEDERS SHALL HAVE CLOSE, OPEN & TRIP INDICATION.
13. SPARE FEEDERS HAVE BEEN PROVIDED AS PER CONTRACT SPECIFICATION.

LEGENDS:-

- 2P MCCB WITH ADJUSTABLE MAGNETIC SHORT CKT. O/C AND INS. TRIP
- 4-POLE MCCB WITH O/L & E/F PROTECTION, FIXED TYPE
- 4-POLE MCCB WITH O/L & E/F PROTECTION, DRAW OUT TYPE
- NON DRAW OUT AIR BREAK SWITCH
- CONTROL FUSE
- BATTERY LINKS/FUSES
- TIMER
- 2 : TIME DELAY PICKUP RELAY
- 27 : DC INSTANTANEOUS UNDER VOLTAGE RELAY
- 59 : DC INSTANTANEOUS OVER VOLTAGE RELAY
- 98 : EARTH LEAKAGE RELAY

SCHEDULE OF EQUIPMENT:-

SL.NO.	DESCRIPTION	UNIT	QTY.	LOCATION
1.	415V, 200A AC DISTRIBUTION BOARD	SET	01	GIS BUILDING
2.	220V, 100A DC DISTRIBUTION BOARD	SET	01	GIS BUILDING
3.	48V, 100A DC DISTRIBUTION BOARD	SET	01	GIS BUILDING
4.	48V, 100A FLOAT cum BOOST BATTERY CHARGER	SET	02	GIS BUILDING
5.	48V, 500AH BATTERY BANK	SET	02	GIS BUILDING
6.	48V, BATTERY MCCB BOX	SET	02	BATTERY ROOM

REV.	DATE	ALTERED BY	CHECKED	APPROVED	ZONE
02	28.12.23		DKS	VK	AS PER CUSTOMER COMMENTS VIDE EMAIL DTD. 28.12.23.
01	09.11.23		DKS	VK	AS PER CUSTOMER COMMENTS DTD. 09.11.23.

	NAME	SIGN	DATE
DRN BY		-sd-	01.11.23
CKD	DKS	-sd-	01.11.23
APPD	VK	-sd-	01.11.23

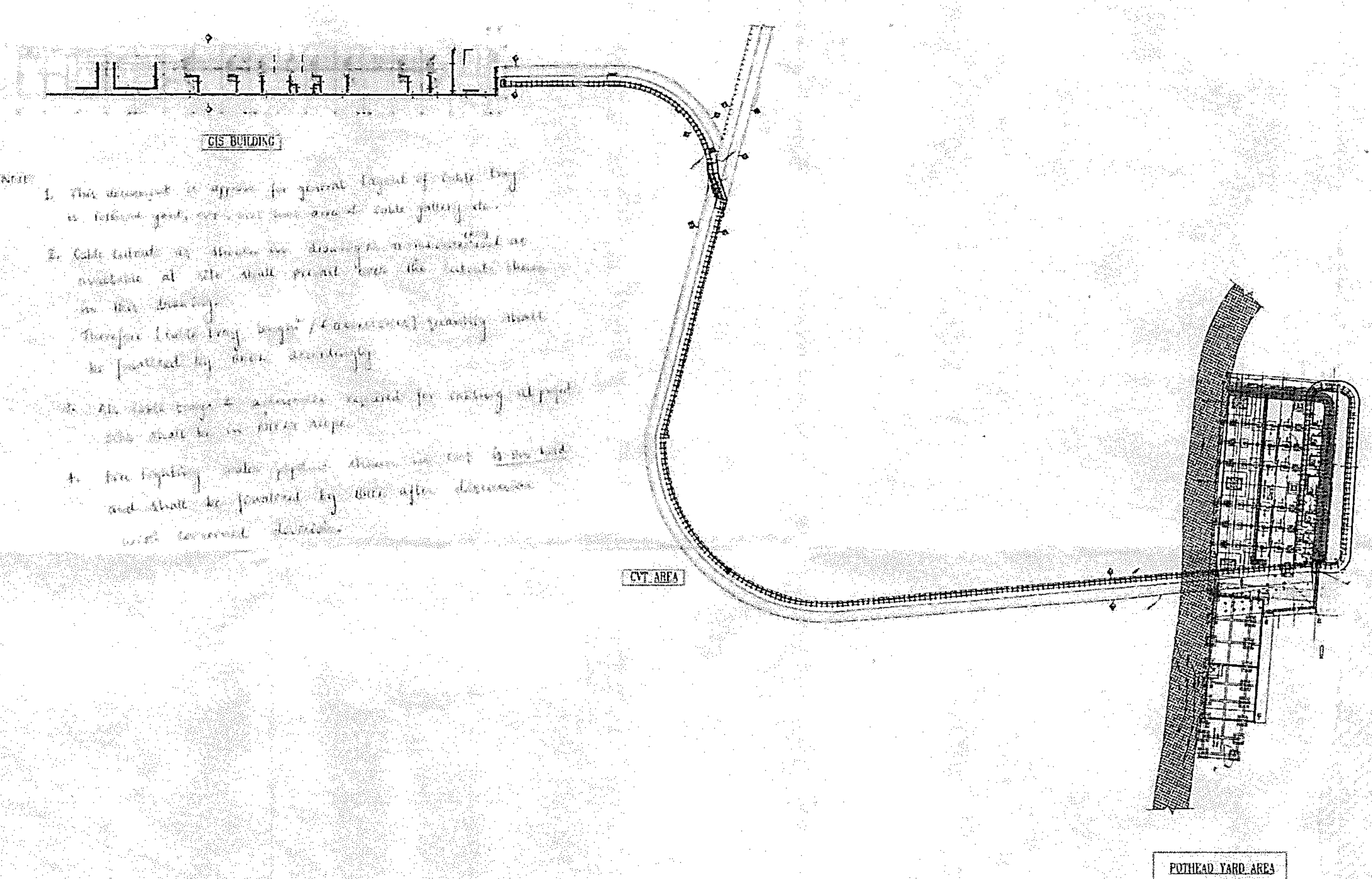
PROJECT: 4X111MW VISHNUGAD PIPALKOTI H.E. PROJECT
CUSTOMER: THDC INDIA LTD.
CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP
SCALE: NTS
TITLE: SINGLE LINE DIAGRAM OF LT AC AND DC SYSTEM
DRAWING NO. TB-3-382-510-004 REV. 02
SH. No. 01 NO. OF SHS. 01

DRAWING No. TB-3-382-510-004

NOTE: This drawing is approved in line with the replies received vide BHEL's Transmittal No. TBEM/VISHNUGAD/PIPALKOTI/THDC/DWG Pothead Yard/35 dated 28.12.2023.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No. TB-0-382-316-006



NOTE:

1. This drawing is approx for general layout of cable tray & trench [illegible] area & cable gallery etc.
2. Cable [illegible] as shown in drawing [illegible] as available at site shall [illegible] the [illegible] shown in this drawing. Therefore [illegible] cable tray [illegible] / accessories quantity shall be finalised by [illegible] accordingly.
3. All cable trays & accessories required for [illegible] site shall be in [illegible] scope.
4. Fire fighting [illegible] shown [illegible] and shall be finalised by [illegible] after discussion with [illegible].

जाँची गई
CHECKED

संस्तुत
RECOMMENDED

यथा टिप्पणी अनुमोदित
APPROVED AS NOTED

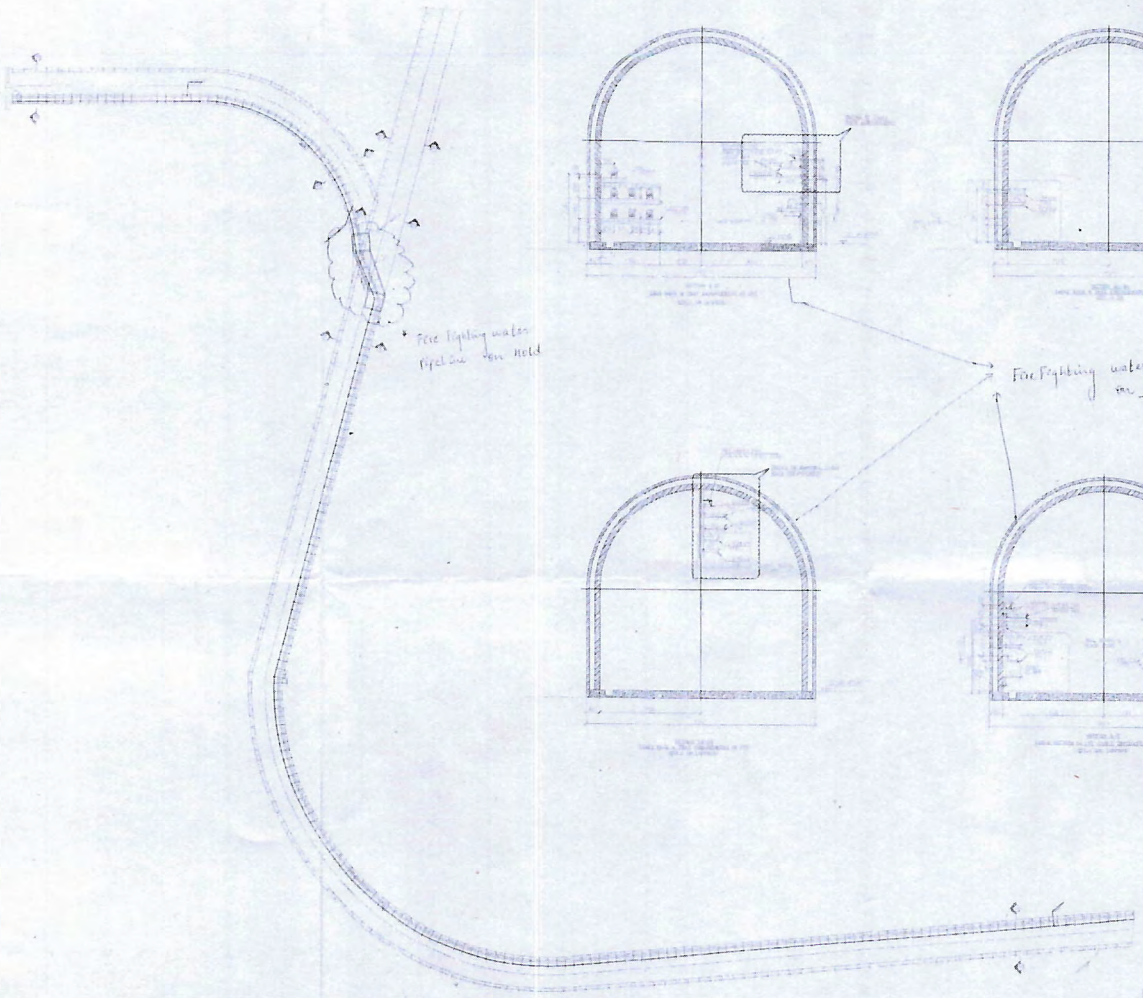
ADDITIONAL INFORMATION & C.Nos.	प्राहक/परियोजना का नाम
STATUS OF DRAWING	THDC INDIA LTD. 4X111MW VISHNUGAD PIPALKOTI H.E.PROJECT
DISTRIBUTION OF PRINTS	भारत हैवी इलेक्ट्रिकल्स लिमिटेड पारेषण व्यापार समूह BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION BUSINESS GROUP
	अनुपात / SCALE; CARD CODE; DEPT. TBEM; CODE 382
	शीर्षक/TITLE: CABLE RACK TRAY & TRENCH LAYOUT FOR GIS CVT & POTHEAD YARD AREA.
	ड्रॉइंग सं./DRAWING NO. TB-0-382-316-006; REV. 02

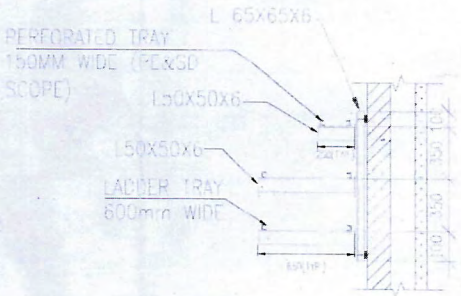
AO SIZE

COMPUTER DRG. PATH NAME

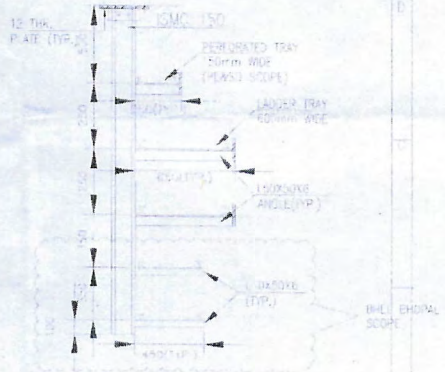
SIGN. & DATE | REF. DRG. No. | INVENTORY No.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)





DETAIL OF CABLE RACK ARRANGEMENT AFTER CROSSING CULVERT



DETAIL OF HANGING CABLE RACK ARRANGEMENT OVER CROSSING CULVERT

CVT AREA

THDC INDIA LTD.
4X111MW VISHNUGAD PIPALKOTI H.E PROJECT

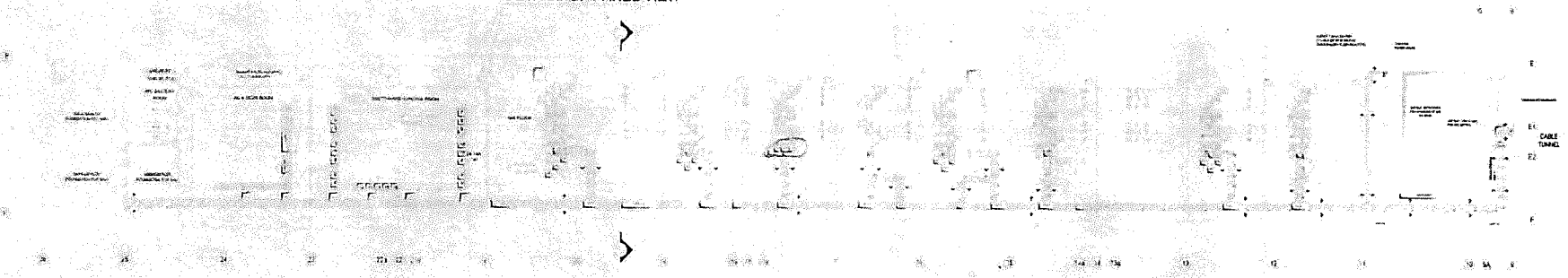
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

CABLE RACK TRAY & TRENCH LAYOUT FOR GIS CVT & POTHEAD YARD AREA

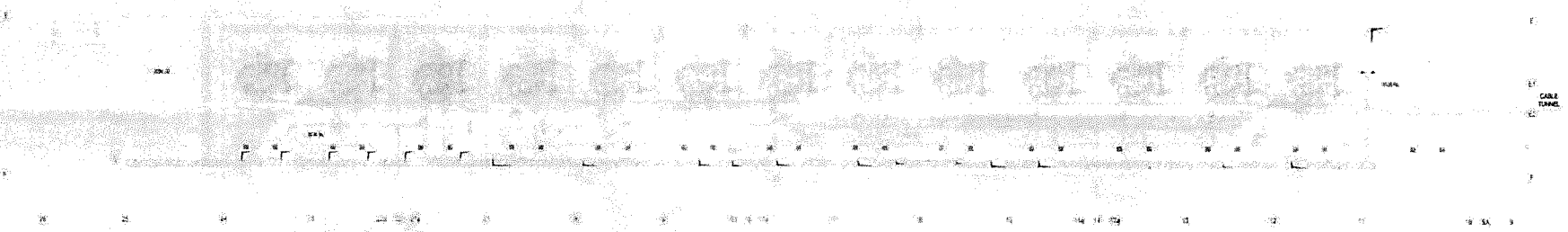
78-0-382-316-006 02

A0 SIZE

DETAILS OF PANEL VIEW

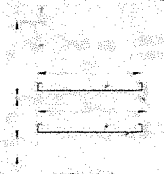


PLAN AT EL 1046.00



PLAN AT EL 1043.50

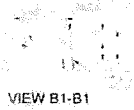
NOTE:-
VIEW "B-B" SHOWN IN THE DRAWING NO. TS-0-382-316-006 (SHEET 03 OF 04)



VIEW A-A
HANGING RACK DETAILS
QTY. = 41+5 (APPROX)

VIEW C-C
HANGING RACK CABLE GALLERY
DETAILS
QTY. = 10+2 (APPROX)

VIEW C1-C1
HANGING RACK CABLE GALLERY
DETAILS
QTY. = 05+01 (APPROX)



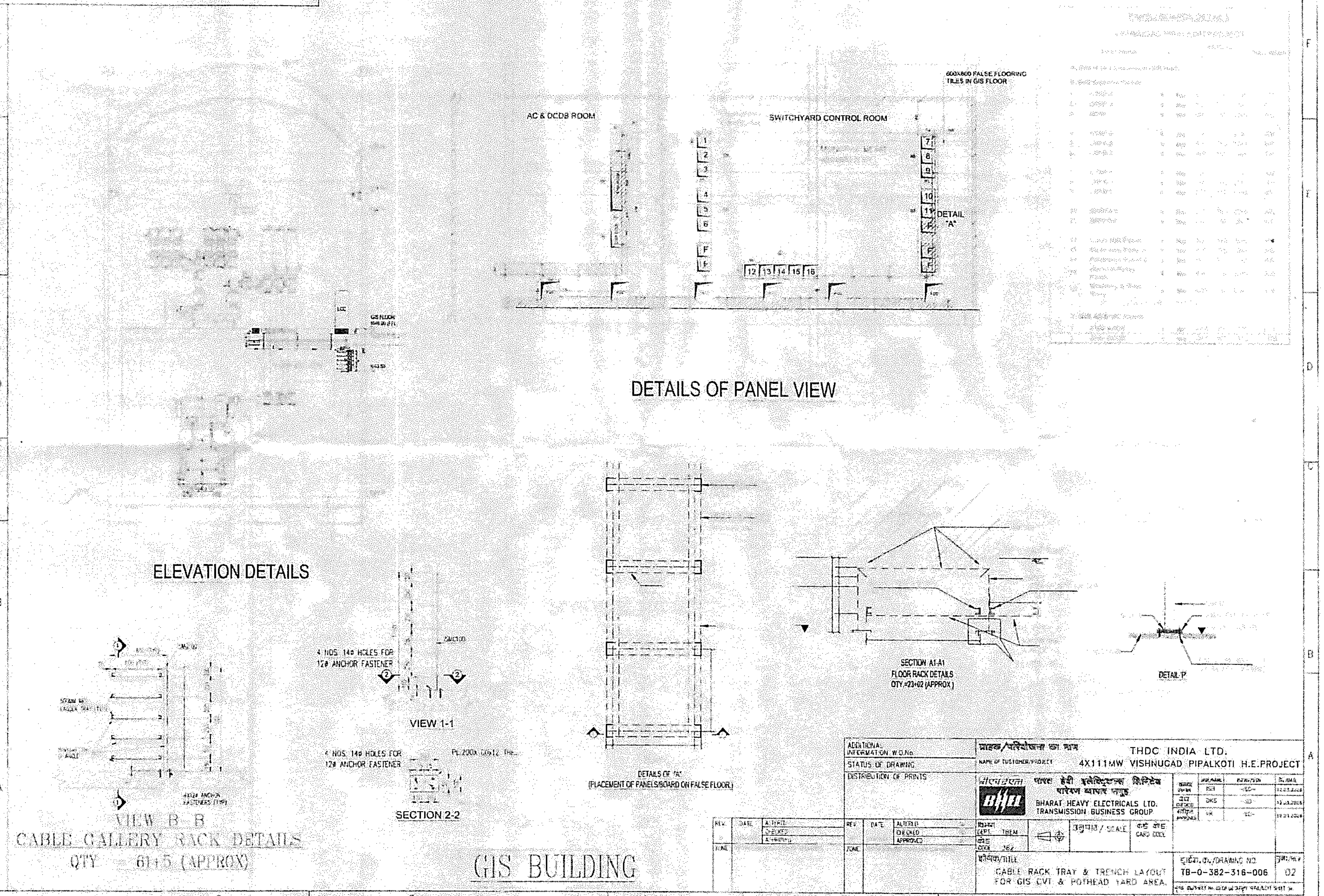
VIEW B1-B1
CABLE GALLERY RACK DETAILS
QTY. = 05+01 (APPROX)

VIEW B2-B2
CABLE GALLERY DOWN RACK
DETAILS
QTY. = 04+01 (APPROX)

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING No. TB-0-382-316-006

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


DETAILS OF PANEL VIEW
AC & DCDB ROOM
SWITCHYARD CONTROL ROOM
600X800 FALSE FLOORING TILES IN GIS FLOOR
DETAIL "A"
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
ELEVATION DETAILS
4 NOS. 14Ø HOLES FOR 12Ø ANCHOR FASTENER
VIEW 1-1
SECTION 2-2
VIEW B-B
CABLE GALLERY RACK DETAILS
QTY = 61+5 (APPROX)
DETAILS OF 'A'
(PLACEMENT OF PANELS/BOARD ON FALSE FLOOR)
SECTION A1-A1
FLOOR RACK DETAILS
QTY.=23+02 (APPROX.)
DETAIL 'P'
GIS BUILDING

ग्राहक/परियोजना का नाम	THDC INDIA LTD.
NAME OF CUSTOMER/PROJECT	4X111MW VISHNUGAD PIPALKOTI H.E.PROJECT

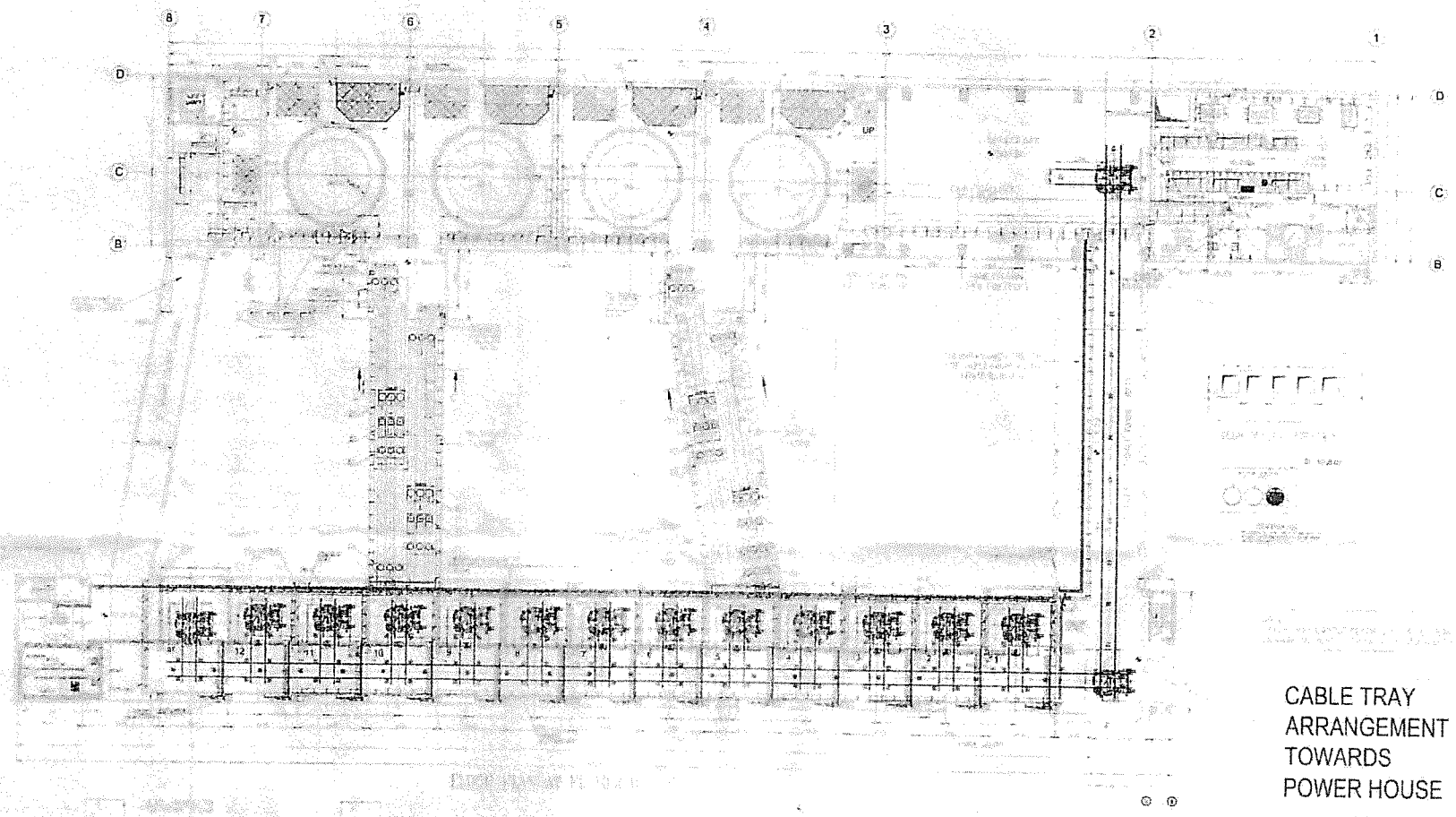
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
पारेषण व्यापार समूह
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION BUSINESS GROUP

ADDITIONAL INFORMATION W.O.No.
STATUS OF DRAWING
DISTRIBUTION OF PRINTS

शीर्षक/TITLE
CABLE RACK TRAY & TRENCH LAYOUT FOR GIS CVT & POTHEAD YARD AREA.

ड्राइंग सं./DRAWING NO. TB-0-382-316-006
REV. 02

AO SIZE



CABLE TRAY
ARRANGEMENT
TOWARDS
POWER HOUSE

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRAWING NO. TB-0-382-316-006

REFER BHEL BHOPAL
DRAWING NO: PHPL/2025/84.01
(2X1010KVA SDG SET ROOM
LAYOUT PLAN & SECTION
ELEVATION DRAWING-
POTHEAD YARD)

FIRST FLOOR PLAN

ELEVATION

POTHEAD YARD AREA

FRONT VIEW OF BMK

PLAN OF BMK

FGL.

COMPUTER DRG. PATH NAME :

INVENTORY No. | SIGN. & DATE | REF. DRG. No.

ADDITIONAL INFORMATION W.O.No.	
STATUS OF DRAWING	
DISTRIBUTION OF PRINTS	

ग्राहक/परियोजना का नाम / NAME OF CUSTOMER/PROJECT: THDC INDIA LTD. 4X111MW VISHNUGAD PIPALKOTI H.E.PROJECT

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

REV.	DATE	ALTERED / DRAWN / APPROVED

ZONE:

DESIGN			
DEPT.	SEM		
CHKD.			
CODE	TB2		

SCALE: NTS | SHEET SIZE: A0 | YARD CODE:

शीर्षक/TITLE: CABLE RACK TRAY & TRENCH LAYOUT FOR GIS CVT & POTHEAD YARD AREA.

सिस्टम डी. DRAWING NO: TB-0-382-316-006 | REV. NO: 02

A0 SIZE

SIEMENS energy

I&C Commissioning Tools_V13.0

No Sr.	Description	Image	Make	Model	Range	Quantity/ Set
1	Multi meter		FLUKE	FLUKE 179	1000V AC/DC; 10A AC/DC (with test leads and current jacks); resistance to 50 MΩ; capacitance to 10,000 µF, frequency to 100 kHz; temperature from -40 °C to 400 °C	1
2	CRM KIT		MEGGER	MOM 200A , MOM 600A	*Mains voltage* 115 / 230 V AC, 50 / 60 Hz *Temperature* *Operating* 0°C to +50°C (32°F to +122°F) **Resistance** *Range* 0 – 1999 µΩ 0 – 19.99 mΩ **Output** *Current* 0 – 200 A DC *Open circuit voltage* 4.7 VDC *Current shunt output* 10 mV / 100 A ±0.5%, max 20 mV out, max 10 V to protective earth (ground)	1
3	SF6 Multi-analyzer		DILO	Type no.: 3-038R- / 3-038-	<u>General data:</u> Input pressure: p_e 0.3 – 9bar Operating temperature: -10° - +40 °C Operating voltage: 90 – 264V /50 – 60Hz (L, N, PE) Interface: USB Mains fuse: 2 x 1.6 A/T (time delay) Measuring time (individual measurement): < 15 min. (automatically calculated) Limit value vol.-%: 0.0 – 99.9 vol.-% Limit value dew point: -60 °C – +20 °C	1

SIEMENS energy

I&C Commissioning Tools_V13.0

No Sr.	Description	Image	Make	Model	Range	Quantity/ Set
4	Megger insulation tester 5 kV MIT 520		MEGGER	MIT515DC	A.C. voltage (auto-ranging) MIT515, MIT525, MIT1025: 90-264 V rms, 47- 63 Hz 100 VA MIT1525 kV: 90-264 V rms, 47- 63 Hz 200 VA Battery charge time 2.5 hours deep discharge, 2 hours normal discharge Battery life 11.1 V, 5.2Ah Li-ion batteries, meet IEC 62133:2003, MIT1525 has 2 battery packs	1
5	CB Timing kit		MEGGER	CB Analyzer EGIL	**General** *Mains voltage* 115 / 230 V AC (switchable), 50 / 60 Hz *Power consumption* 100 VA (max) **Breaker operation** *Sequences* C, O, C-O, O-C, O-C-O *Continuous current* 5 A	1
6	DCRM kit (Optional)		SCOPE	HISAC ULTIMA	Trigger Options-O, C, C-O, O-C, O-C-O Power-230 V AC ± 15% , 50Hz ± 10% CRM Resistance Range-1000 / 2000 / 4000 / 8000 µΩ Selectable	1
7	CT , VT testing kit		OMICRON	CPC 100	**IAC/DC INPUT** Fuse-protected with a 10A very quick-acting fuse **2kV AC** High voltage output Mains power supply, 1 phase, 85V-264V AC **800A AC** (6.1-6.5V AC)	1

SIEMENS energy

I&C Commissioning Tools_V13.0

No Sr.	Description	Image	Make	Model	Range	Quantity/ Set
8	Leak detector		DILO	3-033-R002	Power Supply: Two (2) “C” cell alkaline batteries Sensitivity: 5 g SF6 / year Operating Temperature: 32 °F to 126 °F (-0 °C to 52 °C)	1
9	CT testing kit (optional)		OMICRON	CT Analyzer	Mains fuse: 2 x T6.3A / 250V, high breaking capacity **Output** Generator output, 120V/15A peak max. **Sec** Measurement input for secondary side of CT, 300VAC max., 500 kΩ input impedance **Prim** Measurement input for primary side of CT, 30VAC max., 150 kΩ input impedance	1
10	HV test kit Outdoor		HIGHVOLT	WRV 3.6/680 M	Main supply V 230/400 ±10% Output voltage V_{rms} 10 … 550 Rated output current A 70 Frequency range Hz 18 … 300 Duty cycle Continuous operation Rated voltage kV 680 Rated current[2)] A 3.6 Frequency range Hz (40[3)]…) 50 … 300	1

SIEMENS energy

I&C Commissioning Tools_V13.0

No Sr.	Description	Image	Make	Model	Range	Quantity/ Set
11	HV test Kit Indoor		HIGHVOLT	WRV 1.5/680	Power supply: 3ø PNE 50Hz, 400V, +/- 10%, 63 A. Rated power: 43 kVA (Control Panel), 1000kVA (Reactor) Rated voltage :680 kV, 1ø AC Rated current:1.5 A Rated inductivity:720 H Resonance frequency range: 50…300 Hz	1
12	Gas handling unit with accessories		DILO		**General** Main supply 420 V AC	1
13	PD test kit		QUALITROL	QUALITROL – QCM-PPDM	Power supply - 110 V 50/60 Hz Supply current- 200 mA Input - 3 UHF channels UHF bandwidth - 100 - 2000 MHz	1

GIS General Installation tools set V_14

Sr. No.	Tools Sr.No.	Description	Image	Quantity
1		ENERPAC Hydraulics pump P80 with hydralic pressure cylinder and High Pressure hose 3/8" 18 NPT 900mm high pressure hydraulic		4
2		Double open-end wrench 10-parts 4-11 ELECTRIC		1
3		Open Ring Spanner (22 to 32) +(10-32) set		1 set
4		Ratchet Spanner 10mm		2
5		Ratchet Spanner 13mm		2
6		Ratchet Spanner 17mm		2
7		Ratchet Spanner 19mm		2
8		Ratchet Spanner 24mm		2
9		Adaptor 1/2" to 3/8"		1

Sr. No.	Tools Sr.No.	Description	Image	Quantity
10		Adaptor 1/4" to 3/8"		1
11		Adaptor 1/4" to 1/2"		1
12		Torque wrench (4-20 NM)		1
13		Torque wrench 10-60 Nm plug in Adaptor		1
14		Torque wrench 40-200 Nm 730N/5 plug in adaptor		1
15		Torque wrench 60-320 Nm		1
16		Belt wrench		1
17		725 QR/S- 1PC Plug in ratchet 3/8" shank 9X12 size 5 735		2
18		Plug in ratchet 1/2" shank 14X18 size 20 735		2
19		10mm 731/10 open Slot Socket		1

Sr. No.	Tools Sr.No.	Description	Image	Quantity
20		13 mm 731/10 open Slot Socket		1
21		open-end wrench plug-in tool shank 9 x 12 mm 17 mm 733/10		1
22		open-end wrench plug-in tool shank 9 x 12 mm 19mm 731/10		1
23		Plug in tool 24mm SW jaw 14x18 square		2
24		Ring wrench plug-in tool shank 14 x18 mm 17 mm 732/40		2
25		Ring Wrench plug in tool shank 14x18mm 19mm 732/40		2
26		Ring Wrench plug in tool shank 14x18 mm 24mm 732/40		2
27		Hammer wooden handle1.5kg		1
28		Mallet with wooden handle 40		1
29		Soft face hammer 50mm		1

Sr. No.	Tools Sr.No.	Description	Image	Quantity
30		Chain pulley 750kg 1.5-meter stroke		2
31		Chain pulley 1500kg 1.5-meter stroke		2
32		Industrial Vacuum Cleaner (3000W)		1
34		Metal Spirit level 1000mm		1
35		Metal Spirit level 500 mm length		1
36		Metal Spirit level 400mm		1
37		Metal Spirit level(magnatic) 200mm		1
38		65mm Single open-end spanner		1
39		50mm=1pc Single open 55mm=1pc Single open		2
40		46 Single open		1

Sr. No.	Tools Sr.No.	Description	Image	Quantity
41		30 Single open		1
42		32 Single Open		1
43		Socket spanner 1/4 inch +1/2 inch 63-parts Hexagon and TORX		1
		Socket spanner 1/4 inch +1/2 inch 29-parts Hexagon		1
44		GEDORE Screwdriver insert 9-piece 1/2" 5-17mm		1
45		STAHLWILL 512		1
46		Combo Pliers 200mm		1
47		Water Pump Pliers,250mm, 300mm		2
48		Hexagon Allen key set 1.5-10 mm ball-end		1
49		Round Sling 2 Ton 2 Meter		4

Sr. No.	Tools Sr.No.	Description	Image	Quantity
50		Flat Sling 12Ton 2Meter		1
51		Round Sling 3 Ton 8Meter		2
52		Round Sling 2 Ton 10 Meter		2
53		Round Sling 2 Ton 4 Meter		2
54		Round Sling 5 Ton 3 Meter		2
55		Round Sling 3 Ton 4 Meter		2
56		Round Sling 8 Ton 6 Meter		2
57		Round Sling 2 Ton 1 Meter		4
58		Round Sling 5Ton 6Meter		2
59		Steel tape measure 10 M length		1

Sr. No.	Tools Sr.No.	Description	Image	Quantity
60		Steel tape measure 15M length		1
61		Plastic folding rule 2m		1
62		File Brush 115x40 mm		1
63		Cable drum steel sheet with 50 m rubber cable 3x1.5 mm2 (Optional for big project)		1
64		File Set (Dick)		1 Set
65		Plumb bob 300g with plumb line 50 m perlon white		3 Plumb + 1 Rop
66		13 long Hex Socket 1/2"		1
67		17 long hex socket 1/2"		1
68		19 long hex socket		1
69		24 long Hex Socket 1/2"		1

Sr. No.	Tools Sr.No.	Description	Image	Quantity
70		Plug in Adaptor 14x18 to 9x12 7370/10		2
71		Plug in adaptor 9x12 to 14x18 7370/40		2
72		8 Allen Long 1/2” 120mm		1
73		10 Allen 1/2” 140mm		1
74		12Allen 1/2” 140mm		1
75		5 Ball hex allen socket		1
76		6 Ball hex allen socket		1
77		8 Ball hex allen socket		1
78		10 Ball hex allen socket		1
79		Round Flat Nose Pliers 200mm curved 2 component grip		2

Sr. No.	Tools Sr.No.	Description	Image	Quantity
80		Side Cutter 180mm		1
81		Wire Stripping Tools 0.08-6mm2		1
82		Crimp Pliers PZ 16 for wire end sleeves		1
83		Crimp Pliers PZ 3 for wire end sleeves		1
84		Crimping lever pliers Preci Force for non-insulated Cable shoe and plug Conn		1
85		Harting Crimper plier		1
86		Crimping pliers 180mm self-adjusting		1
87		ATORN slot end screwdriver set		1 Set
88		Multipurpose Scissure 205mm non-rusting		1

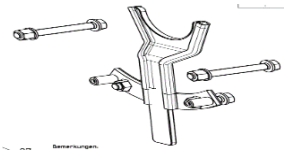
Sr. No.	Tools Sr.No.	Description	Image	Quantity
89		Eye bolt M12 (stud Length 75-100mm)		2
90		Eye bolt M16 (stud Length 75-100mm)		2
91		Shackle M20mm		4
92		Shackle 16mm		4
93		Multi-meter		1
94		Safety Goggle		2
95		Safety Helmet		2
96		Body Harness		2
97		Hook Wrench 80-90 (optional only for 8DN9)		2
98		Hook Wrench 95-100 (optional only for 8DN9)		2

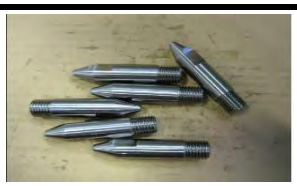
Sr. No.	Tools Sr.No.	Description	Image	Quantity
99		Leak Detector		1
100		Metal Box		1
101		Tools Trolly		1
I&C		**2024**		
Checked By: Shubham T.	**Verified By: Arjun J.**	**Approved By: Harsh Jain.**		
Sign:				
Date :-		**Site :**		

SIEMENS energy

DOC. No: - SE GP T SP EXE I&C/8DQ1 SPECIAL TOOL

8DQ1 SPECIAL TOOL FOR CENTERING _V14

Sr. No	Part Code	Installation Tools	Image	Qty
1	580-05661-005	8DQ1 Rod Head Contact Centering tool		1
2	580-05839-001	Contact Piece Setting Tool		1
3	580-07302-001	Bus Duct Conductor Holding Tool		2
4		Rollers for Busduct conductor		2
5		Centering Bush for Centering Device setting		2
6	459-02931-002	Guide Pin M12		4
7	580-05062-001	Guide Pin M16		6

8	459-02931-001	Guide Pins M12x75		6
9	459-02931-002	Fitting screws M12		6
10	580-05062-010	Guide Pins M16x75		6
11	459-02931-003	Fitting screws M12x75		6
12	580-050620-002	Fitting Screw M16x50		6
13	580-050620-003	Fitting Screw M16x90		6
14		M16 Long Guide pin		6

15	459-02931-004	Fitting screws M16×75		6
16	459-02931-005	Fitting Screw M12×45		6
Checked By : Shubham T.		Verified By : Arjun J.	Approved By : Sarvanan M	
Sign :				
Date :		**Site:**		

Remark: Any special testing other than approved FQP is requested, corrsponding kit shall be arranged by EPC on there own .

SIEMENS energy

TR 3001.1 High Voltage Switchgear Type 8D. 72,5 kV and above. Checklist on Before of Installation Activities

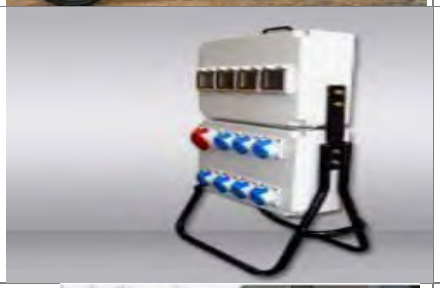
Site Name:		Contract No.:			
Customer:		Bay Serial Number	From		
Substation:			To		
Switchgear type:		Rated voltage:			kV

Sl. No.	Check Point - Indoor	Reference image	Qty	Yes	No
1.	Availability of Franna crane F-15 of 15Ton capacity along with material lifting slings. Slings Length - 5 meter & 3 meter (Qty- 4 no. of each) with valid calibration certificate.		1		
2.	Availability of Scaffolding with proper foot plate, intermediate guard rails, Toe board, working platform, ladder with anti-rust treatment		4 set		
3.	Availability of Aluminum scaffolding with proper foot plate, roller, intermediate guard rails, working platform, ladder with anti-rust treatment		2 set		
4.	Availability of Hydraulic plate truck with 2Ton capacity.		2 nos.		
5.	1.Provide midpoint of Circuit breaker, GIB wall cutout and both side GIB foundation. 2) Availability of Surveyor with total station for surveying along with line marking related materials 3) In case of any deviation joint acceptance document should be signed.		According to site condition.		

TR 3001.1 High Voltage Switchgear Type 8D. 72,5 kV and above. Checklist on Before of Installation Activities

6.	1. Availability of Uninterrupted Portable AC power source. 1 Phase 230V, 50Hz, with 32Amp MCB rating and 3 Phase, 415V, 50Hz with 63 Amp MCB rating. 2) Availability of single-phase extension board with long (20 M.) cables for vacuum cleaner		1 set		
7.	Arrangement hazardous waste disposal bins and a special place for disposal of waste.		4.Nos		
8.	Arrangement of all GIS cable housing female bushing dummy covers for the HV testing from manufactures of HV bushing. (if HV bushing under customer scope)		As per cable housing bays		
Sl. No	Check Point – Outdoor	Reference image	Quantity	Yes	No
1	As per Siemens standard we recommend Franna crane F-15 of 15Ton capacity along with material lifting slings. Slings Length - 5 meter & 3 meter (Qty- 4 no. of each) with valid calibration certificate.		1 No.		
2	Availability tarpaulin or dust proof covers. The surrounding area must be covered by suitable means of tarpaulin or dust proof covers		1 No.		
3	Temporary outdoor shed arrangements must be done with some protective dust proof covers/Tarpaulin for GIS assembly, and GIB cleaning requirements.		1 No.		

TR 3001.1 High Voltage Switchgear Type 8D. 72,5 kV and above. Checklist on Before of Installation Activities

4	1)Embedded plate positioning must be as per approved civil diagram. All the GIB foundation center must be as per drawing. 2). In case of any deviation joint acceptance document should be signed.		1 No.		
5	Scaffolding with proper foot plate, intermediate guardrails, Toe board, working platform, ladder and with anti-rust treatment is required.		6 feet – 2 quantity and as per site request		
6	Aluminum Scaffolding with proper foot plate, Roller, intermediate guardrails, Toe board, working platform, ladder is required		3 Set		
7	Availability of the man lifter throughout site erection, gas works and commissioning on time		1 No.		
8.	1. Availability of Uninterrupted Portable AC power source. 1 Phase 230V, 50Hz, with 32Amp MCB rating and 3 Phase, 415V, 50Hz with 63 Amp MCB rating. 2) Ensure the single-phase extension board with long (Approx.20 M.) cables for vacuum cleaner		1 set		
9.	Arrange hazardous waste disposal bins and a special place for disposal of these waste.		2 No's		

SIEMENS energy

TR 3001.1 High Voltage Switchgear Type 8D. 72,5 kV and above. Checklist on Before of Installation Activities

Tools Requirements Prior To Commencement of Material Unpacking Activities at Customer Premises					
Sr. No	Tools Requirements	Reference Photos	Quantity	Yes	No
1	Wooden Crate Opening Tools		1		
2	chisel		2		
3	Open & Ring spanner set 6-32mm		1 set		
4	Adjustable wrench Spanner		1		
5	Hammer		1		
6	Cutter Kinfe		1		
7	socket spanner set		1 set		
8	Flat Webbing Sling 5 Ton (8 mtr , 5 mtr & 3mtr)		4 No. each		

TR 3001.1 High Voltage Switchgear Type 8D. 72,5 kV and above. Checklist on Before of Installation Activities

9	D shackle Big		4		
10	D shackle Small		4		
11	Chain pulley block		2		
12	Wire Rope Sling		4		
13	Pliers and Screwdriver set		1		

REMARKS:

Responsible Person			
Name:		Designation	
Signature:		Mobile Number	

ANNEXURE-400kV GIS Spares

Annexure- Mandatory Maintenance & Testing Equipment for 400kV GIS & other Pothead Yard Equipment

Sl.No.	Description	Unit	Quantity
A	**400kV GIS**		
1	SF6 gas processing unit	Set	1
2	Contact resistance metering desk with cables	Set	1
3	Circuit Breaker analyser kit with DCRM having minimum 15 channels alongwith Laptop	Set	1
4	Ladder/ walkways/ mobile platform	Set	1
5	Portable gas leak detector	Set	1
6	Portable dust counter	Set	1
7	Special gas mask for GIS maintenance	Set	2
8	Power operated insulation tester	Set	1
9	Tong tester for suitable range	Set	1
10	Portable SF6 gas analyser offline	Set	1
11	Dew point meter	Set	1
12	Mobile platform/ A-type ladder	Set	1
B	**Any other item/ equipment, not specifically mentioned**	**Lot**	**1**

List of Enclosures- Drawings/ Documents		Rev No. 00
1	General Tools & tackles to be arranged by ETC Contractor	Annexure-A
2	General List of Test Equipment to be arranged by ETC Contractor	Annexure-B
3	General tools & tackles for 400kV GIS to be arranged by ETC contractor	Annexure-1A
4	Special tools & tackles, testing instrument/ equipment for 400kV GIS to be arranged by GIS OEM/ manufacturer (M/s Siemens)	Annexure-1B
5	List of Mandatory Maintenance & Testing Equipment	Annexure- Mandatory Maintenance & Testing Equipment
6	List of Mandatory Spares for 400kV GIS	Annexure- Mandatory Spares for for 400kV GIS & other Pothead Yard Equipment
7	Standard scope for ETC works	Annexure- Standard Scope
8	Project specific scope for ETC works	Annexure- Project Scope
9	Project specific drawings (i) 400kV GIS- Single Line Diagram (ii) 400kV GIS- Layout Drawing (iii) Layout Plan & Section Drawing of Pothead yard (iv) Structure Loading Diagram (v) Equipment Earthing Details (vi) Earthmat Layout (vii) Conceptual 11kV Swicthgear Room, and (viii) Conceptual GIS hall with control room	
10	Technical specification for Equipment Fixing Hardrware	TB-XXX-618-002a
11	THDCIL Contract specification for Erection, Commissioning, cabling, earthing and other relevant works	ANNEXURE-THDCIL ETC

Note:

The enclosed drawings/ documents are approved, though, it may change during contract execution stage, as per site conditions.

Annexure- Mandatory Spares for for 400kV GIS & other Pothead Yard Equipment

Sl. No.	Description	Unit	Qty
A	**400kV GIS & accessories**		
1	One pole of complete interrupter unit of 420kV, 2000A circuit breaker with operating mechanism	Set	1
2	Complete drive mechanism including motor for 420kV, 2000A, disconnector	Set	1
3	Complete drive mechanism including motor for 420kV, 2000A, earthing switch	Set	1
4	Complete drive mechanism including motor for 420kV, 2000A fast acting earthing switch	Set	1
5	Trip coils for circuit breakers	Nos.	6
6	Closing coils for circuit breakers	Nos.	6
7	Complete set of rupture disc	Set	2
8	Pressure switch/ gas pressure transmitter	Set	2
9	Pressure Gauge	Set	2
10	Gas Density Relay	Set	2
11	Gas permeable Insulator/ bushing	Set	2
12	Non-gas permeable Insulator/ bushing	Set	2
B	**400kV Isolator**		
1	One complete pole of 400kV, 2000A, 3x1 phase, 40kA for 1 sec, horizontal double break (HDB) type isolator, individual pole motor operated & ganged operated electrically with 2 earth switch, individual pole motor operated & ganged operated mechanically, along with operating mechanism and other accessories in all respect, excluding post insulator, structure and terminal connector etc.	No	1
C	**Composite long Insulator with Stringing Hardware:**		
1	**400kV Double tension composite long rod insulator string hardware asembly** with insulators complete with all stringing hardware accessories including corona ring and tension clamp suitable for twin ACSR Moose conductor with 450mm sub conductor spacing with/ without turn buckle.	Set	1
2	**400kV Single suspension composite long rod insulator string hardware asembly** with insulators complete with all stringing hardware accessories including corona ring and drop/ straight clamp suitable for twin ACSR Moose conductor with 450mm sub conductor spacing.	Set	1
D	**Clamps & conmnectors**	Lot	1
E	**LT Switchgear**		
	ACDB		
1	415V MCCBs (10% of each type but not less than one)	Lot	1
2	240V AC MCBs (10% of each type but not less than one)	Lot	1
3	220V DC MCBs (10% of each type but not less than one)	Lot	1
4	Relays (2 nos. of each type)	Lot	1
5	CTs (2 set of each rating)	Lot	1
6	PTs (2 set of each rating)	Lot	1
7	Voltmeters	No.	2
8	Ammeters	No.	6
9	KWH meters	No.	6
10	Glass covers for relays with rubber gaskets (6 nos. of each size)	Lot	1

11	Glass covers for measuring instruments with rubber gaskets (6 nos. of each size)	Lot	1
12	Indicating lamps	No.	200
13	Indicating lamp assembly (W/O lamp)	No.	200
14	Glass dome covers of different colours (500 nos. of each colour)	Lot	1
15	Fuse units (100 sets of each rating)	Lot	1
16	Push buttons (100 nos. of each shade)	Lot	1
17	Contactors (12 nos. of each rating)	Lot	1
18	Timers	No.	12
19	Terminal blocks	No.	50
20	Brass screws (50 packets of each size)	Lot	1
21	Spring washers (50 packets of each size)	Lot	1
22	Ferrules (1000 nos. of each size)	Lot	1
23	Auto-manual switches	No.	12
24	Bus bar supporting insulators with fittings	No.	30
25	Strip heaters	No.	12
26	Thermostats for heaters	No.	6
	220V DCDB & 48V DCDB		
26	MCCB of each rating/type with door operating handle (10% of total with minimum of 1 no. each)	Lot	1
27	Contactors of each rating	Set	2
28	Indicating lamps with lamp covers (10% of total)	Lot	1
29	Terminal blocks (10% of total)	Lot	1
30	Selector switches of each type/ rating	Set	2
31	Indicating instruments with transducers of each size/ type	Set	2
32	Trip element of each type/ size	Set	2
33	Under voltage relay	No.	2
34	HRC fuses of each type / size	Set	3
35	Sensors, transducers etc. of each type/ size (10% of total with minimum of 2 nos. each)	Set	3
F	**48V Battery Charger**		
1	AC Contactor (if applicable)	Set	2
2	DC Contactor (if applicable)	Set	2
3	Required HRC Fuses of appropriate rating	Set	2
G	**PLCC Panels**		
1	Power Amplifier Unit	Set	3
2	Remaining Modules/ Sub Unit (Other than items in S.No. 1 above/ Power Amlifier Unit)	Set	3
H	**Any other item/ equipment, not specifically mentioned**	Lot	1

Annexure- Project Scope for ETC Works

REV00

Sl. No.	Particulars	Remarks
1	Scope of work includes erection, testing & commissioning (ETC), including taking over (with due verification) of already unloaded material at store (THDCIL/ PSNR store), shifting to & fro from store (THDCIL/ PSNR store) to work location (GIS Building/ Pothead yard)/ any other location within project premises (maximum upto 15kms), verification of material, material reconciliation, record keeping, material relocation as per site requirements, safe keeping, pre-erection assembly, erection of the material/ equipment as per drawings/ instruction of site incharge, complete testing & commisioining, reconciliation after completion of ETC and handing over surplus material & spares to BHEL/ THDCIL). The Scope also includes provision of manpower, tools & plant, testing kit required for erection, testing & commissioning work, hydra, crane, man lifter and/ or any other machinery/ arrangement to be made for working at height as required for completion of work, in all respect. The work shall be carried out as per instruction of Engineer in Charge (BHEL/ THDCIL). **The work location shall be at Pothead yard, CVT and GIS Building, which are at located at the distance of approx. 800 meters at the elevation level of +1102.00 & +1046.00 respectively.**	
2	**ETC of 400kV GIS** as per enclosed single line diagram. Work shall include **surveying & marking** on GIS floor and other area, erection/installation, testing and commissioning of 400kV GIS including LCC Panels and its accesories. The supervision for installation shall be provided by GIS manufacturer/ OEM. Arrangement of general tools & tackles shall be done by ETC contractor as per Annexure-1A but not limited to this list, However, arrangement of special tools & tackles, testing instruments/ equipment shall be in the scope of GIS OEM as per Annexure-1B. The scope of work includes complete installation of GIS, GIB and SF6 to oil bushing (for generator transformer bay), SF6 to cable module (For line feeder bay), including all the work/ services required for ETC of complete GIS, support structure, earthing/ grounding, internal cabling between GIS to LCC, SF6 gas treatment, handling/ filling/ top-up etc. complete in all respect. Shifting of complete GIS bays including GIBs shall be done though Main Access Tunnel/ **a**ny other access tunnel through trailor/ crane and further it shall be lifted by EOT crane on main cutout on GIS floor and further, it shall be dragged on GIS floor for final installation. Dragging of complete GIS bay from unloading platform/ ramp till the final location shall be in ETC contractor's scope of work. Majority of GIS related work shall be carried out in GIS hall & Transformer hall.	
3	Cable Trench Material: Work includes welded type GI rack arrangement and Tray arrangement for cable trenches in Pothead yard, Cable & Ventliation Tunnel (CVT), GIS hall with Control Room, Power House Control Room, 11kV Switchgear Room etc. The work shall include cutting, drilling, fabrication, punching, welding and painting work with protective zinc rich paint and minor civil works, compelete in all respect. Cable rack assembly shall be 1/2/3/4/5 tier as per site requirement and shall be installed and fixed with the fixing wall/ surafce with anchor/ fastners, preferably. Cutting, drilling, punching, minor civil works are also included in the scope.	
4	**ETC of LT Switchgear, Battery Bank, Battery Charger System f**or auxiliary supply arrangement includes installation/ fixing, inter panel connection, bus wiring and earthing work etc. however, supervision for installation, testing and commissioning shall be provided by OEM/ manufacturer, as the case may be.	
5	**ETC of SAS/ CRP: 400kV & 220kV Control & Relay Panels, Station Automation system** includes installation/ fixing, inter panel connection, bus wiring and earthing work etc. Testing and commissioning of Relays from OEM/ manufacturer shall be arranged. however, necessary manpower support, wiring, bus wiring, tools, tackles and testing shall be in scope of ETC contractor.	
6	**(i) Work of 400kV XLPE EHV Cable & its accessories:** This package shall be dealt by other contractor of BHEL and, hence work related with these items shall not be covered under the scope of ETC contractor. **(ii) Work of 11KV Distribution Line with accessories:** This package shall be dealt by other contractor of BHEL and, hence work related with these items shall not be covered under the scope of ETC contractor.	
7	**Cable Trench Material:** Work includes welded type GI rack arrangement and Tray arrangement for cable trenches in Switchyard, GIS hall & transformer hall, Control Room Building, 11kV Switchgear Room. The work shall include cutting, drilling, fabrication, punching, welding and painting work with protective zinc rich paint and minor civil works, compelete in all respect Cable rack assembly shall be 1/2/3/4/5 tier as per site requirement. Cutting, drilling, punching, minor civil works also included in the scope.	
8	**Cable fire sealing Works:** Cable/cable tray openings in walls and floors or through pipe sleeves from one area to another or from one elevation to another within the unit shall be seated by a fire proof sealing system (FPSS). The FPSS shall effectively prevent the spread of fire from the flaming to non-flaming side of a fire. Wherever the cables/ cable trays pass through walls/ floors, fire proof cable penetration seals rated for one hour shall be provided. This shall be by suitable block system using individual blocks with suitable framework or by silicon RTV foaming system. In case foaming system is offered, damming board, if used, shall not be considered for fire rating criteria. Any of the system offered shall be of proven type as per BS: 476 (Part-20) or equivalent standard. In order to prevent fire propagation through cable penetrations, after laying, dressing & clamping of cables, all the openings shall be properly sealed by using Fire Stop Mortar Seal and Fire Retardant Cable coating compound. Also the cable runs both before and after the fire scale shall be suitably sprayed with anti-fire propagation liquid.	

9	**Supply of Insulating mats:** The scope covers supply and laying of insulating mats conforming to Internation standards. These insulating mats shall be laid in front of all floor mounted AC and DC switchboards and control & relay panels located in control room building/ Switchyard panel room / GIS LCC Panel etc. The insulating mats shall be made of elastomer material free from any insertions leading to deterioration of insulating properties. It shall be resistant to acid, oil and low temperature. Upper surface of the insulating mats shall have small aberration (rough surface without edges) to avoid slippery effects while the lower surface shall be plain or could be finished slip resistant without affecting adversely the dielectric property of the mat. Insulating mat (wherever applicable) shall be of pastable type, to be fixed permanently on the front and rear side of the panels except for the chequered plate area which shall not be pasted as per requirement. The insulating mats shall generally be fixed and joints shall be welded as per recommendations in International standards. Width of insulating mats shall generally be of 1.5 meters or as per site requirements. Length shall be supplied as per site requirements.	
10	**Supply of Cable Tags & Markers** Each cable and conduit run shall be tagged with numbers that appear in the cable and conduit schedule. The tag shall be of aluminium with the number punched on it and securely attached to the cable conduit by not less than two turns of 20 SWG GI wire conforming to International standards. Cable tags shall be of rectangular shape for power cables and of circular shape for control cables. Location of cables laid directly underground shall be clearly indicated with cable route marker made of galvanised iron plate. Location of underground cable joints shall be indicated with cable route marker with an additional inscription “Cable joints”. The cable route marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road and drain crossings as per relevant standard. Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry and at each end & turning point in cable tray/trench runs. Cable tags shall be provided inside the switchgear, motor control centres, control and relay panels etc., wherever required for cable identification, where a number of cables enter together through a gland plate.	
11	All ETC works shall be done as per BHEL/THDCIL Specification & standard FQP. Miscellaneous works pertaining to switchyard area is deemed to included.	
12	Equipment bolted connection after being checked and tested shall be painted with anticorrosive paint/ compound be welded. For rust protection, the welds shall be treated with zinc chromate primer and coated with zinc rich paint.	
13	All the drawing/ documents including Single Line Diagram, Layout drawing, Erection Key Diagram etc. are approved, hwoever, it shall subject to revision during detailed engineering / contract stage. Bidder to quote accordingly.	
14	Rating & type of Battery & Battery Charger are approved, however, it may subject to revision during detailed engineering/ contract stage. Bidder to quote accordingly.	
15	Quantity for individual item are indicative and may change as per final engineering and site requirement.	
16	Prices quoted for items are deemed to be inclusive of miscellaneous works including erection of clamps & connectors, earthing work etc.	

Annexure- Standard Scope for ETC Works		
		REV00
Sl. No.	Particulars	Remarks
1	**Contract Variation-** Individual item may vary up-to any extend and even may get deleted, however overall contract value may vary +/- 30%. The validity for variations shall be valid up-to contract stage.	
2	**Standard Project Scope-** Loading/ unloading, handling, preservation & upkeeping, shifting to & from stores, proper storage, assembly, installation, pre-commissioning test and commissioning tests (as per BHEL/ Customer FQP/ OEM recommendations) are included in the scope. Shifting of the material from store to site shall be done with truck/ trailor.The scope of work includes loading of material with hydra on truck/ trailor at store, unloading of the material from truck/ trailor at site with Hydra/ crane etc. complete in all respect. Standard/ General tools & tackles mentioned in tender document is included in the scope of contractor.	
3	**Materials supplied by ETC Contractor-** ETC contractor shall supply material of proven design and make, which have already been extensively used and type tested (as applicable). ETC contractor shall obtain approval from Engineer incharge- BHEL/ Customer prior to supply at site.	
4	**Power Frequency/ HV test kit for GIS-** Power Frequency/ HV test kit is in scope of GIS OEM/ maufactuere, however, ETC contractor shall extend all possible help and support is unloading, shfting to location, unpacking and installation of HV test for HV testing. After successful HV testing, contractor shall support in packing, shifting and loading of HV test kit in trailor.	
5	The ETC works shall be carried out in line with engineering drawing/ other technical details mentioned elsewhere, however, instruction of Engineer incharge/ BHEL shall be final and binding for execution of work.	
6	Minor Civil works including modification of civil foundations, making holes in the trenches/ control room building, GIS building, grouting, fixing of trench material, sealing of GI/ PVC/ HDPE Pipe/ conduits shall be in the scope of ETC contractor.	
7	Removal of gravel, if gravelling is already done, for connection of Equipment earthing strip to the existing mat (wherever earthing mat is already laid), and after completion of earthing, ETC contractor shall be make it good to bring it in original shape.	
8	All painting materials & other consumable as per contractual requirements shall be part of ETC works. All the supply materilals under scope of ETC contractor shall subject to customer approval, prior to supply and installation at site.	
9	All the phases are to be identified by painting the structures Red, Yellow and Blue by reflecting colour as per as built condition. Phase identification colour is to be provided around the top of the structure with colour band of 100 mm width at a height of approximately 2000mm from the finished ground level.	
10	Equipment erection (per say Surge Arrestor) means complete erection, metallics, connectors (expansion/ rigid tubular for aluminium Tube/ single/ double/ quadraple conductor), connection to the next in line (if connected to overhead busbar or droppers) including PG clamps/ Tee connectors etc in line with electrical layout drawings.	
11	Equipment and tower erection would include supply and erection of miscellaneous items, such as Phase colour discs, labels painting of equipments, phase colour painting, phase marking, bay identification board, danger plates, rubber mats, device number marking on the equipment, keyboard etc as per site requirements. Supply & Mounting of phase color discs & Danger plates shall be as per IS 3864.	
12	Welding of Aluminium tubes (supply of welding sleeves are excluded) is in ETC contractor's scope and joints shall be tested by radiography & dye penetration test. Welding and Bending machines and any other equipment shall be in ETC Contractor scope.	
13	Completete ETC package is under the scope of ETC contractor. All T&P including oil filterating machine, cranes etc. required to complete the work shall be provided by ETC contractor only.	
14	Quantities identified for supply items are provisional and shall be confirmed/ finalized during detailed engineering stage/ execution of work at site.	
15	**MS Welding -** The MS flat/ angle/ channel shall be finally painted with two coats of Red oxide primer and two coats of Zinc riched enamel paint.	
16	In cable tray/ ladder if minor fabrication is required the same shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint. Supporting steel shall be painted before laying of cables. The painting shall be done with one coat of red lead paint and two coats of approved bituminous aluminium paint	
17	All erection T&P's, tools & tackels, testing instruments (duly calibrated) as per **Annexure-A & B** shall be arranged by ETC Contractor at it's own cost on returnable basis. Please note that this is only indicative list and hence, any other requirement not mentioned below but required for sucessful completion of ETC work shall be in ETC contractor's scope.	

18	In addition to above few other general Tools and Tackles to be arranged by ETC Contractor on returnable basis specifically for GIS erection & testing as informed by respective OEMs of GIS are also enclosed as **Annexure-1A & 2A.** Contractor to arrange the same.	