

E-TENDER SPECIFICATION

S. No.	E- TENDER SPECIFICATION NUMBER
01	BHE/PW/PUR/BWT6-ELE/2465

FOR

HANDLING AT SITE STORES/STORAGE YARD, TRANSPORTATION TO SITE OF WORK, COMPLETE ERECTION, CHECKING OF CALIBRATION, TESTING, ASSISTANCE FOR COMMISSIONING AND HANDING OVER OF HT/LT POWER TRANSFORMERS, ISOLATED PHASE BUS DUCT FOR GENERATOR TRANSFORMER, SEGREGATED PHASE BUS DUCT FOR STATION TRANSFORMER /UNIT AUX. TRANSFORMER, ELECTROSTATIC PRECIPITATOR, GENERATOR CONTROL & PROTECTION PANELS, 11KV/3.3KV/0.415KV SWITCHGEAR BOARDS /MCC, SOOT BLOWER SYSTEM, EXCITATION SYSTEM, 220 VOLT BATTERY SYSTEM AND ELECTRICAL HOIST AND ASSOCIATED EQUIPMENT'S & ASSOCIATED AUXILIARIES FOR **BHUSAWAL TPS, UNIT-6, 1x660 MW, MAHAGENCO PROJECT.**

VOLUME I E- Technical Specifications (Part-1 of 2)

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LAYOUT, FLOOR PLAN & KEY DIAGRAM
FOR
11 KV, UNIT SWITCHBOARD, 6BA
FOR
1X660 MW BHUSAWAL TPS

INVENTORY NO.		SIGN & DATE		REF DRG. NO.	
REV	DATE	ALT.	REV	DATE	ALT.
		OKD.			OKD.
		APPD.			APPD.
ZONE			ZONE		

MDL NO.-BP-DG-415-401-001					
REV	DATE	ALT.	REV	DATE	ALT.
		OKD.			OKD.
		APPD.			APPD.
ZONE			ZONE		

OWNER :		MAHARASHTRA STATE POWER GENERATION CORPORATION LTD.,	
CONSULTANT :		MAHARASHTRA STATE INDIA	
PROJECT :		DEVELOPMENT CONSULTANTS PVT. LTD.	
TYPE OF PRODUCT :		11 KV INDOOR METALCLAD SWGR. TYPE-VM12	
PROJECT :		1X660 MW BHUSAWAL TPS	
TITLE		BHARAT HEAVY ELECTRICALS LIMITED	
LAYOUT FLOOR PLAN & KEY DIAGRAM FOR 11KV UNIT		BHOPAL	
SWBD-68A		NO. OF SHEETS	
		05	
		REV. NO.	
		01	

INVENTORY NO.	SIGN & DATE	REF DRG. NO.
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REV	DATE	ALT.	CHK.	APPD.

REV	DATE	ALT.	CHK.	APPD.

REV	DATE	ALT.	CHK.	APPD.

REV	DATE	ALT.	CHK.	APPD.

REV	DATE	ALT.	CHK.	APPD.

REV	DATE	ALT.	CHK.	APPD.

REV	DATE	ALT.	CHK.	APPD.

MDL NO.-BP-DG-415-401-001

11 KV INDOOR METALCLAD SWGR. TYPE-VMI12

OWNER : MAHARASHTRA STATE POWER GENERATION CORPORATION LTD.,
CONSULTANT : MAHARASHTRA STATE,INDIA
PROJECT : 1X660 MW BHUSAWAL TPS
DEVELOPMENT CONSULTANTS PVT. LTD.

DEPT. CODE 409

SCALE WEIGHT UNITS

UNCL. DIMS. GR. W.O.N.O. 97053 Q 47602

DRG. NO. 3 521 00 5 6434

NO. OF SHEETS 02

REV. NO. 00

CARD NO. 00

NO. OF SHEETS 05

REV. NO. 00

CARD NO. 00

NO. OF SHEETS 05

REV. NO. 00

CARD NO. 00

NO. OF SHEETS 05

REV. NO. 00

CARD NO. 00

NO. OF SHEETS 05

REV. NO. 00

CARD NO. 00

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REV. NO. 00

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NO. OF SHEETS 05

REV. NO. 00

CARD NO. 00

NO. OF SHEETS 05

REV. NO. 00

CARD NO. 00

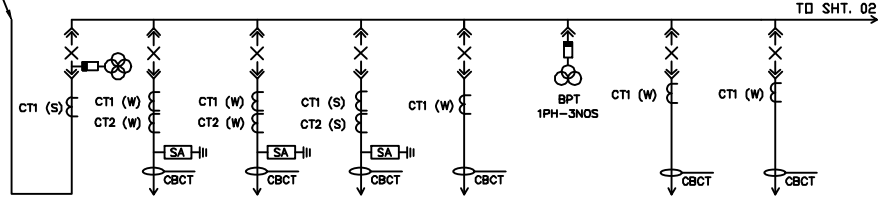
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REV. NO. 00

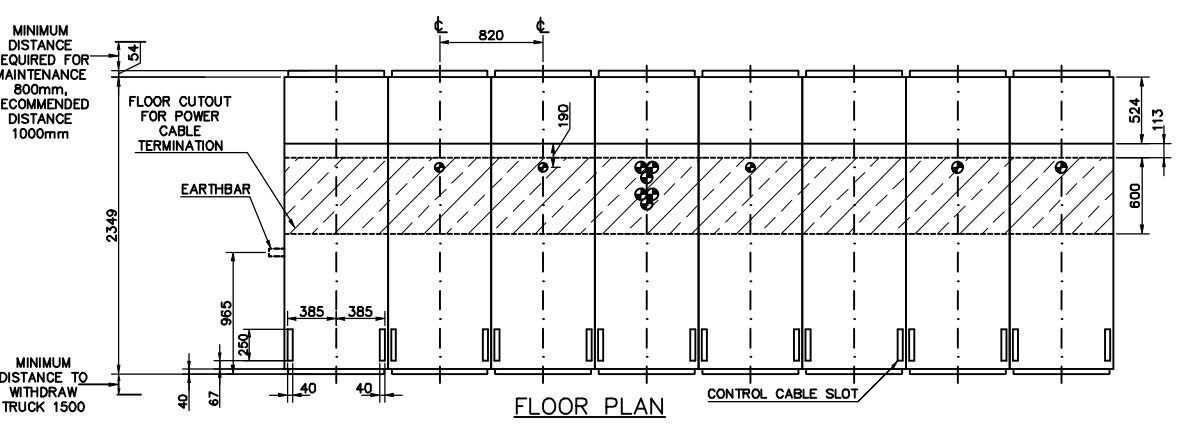
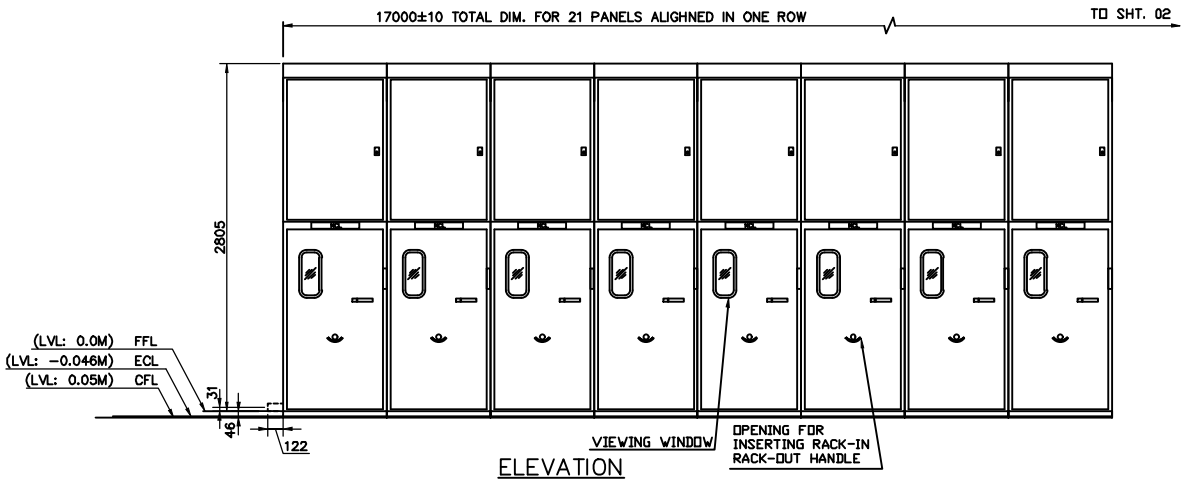
CARD NO. 00

2500A TOP BUSDUCT REAR ENTRY(CRYB)

11 KV, 2500A, UNIT SWBD-6BA, 44 KA FOR 3 SEC.



SHIPPING SECTION	1	2	3	4	5	6	7	8
PANEL NO.	TIE2	MFD3	MFD5	MFD1	TRF2	BPT1	TRFD1	TRF2
MODULE NAME	TIE2	MFD3	MFD5	MFD1	TRF2	BPT1	TRFD1	TRF2
UNIT SERIAL NO.	9158083	9158084	9158085	9158086	9158087	9158088	9158089	9158090
FEEDER CABLE SIZE(SQ. MM)	BUS DUCT	1-3CX240	1-3CX240	6-1CX300	1-3CX240	-	1-3CX240	1-3CX240
RATING (AMPS)	2500 A	630 A	630 A	1000 A	630 A	-	630 A	630 A
CIRCUIT LABEL DETAILS	TIE FROM STN. SWBD 08A	PA FAN -6A 3600 KW	FD FAN-6A 1650 KW	ID-FAN-6A 10400 KW	ESP SERVICE TRF#6DCT01, 2000KVA	BUS PT	ESP SERVICE TRF#6DCT01, 2000KVA	ESP SERVICE TRF#6DCT01, 2000KVA
CT1 DETAILS	RATIO	2500/1-5A	300/1-5A	150/1-5A	1000/1-5A	150/1-5A	-	150/1-5A
	CORE-I OUTPUT / CLASS	15VA,5P20	15VA,5P20	15VA,5P20	15VA,5P20	-	15VA, 5P20	15VA, 5P20
	CORE-II OUTPUT / CLASS	15VA,0.2S	15VA,0.2S	15VA,0.5S	15VA,0.2S	15VA,0.5S	-	15VA, 0.5S
CT2 DETAILS	RATIO	-	300/1A	150/1A	1000/1A	-	-	-
	CORE-I OUTPUT / CLASS	-	CL-PS V _k >=40Rct+150V I _e <30mA AT V _k /2	CL-PS V _k >=40Rct+150V I _e <30mA AT V _k /2	CL-PS V _k >=40Rct+150V I _e <30mA AT V _k /2	-	-	-
	CORE-II OUTPUT / CLASS	-	-	-	-	-	-	-
PT DETAILS	RATIO	-	-	-	-	11KV/110V/110V/√3/√3/√3	-	-
	WDG.-1 OUTPUT/ACCURACY.	-	-	-	-	100VA,0.2/3P	-	-
	WDG.-2 OUTPUT/ACCURACY.	-	-	-	-	100VA,3P	-	-
AMMETER SCALE	0-2500A	0-300/1800A	0-150/900 A	0-1000/6000A	0-150A	-	0-150A	0-150A
VOLTMETER SCALE	0-15KV	-	-	-	-	0-15 KV	-	-
CBCT DETAILS(POC)	-	3A	3A	3A	3A	-	3A	3A



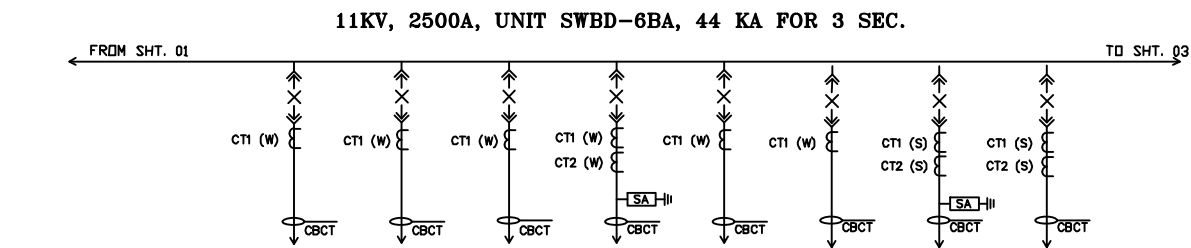
FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN mm.

INVENTORY NO.	SIGN & DATE	REF DRG. NO.
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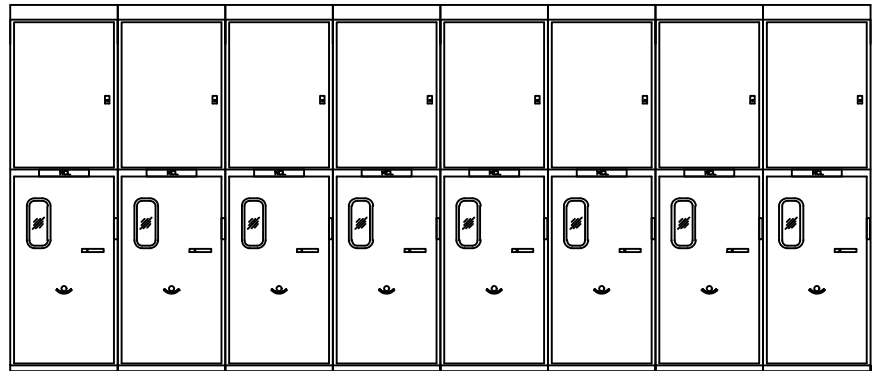
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REV	DATE	ALT.	CHK.	APPD.	ZONE
REV	DATE	ALT.	CHK.	APPD.	ZONE

MDL NO.-BP-DG-415-401-001

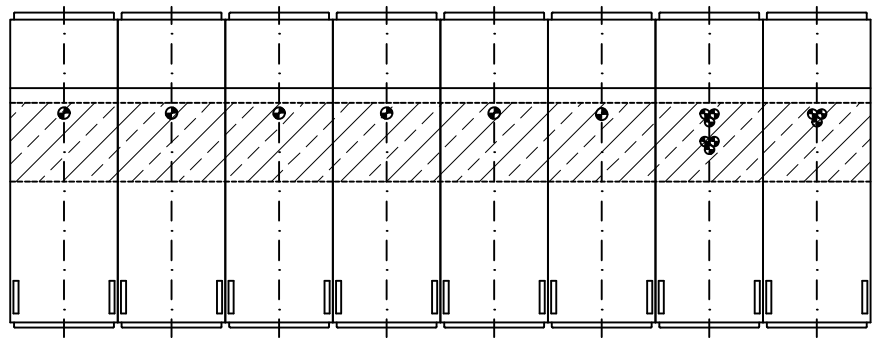


SHIPPING SECTION		5	10	11	12	13	14	15	16
PANEL NO.		9	10	11	12	13	14	15	16
MODULE NAME		TRF2	TRF2	TRF2	MFD4	TRF1	TRF2	MFD1	TRFD1
UNIT SERIAL NO.		9158091	9158092	9158093	9158094	9158095	9158096	9158097	9158098
FEEDER CABLE SIZE(SQ. MM)		1-3CX240	1-3CX240	1-3CX240	1-3CX240	1-3CX240	1-3CX240	6-1CX300	3-1CX630
RATING (AMPS)		630 A	630 A	630 A	630 A	630 A	630 A	1000 A	630 A
CIRCUIT LABEL DETAILS		ESP SERVICE TRF#6DFT01, 2000KVA	ESP SERVICE TRF#6DGT01, 2000KVA	ESP SERVICE TRF#6DHT01, 2000KVA	CW PUMP-6A 3200 KW	BOILER SERVICE TRF #6DST01, 2500 KVA	TURBINE SERVICE TRF #6DAT01, 2000 KVA	SPARE MOTOR FEEDER (10400 KW)	SPARE TRF FEEDER, 10MVA
CT1 DETAILS	RATIO	150/1-5A	150/1-5A	150/1-5A	300/1-5A	200/1-5A	150/1-5A	1000/1-5A	630/1-5A
	CORE-I OUTPUT / CLASS	15VA, 5P20	15VA, 5P20	15VA, 5P20	15VA, 5P20	15VA, 5P20	15VA,5P20	15VA,5P20	15VA,5P20
	CORE-II OUTPUT / CLASS	15VA, 0.5S	15VA, 0.5S	15VA, 0.5S	15VA, 0.2S	15VA, 0.5S	15VA,0.5S	15VA,0.2S	15VA,0.2S
CT2 DETAILS	RATIO	-	-	-	300/1A	-	-	1000/1A	630/1A
	CORE-I OUTPUT / CLASS	-	-	-	CL-PS V _k >=40Rct+300V I _e <30mA AT V _k /2	-	-	CL-PS V _k >=40Rct+150V I _e <30mA AT V _k /2	CL-PS V _k >=40Rct+100V I _e <30mA AT V _k /2
	CORE-II OUTPUT / CLASS	-	-	-	-	-	-	-	-
PT DETAILS	RATIO	-	-	-	-	-	-	-	-
	WDG.-1 OUTPUT/ACCURACY.	-	-	-	-	-	-	-	-
	WDG.-2 OUTPUT/ACCURACY.	-	-	-	-	-	-	-	-
AMMETER SCALE		0-150A	0-150A	0-150A	0-300/1800 A	0-200A	0-150A	0-1000/6000A	0-630A
VOLTMEETER SCALE		-	-	-	-	-	-	-	-
CBCT DETAILS(POC)		3A	3A	3A	3A	3A	3A	3A	3A

FROM SHT. 01 REFER SHT. 01 FOR TOTAL DIM. TO SHT. 03



ELEVATION



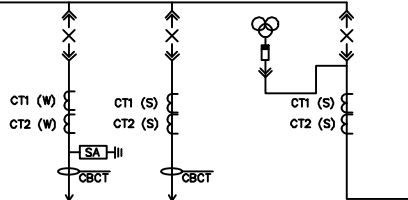
FLOOR PLAN

OWNER :		MAHARASHTRA STATE POWER GENERATION CORPORATION LTD.,	
CONSULTANT :		MAHARASHTRA STATE,INDIA	
PROJECT :		1X660 MW BHUSAWAL TPS	
TYPE OF PRODUCT :		11 KV INDOOR METALCLAD SWGR. TYPE-VMI2	
DEPT. CODE		SMBD-6BA	
SCALE		W.O.N.O. 97053 Q 47602	
TITLE		LAYOUT FLOOR PLAN & KEY DIAGRAM FOR 11KV UNIT	
SHEETS		NO. OF SHEETS 05	
REV.		00	

11KV, 2500A, UNIT SWBD-6BA, 44 KA FOR 3 SEC.

2500A TOP BUSDUCT REAR ENTRY(BYR)

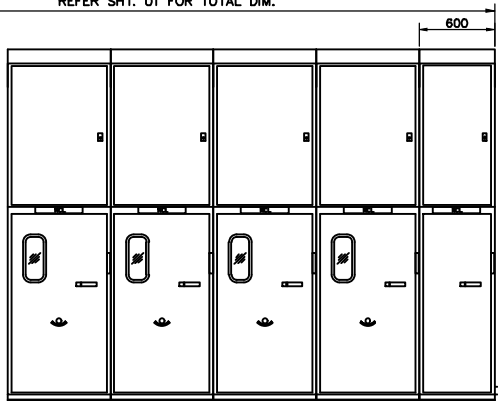
FROM SHT. 02



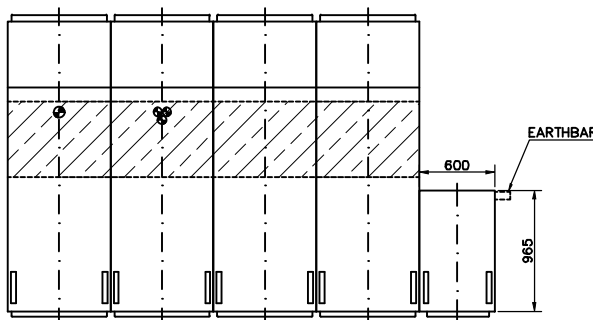
SHIPPING SECTION		9	10	11
PANEL NO.		17	18	19
MODULE NAME		MFD7	TRFD1	FP22
UNIT SERIAL NO.		9158099	9158100	9158101
FEEDER CABLE SIZE(SQ. MM)		1-3CX240	3-1CX630	BUS DUCT
RATING (AMPS)		630 A	630 A	2500 A
CIRCUIT LABEL DETAILS		CEP-6A 1200 KW	UNIT AUX. TRF #6CAT01, 10MVA	LINE PT
INCOMER FROM UNIT TRANSFORMER #6A				LV PANEL
CT1 DETAILS	RATIO	100/1-5A	630/1-5A	-
	CORE-I OUTPUT / CLASS	15VA,5P20	15VA,5P20	-
	CORE-II OUTPUT / CLASS	15VA,0.2S	15VA,0.2S	-
CT2 DETAILS	RATIO	100/1A	630/1A	-
	CORE-I OUTPUT / CLASS	CL-PS V _k >=40R _{ct} + 100V I _e <=30mA AT V _k /2	CL-PS V _k >=40R _{ct} + 100V I _e <=30mA AT V _k /2	15VA,5P20
	CORE-II OUTPUT / CLASS	-	-	15VA,0.2S
PT DETAILS	RATIO	-	-	11KV/110V/110V √3/√3/3
	WDG.-1 OUTPUT/ACCURACY.	-	-	100VA,0.2/3P
	WDG.-2 OUTPUT/ACCURACY.	-	-	100VA,3P
AMMETER SCALE		0-100/600 A	0-630A	0-2500A
VOLTMETER SCALE		-	-	0-15KV
CBCT DETAILS(POC)		3A	3A	-

FROM SHT. 02

REFER SHT. 01 FOR TOTAL DIM.



ELEVATION



FLOOR PLAN

MDL NO.-BP-DG-415-401-001

OWNER : MAHARASHTRA STATE POWER GENERATION CORPORATION LTD.,
CONSULTANT : MAHARASHTRA STATE INDIA
PROJECT : 1X660 MW BHUSAWAL TPS
TYPE OF PRODUCT : 11 KV INDOOR METALCLAD SWGR. TYPE-VM12

INVENTORY NO.		SIGN & DATE		REF DRG. NO.	
ZONE	REV	DATE	ALT.	ZONE	REV
			CHK.		
			APPD.		
ZONE	REV	DATE	ALT.	ZONE	REV
			CHK.		
			APPD.		
NAME	SIGN.	DATE	NAME	SIGN.	DATE
CHKD	-SD-	10.10.19	CHKD	-SD-	10.10.19
APPD	-SD-	10.10.19	APPD	-SD-	10.10.19
DRAWN	S.K.S.	10.10.19	DRAWN	S.K.S.	10.10.19
MAK.	-SD-	10.10.19	MAK.	-SD-	10.10.19
DISTRIBUTION OF PRINTS			DISTRIBUTION OF PRINTS		
O.COPY 2 NOS.	DIAGRAM 1 NO.		O.COPY 2 NOS.	DIAGRAM 1 NO.	
SWM 6 NOS.	CUSTOMER 6 NOS.		SWM 6 NOS.	CUSTOMER 6 NOS.	
TCX (SWM) 1 NO.			TCX (SWM) 1 NO.		
DEPT.	CODE	SCALE	WEIGHT	UNITL. DIMS. GR.	W.O.N.O.
SWE	409	NTS	-	REFER CG. 06503	97053 Q 47602
TITLE		LAYOUT FLOOR PLAN & KEY DIAGRAM FOR 11KV UNIT		NO. OF SHEETS	
BHARAT HEAVY ELECTRICALS LIMITED		BOPAL		REV.	
SWBD-6BA				NO.	
				04	

10	NOTES
a.	WIDTH OF PANELS SHALL BE 820mm
b.	WHEREVER DIMENSIONAL TOLERANCE NOT GIVEN SHALL BE TAKEN AS +/-5mm
c.	APPROX WEIGHT OF ONE PANEL SHIPPING SECTION 1300 Kg
d.	APPROX WEIGHT OF TWO PANEL SHIPPING SECTION 2600 Kg
e.	PANEL IDENTIFIED FOR BUS EARTHING (UNIT SL. NO. 9158111, IF** PANEL NO. 12)
11.	ALL COVERS AND DOORS SHALL BE PROVIDED WITH EPDM GASKET.
12.	BUSBAR SLEEVES SHALL BE PROVIDED WITH COLOR CODED BANDS R.Y.B FOR EACH PHASE FOR EASY IDENTIFICATION.
13.	INSTRUMENT SAFETY FACTOR FOR ALL METERING CORES OF CT SHALL BE AS LOW AS PRACTICABLE & SHOULD BE LESS THAN 10
14.	SURGE PROTECTIVE DEVICE SHALL BE PROVIDED TO LIMIT OVER VOLTAGE TO 2.5 TIMES THE PEAK VALUE OF RATED PHASE TO NEUTRAL VOLTAGE
15.	CBCT SHALL BE DESIGNED FOR MINIMUM PRIMARY OPERATING CURRENT(PDOC) OF 3A, EXACT CBCT RATIO SHALL BE INFORMED AFTER MANUFACTURING.
16.	LEGEND
	VCB : VACUUM CIRCUIT BREAKER
	SA : SURGE ARRESTOR
	CT : CURRENT TRANSFORMER
	PT : POTENTIAL TRANSFORMER
	S : SLOT/WINDOW TYPE CT
	W : WOUND PRIMARY TYPE CT
	BPT : BUS PT
	FPT : FEEDER/LINE PT
	CBCT: CORE BALANCE CT
	CFL : CONCRETE FLOOR LEVEL
	FFL : FINISHED FLOOR LEVEL
17.	REFERENCE DOCUMENTS
a.	11KV UNIT SINGLE LINE DIAGRAM : - PE-DG-415-505-E001
18.	SHUTTER BARRIER SHALL BE PROVIDED IN PLACE OF EPOXY SEAL OF BUSHING BETWEEN BREAKAR CHAMBER TO BUSBAR/CT CHAMBER FOR SWITCHGEAR PANELS RATED 2750 AMPS & ABOVE. (1 INCHER & TIE PANEL)
19.	PANEL MATERIAL THICKNESS -3mm FOR LOAD BEARING -2mm FOR REST OF PANEL.
20.	PRESSURE RELIEF VENT IS PROVIDED AT THE TOP EACH PANEL.
21.	FDR CT RATIO LESS THAN OR EQUAL TO 200/1-5A, STC SHALL BE 44KA/1Sec.

*

OWNER : MAHARASHTRA STATE POWER GENERATION CORPORATION LTD.,
MAHARASHTRA STATE,INDIA

CONSULTANT : DEVELOPMENT CONSULTANTS PVT. LTD.

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[illegible]

PROJECT :	1X660 MW BHUSAWAL TPS
TYPE OF PRODUCT :	11 KV INDOOR METALCLAD SWGR. TYPE-VM12

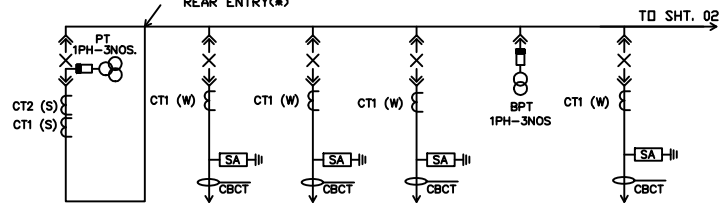
BHARAT HEAVY ELECTRICALS LIMITED Bhopal										CARD NO.	RENO.	
A/LD.	NAME	SIGN.	DATE							CARD NO.	00	
CRD.	DRAWN	S.K.S.	-SD-	10.10.19							CARD NO.	--
APPD.	M/H.N.	-SD-	10.10.19									
	APPD	MAK.	-SD-	10.10.19								
TITLE LAYOUT FLOOR PLAN & KEY DIAGRAM FOR 11KV UNIT												
SWBD-6BA												
DISTRIBUTION OF PRINTS				DEPT.		CODE						
O.COPY	2 NOS.	DIAGRAM	1 NO.									
SWM	6 NOS.	ENGINEER	1 NO.									
TCX (SWM) 1 NO.	CUSTOMER	6 NOS.	SWE	409								
SCALE		WEIGHT		UNROL DIMS. GR.		REFR. CO. 96503		TABLR 25-1				
NTS		-		W.O.NO.		Q 47602		DRG. 3 521 00 5 6434				

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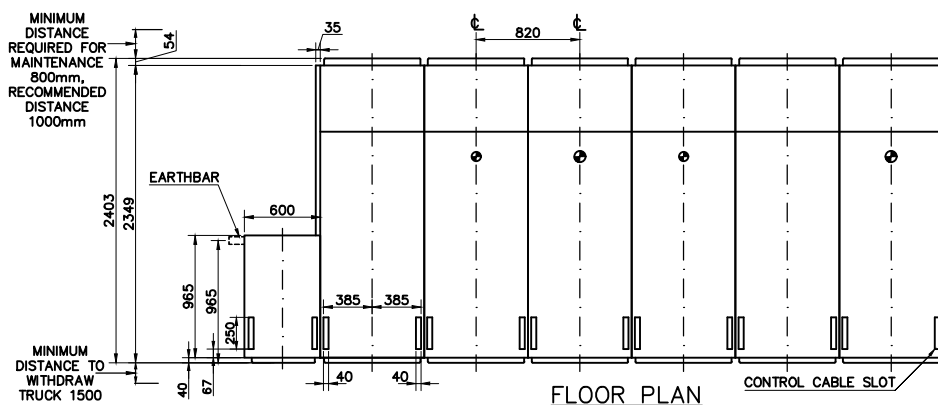
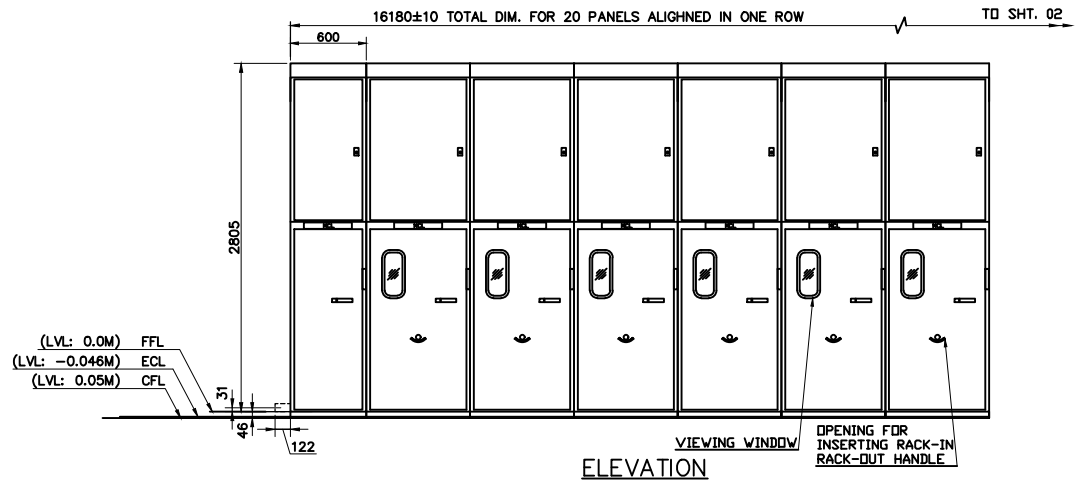
ZONE	REV	DATE	ALT.
			CKD.
			APPD.

3.3KV, 2250A, UNIT AUX. SWBD-6CA, 50 KA FOR 1 SEC.

2250A TOP BUSDUCT
REAR ENTRY(※)



SHIPPING SECTION		1	2	3	3	5	4
PANEL NO.		1A	2	2	3	4	6
MODULE NAME		LV	1F1**	MF	MF	MF	BPT1
UNIT SERIAL NO.		9158671	9158671	9158673	9158674	9158675	9158676
FEEDER CABLE SIZE(SQ. MM)		—	BUS DUCT	1-3CX240	1-3CX240	1-3CX240	—
RATING (AMPS)		—	2250 A	1250 A	1250 A	1250 A	—
CIRCUIT LABEL DETAILS		LV PANEL	INCOMER FROM UNIT AUX. TRANSFORMER #6CAT01	ACW PUMP-6A 620 KW	BCW PUMP-6A 750 KW	BOILER FILL PUMP-6A	BUS PT
							MILL MOTOR - 6C 807KW
CT1 DETAILS	RATIO	—	2250/1A	200/1-1A	200/1-1A	50/1-1A	—
	CORE-I OUTPUT / CLASS	—	CL-PS V _k >=30Rct+ 50V I _e <=30mA AT V _k /2	15VA, 5P20	15VA, 5P20	15VA, 5P20	—
	CORE-II OUTPUT / CLASS	—	—	15VA, 0.5S	15VA, 0.5S	15VA, 0.5S	—
CT2 DETAILS	RATIO	—	2250/1-1A	—	—	—	—
	CORE-I OUTPUT / CLASS	—	15VA,5P20	—	—	—	—
	CORE-II OUTPUT / CLASS	—	15VA,0.2S	—	—	—	—
PT DETAILS	RATIO	—	$\frac{3.3kV}{\sqrt{3}} / \frac{110V}{\sqrt{3}} / \frac{110V}{3}$	—	—	—	$\frac{3.3kV}{\sqrt{3}} / \frac{110V}{\sqrt{3}} / \frac{110V}{\sqrt{3}}$
	WDG.-1 OUTPUT/ACCURACY.	—	100VA,0.2/3P	—	—	—	100VA,0.2/3P
	WDG.-2	—	50VA,3P	—	—	—	—
	OUTPUT/ACCURACY.	—	—	—	—	—	—
AMMETER SCALE		—	0-2250A	0-200/1200 A	0-200/1200 A	0-50/300A	—
VOLTMETER SCALE		—	0-4KV	—	—	—	0-4 KV
CBCT DETAILS(POC)		—	—	3A	3A	3A	—



OWNER :	MAHARASHTRA STATE POWER GENERATION CORPORATION LTD., MAHARASHTRA STATE,INDIA
CONSULTANT :	DEVELOPMENT CONSULTANTS PVT. LTD.
PROJECT :	1X660 MW BHUSAWAL TPS
TYPE OF PRODUCT :	3.3 KV INDOOR METALCLAD SWGR. TYPE-VM12

**MAHARASHTRA STATE POWER GENERATION CORPORATION LTD.,
MAHARASHTRA STATE INDIA**

DEVELOPMENT CONSULTANTS PVT. LTD.

PROJECT :	1X660 MW BHUSAWAL TPS
TYPE OF PRODUCT :	7.7 KV INDOOR METALLIC SWCH TYPE VU400

TYPE OF PRODUCT : 3.3 KV INDOOR METALCLAD SWGR. TYPE-VM12

BHARAT HEAVY ELECTRICALS LIMITED

BHO PAL

TITLE LAYOUT FLOOR PLAN & KEY DIAGRAM FOR 3.3KV UNIT
SWBD-6CA

SWBD-6CA

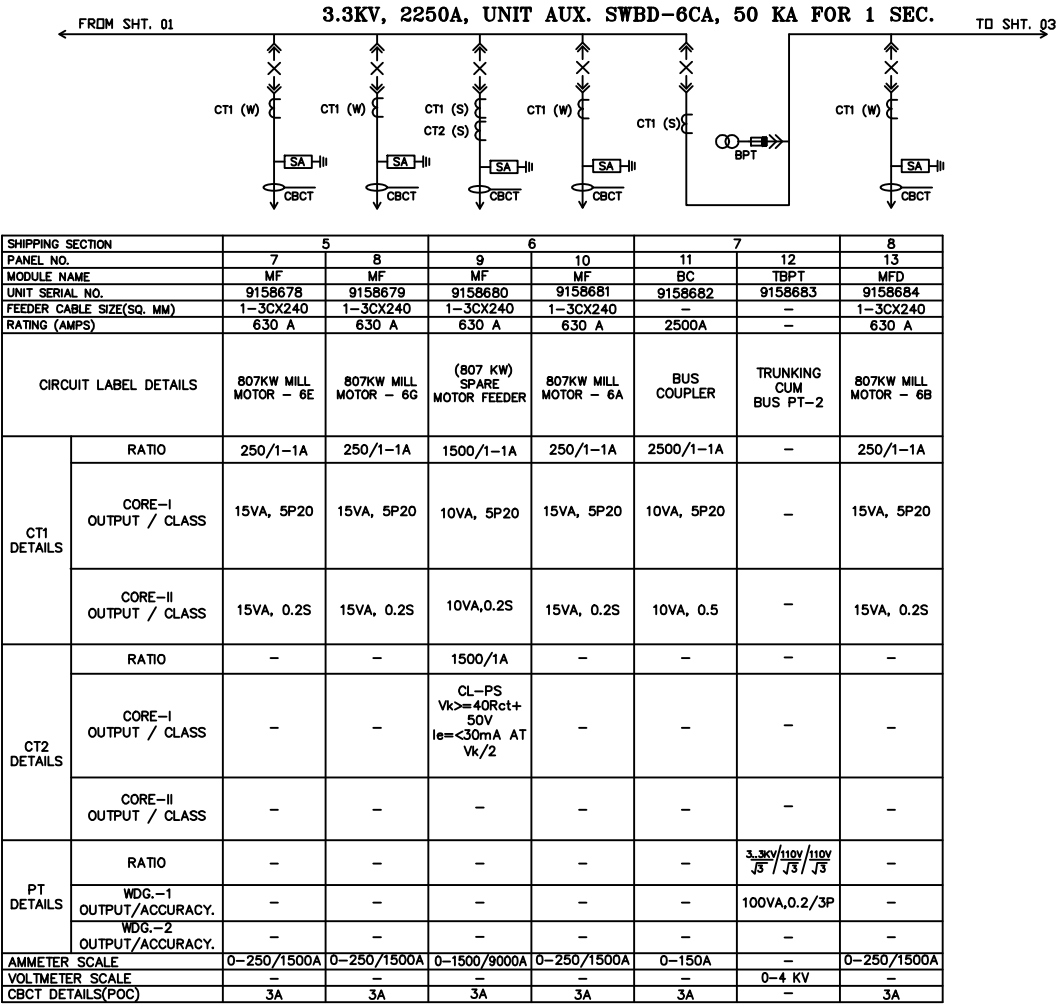
DEPT.	CODE
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DISTRIBUTION OF PRINTS	
2 NOS.	1 NO.
0.COPY	DIAGRAM

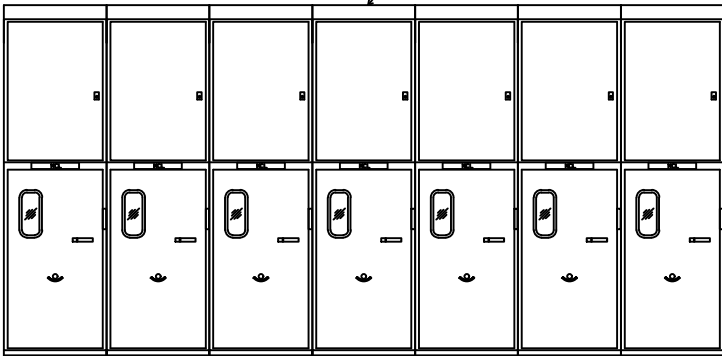
	SCALE	W.T.	UNTOI.	DIMS.	GR.	W.O.	NO.	DRG.
	NTS	-	RETER	CG	08503	97053	Q 47605	3
SWE	409		TABLE	2.5-1				521 00 5 6455

SWM	6 NOS.	ENGINEER 1 NO.
TCX (SWM)	1 NO.	CUSTOMER 6 NOS.

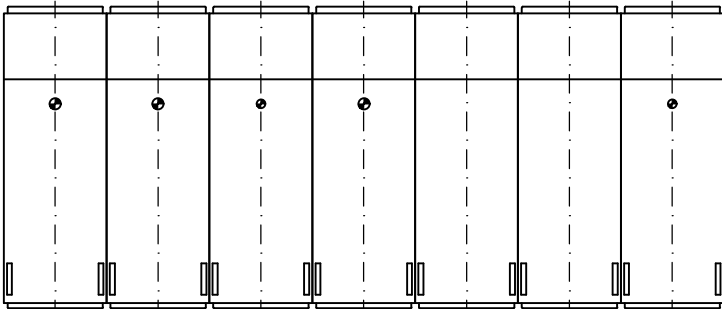
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REV	DATE	REV
DATE	DATE	DATE
ALT.	ALT.	ALT.
CD.	CD.	CD.
APPD.	APPD.	APPD.
ZONE	ZONE	ZONE
NAME	NAME	NAME
SIGN.	SIGN.	SIGN.
DATE	DATE	DATE
CD.	CD.	CD.
APPD.	APPD.	APPD.
ZONE	ZONE	ZONE
DRAWN	DRAWN	DRAWN
S.K.S.	S.K.S.	S.K.S.
DATE	DATE	DATE
CD.	CD.	CD.
APPD.	APPD.	APPD.
ZONE	ZONE	ZONE
DISTRIBUTION OF PRINTS	DISTRIBUTION OF PRINTS	DISTRIBUTION OF PRINTS
0 COPY	0 COPY	0 COPY
2 NOS.	2 NOS.	2 NOS.
ENGINEER	ENGINEER	ENGINEER
1 NO.	1 NO.	1 NO.
TCX (SWM) 1 NO.	TCX (SWM) 1 NO.	TCX (SWM) 1 NO.
CUSTOMER 6 NOS.	CUSTOMER 6 NOS.	CUSTOMER 6 NOS.
DEPT.	DEPT.	DEPT.
CODE	CODE	CODE
SWE	SWE	SWE
409	409	409
SCALE	SCALE	SCALE
NTS	NTS	NTS
WEIGHT	WEIGHT	WEIGHT
INTD. DIMS. OR	INTD. DIMS. OR	INTD. DIMS. OR
REFR. CG. 06503	REFR. CG. 06503	REFR. CG. 06503
TABLE 2.5-1	TABLE 2.5-1	TABLE 2.5-1
W.O.NO.	W.O.NO.	W.O.NO.
97053 Q 47605	97053 Q 47605	97053 Q 47605
DRG. NO.	DRG. NO.	DRG. NO.
3 521 00 5 6455	3 521 00 5 6455	3 521 00 5 6455
NO. OF SHEETS	NO. OF SHEETS	NO. OF SHEETS
04	04	04
SHEET NO.	SHEET NO.	SHEET NO.
02	02	02
REV.	REV.	REV.
NO.	NO.	NO.
00	00	00



FROM SHT. 01 REFER SHT. 01 FOR TOTAL DIM. TO SHT. 03



ELEVATION



FLOOR PLAN

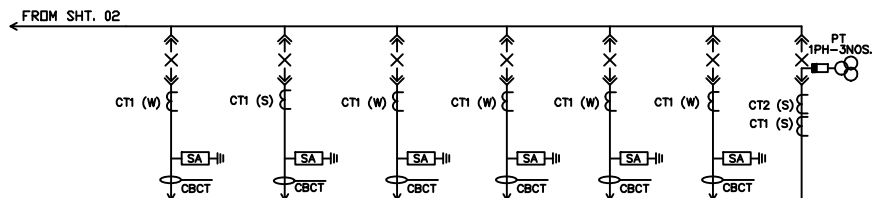
OWNER : MAHARASHTRA STATE POWER GENERATION CORPORATION LTD.,
CONSULTANT : MAHARASHTRA STATE, INDIA
PROJECT : DEVELOPMENT CONSULTANTS PVT. LTD.
TYPE OF PRODUCT : 3.3 KV INDOOR METALCLAD SWGR. TYPE-VM12
1X660 MM BHUSAWAL TPS

BHARAT HEAVY ELECTRICALS LIMITED
Bhopal

SWBD-6CA

REVISION NO. 00
SHEET NO. 02

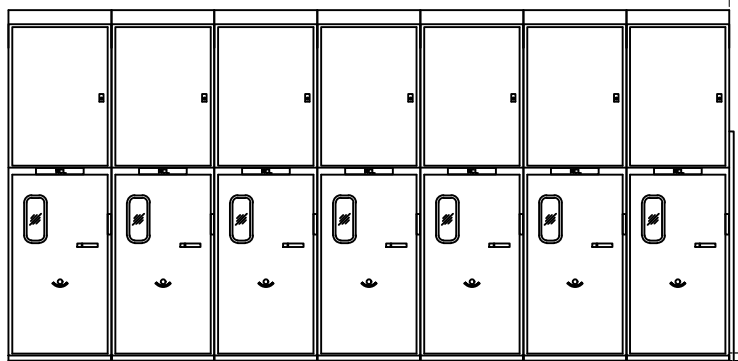
3.3KV, 2250A, UNIT AUX. SWBD-6CA, 50 KA FOR 1 SEC.



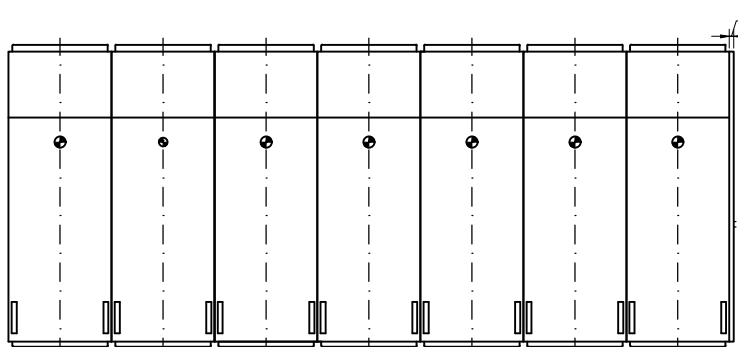
SHIPPING SECTION		8	9	10	11	12	13
PANEL NO.		14	15	16	17	18	19
MODULE NAME		MF	MF	MF	MF	MF	MF
UNIT SERIAL NO.		9158685	9158686	9158687	9158688	9158689	9158691
FEEDER CABLE SIZE(SQ. MM)		1-3CX240	1-3CX240	1-3CX240	1-3CX240	1-3CX240	BUS DUCT
RATING (AMPS)		630 A	630 A	630 A	630 A	630 A	2250 A
CIRCUIT LABEL DETAILS		620KW ACW PUMP - 6B	(807 KW) SPARE MOTOR FEEDER	807KW MILL MOTOR - 6D	807KW MILL MOTOR - 6F	807KW MILL MOTOR - 6H	180KW BOILER FILL PUMP-6A
CT1 DETAILS	RATIO	200/1-1A	250/1-1A	250/1-1A	250/1-1A	250/1-1A	50/1-1A
	CORE-I OUTPUT / CLASS	15VA, 5P20	15VA, 5P20	15VA, 5P20	15VA, 5P20	15VA, 5P20	15VA, 5P20
	CORE-II OUTPUT / CLASS	15VA, 0.2S	15VA, 0.2S	15VA, 0.2S	15VA, 0.2S	15VA, 0.2S	15VA, 0.5S
CT2 DETAILS	RATIO	-	-	-	-	-	2250/1-1A
	CORE-I OUTPUT / CLASS	-	-	-	-	-	15VA, 5P20
	CORE-II OUTPUT / CLASS	-	-	-	-	-	15VA, 0.2S
PT DETAILS	RATIO	-	-	-	-	-	3.3KV/110V/110V/5/3/3
	WDG.-1 OUTPUT/ACCURACY.	-	-	-	-	-	100VA, 0.2/3P
	WDG.-2 OUTPUT/ACCURACY.	-	-	-	-	-	100VA, 3P
AMMETER SCALE		0-200/1200A	0-200/1200A	0-250/1500A	0-250/1500A	0-250/1500A	0-50/300A
VOLTMETER SCALE		-	-	-	-	-	0-2250A
CBCT DETAILS(POC)		3A	3A	3A	3A	3A	3A

FROM SHT. 02

REFER SHT. 01 FOR TOTAL DIM.



ELEVATION



FLOOR PLAN

OWNER : MAHARASHTRA STATE POWER GENERATION CORPORATION LTD.,
CONSULTANT : MAHARASHTRA STATE, INDIA
PROJECT : 1X660 MW BHUSAWAL TPS
TYPE OF PRODUCT : 3.3 KV INDOOR METALCLAD SWGR. TYPE-VM12

BHARAT HEAVY ELECTRICALS LIMITED

BOPAL

SWBD-6CA

LAYOUT FLOOR PLAN & KEY DIAGRAM FOR 3.3KV UNIT

NO. OF SHEETS 04

REV. NO. 00

DRG. NO. 521 00 5 6455

SHEET NO. 03

DEPT. CODE 409

SCALE WEIGHT NTS

UNTO. DIMS. OR REFER CG 06503

W.O.NO. 97053 Q 47605

TABLE 23-1

SWE

DATE 14.09.19

SIGN. -SD-

NAME S.K.S.

M.H.N.

APRD

MAK.

-SD-

14.09.19

DISTRIBUTION OF PRINTS

O.COPY 2 NOS.

SWM 6 NOS.

TCX (SWM) 1 NO.

CUSTOMER 6 NOS.

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NAME S.K

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED.
IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

Sl. No	TECHNICAL PARAMETERS	UNIT	VALUE
1.	SYSTEM PARAMETER:		
a.	SYSTEM NOMINAL	kV	3.3
b.	SYSTEM HIGHEST	kV	3.6
c.	PHASE	Nos	3
d.	FREQUENCY	Hz	50
e.	NEUTRAL EARTHING (RESISTANCE)	-	LDW RESISTANCE GROUND
f.	INSULATION LEVEL	POWER FREQUENCY IMPULSE	KVrms kVp 10 40
g.	BREAKING CAPACITY	kA at kV	3.3kV at 40KA
h.	MAKING CAPACITY	kAp	100
i.	STC FDR 1 OR 3 SECS	SWITCHGEAR CT	40/3
2.	FINISH (ELECTRO STATIC POWDER COATING)	kA / Secs	
a.	EXTERIOR, INTERIOR COLOUR OF PANEL		RAL 7032
b.	TRUCK		RAL 9002
3.	AUXILIARY SUPPLY:		
a.	CLOSING CIRCUIT, TRIPPING CIRCUIT,	VDC	220
b.	INDICATION CIRCUIT		
b.	SPRING CHARGING MOTOR	VDC	220
c.	HEATER AND ILLUMINATION CIRCUIT	V AC	240
4.	EARTHBAR		
a.	MATERIAL	(Cu/Al/GI)	CU
b.	SIZE	Sqmm	6 X 50
5.	TOP BUSBAR:		
a.	RATING	Amps	2250 A
b.	MATERIAL	(Cu/Al)	CU
c.	Nos & SIZE	Sqmm	100 - 12x75
d.	INSULATION SLEEVE HEAT SHRINKABLE		PVC
6.	LT BUSBAR WITH PVC SLEEVE:		
a.	MATERIAL	(Cu/Al)	AL
b.	SIZE	Sqmm	5x20
c.	DC BUSBAR	Nos	04
d.	AC BUSBAR	Nos	04
7.	DEGREE OF PROTECTION		-
a.	RELAY COMPARTMENT		1P52
b.	HT COMPARTMENT		1P4X
8.	FOUNDATION DRAWING	SWGR WITH 2403 DEEP PANEL.	35210005291
	FBR	LV PANEL.	35210005415
9.	EARTHING TRUCK(COMMON FBR 184)		
a.	FEDER EARTHING BREAKER (FEB SUITABLE UP TO 2250A)		9158692
b.	BUSBAR EARTHING BREAKER (BEB SUITABLE FOR 2250A)		9158693

10.	NOTES
a.	WIDTH OF PANELS SHALL BE 820mm
b.	WHEREVER DIMENSIONAL TOLERANCE NOT GIVEN SHALL BE TAKEN AS +/-5mm
c.	APPROX. WEIGHT OF ONE PANEL SHIPPING SECTION 1250 KG
d.	APPROX. WEIGHT OF TWO PANEL SHIPPING SECTION 2500 KG
e.	APPROX. WEIGHT OF 1220 WIDE SINGLE PANEL 1600 KG
f.	PANEL IDENTIFIED FOR BUS EARTHING (UNIT SL. NO. 9158672, 9158691 IF *** PANEL, NO. 01 & 20)
11.	ALL COVERS AND DOORS SHALL BE PROVIDED WITH EPDM GASKET.
12.	BUSBAR SLEEVES SHALL BE PROVIDED WITH COLOR CODED BANDS R,Y,B FOR EACH PHASE FOR EASY IDENTIFICATION.
13.	INSURANT SAFETY FACTOR FOR ALL METERING CORES OF CT SHALL BE AS LOW AS PRACTICABLE & SHOULD BE LESS THAN 10
14.	SURGE PROTECTIVE DEVICE SHALL BE PROVIDED TO LIMIT OVER VOLTAGE TO 2.5 TIMES THE PEAK VALUE OF RATED PHASE TO NEUTRAL VOLTAGE
15.	CCT SHALL BE DESIGNED FOR MINIMUM PRIMARY OPERATING CURRENT (POC) OF 3A, EXACT CCT RATIO SHALL BE INFORMED AFTER MANUFACTURING.
16.	LEGEND
	VCB : VACUUM CIRCUIT BREAKER
	SA : SURGE ARRESTOR
	CT : CURRENT TRANSFORMER
	PT : POTENTIAL TRANSFORMER
a.	S : SLOT/WINDOW TYPE CT
	V : WOUND PRIMARY TYPE CT
	BPT : BUS PT
	FPT : FEEDER/LINE PT
	CBCT CORE BALANCE CT
	CFL : CONCRETE FLOOR LEVEL
	FFL : FINISHED FLOOR LEVEL
17.	REFERENCE DOCUMENTS
a.	11KV UNIT SINGLE LINE DIAGRAM :- PE-DG-415-505-E051
18.	SHUTTER BARRIER SHALL BE PROVIDED IN PLACE OF EPOXY SEAL OF BUSHING BETWEEN BREAKER CHAMBER TO BUSBAR/CT CHAMBER FOR SWITCHGEAR PANELS RATED 2750 AMPS & ABOVE. (INCUNDER & TIE PANEL)
19.	PANEL MATERIAL THICKNESS -3mm FOR LOAD BEARING -2mm FOR REST OF PANEL.
20.	PRESSURE RELIEF VENT IS PROVIDED AT THE TOP EACH PANEL.

[illegible]

OWNER :	MAHARASHTRA STATE POWER GENERATION CORPORATION LTD., MAHARASHTRA STATE,INDIA
CONSULTANT :	DEVELOPMENT CONSULTANTS PVT. LTD. 1X660 MW BHUSAVAL TPS
PROJECT :	
TYPE OF PRODUCT :	3.3 KV INDOOR METALCLAD SWGR. TYPE-VMI12

3.3 KV INDOOR METALCLAD SWGR. TYPE-VM12

BHARAT HEAVY ELECTRICALS LIMITED

AL

THE LAYOUT FLOOR PLAN & KEY DIAGRAM FOR 3.3KV UNIT

SWBD-6CA

SCALE WEIGHT	UNTOI DIMS. GR. REFER CG 06503	W.O.NO. 97053 Q 47605	DRG. 3 521 00 5 6455
NTS	TABLE 2.5-1		

TECHNICAL DATA SHEET OF 95KVp/ 1000mA EC_HVR FOR ESP

DEVELOPMENT CONSULTANT PVT. LTD.			
Reviewed only for general conformance with contract drawings and specifications; Contractor to be responsible for any error and for fulfilment of details requirements of contract documents.			
CODE:- 1 (ONE)		DATE:- 05.03.2020	
DISTRIBUTED BY:- SALONI BELNEKAR			
1	Approved	4	For information only
2	Approved Subject to compliance to comments, Proceed with manufacturing/construction. Revised document required to be submitted after incorporating the comments.	V	Null and Void (Not applicable)
3	Not Approved. Resubmission required		
SEE COVERING LETTER			
LETTER REF.NO.:- 18V06-E-LOT-BHEL-0127			

PROJECT: 1x660MW BHUSAWAL THERMAL POWER STATION UNIT-6

	Owner: Maharashtra State Power Generation Co. Ltd.		
	Owner Consultant: Development Consultants Private Ltd.		
	BHARAT HEAVY ELECTRICALS LIMITED JHANSI		
TITLE: TECHNICAL DATA SHEET OF 95KVp/ 1000mA EC_HVR FOR ESP			
DRAWING NO	TRE/72064N/TDS	REV	03



**MAHARASHTRA STATE POWER
GENERATION CO. LTD.**

BHUSAWAL T.P.S UNIT-6: 1 X 660 MW



**DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS. VASHI, NAVI MUMBAI**

Doc No.: TRE/72064N/TDS REV: 03

DATA SHEET FOR 95 KVp / 1000 mA HVR TRANSFORMER FOR ESP

Sl. No.	Description	Unit	Data
1	Rated Power	KVA	100
2	Transformer No-Load Voltage Ratio		373.5 / 74030
3	Input Voltage	Vrms	415 ± 10 %
4	Input Current	Arms	267.7
5	Output Voltage (Negative Polarity)	KVp	95
6	Output Current	mA (mean)	1000
7	Frequency	Hz	50
8	Design ambient temperature		50 °C
9	No. of Phases		1
10	Cooling		ONAN
11	Rectifier type		Silicon Diode Bridge Rectifier
12	High voltage terminal		Single, from side
13	Losses		
	a) No-Load losses (at rated No-load volts and frequency)	Watt	450 W + IS TOL.
	b) Load losses (At rated output current)	Watt	4000 W + IS TOL.
14	Temperature Rise above an ambient of 50° C		
	a) Oil temperature rise	°C	50° C
	b) Winding temperature rise	°C	55° C

BHARAT HEAVY ELECTRICALS LIMITED, JHANSI



**MAHARASHTRA STATE POWER
GENERATION CO. LTD.**

BHUSAWAL T.P.S UNIT-6: 1 X 660 MW



**DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS. VASHI, NAVI MUMBAI**

Doc No.: TRE/72064N/TDS REV:03

DATA SHEET FOR 95 KV_p / 1000 mA HVR TRANSFORMER FOR ESP

Sl. No.	Description	Unit	Data
15	Oil type		Silicon Oil
16	Volume of oil (Approx.)	Litres	640
17	Approximate overall dimensions		
	a) Length	mm	1890
	b) Width	mm	1590
	c) Height	mm	1980
18	Approximate total weight (with oil)	Kg	1950
19	HV Bushing (-ve)		52 KV Porcelain Bushing
20	HV Bushing (+ve)		Epoxy moulded terminal
21	LV bushing		1.1 KV Porcelain bushing
22	AC Reactor		1.15 mH
23	RF choke		50 mH
24	Shunt Resistor		2 ohms wire-wound resistor
25	HV Rectifier		95 KV _p / 1400 mA Full wave Bridge
26	Manufacturer's Name		BHEL, Jhansi
27	Quantity		108 nos.
28	Relative Humidity	%	95
29	Reference Standard		Generally to IS: 2026 (wherever applicable)
30	Type of Construction (Core / Shell)		Core



**MAHARASHTRA STATE POWER
GENERATION CO. LTD.**

BHUSAWAL T.P.S UNIT-6: 1 X 660 MW



**DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS. VASHI, NAVI MUMBAI**

Doc No.: TRE/72064N/TDS REV:03

DATA SHEET FOR 95 KV_p / 1000 mA HVR TRANSFORMER FOR ESP

Sl. No.	Description	Unit	Data
31	Thermal time constant	Hours	9 (Approx.)
32	Magnetizing inrush current	Amp	28 (Approx.)
33	No Load current at rated frequency and at		
	i. 90 % voltage	Amp	3.5 (Approx.)
	ii. 100 % voltage (at 373.5 V)	Amp	5.0 (Approx.)
	iii. 110 % voltage	Amp	7.0 (Approx.)
34	Power factor at no load		0.45 (Approx.)
35	Weights of transformer		
	a. Core	kG	250 (Approx.)
	b. Windings		
	i. HV	kG	185 (Approx.)
	ii. LV	kG	
	c. Insulation	kG	65 (Approx.)
	d. Tank and fittings	kG	500 (Approx.)
	e. Total Weight	kG	1950 (Approx.)
36	Dimensions		
	a. Tank (l x b x h)	mm	924 x 773 x 1005 (Approx.)
	b. Overall (l x b x h)	mm	1890 x 1590 x 1980 (Approx.)
37	Shipping Details		
	a. Weight of heaviest package	kG	1950 (Approx.)
	b. Total shipping weight	kG	2000 (Approx.)
	c. No. of packages		
	d. Dimensions of largest package	mm	2100 x 1800 x 2200(Approx.)
	e. Parts detached for transport		Rollers



**MAHARASHTRA STATE POWER
GENERATION CO. LTD.**

BHUSAWAL T.P.S UNIT-6: 1 X 660 MW



**DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS. VASHI, NAVI MUMBAI**

Doc No.: TRE/72064N/TDS REV:03

DATA SHEET FOR 95 KVp / 1000 mA HVR TRANSFORMER FOR ESP

Sl. No.	Description	Unit	Data
38	Core		
	a. Material Detail		Cold Rolled Grain Oriented Silicone
	b. Form of core		Circular, Core Type
	c. Net core Area	Sq.mm.	13140 (Approx.)
	d. Type of joint between core & yoke		Interleaved
	e. Thickness of stampings	mm	0.28 (Approx.)
	f. Percentage silicon content		3.15 (Approx.)
	g. Maximum flux density in core at rated frequency and at		
	i. 90 % voltage	Wb / sq. m	1.35 (Approx.)
	ii. 100 % voltage	Wb / sq. m	1.50 (Approx.)
	iii. 110 % voltage	Wb / sq. m	1.65 (Approx.)
	h. Type of core binding		By Surgical Tape
39	Winding		
	a. Type of winding		LV-Spiral / HV-Distributed Run over
	b. Current density at rated load		
	i. HV	Amp/sq.	2.00 (Approx.)
	ii. LV	Amp/sq.	1.7 (Approx.)
	c. Conductor Area		
	i. HV	Sq. mm	0.78 (Approx.)
	ii. LV	Sq. mm	163 (Approx.)
	d. Maximum current density under short circuit		
	i. HV	Amp/sq.	5.8 (Approx.)
	ii. LV	Amp/sq.	5.5 (Approx.)
	Clearances		
	a. Minimum clearance between phases (in air)	mm	Not Applicable
	b. Minimum clearance of HV winding to tank in oil	mm	85 mm (approx.)
	c. Minimum clearance of HV winding to earth in oil	mm	85 mm (approx.)
	d. Clearance between coils	mm	59 (approx.)
	e. Clearance between core and coil	mm	8 mm (approx.)



**MAHARASHTRA STATE POWER
GENERATION CO. LTD.**

BHUSAWAL T.P.S UNIT-6: 1 X 660 MW



**DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS. VASHI, NAVI MUMBAI**

Doc No.: TRE/72064N/TDS REV:03

DATA SHEET FOR 95 KV_p / 1000 mA HVR TRANSFORMER FOR ESP

Sl. No.	Description	Unit	Data
41	Tank details		Structural steel – Welded Type Construction
	a. Approximate thickness of		
	i. Sides	mm	3.0 (Approx.)
	ii. Bottom	mm	6.0 (Approx.)
	iii. Cover	mm	6.0 (Approx.)
42	Efficiency at 75 °C and unity power factor at		
	a) At Full Load	%	95.7 (approx.)
	b) At 3/4 Full Load	%	96.6 (approx.)
	c) At 1/2 Full Load	%	97.3 (approx.)
43	Flash Point of transformer oil °C above 300		
44	Oil level gauge		Prismatic toughened gauge glass
45	Class of insulation (HV and LV)		Class - A
46	Noise level	dB	68 dB (approx.) (Refer Cl. No.-0.05 of NEMA TR-1 and note that High voltage rectifier transformers are not covered by the
47	Paint Shade		Seimens Grey RAL-7032
48	Dielectric strength of oil		30 kVmin
49	Conducting materials of windings (HV and LV)		Copper
50	Range of Oil temp. indicator (Oil and Winding)	°C	0 to 150 (for oil)
51	HV Rectifier		95 KV _p / 1400 mA Silicone diode Single Phase Full wave Bridge rectifier

**MAHARASHTRA STATE POWER
GENERATION CO. LTD.****BHUSAWAL T.P.S UNIT-6: 1 X 660 MW****DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS. VASHI, NAVI MUMBAI****Doc No.: TRE/72064N/TDS REV:03****DATA SHEET FOR 95 KV_p / 1000 mA HVR TRANSFORMER FOR ESP**

Sl. No.	Description	Unit	Data
52	RF choke		50 mH Air Core Choke
53	AC Reactor		1.15 mH Iron Core Reactor
54	HV Resistor Board		78 Mega Ohm HV Resistor Column

Data Sheet for High Voltage Rectifier Transformer Auxiliary Equipment

1. A C Reactor:

This is provided for limiting the primary current in the event of flash over during sparking on DC side while in operation. It also helps in improving the form factor of the current. The AC Reactor is housed in the same oil filled tank along with the main transformer.

- a) Type - Iron Core with gaps
- b) Inductance - 1.15mH (Tol. +20%)
- c) Rated Current - 267.7Amps
- d) Voltage - 415 V
- e) No. of Phases - Single
- f) Frequency - 50 Hz
- g) Type of Cooling - ONAN

2. Diode Bridge Rectifier Stack:

The high voltage rectifiers are made of specially designed diodes. They are used to rectify High Voltage AC output of the transformer into DC. The diode bridge is designed to withstand repetitive peaks of voltage and current encountered during precipitator application. It is connected to the output of transformer HV for full wave rectification of the high voltage transformer output. The Diode stack is also housed in the same oil filled tank along with the main transformer.

- a) Type - Four arm Full wave diode bridge rectifier
- b) Continuous forward current - 1.4 Amp
- c) Peak repetitive forward current - 5 Amps
- d) Surge non-repetitive forward current - 50 Amps

Typical Characteristic of Individual Diode

- a) Repetitive Peak Reverse voltage - 800 V
- b) Average Forward current - 2.5 Amps
- c) Avalanche Breakdown Voltage - 900 – 1600 V

3. R F Choke:

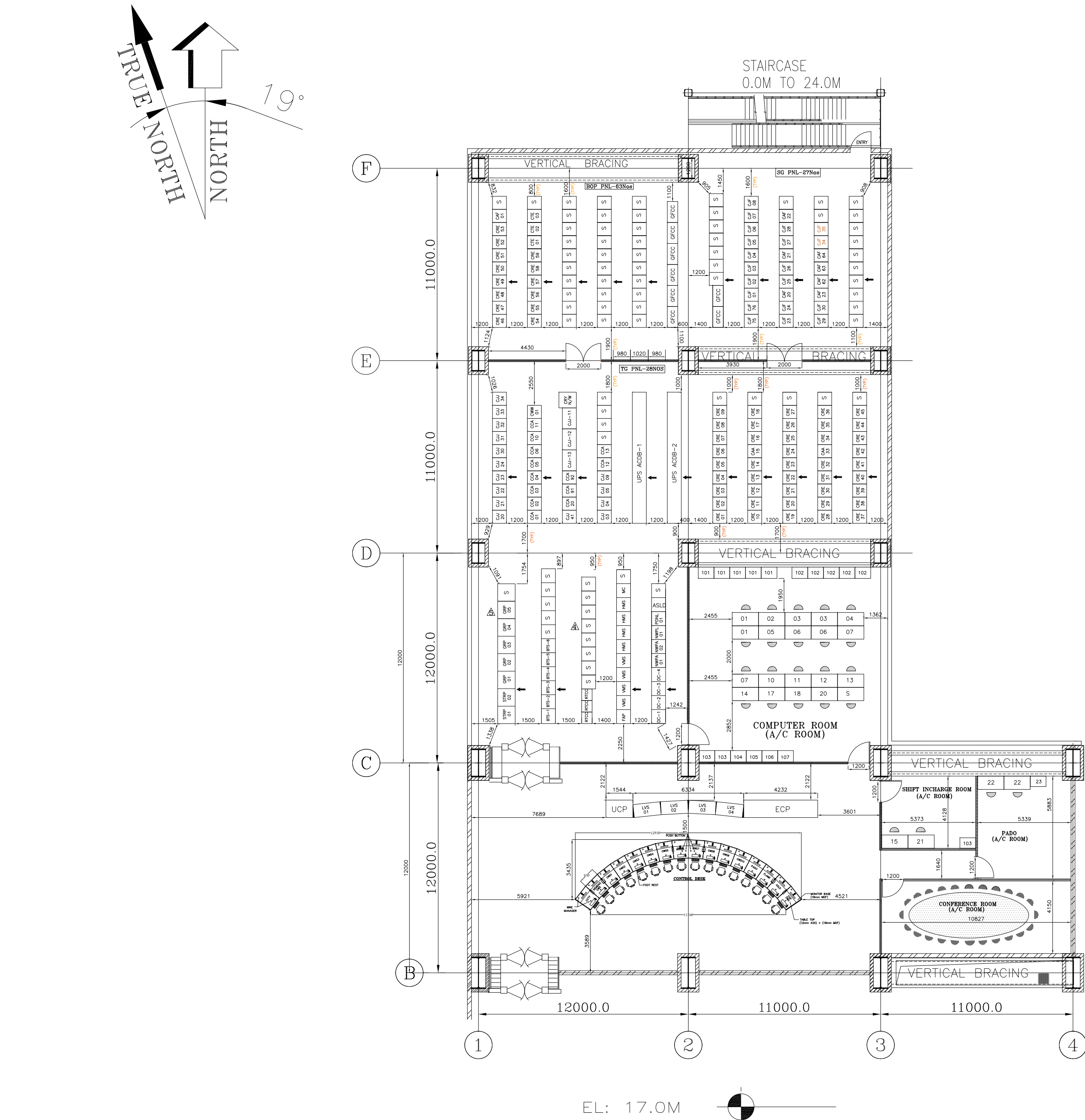
The choke provides high impedance to high frequency currents that are generated due to sparking in the electrodes in ESP field. It also provides limiting effect on di/dt for the rectifier diodes. The RF Choke is also housed in the same oil filled tank along with the main transformer, AC Reactor and diode stack.

- a) Type - Air Core choke
- b) Inductance - 50mH (Tol. +20%)
- c) Rated Current - 1400 mAmps (DC)
- d) Voltage - Connected in series with 95 KVp DC output
- e) Type of Cooling - ONAN

4. **High Voltage Resistor Board:**

The HV Resistor Board is provided to measure output DC voltage of the transformer. The HV Resistor board is connected across the high voltage DC and earth. The resistor board forms a voltage divider circuit and the feedback to read high voltage DC. It is made up of a chain of high accuracy thick film resistors, connected in series, mounted on PCB assembly. The HV resistor board also has protection diodes mounted on it to provide safety to current measuring shunt resistor. The HV Resistor Board is also housed in the same oil filled tank along with the main transformer, AC Reactor, RF Choke and diode stack.

- a) Type - Thick Film High Voltage Resistance
- b) Total Resistance - 78.18 M Ohms (Tol. $\pm 2\%$)
- c) Individual Resistors - 3.9 M Ohms and 360 K Ohms
- d) Watts - 4 W for 3.9 M Ohms and 1 W for 360 K Ohms
- e) Voltage - Connected across 95 KVp DC output
- f) Type of Cooling - ONAN



LEGEND

- BRICK WALL.
- AL. FRAMED PARTIAL GLAZED GLASS WALL,
- FRONT OF THE PANEL

NOTE:-

- ALL DIMENSIONS ARE IN MM AND ELEVATIONS IN METER.
- DOORS AND WALLS SHALL BE CONSTRUCTED AFTER PANEL INSTALLATION.
- THE CLEAR HEIGHT OF THE CONTROL ROOM BETWEEN FLOOR AND FALSE CEILING SHALL BE MINIMUM 3.5 Mtr CONSIDERING LVS.
- PEM-CVL TO CONSIDER THE REQUIREMENT OF COVERING THE COLUMNS & BRACING.
- PEM-CVL TO CONSIDER THE REQUIREMENT OF CHEQUERED PLATES TO COVER UNUSED CUTOUTS AFTER ERECTION OF ALL PANELS.
- HEIGHT OF ALL DOUBLE DOORS FOR SHALL BE 2.5 MTR AND SINGLE DOORS SHALL BE OF 2.1 MTR.
- S-SPARE SPACE FOR PANEL/ PC/ PRINTER.

REF.DRG.

1. TG HALL EQUIPMENT LAYOUT PLAN AT 17.0M FLOOR :PE-DG-415-100-M005

ELECTRONIC EQPT ROOM (EER)

SL NO.	PANEL	DESCRIPTION	DIMENSIONS (WxDxH)	SCOPE	REMARKS
1.	SG PNL	SG DCS PANELS DENOTED AS CJP75-76, CJP01-08, CJP23-30, CJP34-35, CAF20-23, CAF62-64,	750 x 800 x 2067	EDN	TENTATIVE
2.	BOP C&I PNL	STATION C&I DCS PANELS DENOTED AS CRE01-53, CTE01-03, CRE54-59, CFA01,	750 x 800 x 2067	EDN	TENTATIVE
3.	TG PNL	TG DCS PANELS DENOTED AS : CJI03-05, CJI09, CJI41 CJI20-24, CJI50-54, CCA01-06, CCA10-13, CCA20 CCA91-92 & CWW01.	750 x 800 x 2067	EDN	TENTATIVE
4.	SIEMENS PNL	TG SIEMENS PNL (1 NOS) CRY	900 x 1000 x 2200	HWR	TENTATIVE
5.	DC-1&2	MV DATA CONCENTRATOR PANEL (2 NO) DC-1, DC-2	1200 x 800 x 2200	HWR	TENTATIVE
6.	DC-3&4	LV DATA CONCENTRATOR PANEL (2 NO) DC-3, DC-4	800 x 800 x 2315	BPL	TENTATIVE
7.	HMI N/W PNL	NETWORK PANEL (2 NOS) NWPO1-02, NETWORK PANEL LINKS PANEL-NWPL01 POWER DISTRIBUTION CUM LINK- PDNLO1	800 x 800 x 2415	EDN	TENTATIVE
8.	GFCC	GRAVIMETRIC FDR PANELS (8 NOS)	800 x 800 x 2415	EDN	
9.	VMS	VIBRATION MONITORING SYSTEM (4 NOS)	1200 x 600 x 2315	TRY	TENTATIVE
10.	BTS	BUS TRANSFER SYSTEM (6 NOS)	800 x 800 x 2415	EDN	TENTATIVE
11.	HMS	HART MANAGEMENT SYSTEM (04 NOS)	800 x 800 x 2355	BPL	TENTATIVE
12.	GRP	GEN/GT/UT PROTECTION PANEL (05 NOS)	800 x 800 x 2355	EDN	TENTATIVE
13.	STRP	STATION TRF. PROTECTION PANEL (02 NOS)	1000 x 1000 x 2067	BPL	TENTATIVE
14.	MC	MASTER CLOCK (1 NO.)	1000 x 1000 x 2067	EDN	TENTATIVE
15.	ASLD	ACOUSTIC STEAM LEAK DETECTION STATION (1 NO.)	800 x 800 x 2315	EDN	
16.	RTCC	REMOTE TAP CONTROL CHANGER (3 NO.)	800 x 800 x 2315	EDN	
17.	FAP	FIRE ALARM PANEL	660 x 600 x 2300	BPL	
			800 x 800 x 2200	PESD	

CENTRAL CONTROL ROOM

SL NO.	PANEL	DESCRIPTION	DIMENSIONS (WxDxH)	SCOPE	
1.	OWS	UNIT DDCMS-10NOS (SG-2, BMS-2, TG-1, STN C&I-2, OFFSITE-1, EDMS-2) TG SIEMENS - 01 NO CCTV MONITOR-01 NO ASLD OWS - 01 NO PADO OWS - 01 NO ESP OWS - 01 NO FLAME MONITOR - 01 NO	12930 x 3435 x 750	EDN	
2.	LVS	LARGE VIDEO SCREEN (04 NOS)	1550 x 743 x 2072	HWR	
3.	ECP	ELECTRICAL CONTROL PANEL	4232 x 1000 x 2355	EDN	
4.	UCP	UNIT CONTROL PANEL	1544 x 1000 x 2355	EDN	
5.	STATION INCHARGE ROOM	SHIFT INCHARGE OWS- (01 NO) 21-PADO OWS (01 NO) COLOR LASER JET PRINTER (A3)- (01 NO)	1500 x 750 x 735	EDN	
6.	PADO ROOM	22-PADO SERVER (02 NOS) 23-PADO A4 PRINTER (01 NO)	1500 x 750 x 735	EDN	

COMPUTER ROOM

SL NO.	DESCRIPTION	QTY.	DIMENSIONS (WxDxH)	SCOPE	REMARKS
1.	01-ENGG. WORK STATION	2 NOS	1500 x 750 x 735	EDN	
	02-PERFORMANCE CAL. PC	1 NO	1500 x 750 x 735	EDN	
	03-HISTORIAN STATION	2 NOS	1500 x 750 x 735	EDN	
	06-OWS HV DATA CONCENTRATOR WITH PRINTER	2 NOS	1500 x 750 x 735	BPL	TENTATIVE
	07-OWS LV DATA CONCENTRATOR WITH PRINTER	2 NOS	1500 x 750 x 735	EPD	TENTATIVE
	10-EWS FOR GRP RELAYS WITH PRINTER	1 NO	1500 x 750 x 735	BPL	
	11-OPC STATION (MAX LINK)	1 NO	1500 x 750 x 735	EDN	
	12-MIS STATION (SERVER)	1 NO	1500 x 750 x 735	EDN	
	13-EWS SIEMENS	1 NO	1500 x 750 x 735	HWR	TENTATIVE
	14-OWS FAP	1 NO	1500 x 750 x 735	PESD	
	05-RMCMS/VMS PC	1 NO	1500 x 750 x 735	EDN	
	17-TERMINAL SERVER	2 NOS	1500 x 750 x 735	EDN	
	04-HMS PC	1 NO	1500 x 750 x 735	EDN	
	18-MAX OWS	1 NO	1500 x 750 x 735	EDN	
	20-TSI PC	1 NO	1500 x 750 x 735	EDN	
2.	PRINTERS				
	101 DOT MATRIX PRINTER (A4)	5 NOS	900 x 650 x 740	EDN	
	102-COLOR LASER JET PRINTER (A4)	5 NOS	900 x 650 x 740	EDN	
	103-COLOR LASER JET PRINTER (A3)	2 NOS	900 x 650 x 740	EDN	
	104-MULTIFUNCTION PRINTER (A3)	1 NO	900 x 650 x 740	EDN	
	107-FAP PRINTER	1 NO	900 x 650 x 740	PESD	
	105-VMS PRINTER	1 NO	900 x 650 x 740	EDN	
	108-HMS PRINTER	1 NO	900 x 650 x 740	EDN	

ALL DIMENSIONS ARE IN mm

												CUSTOMER					OWNER  MAHAGENCO		MAHARASHTRA STATE POWER GENERATION CO.LTD. (MAHAGENCO)																							
												CUSTOMER'S CONSULTANT																														
												JOB NO. 415					PROJECT:-		1x660 MW BHUSAVAL TPS UNIT-6																							
												STATUS CONTRACT																														
												DISTRIBUTION																														
REV. 06	DATE 01.02.21	DRW VS	DSN VKV	CHD SCS	APPD DP	REV. 03	DATE 27.12.18	DRW VS	DSN VKV	CHD SCS	APPD SM	REV. 01	DATE 21.07.18	ALTD VS	CHD VKV	APPD SCS	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA				DEPT CODE I	<table><tr><td></td><td>NAME</td><td>SIGN</td><td>DATE</td></tr><tr><td>DRAW</td><td>VS</td><td>-sd-</td><td>09.05.2018</td></tr><tr><td>BESN</td><td>VS/VKV</td><td>-sd-</td><td>09.05.2018</td></tr><tr><td>CHD</td><td>SCS</td><td>-sd-</td><td>09.05.2018</td></tr><tr><td>APPD</td><td>DP</td><td>-sd-</td><td>09.05.2018</td></tr></table>		NAME	SIGN	DATE	DRAW	VS	-sd-	09.05.2018	BESN	VS/VKV	-sd-	09.05.2018	CHD	SCS	-sd-	09.05.2018	APPD	DP	-sd-	09.05.2018
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REV. 05	DATE 23.05.20	DRW VS	DSN VKV	CHD SCS	APPD SM	REV. 02	DATE 22.09.18	DRW VS	DSN VKV	CHD SCS	APPD SM																															
1. REVISED IN LINE WITH CUSTOMER COMMENTS.												1. REVISED IN LINE WITH CUSTOMER COMMENTS.												TITLE CCR/CER/COMPUTER ROOM LAYOUT (AT EL 17.0M)																		
																								CUSTOMER PACKAGE CODE - DEPT. SCALE 1:1 DRAWING NO.																		
DISCIPLINE												M C E I L SIGN DATE												DRAWING NO. PE-DG-415-145-I401																		
																								SHEET 1 OF 1 REV. 06																		

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

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			CHECKED		01	14.12.19	CHECKED	RKS	W.D.68001-A-512-01												
					REVISED IN LINE WITH CUSTOMER'S COMMENTS				STATUS OF DRAWING												
									DISTRIBUTION OF PRINTS												
DEVELOPMENT CONSULTANT PVT. LTD. Reviewed only for general conformance with contract drawings and specifications; Contractor to be responsible for any error and for fulfilment of details requirements of contract documents. CODE:- 1 (ONE)* DATE:- 08.01.2020 DISTRIBUTED BY:- SALONI BELNEKAR <table border="1" style="width: 100%;"> <tr> <td style="width: 10%;">✓</td> <td style="width: 40%;">Approved</td> <td style="width: 10%;">4</td> <td style="width: 40%;">For information only</td> </tr> <tr> <td>2</td> <td>Approved Subject to compliance to comments, Proceed with manufacturing/construction. Revised document required to be submitted after incorporating the comments.</td> <td>V</td> <td>Null and Void (Not applicable)</td> </tr> <tr> <td>3</td> <td>Not Approved. Resubmission required</td> <td></td> <td></td> </tr> </table> SEE COVERING LETTER LETTER REF.NO.:- 18V06-E-LOT-BHEL-0090										✓	Approved	4	For information only	2	Approved Subject to compliance to comments, Proceed with manufacturing/construction. Revised document required to be submitted after incorporating the comments.	V	Null and Void (Not applicable)	3	Not Approved. Resubmission required		
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REF. DRG. No.	CUSTOMER:		M/s MSPGCL																		
	CONSULTANT :		DEVELOPMENT CONSULTANTS PVT. LTD. CONSULTING ENGINEERS VASHI NAVI MUMBAI																		
	LOCATION:		BHUSAWAL																		
	LOA NO.		DG/BSL U-6/2011/T-1/BTG+BOP EPC CONTRACT/SUPPLY/0054 DTD 7/1/18																		
	DOC. NO.		BP-DG-415-301-0013 BP-DG-415-301-0012																		
SIGN & DATE	PROJECT:		1X660MW BHUSAWAL UNIT-6																		
	TYPE OF PRODUCT OR NAME OF CUSTOMER / PROJECT		275MVA, 21/420/√3KV, 1-PHASE, ONAN/ONAF/OFAP COOLED GEN. TRANSFORMER																		
	BHARAT HEAVY ELECTRICALS LTD. BHOPAL		PRP.	S.S.	-SD-	05.04.19	APPD	R.K.S	-SD-	05.04.19											
INVENTORY No.	DEPT. TRE	GRADE OF DIM. TOL. C/M/F		SCALE X-AXIS Y-AXIS	WEIGHT(KG) N/A	REF. TO ASSY. DRG.			ITEM No.	75 77											
	CODE 406					—			—	—											
TITLE					1	7			22	REV.											
GENERATOR TRANSFORMER-DATA SHEET					CARD CODE	DOC. NO. TRE/68001/GTP			01												
						SHEET No. 01			No. OF SHEETS 17												

NAME OF MANUFACTURER : BHEL BHOPAL
REFERENCE STANDARD : IS 2026

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : VIII-B
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 1
REV: R0	DATA/DOCUMENTS TO BE FURNISHED BY BIDDER		Page 12 of 380
<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
(a)	H.V.		420 / $\sqrt{3}$
(b)	L.V.		21
1.2.4	Rated Current	Amps.	
(a)	H.V.		1134
(b)	L.V.		13095
1.2.5	Rated Frequency	Hz	50
1.2.6	Connection		
(a)	H.V.		Star with neutral earthed
(b)	L.V.		Delta
1.2.7	Vector Group Reference		YNd11 (after bank formation)
1.2.8	Voltage Withstand Time	Sec.	
(a)	110% of rated voltage		Continuous
(b)	125% of rated voltage		60 sec
(c)	140% of rated voltage		5 sec
(d)	150% of rated voltage		2-3 secs
1.2.9	Overfluxing Capability		
(a)	For Overfluxing Factor 1.1	Sec.	Continuous
(b)	For Overfluxing Factor 1.25	Sec.	60 sec
(c)	For Overfluxing Factor 1.4	Sec.	5 sec
1.3	<u>TEMPERATURE</u>		
1.3.1	Reference Ambient Temperature		50 deg C

OWNER'S CONSULTANT : DEVELOPMENT CONSULTANTS PVT. LTD.
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REV: R0		DATA/DOCUMENTS TO BE FURNISHED BY BIDDER	
		Page 13 of 380	
<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
1.3.2	Temperature rise over reference ambient	Deg.C	
(a)	Of Top oil by thermometer		40 deg C
(b)	Of winding by resistance		45 deg C
1.3.3	Maximum continuous over loading capacity of the transformer without exceeding the specified winding temperature		As per IS-6600/IEC-60076-7
1.4	<u>TAPPINGS</u>		
1.4.1	Type		OCTC
1.4.2	Capacity		100kV 1250A
1.4.3	Range - Steps x % Variation		+/- 2 steps @ 2.5 %
1.4.4	Taps provided on HV/LV Winding		HV
1.5	<u>INSULATION LEVEL</u>		
1.5.1	H.V. LI /SI /AC	kVp/kVp/kV	1425/1050/630
1.5.2	L.V. LI /AC	kVp/kV	125/50
1.5.3	H.V. Neutral LI /AC	kVp/kV	95/38
1.5.4	L.V. Neutral LI /AC	kVp/kV	-----
1.6	Impedances at Principal Tap at Rated Frequency and 75 Deg.C winding temperature %		
1.6.1	Base MVA		275 MVA

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REV: R0	DATA/DOCUMENTS TO BE FURNISHED BY BIDDER		Page 14 of 380
<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
1.6.2	Impedance		13.5% ± 5% TOL.
1.6.3	Reactance		13.4% approx
1.6.4	Resistance at 75	Deg.C	HV: 0.078 ohms approx
1.6.5	Zero Sequence Impedance at	Deg.C	13.23 % approx
1.6.6	Capacitance of Windings micro farad /phase		
(a)	H.V. – Earth		2800 pF Approx.
(b)	L.V. – Earth		10000 pF Approx.
(c)	H.V. - L.V.		3200 pF Approx.
1.7	<u>GUARANTEED LOSSES AT PRINCIPAL TAP, FULL LOAD AND 75</u>	Deg.C kW	
1.7.1	No load losses		100 kW max
1.7.2	Load losses		370 kW max
1.7.3	Cooler losses		9 kW max
1.7.4	Tolerance on losses		no positive tol
1.8	<u>EFFICIENCY AT 75 DEG.C AND 0.8 POWER FACTOR LAG</u>	%	
1.8.1	At full load		99.78 % Approx
1.8.2	At 3/4 full load		99.81 % Approx
1.8.3	At 1/2 full load		99.82 % Approx
1.8.4	Maximum Efficiency		99.86 % approx

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	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 1
	REV: R0	DATA/DOCUMENTS TO BE FURNISHED BY BIDDER	Page 15 of 380
<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
(a)	Load and Power Factor at which it occurs		52% load at unity power factor
1.9	<u>REGULATION AT FULL LOAD AT 75</u>	Deg.C %	
1.9.1	At unity power factor		1.10 % Approx
1.9.2	At 0.8 power factor lagging		8.20 % Approx
1.10	<u>NO LOAD CURRENT REFERRED TO HV</u>	Amps.	
1.10.1	At 90% rated voltage		0.3 % approx of rated current
1.10.2	At 100% rated voltage		0.6 % approx of rated current
1.10.3	At 110% rated voltage		1.5 % approx of rated current
1.10.4	At 125% rated voltage		7 % approx of rated current
1.10.5	At 140% rated voltage		11 % approx of rated current
1.11	<u>APPROXIMATE MAXIMUM FLUX DENSITY</u>	Web/Sq. m	
1.11.1	At 90% rated voltage		1.55
1.11.2	At 100% rated voltage		1.72
1.11.3	At 110% rated voltage		1.9
1.11.4	At 125% rated voltage		2.16
1.11.5	At 140% rated voltage		2.42
1.12	<u>MAXIMUM CURRENT DENSITY</u>	Amps/Sq .cm	
1.12.1	H.V. Winding		280 A/sq cm

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 MAHARASHTRA STATE POWER GENERATION CO. LTD.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : VIII-B
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section – 1
	REV: R0	DATA/DOCUMENTS TO BE FURNISHED BY BIDDER	Page 16 of 380
<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
1.12.2	L.V. Winding		280 A / Sq cm
1.13	<u>WITHSTAND TIME</u> <u>WITHOUT INJURY FOR</u>	Sec.	
1.13.1	Three phase dead short-circuit at terminal with rated voltage maintained on the other side		2 sec
1.13.2	Single phase short-circuit at terminal with rated voltage maintained on other side		2 sec
1.14	<u>COOLING SYSTEM</u>		
1.14.1	(a) No. x Capacity of cooling unit furnished		2 x 60% radiator banks
	(b) No. of cooling units required for full load operation		Two
1.14.2	Each Cooling Unit is provided with		
(a)	No. x kW of oil pump motor		2 (1 running+1 standby) , 1.3 kW
(b)	No. x kW of fan motor		(4 running + 1s/by) per bank, 0.77kW each
(c)	No. of standby fan		1 for each bank
(d)	No. of standby oil pumps		1 for each bank
1.14.3	Motors rated for voltage phase-frequency		415 V , 3-ph , 50 Hz AC
1.14.4	Automatic Operation of cooler pumps and fans provided?		YES

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<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
1.14.5	Transformer is capable of delivering rated output under following conditions		
(a)	Failure of all pumps and fans of one cooling unit		
	(i) Continuous in % rated,	MVA	275MVA, 100%
	(ii) Rated output for	min	20
(b)	Failure of one complete cooling unit including radiator, fans, pumps etc.		
	(i) Continuous in % rated,	MVA	275MVA, 100%
	(ii) Rated output for	min	10
(c)	Failure of fans and pumps of all the cooler units		
	(i) Continuous in % rated,	MVA	275MVA, 100%
	(ii) Rated output for	min	10
(d)	Failure of complete cooling system including radiators, fans, pumps, etc.		
	(i) Continuous in % rated,	MVA	275MVA, 100%
	(ii) Rated output for	min	1
1.14.6	Schematic Flow Diagram of the Cooling System Furnished?		YES
1.14.7	Oil Pumps		Refer oil flow diagram

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<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
(a)	Make		Becon weir/Flowwell/Reputed indigenous make.
(b)	Type		Inline type
(c)	Catalogue Furnished		Shall be furnished alongwith InstructionManual
1.15	<u>DETAILS OF TANK</u>		BELL TYPE TANK
1.15.1	Material		Commercial grade low carbon structural steel
1.15.2	Thickness of sides	mm	10 Approx
1.15.3	Thickness of bottom	mm	20 Approx
1.15.4	Thickness of cover	mm	20 Approx
1.15.5	Tank Designed for		
(a)	Vacuum	mm of Hg	Suitable for full vacuum .
(b)	Pressure		Twice the normal head of oil or normal pressure plus 35 kN/m ² whichever is lower
1.16	<u>CORE</u>		
1.16.1	Type - Core or shell		Core type
1.16.2	Core material		High Grade CRGO SS
1.16.3	Thickness of lamination	mm	0.23/0.27 APPROX
1.16.4	Insulation of lamination		Carlite coating
1.16.5	Equivalent cross-sectional area		17000 sq cm approx.
1.17	<u>COILS</u>		
1.17.1	Type of Coil		
(a)	H.V.		Disc Type

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<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
(b)	L.V.		Helical
1.17.2	Conductor Material		Electrolytic copper
1.17.3	Insulating Material		
(a)	H.V. – Turn		Kraft paper + Oil
(b)	L.V. – Turn		Kraft paper + Oil
(c)	L.V. – Earth		Paper + Pressboard + Oil
(d)	H.V. - L.V.		Paper + Pressboard + Oil
(e)	H.V. Earth		Paper + Pressboard + Oil
1.18	<u>TAP CHANGER</u>		
1.18.1	Make		As per approved vendor
1.18.2	Type		OFF Circuit
1.18.3	Rated Voltage	kV	170
1.18.4	Rated Current	Amps.	2000
1.18.5	Auxiliary Power	kW	
1.18.6	Time required for one step change	Secs.	5
1.18.7	Rated Voltage	Volts	170000
(a)	Tap-change motor		NA for OCTC
(b)	Control circuit		110 V
1.18.8	Control		
(a)	Manual/Local Electrical/ Remote Electrical		manual/local

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<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
(b)	Group/Solo		Solo
1.18.9	Voltage Control Automatic/ Non-automatic		Non automatic
1.18.10	Provision for parallel operation		Yes/No NO
1.18.11	Maximum Short Circuit Current withstand capability		
(a)	Current		24kA
(b)	Time		3 sec
1.18.12	Loose equipment and provisions for remote control furnished as per specification?		NA
1.18.13	Local manual operation feasible from standing height from ground?		Yes
1.18.14	Local indicator furnished for		
(a)	Tap position		Yes
(b)	Operation counter		Yes
1.18.15	In case of off-circuit tap changer		
(a)	Padlocking provided		Yes/No Yes
(b)	Auxiliary switch for interlock provided		Yes/No Yes
(c)	Safety limit switch provided		Yes/No Yes

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<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
(d)	Discrepancy detector provided		Yes/No Yes
1.18.16	In case of On-load tap changer		Not applicable
(A)	Interlocks as per specification provided		
(B)			
(a)	Voltage Regulating relay provided		Yes/No N.A.
	(i) Make		
	(ii) Type		
	(iii) Sensitivity (Dead band) and nominal value range		
	(iv) Timer range		
	(v) Literature furnished.		
(b)	Under voltage Relay		N.A.
	(i) Voltage range		
	(ii) Timer range		
1.19	<u>INSULATING OIL</u>		
1.19.1	Approximate volume Litre		65910 approx. without 10% excess
1.19.2	10% excess oil furnished?		yes
1.19.3			
(a)	Oil conforms to		IS:335

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<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
(b)	Details of oil furnished		Inhibited oil
1.19.4			
(a)	Oil preservation system provided?		Yes
(b)	Type		Aircell type (constant oil pressure) With breather
1.20	<u>BUSHINGS H V /LV</u> <u>HVN/LVN</u>		HV LV HVN
1.20.1	Make		As per MSPGCL approved vendor
1.20.2	Type		OIP <---porcelain---> Hermetically sealed type
1.20.3	Reference Standard		IS:2099
1.20.4	Voltage class	kV	420 36 36
1.20.5	Type of atmosphere		polluted
1.20.6	Creepage Distance	mm	13020 1116 1116
1.20.7	Weight	kg	925 appx 254 appx 51 appx
1.20.8	Free space required for bushing removal		12000 1400 1400
1.20.9	Test terminals for H.V. bushing provided?		yes NA NA
1.20.10	One minute power frequency withstand voltage	kV rms	695 70 70
1.20.11	Impulse withstand voltage KV peak		1550 170 170
1.21	<u>MINIMUM CLEARANCE</u>		
1.21.1	Between Phases		

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- 1.20.12: SC rating of bushing 50/100/78.75 kA (HV/LV/HVN) for 2 sec
1.20.13 : Height of bushing : As per bushing GA drawing (mm)
1.20.14 : Current rating of bushing 2000/20000/3150 A

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<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
(a)	In air		
	(i) HV	mm	NA
	(ii) LV	mm	NA
(b)	In oil		
	(i) HV	mm	NA
	(ii) LV	mm	NA
1.21.2	Between Phase & Earth		
(a)	In air		
	(i) HV	mm	3500
	(ii) LV	mm	320
(b)	In oil		
	(i) HV	mm	ADEQUATE , Propriety data
	(ii) LV	mm	ADEQUATE , Propriety data
1.22	<u>TERMINAL CONNECTIONS</u>		
1.22.1	HV		oil to air OIP Bushings
1.22.2	LV		oil to air porcelain
1.22.3	H.V. Neutral		grounded through copper flat
1.22.4	L.V. Neutral		NA
1.23	<u>MARSHALLING BOX</u>		
1.23.1	Weatherproof, suitable for outdoor duty		YES
1.23.2	Degree of protection		IPW-55

90mm min

20mm min

with Bi-metallic connector

suitable for Isolated phase bus duct connection

(10X125 mm)

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<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
1.24	<u>TERMINAL BLOCKS</u>		
1.24.1	Make		Elmex/Technoplast/Other reputed indigenous make
1.24.2	Type		Stud type
1.24.3	20% spare terminals furnished?		Yes
1.25	<u>WIRING</u>		
1.25.1	Cable type		PVC/SWA PVC
1.25.2	Voltage grade	Volt	1100 V
1.25.3	Conductor Size	Sq.mm	2.5 mm ² 4 mm ² for CT lead
(a)	Material	Cu.	Cu
(b)	Stranded		Yes/No Yes
1.26	<u>TRIP AND ALARM CONTACTS RATINGS</u>		
(a)	220V D.C		0.5 A approx.
(b)	240V A.C.		5.0 A approx.
1.26.1	Voltage	Volt	220 AC/DC
1.26.2	Rated	Amps.	
(a)	Making Current		0.5 A approx.
(b)	Breaking Current (Inductive Breaking)		0.5 A approx.
(c)	Each transformer furnished with fittings and accessories as per specification?		Yes/No Yes

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<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>		
1.27	<u>DETAIL OF CONSERVATOR</u>			
1.27.1	Volume of Conservator		5070 ltrs approx.	
1.27.2	Volume of oil between the highest and lowest levels		4435 ltrs approx.	
1.28	<u>PRESSURE RELEASE DEVICE</u>			
(a)	Minimum pressure the device is set to operation /rupture	KN/Sq.m	7 ± 1 psi	35 kN/m2 49kN/m2
(b)	Alarm and trip contacts provided		yes	
1.29	<u>SPARE PARTS</u>			
(a)	Each transformer furnished with spare parts as per specification		Yes	
1.30	<u>APPROXIMATE OVERALL DIMENSION</u>			
1.30.1	Length	mm	13000 approx	
1.30.2	Breadth	mm	7535 approx.	
1.30.3	Height	mm	9790 approx.	
(a)	Crane lift (a) for untanking core and coil assembly (including sling) (b) tank cover in case of Bell type tank	mm	12500 approx	

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<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
1.31	<u>APPROXIMATE WEIGHTS</u>		
1.31.1	Core and Coil	kg.	175000 approx.
1.31.2	Tank cover for Bell type tank	kg.	16000 approx
1.31.3	Tank , fittings & accessories	kg.	63300 approx.
1.31.4	Oil	kg.	-- 57340 approx.
1.31.5	Total Weight	kg.	295640 approx.
1.32	<u>SHIPPING DATA</u>		
1.32.1	Weight of the heaviest package	kg.	203000 approx.
1.32.2	Dimension of the largest package (L x B x H)	mm	6200 x 4700 x 4800 approx.
1.33	Tests to be conducted on each Transformer		
1.33.1	Routine tests as per specification/ relevant standard		Yes
1.33.2	Tank pressure test on each transformer		
(a)	Test Pressure	KN/Sq.m	Normal head of oil + 35 kN/m2
(b)	Duration	Hours	1
(c)	Permanent deflection		yes on one transformer
1.33.3	Tank vacuum test on each transformer		
(a)	Vacuum	KN/Sq.m	3.33

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<u>SR. NO.</u>	<u>ITEM</u>	<u>UNIT</u>	
(b)	Duration	Hours	1
(c)	Permanent deflection		yes on one transformer
1.33.4	Oil leak test on each transformer		
(a)	Test pressure		Normal head of oil + 35 kN/m2
(b)	Duration		8
1.33.5	Core bolt withstand voltage for 1 minute on each transformer	kV	2 kV
1.34	<u>NEUTRAL CURRENT TRANSFORMER</u>	All bushing CT ¹ s as per R&D plate drawing no. 34690002086	
1.34.1	General	Please add all CT details related HV & LV sides also here.	
1.34.2	Make		
1.34.3	Type		
1.34.4	Reference Standard		
1.34.5	Use		
1.34.6	Rating		
(a)	C.T. Ratio		
(b)	Class		
(c)	Insulation level		
(d)	Burden		
1.34.7	Insulation Class		

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BHARAT HEAVY ELECTRICALS LIMITED, JHANSI TRANSFORMER ENGINEERING



MAHARASHTRA STATE POWER GENERATION CO. LTD.

BHUSAWAL T.P.S UNIT-6: 1 X 660 MW



DEVELOPMENT CONSULTANTS PVT. LTD.

CONSULTING ENGINEERS. VASHI, NAVI MUMBAI

Doc No.: TRE/72060-063N/DS, REV-05

DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
1.	Name of Manufacturer		BHEL, Jhansi				
2.	Type		Cast Resin Dry Type Transformer				
3.	Quantity / Application	Nos.	6 / Station / FGD / Boiler Service	18 / Turbine /ESP / DM Plant / Filtered Water P/H Service	4 / Fire Water P/H / FGD Common Service	4 / Service Building / Lighting Service	3 / Fuel Oil Unloading P/H / Welding Service
4.	Installation		Indoor				
5.	Reference Standards		IS: 11171-1985				
6.	No. of Phases	Nos.	3	3	3	3	3
7.	Frequency	Hz	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz
8.	Rated Power	KVA	2500	2000	1600	1000	630

DEVELOPMENT CONSULTANT PVT. LTD.

Reviewed only for general conformance with contract drawings and specifications;
Contractor to be responsible for any error and for fulfilment of details requirements of contract documents.

CODE:- 1 (ONE)

DATE:- 05.09.2020

DISTRIBUTED BY:- SALONI BELNEKAR

1	Approved	4	For information only
2	Approved Subject to compliance to comments, Proceed with manufacturing/construction. Revised document required to be submitted after incorporating the comments.	V	Null and Void (Not applicable)
3	Not Approved. Resubmission required		

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LETTER REF.NO.:- 18V06-E-LOT-BHEL-0219



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DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
9.	Rated Voltage						
	a) HV	KV	11	11	11	11	11
	b) LV	KV	0.433	0.433	0.433	0.433	0.433
10.	No Load Voltage Ratio - (HV/LV)	KV	11/0.433	11/0.433	11/0.433	11/0.433	11/0.433
11.	Rated Current						
	a) HV	Amp	131.21	104.97	83.98	52.49	33.07
	b) LV	Amp	3333.43	2666.74	2133.40	1333.37	840.02
12.	Tapings	%					
	a) Type		Off circuit bolted links type of tap changer				
	b) Capacity		Full				
	c) Range		+ 5.0 % to - 5.0 % in Steps of 2.5 % on HV side				
	d) Tap provided on HV winding		Yes, on HV winding				
13.	High Voltage Connection		Delta	Delta	Delta	Delta	Delta



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CONSULTING ENGINEERS. VASHI, NAVI MUMBAI

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DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
14.	Low Voltage Connection		Star	Star	Star	Star	Star
15.	Vector Group		Dyn11	Dyn11	Dyn11	Dyn11	Dyn11
16.	Type of Cooling		AN	AN	AN	AN	AN
17.	Temperature						
	a) Ambient temperature	°C	50	50	50	50	50
	b) Average temperature rise in winding by resistance method over ambient temperature	°C	90	90	90	90	90
	b) Temperature Rise on enclosure (accessible portion) by thermometer over ambient temperature	°C	30	30	30	30	30



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MAHARASHTRA STATE POWER GENERATION CO. LTD.

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DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
18.	Winding temperature measuring devices						
	a) Type		RTD (PT-100) with digital temperature scanner				
	b) No. per phase		2 No's Simplex PT-100 per phase				
19.	Impedance at rated current, rated frequency, normal tap (Tap-3) at 75 °C						
	a) Impedance	%	10 % ± IS Tol.	10 % ± IS Tol.	8 % ± IS Tol.	6 % ± IS Tol.	6 % ± IS Tol.
	b) Reactance	%	9.95 % (Approx.)	9.96 % (Approx.)	7.94 % (Approx.)	5.92 % (Approx.)	5.90 % (Approx.)
	c) Resistance	%	0.96 % (Approx.)	0.90 % (Approx.)	0.94 % (Approx.)	0.95 % (Approx.)	1.11 % (Approx.)
	d) Zero Sequence	%	10 % (Approx.)	10 % (Approx.)	8 % (Approx.)	6 % (Approx.)	6 % (Approx.)
	e) X/R Ratio		10.37 (Approx.)	11.07 (Approx.)	8.47 (Approx.)	6.24 (Approx.)	5.31 (Approx.)
20.	No-Load Losses at rated Frequency and 100% rated voltage	KW	4.2 KW + IS Tol.	3.6 KW + IS Tol.	3.0 KW + IS Tol.	2.4 KW + IS Tol.	1.75 KW + IS Tol.



BHARAT HEAVY ELECTRICALS LIMITED, JHANSI

TRANSFORMER ENGINEERING



MAHARASHTRA STATE POWER GENERATION CO. LTD.

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Doc No.: TRE/72060-063N/DS, REV-05

DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
21.	Load Losses at Normal rated current and at 75 °C	KW	24.0 KW + IS Tol.	18.0 KW + IS Tol.	15.0 KW + IS Tol.	9.5 KW + IS Tol.	7.0 KW + IS Tol.
22.	Total Losses	KW	28.2 KW + IS Tol.	21.6 KW + IS Tol.	18.0 KW + IS Tol.	11.9 KW + IS Tol.	8.75 + IS Tol.
23.	Efficiency at 75 °C and at unity power factor						
	a)100 % of Full Load	%	98.88% (Approx.)	98.93% (Approx.)	98.89 % (Approx.)	98.82 % (Approx.)	98.63 % (Approx.)
	b)75 % of Full Load	%	99.06% (Approx.)	99.09 % (Approx.)	99.06 % (Approx.)	98.98 % (Approx.)	98.81 % (Approx.)
	c)50 % of Full Load	%	99.19% (Approx.)	99.20 % (Approx.)	99.16 % (Approx.)	99.05 % (Approx.)	98.90 % (Approx.)
	d)25 % of Full Load	%	99.10% (Approx.)	99.06 % (Approx.)	99.03 % (Approx.)	98.82 % (Approx.)	98.63 % (Approx.)
24.	Efficiency at 75 °C and 0.8 p.f. lagging						
	a)100 % of Full Load	%	98.61 % (Approx.)	98.67 % (Approx.)	98.61 % (Approx.)	98.53 % (Approx.)	98.29 % (Approx.)
	b)75 % of Full Load	%	98.83 % (Approx.)	98.87 % (Approx.)	98.82 % (Approx.)	98.73 % (Approx.)	98.52 % (Approx.)
	c)50 % of Full Load	%	98.99 % (Approx.)	99.20 % (Approx.)	98.96 % (Approx.)	98.82 % (Approx.)	98.63 % (Approx.)
	d)25 % of Full Load	%	98.87 % (Approx.)	99.06 % (Approx.)	98.78 % (Approx.)	98.53 % (Approx.)	98.29 % (Approx.)



BHARAT HEAVY ELECTRICALS LIMITED, JHANSI TRANSFORMER ENGINEERING



MAHARASHTRA STATE POWER GENERATION CO. LTD.

BHUSAWAL T.P.S UNIT-6: 1 X 660 MW



DEVELOPMENT CONSULTANTS PVT. LTD.

CONSULTING ENGINEERS. VASHI, NAVI MUMBAI

Doc No.: TRE/72060-063N/DS, REV-05

DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
25.	Voltage Regulation at full load at 75 °C for						
	a) Unity Power factor	%	1.46 % (Approx.)	1.40 % (Approx.)	1.25 % (Approx.)	1.13 % (Approx.)	1.28 % (Approx.)
	b) 0.8 power factor (lag)	%	7.01 % (Approx.)	6.97 % (Approx.)	5.68 % (Approx.)	4.40 % (Approx.)	4.51 % (Approx.)
26.	a) Maximum efficiency	%	99.20 % (Approx.)	99.20 % (Approx.)	99.17 % (Approx.)	99.05 % (Approx.)	98.90 % (Approx.)
	b) Load at which max. efficiency occurs	%	41.83 % (Approx.) at UPF	44.72 % (Approx.) at UPF	44.72 % (Approx.) at UPF	50.26 % (Approx.) at UPF	50.00 % (Approx.) at UPF
27.	Flux Density	Tesla					
	a) At 90% rated voltage :		1.57 (Approx.)				
	b) At 100% rated voltage :		1.73 (Approx.)				
	c) At 110% rated voltage :		1.90 (Approx.)				
27.b	Over Voltage withstand time for % over voltage of						
	a) 125 %		Continuous				
	b) 125 %		60				
	c) 140 %		5				



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DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
	d) 150 %		1				
28.	Current Density	A/cm ²					
	a) H.V. winding :		280 (Approx.)				
	b) L.V. winding :		280 (Approx.)				
29.	No-Load current referred to HV as percentage of rated full load current	%					
	a) At 90% rated voltage		1.0 % (Approx.)	1.0 % (Approx.)	1.0 % (Approx.)	1.5 % (Approx.)	1.75 % (Approx.)
	b) At 100% rated voltage		1.5 % (Approx.)	1.5 % (Approx.)	1.5 % (Approx.)	2.0 % (Approx.)	2.5 % (Approx.)
	c) At 110% rated voltage		2.5 % (Approx.)	2.5 % (Approx.)	2.5 % (Approx.)	4.0 % (Approx.)	5.0 % (Approx.)
30.	Impulse Voltage withstand level						
	a) HV Winding	KV _p	75				
	b) LV Winding	KV _p	-				



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CONSULTING ENGINEERS. VASHI, NAVI MUMBAI

Doc No.: TRE/72060-063N/DS, REV-05

DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
31.	Power Frequency Voltage withstand level for one minute						
	a) HV Winding	KV _{rms}	28				
	b) LV Winding	KV _{rms}	3				
32.	Withstand Time Without Injury for Single/Three phase dead short-circuit at terminal with rated voltage maintained on the other side:	(Sec.)	2 sec (Thermal)				
33.	Insulation Class		'H' with Winding temperature rise limited to "F"				
34.	Core						
	a) Type		Core Type				
	b) Material & Grade		CRGO Si Steel & M4/Equivalent				
	c) Thickness of lamination		0.27 mm (Approx.)				



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DEVELOPMENT CONSULTANTS PVT. LTD.

CONSULTING ENGINEERS. VASHI, NAVI MUMBAI

Doc No.: TRE/72060-063N/DS, REV-05

DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
	d) Insulation of lamination		Carlite				
35.	Type of Coil						
	i) HV		Disc/spiral				
	ii) LV		Layer/helical				
36.	Insulating Material						
	a) HV – Turn		Epoxy Resin / Enamel / Fibre Glass				
	b) LV – Turn		Epoxy Resin / Fibre Glass				
	c) LV – Earth		Epoxy Resin / Fibre Glass / Air				
	d) HV – LV		Enamel / Epoxy Resin / Fibre Glass / Air				
	e) HV Earth		Enamel / Epoxy Resin / Fibre Glass / Air				
37.	Method of Casting		Vacuum Cast, Epoxy Resin Encapsulated coils.				
38.	Separate encapsulation for HV and LV windings provided?		Yes				



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DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
39.	HV Terminal Arrangement		Through Cable Box				
40.	a) LV Terminal Arrangement		Through Non-Segregated Phase Bus Duct				
	b) LV Neutral Arrangement		50X5 mm Copper Flat shall be provided & the same shall be connected to 75X10 mm GS Flat				
41.	Total Approximate weight	Kg	8000 (Approx.)	7000 (Approx.)	6600 (Approx.)	4600 (Approx.)	3600 (Approx.)
42.	Approximate Overall Dimensions with Enclosure						
	Length X Breadth X Height	mm	As per OGA				
43.	Enclosure						
	a) Material		HRC Sheet Steel				
	b) Thickness		2mm Thick				
	c) Protection Class		IP-33				
	d) Padlocking arrangement		Yes				
44.	Wheels		Plain, Bi-directional Rollers				



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Doc No.: TRE/72060-063N/DS, REV-05

DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
45.	Materials						
	a) Core material & Grade		CRGO Si Steel & M4/Equivalent				
	b) Windings		Electrolytic Grade Copper				
	c) Enclosure		2mm Thick HRC Sheet Steel				
	d) Insulation		Fiber Glass / Epoxy Resin				
	e) Makes of all materials		As per MSPGCL approved Vendor list / As per BHEL vendor list as approved by MSPGCL				
46.	Paint		Epoxy paint, Shade RAL 7032 with average paint thickness 100 microns				
47.	Bushings						
	a) Make		As per MSPGCL approved Vendor list / As per BHEL vendor list as approved by MSPGCL				
	b) Type		Epoxy Resin molded				
	c) Reference Standard		IS 2099				
	d) Voltage class KV		HV-12 KV; LV and LV neutral: Not Applicable (Terminated through Bus Bars)				
	e) Creepage distance	mm	HV: 325mm / 27.08 mm/KV ; LV: Not Applicable				
	f) Weight	Kg	10 kg (Approx.)				
	g) Free space required for bushing removal		500 mm (Approx.)				



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Doc No.: TRE/72060-063N/DS, REV-05

DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
48.	Clearances						
	a) Between phases						
	HV / LV	mm	130 / 26 mm				
	b) Between phase & earth						
	HV / LV	mm	110 / 26 mm				
49.	Marshalling Box						
	a) Weatherproof		Yes				
	b) Degree Of Protection		IP:55				
	c) Provided with removable gland Plate		Yes				
50.	Terminal Blocks						
	a) Make		As per MSPGCL approved Vendor list / As per BHEL vendor list as approved by MSPGCL				
	b) Type		Pin Type				
	c) 20% Spare terminals		Yes				



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DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
51.	Wiring						
	a) Cable type		Power Supply and CT wiring – PVC Cable; PT-100 and control wiring – PTFE Wire				
	b) Voltage grade	V	650 V				
	c) Conductor size	Sq.	Power Supply and CT wiring – 2.5 sq.mm PVC; PT-100 and control wiring – 19//0.005" dia PTFE wire				
52.	Trip & Alarm Contacts						
	a) Voltage		240 V AC / 220 V DC				
	b) Rated/Making Current		5 A at 240 V AC / 0.5 A at 220 V DC				
53.	Neutral CT details						
	a) Quantity per transformer	Nos.	2	2	2	2	2
	b) CT -1		For LV-51 NS	For LV-51 NS	For LV-51 NS	For LV-51 NS	For LV-51 NS
	i) No. of Cores	No.	1	1	1	1	1
	ii) Ratio		4000 / 1 A	3200 / 1 A	2500 / 1 A	1600 / 1 A	1000 / 1 A
	iii) Class		5P20	5P20	5P20	5P20	5P20
	iv) Burden	VA	15	15	15	15	15
	c) CT -2		For LV-64 REF	For LV-64 REF	For LV-64 REF	For LV-64 REF	For LV-64 REF
	i) No. of Cores	No.	1	1	1	1	1



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BHUSAWAL T.P.S UNIT-6: 1 X 660 MW



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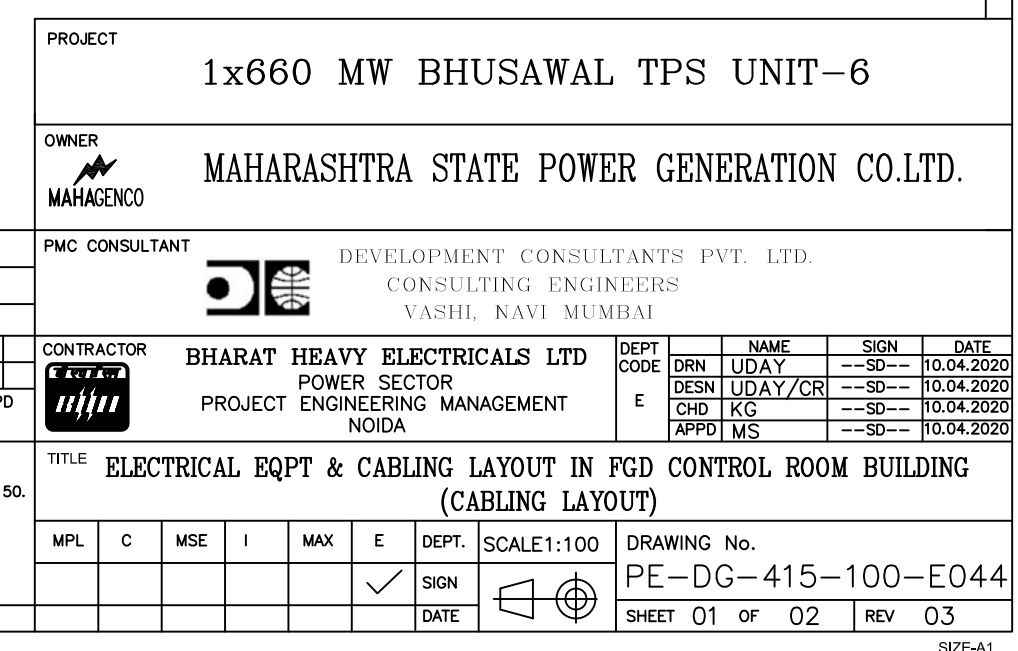
CONSULTING ENGINEERS. VASHI, NAVI MUMBAI

Doc No.: TRE/72060-063N/DS, REV-05

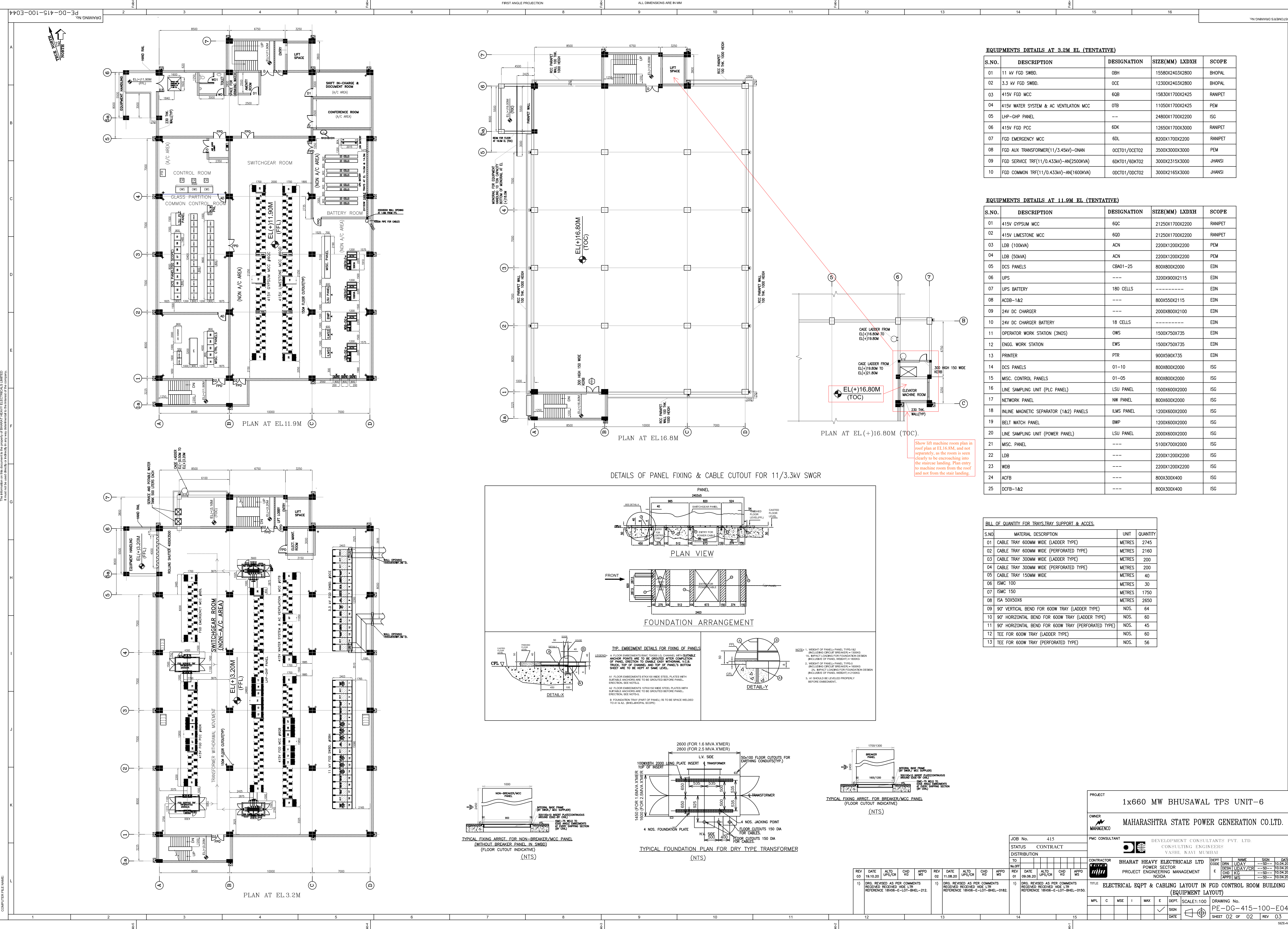
DATA SHEET FOR LT SERVICE CAST RESIN DRY TYPE TRANSFORMER

Sl. No.	Description	Unit	Data				
			2500 KVA	2000 KVA	1600 KVA	1000 KVA	630 KVA
	ii) Ratio		4000 / 1 A	3200 / 1 A	2500 / 1 A	1600 / 1 A	1000 / 1 A
	iii) Class		PS	PS	PS	PS	PS
	iv) Knee Point Voltage(Vk)	V	≥ 500	≥ 500	≥ 500	≥ 500	≥ 500
	v) Magnetizing Current(Ie)	mA	≤ 30	≤ 30	≤ 30	≤ 30	≤ 30
	vi) Rct	Ω	≤ 20	≤ 16	≤ 12.5	≤ 8	≤ 5

Notes: Reference SLD document no.: PE-DG-415-565-E001



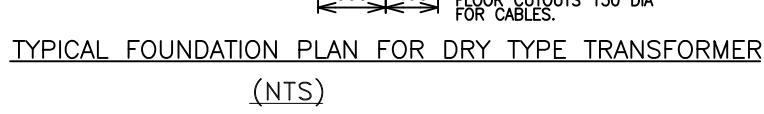
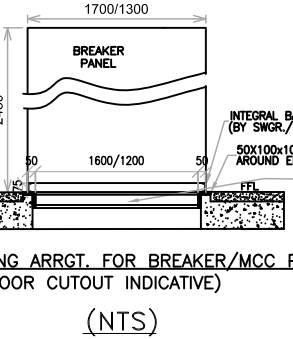
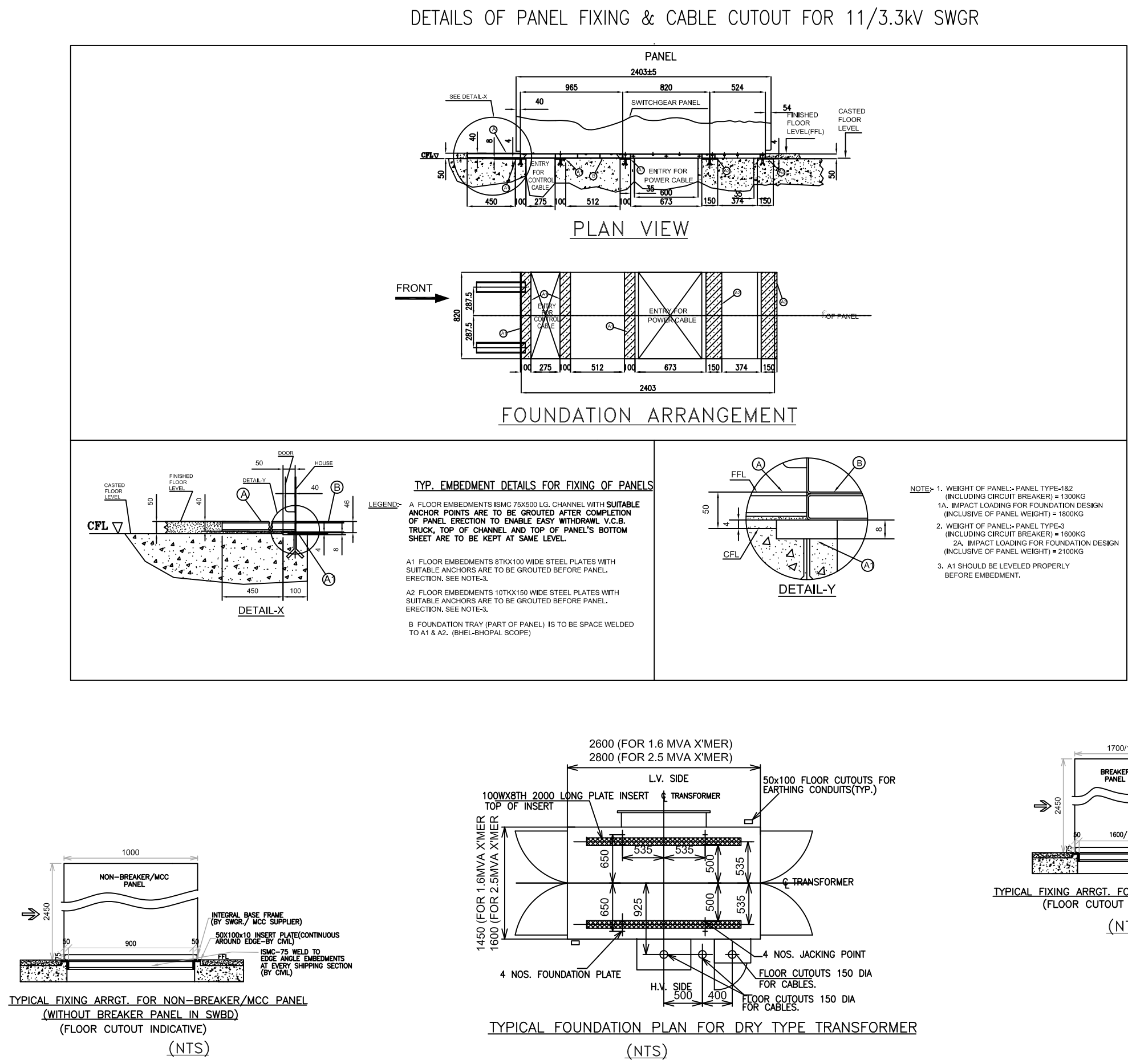
LETTER REF.NO.:— 18V06-E-LOT-BHEL-0239



EQUIPMENTS DETAILS AT 3.2M EL. (TENTATIVE)				
S.NO.	DESCRIPTION	DESIGNATION	SIZE(MM) LXDHX	SCOPE
01	11 KV FGD SWBD.	OBH	15580X2403X2800	BHOPAL
02	3.3 KV FGD SWBD.	OCE	12300X2403X2800	BHOPAL
03	415V FGD MCC	6QB	15830X1700X2425	RANIPET
04	415V WATER SYSTEM & AC VENTILATION MCC	OTB	11050X1700X2425	PEM
05	LHP-GHP PANEL	---	24800X1700X2200	ISG
06	415V FGD PCC	6DK	12650X1700X3000	RANIPET
07	FGD EMERGENCY MCC	6DL	8200X1700X2200	RANIPET
08	FGD AUX TRANSFORMER(11/3.45kV)-ONAN	OCETO1/OCETO2	3500X3000X3000	PEM
09	FGD SERVICE TRF(11/0.433kV)-AN(2500KVA)	6DKT01/6DKT02	3000X2315X3000	JHANSI
10	FGD COMMON TRF(11/0.433kV)-AN(1600KVA)	ODCT01/ODCT02	3000X2165X3000	JHANSI

EQUIPMENTS DETAILS AT 11.9M EL. (TENTATIVE)				
S.NO.	DESCRIPTION	DESIGNATION	SIZE(MM) LXDHX	SCOPE
01	415V GYPSUM MCC	6QC	21250X1700X2200	RANIPET
02	415V LIMESTONE MCC	6QD	21250X1700X2200	RANIPET
03	LDB (100KVA)	ACN	2200X1200X2200	PEM
04	LDB (50KVA)	ACN	2200X1200X2200	PEM
05	DCS PANELS	CBA01-25	800X800X2000	EDN
06	UPS	---	3200X900X2115	EDN
07	UPS BATTERY	180 CELLS	-----	EDN
08	ACDB-1&2	---	800X550X2115	EDN
09	24V DC CHARGER	---	2000X800X2100	EDN
10	24V DC CHARGER BATTERY	18 CELLS	-----	EDN
11	OPERATOR WORK STATION (3NOS)	OWS	1500X750X735	EDN
12	ENG. WORK STATION	EWS	1500X750X735	EDN
13	PRINTER	PTR	900X590X735	EDN
14	DCS PANELS	01-10	800X800X2000	ISG
15	MISC. CONTROL PANELS	01-05	800X800X2000	ISG
16	LINE SAMPLING UNIT (PLC PANEL)	LSU PANEL	1500X600X2000	ISG
17	NETWORK PANEL	NW PANEL	800X600X2000	ISG
18	INLINE MAGNETIC SEPARATOR (1&2) PANELS	ILMS PANEL	1200X600X2000	ISG
19	BELT WATCH PANEL	BWP	1200X600X2000	ISG
20	LINE SAMPLING UNIT (POWER PANEL)	LSU PANEL	2000X600X2000	ISG
21	MISC. PANEL	---	5100X700X2000	ISG
22	LDB	---	2200X1200X2200	ISG
23	WDB	---	2200X1200X2200	ISG
24	ACFB	---	800X300X400	ISG
25	DCFB-1&2	---	800X300X400	ISG

BILL OF QUANTITY FOR TRAYS, TRAY SUPPORT & ACCES.		
S.NO.	MATERIAL DESCRIPTION	UNIT QUANTITY
01	CABLE TRAY 600MM WIDE (LADDER TYPE)	METRES 2745
02	CABLE TRAY 600MM WIDE (PERFORATED TYPE)	METRES 2160
03	CABLE TRAY 300MM WIDE (LADDER TYPE)	METRES 200
04	CABLE TRAY 300MM WIDE (PERFORATED TYPE)	METRES 200
05	CABLE TRAY 150MM WIDE	METRES 40
06	ISMC 100	METRES 30
07	ISMC 150	METRES 1750
08	ISA 50X50X6	METRES 2650
09	90° VERTICAL BEND FOR 600W TRAY (LADDER TYPE)	NOS. 64
10	90° HORIZONTAL BEND FOR 600W TRAY (LADDER TYPE)	NOS. 60
11	90° HORIZONTAL BEND FOR 600W TRAY (PERFORATED TYPE)	NOS. 45
12	TEE FOR 600W TRAY (LADDER TYPE)	NOS. 60
13	TEE FOR 600W TRAY (PERFORATED TYPE)	NOS. 56



REV	DATE	ALTD	CHD	APPO	REV	DATE	ALTD	CHD	APPO
03	19.10.20			MS	02	11.08.20			MS

PROJECT

1x660 MW BHUSAWAL TPS UNIT-6

OWNER

MAHARASHTRA STATE POWER GENERATION CO.LTD.

PWC CONSULTANT

DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
YASHI RAVI MUMBAI

JOB No.

415

STATUS

CONTRACT

DISTRIBUTION

TO

DATE

ALTD

CHD

APPO

CONTRACTOR

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT

NAME

DATE

1) DRG. REVISED AS PER COMMENTS RECEIVED RECEIVED VIDE LTR REFERENCE 18V06-E-L0T-BHEL-0182.

2) DRG. REVISED AS PER COMMENTS RECEIVED RECEIVED VIDE LTR REFERENCE 18V06-E-L0T-BHEL-0182.

3) DRG. REVISED AS PER COMMENTS RECEIVED RECEIVED VIDE LTR REFERENCE 18V06-E-L0T-BHEL-0182.

TITLE

ELECTRICAL EQPT & CABLING LAYOUT IN FGD CONTROL ROOM BUILDING (EQUIPMENT LAYOUT)

SCALE

1:100

DRAWING No.

PE-DG-415-100-E044

SHEET

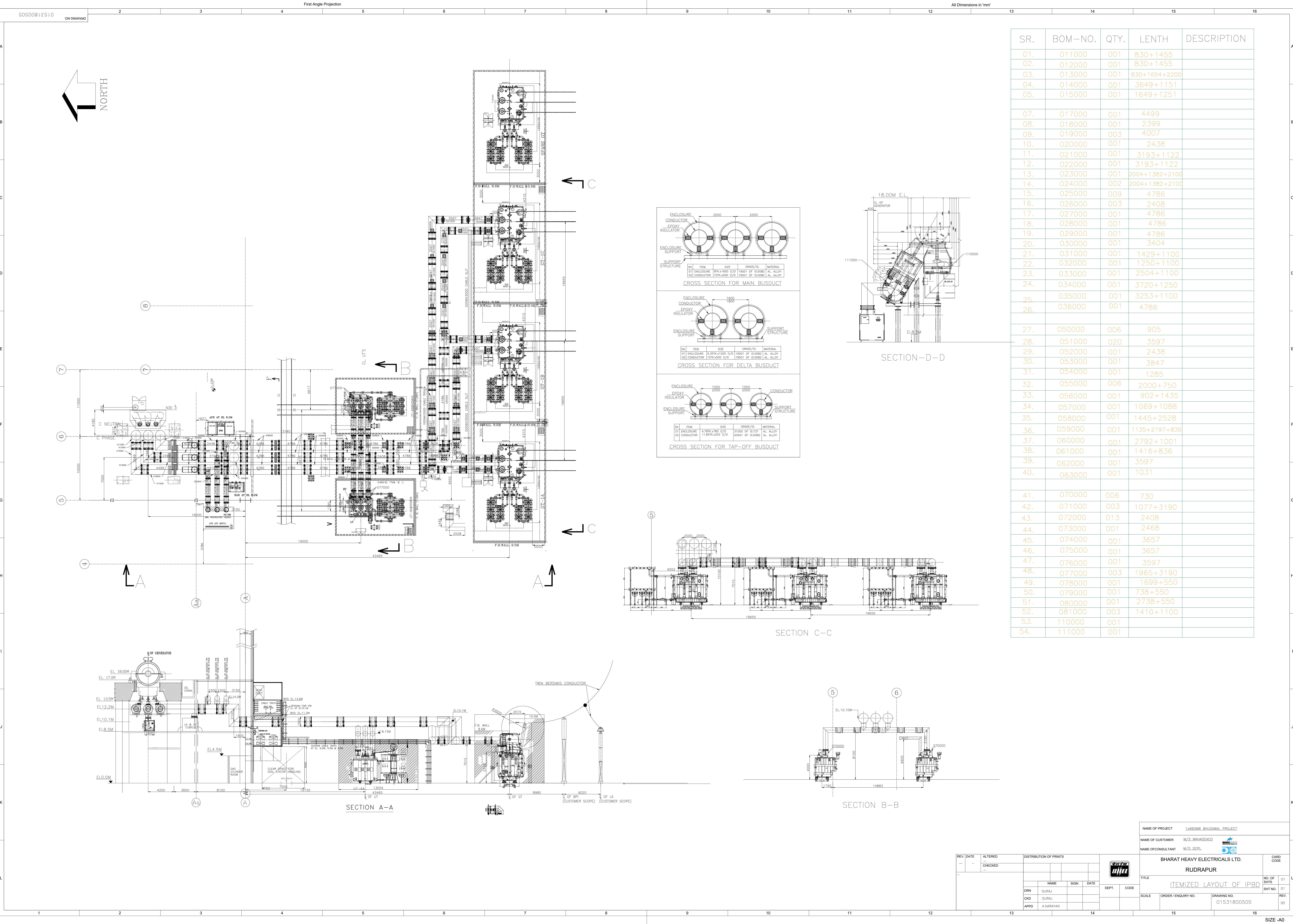
02 OF 02

REV

03

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INVENTORY NO. :
REV. DATE :
REF. DRG. NO. :



SR.	BOM-NO.	QTY.	LENTH	DESCRIPTION
01.	011000	001	830+1455	
02.	012000	001	830+1455	
03.	013000	001	830+1654+2200	
04.	014000	001	3649+1151	
05.	015000	001	1649+1251	
07.	017000	001	4499	
08.	018000	001	2399	
09.	019000	003	4007	
10.	020000	001	2438	
11.	021000	001	3193+1122	
12.	022000	001	3193+1122	
13.	023000	001	2004+1382+2100	
14.	024000	002	2004+1382+2100	
15.	025000	009	4786	
16.	026000	003	2408	
17.	027000	001	4786	
18.	028000	001	4786	
19.	029000	001	4786	
20.	030000	001	3404	
21.	031000	001	1429+1100	
22.	032000	001	1250+1100	
23.	033000	001	2504+1100	
24.	034000	001	3720+1250	
25.	035000	001	3253+1100	
26.	036000	001	4786	
27.	050000	006	905	
28.	051000	020	3597	
29.	052000	001	2438	
30.	053000	001	3847	
31.	054000	001	1285	
32.	055000	006	2000+750	
33.	056000	001	902+1435	
34.	057000	001	1069+1088	
35.	058000	001	1445+2528	
36.	059000	001	1135+2197+836	
37.	060000	001	2792+1001	
38.	061000	001	1416+836	
39.	062000	001	3597	
40.	063000	001	1031	
41.	070000	006	730	
42.	071000	003	1077+3190	
43.	072000	013	2408	
44.	073000	001	2468	
45.	074000	001	3657	
46.	075000	001	3657	
47.	076000	001	3597	
48.	077000	003	1965+3190	
49.	078000	001	1699+550	
50.	079000	001	738+550	
51.	080000	001	2738+550	
52.	081000	003	1410+1100	
53.	110000	001		
54.	111000	001		

REV. DATE	ALTERED	DISTRIBUTION OF PRINTS	NAME OF PROJECT	1x650MM BUSBAR PROJECT
	CHECKED		NAME OF CUSTOMER	M/S. MAHESHO
			NAME OF CONSULTANT	M/S. DCL
			BHARAT HEAVY ELECTRICALS LTD.	CARD CODE
			RUDRAPUR	
			TITLE	ITEMIZED LAYOUT OF IPBD
			SCALE	ORDER / ENQUIRY NO.
				DRAWING NO.
				01531800505
				REV.
				00