BILL OF MATERIAL FOR 220V DC DISTRIBUTION BOARD-1(1D)(MCRB)

S.NO.	ITEM CODE	DESCRIPTION	MAKE	RATING	QTY.
A	**BILL OF MATERIAL FOR MODULE - (DC)**				**1 No.**
1	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER LINK, ROTARY OPERATING MECHANISM (ROM), ICS = 100% ICU	L&T/C&S/HAVELLS	300A, 20kA, 220V DC	03
2	**A1**	DC ANALOG AMMETER, 96 X 96 Sq MM, WITH 0–75mV SHUNT	AE/RISHAB/NEWTEK/SECURE	90–0–400A	01
3	**Ct**	DC CURRENT TRANSDUCER , SINGLE OUTPUT–4–20mA, WITH 0–75mV SHUNT, AUX. SUPPLY 240V AC	AE/RISHAB/SECURE	0–400A	01
B	**BILL OF MATERIAL FOR MODULE (H1)**				**2 Nos.**
1	**MCCB ISOLATOR**	DOUBLE POLE SINGLE THROUGH TYPE ON/OFF AIR BREAK SWITCH (MCCB ISOLATOR), WITH DOOR INTERLOCKING AND PAD LOCKING FACILITY	L&T/C&S/HAVELLS	300A, 220V DC	01
0	––	MECHANICAL LOCK 2 LOCK 1–KEY FOR 300A AIR BREAK SWITCH	PGCIL APPROVED	––	1–SET
C	**BILL OF MATERIAL FOR MODULE (X)**				
1	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER & ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	300A, 20kA, 220V DC	01
2	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER & ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	200A, 20kA, 220V DC	01
3	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	32A, 20kA, 220V DC	32
D	**BILL OF MATERIAL FOR MODULE - (S1)**				**1 No.**
1	**27**	DC INSTANTANEOUS UNDER VOLTAGE RELAY WITH 95% OF 220V DC. THE RESETTING RATIO OF RELAY OF RELAY SHOULD NOT BE MORE THAN 1.25. THE RELAY SHALL BE PROVIDED WITH A SERIES RESISTOR AND A PUSH BUTTON ACROSS IF FOR RESETTING (PICK UP) THE RELAY AT ABOUT 105% OF THE DROP OUT VOLTAGE, FLUSH MOUNTED, AUX. SUPPLY 240V AC	C&S/JVS/ASHIDHA/PROCOM	NOMINAL VOLTAGE–220V DC	01
2	**59**	DC INSTANTANEOUS OVER VOLTAGE RELAY WITH SETTING RANGE OF 110% OF 220V DC. THE RESETTING RATIO OF RELAY SHOULD NOT BE LESS THAN 0.8. THE RELAY SHALL HAVE A PUSH BUTTON IN SERIES OF RESETTING THE RELAY AT ABOUT 95% OF THE OPERATING VOLTAGE, FLUSH MOUNTED, AUX. SUPPLY 240V AC	C&S/JVS/ASHIDHA/PROCOM	NOMINAL VOLTAGE–220V DC	01
3	**96**	DC EARTH LEAKAGE RELAY ONLY FOR 220V DC SYSTEM HAVING ADJUSTABLE PICK UP RANGE BETWEEN 3 TO 7 MILLIAMPS, FLUSH MOUNTED, AUX. SUPPLY 240V AC	C&S/JVS/ASHIDHA/PROCOM	NOMINAL VOLTAGE–220V DC	01
4	**V**	DC ANALOG VOLTMETER 96 X 96 Sq MM	AE/RISHAB/NEWTEK/SECURE	300–0–300V	01
5	**VSS**	VOLTAGE SELECTOR SWITCH,3POSITION (+VE/–VE, +VE/EARTH, –VE/EARTH), CAM TYPE, 2POLE, THREE WAY WITH OFF,	SALZER/KAYCEE	6A	01
6	**h1**	'DC SUPPLY ON' INDICATION LAMP, 22.5 Sq. mm. DIA ,LED TYPE, RED	ESBEE/VAISHNO/C&S	220V DC	01
7	**EB**	ELECTRONIC BUZZER, 220V DC	SECO	––	01
8	**CF3-4**	HRC FUSE BASE	L&T/C&S/HAVELLS	20A	02
9	**CF3-4**	HRC FUSE LINK	L&T/C&S/HAVELLS	6A	02
10	**Vt**	DC VOLTAGE TRANSDUCER, SINGLE OUTPUT–4–20mA,CL–1.0, AUX. SUPPLY 240V AC	AE/RISHAB/SECURE	220V DC	01

NOTE:– ALL COMPONENTS SHALL BE POWER GRID (QA&I) APPROVED MAKE

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	––	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	BILL OF MATERIAL
TITLE	220V DC DISTRIBUTION BOARD–1(1D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–705

JOB NO. 1241A

SH. NO.:– 01 OF 02

BILL OF MATERIAL FOR 220V DC DISTRIBUTION BOARD-1(1D)(MCRB)

S.NO.	ITEM CODE	DESCRIPTION	MAKE	RATING	QTY.
E	**BILL OF MATERIAL FOR MISC.**				
1	**CF1-2**	HRC FUSE BASE	L&T/C&S/HAVELLS	20A	02
2	**CF1-2**	HRC FUSE LINK	L&T/C&S/HAVELLS	10A	02
3	**DS**	DOOR SWITCH, 1C/O	SURAJ	--	02
4	**PL**	PANEL ILLUMINATION LIGHT, 240V AC	HAVELLS	5W	02
5	**SH**	SPACE HEATER, 240V AC	HOTWEL	60W	02
6	**TH**	THERMOSTATE, 240V AC	ELCON	30 – 85°C	02
7	**SW - SOCKET**	5/15A SWITCH SOCKET	ANCHOR	--	01

NOTE:– ALL COMPONENTS SHALL BE POWER GRID (QA&I) APPROVED MAKE

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. -- | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	BILL OF MATERIAL
TITLE	220V DC DISTRIBUTION BOARD–1(1D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–705 | SH. NO.:– 02 OF 02

1 2 3 4 5 6 7 8 9

ENGINEERING DRAWING DETAILS FOR

220V DC DISTRIBUTION BOARD-2(2D)(MCRB)

PROJECT :- 765/400/220kV BIKANER-III POOLING STATION

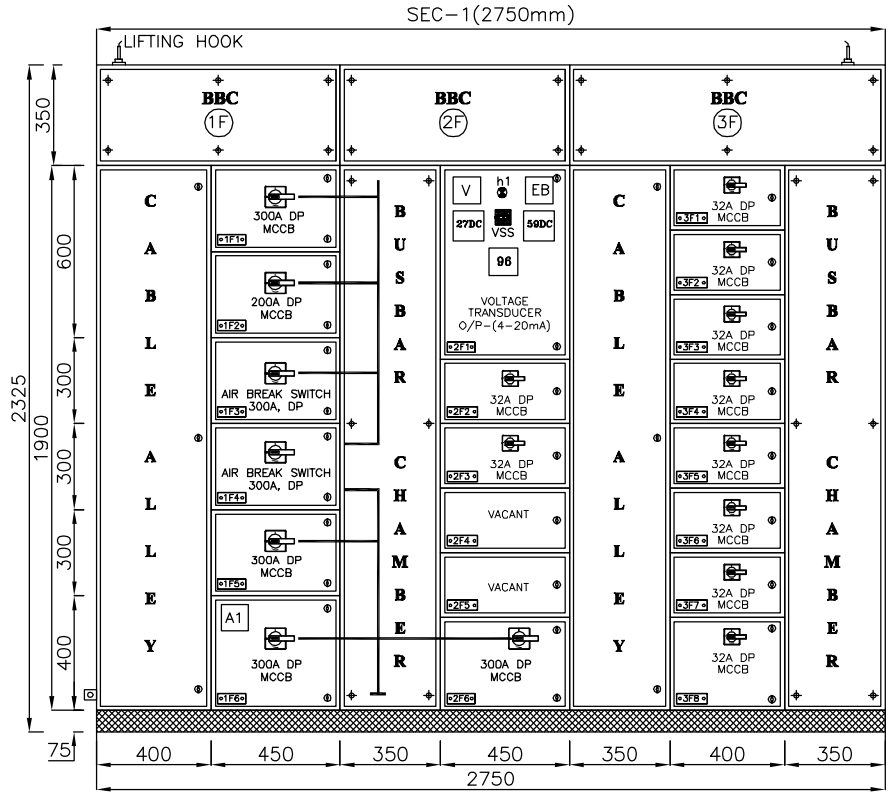
CLIENT :- POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR :- BHARAT HEAVY ELECTRICAL LIMITED (BHEL)
TRANSMISSION PROJECTS DIVISION

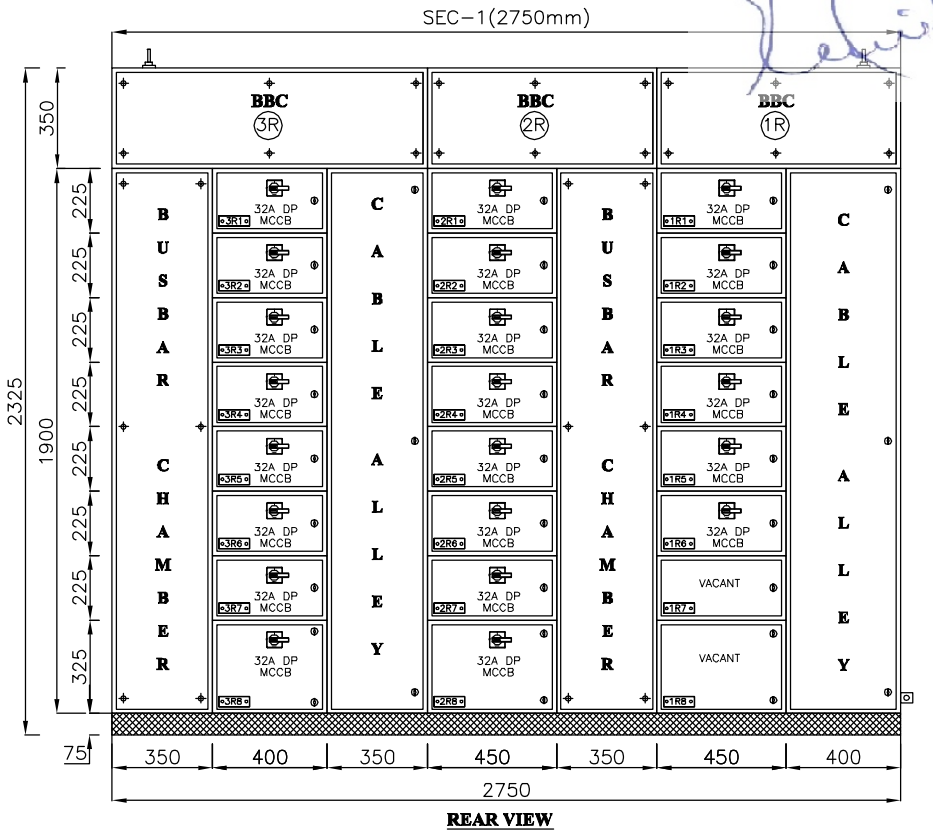
	04.	-	DRAWN	MP	
	03.	-	CHKD.	VDP	
	02.	-	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

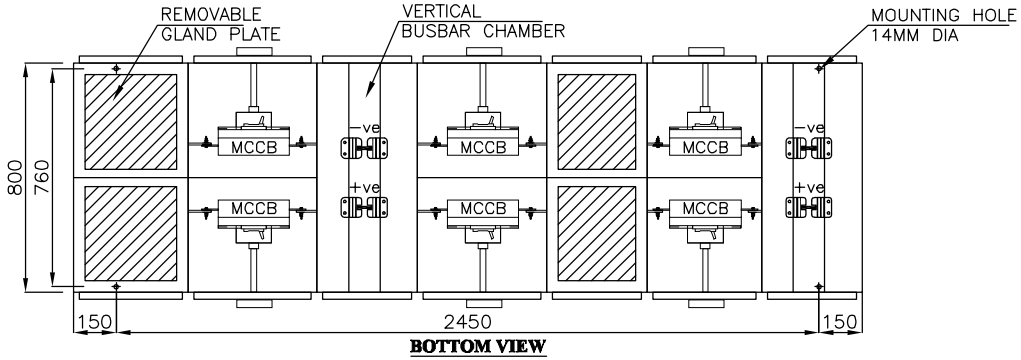
DRAWING	COVER PAGE		JOB NO. 1241A
TITLE	220V DC DISTRIBUTION BOARD-2(2D)(MCRB)		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT: POWER GRID CORPORATION OF INDIA LIMITED		CONTRACTOR:- BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-006		SH. NO. 01 OF 01



FRONT VIEW



REAR VIEW



BOTTOM VIEW

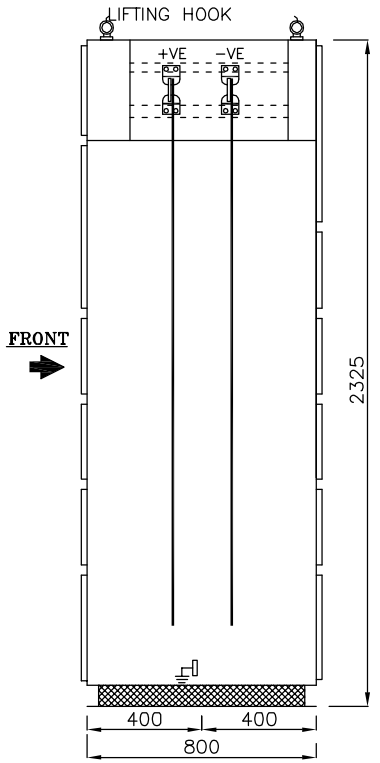
	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	GENERAL ARRANGEMENT DRAWING
TITLE	220V DC DISTRIBUTION BOARD–2(2D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–106

JOB NO. 1241A

SH. NO. 01 OF 02



SIDE VIEW(HORIZONTAL BUS BARS ALONG WITH DETAILS OF BUS BAR SUPPORTS.)

PANEL DIMENSIONS

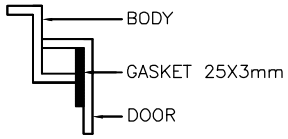
HEIGHT : 2325 mm.
WIDTH : 2750 mm.
DEPTH : 800 mm.

BUS BAR SIZE :-

POSITIVE : 1x40x10 Sq.mm Alu.
NEGATIVE : 1x40x10 Sq.mm Alu.
EARTH : 1x40X05 Sq.mm GS.

LEGEND DETAILS

A1 = ANALOG DC AMMETER
V = ANALOG DC VOLT METER
96 = BATTERY EARTH FAULT RELAY
27DC = DC UNDER VOLTAGE RELAY
59DC = DC OVER VOLTAGE RELAY
EB = ELECTRONIC BUZZER



DETAIL-'A'

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

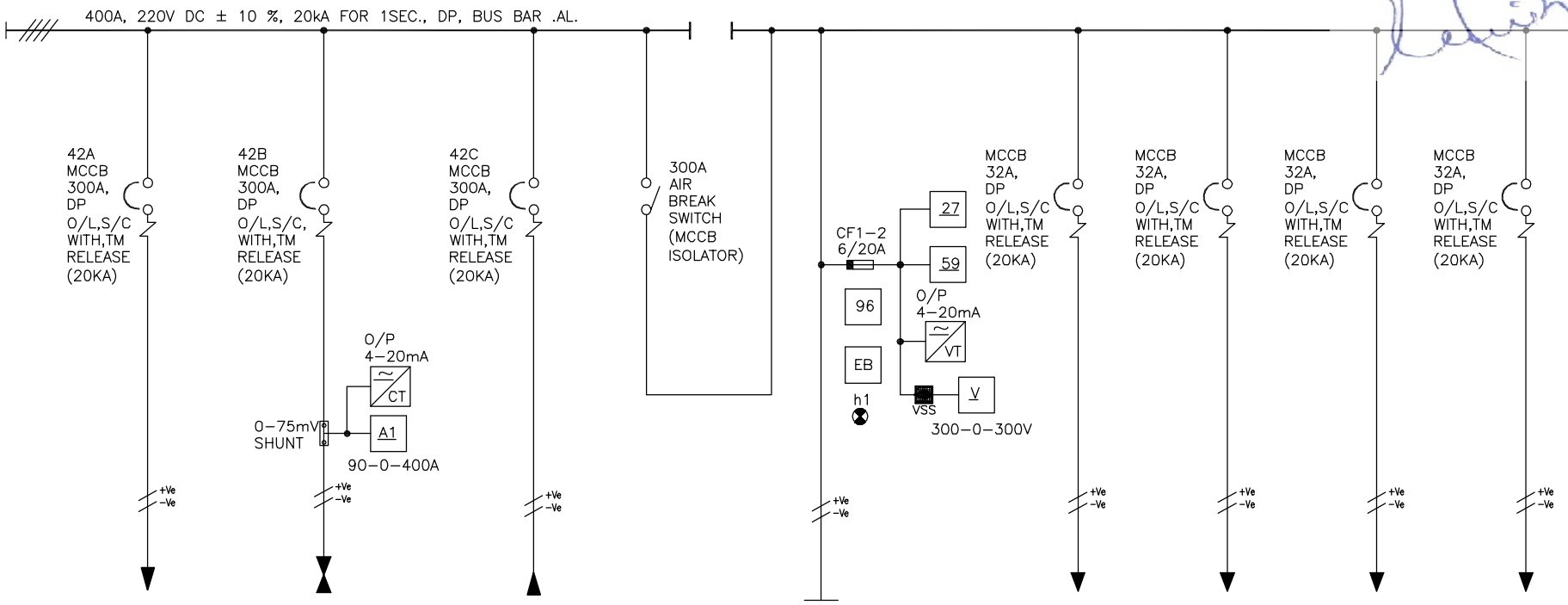
DRAWING	GENERAL ARRANGEMENT DRAWING
TITLE	220V DC DISTRIBUTION BOARD-2(2D)(MCRB)
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER-III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:-
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024-2025/1241A-106 SH. NO. 02 OF 02



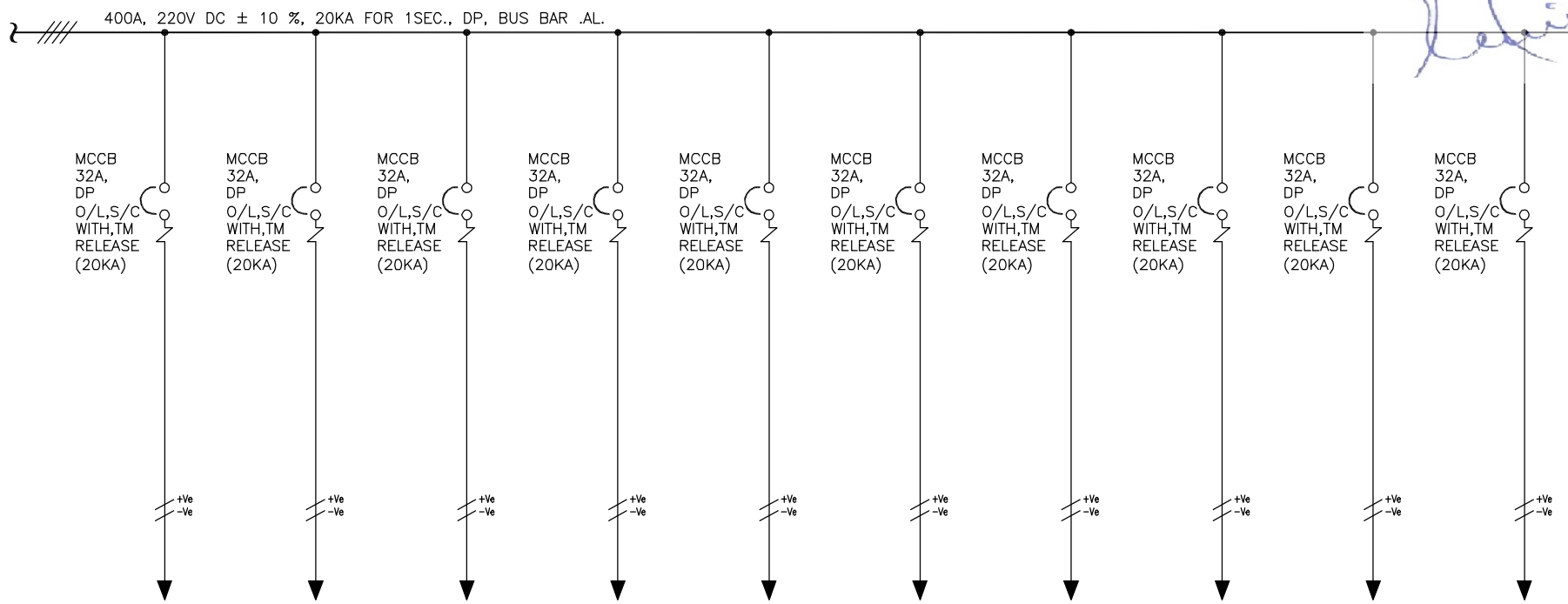
FEEDER NUMBER	2F6	1F6	1F5	1F4	2F1	2F2	2F3	3F1	3F2
MODULE TYEP	DC	DC	DC	H1	S1	X	X	X	X
FEEDER RATING	300A	300A	300A	300A	--	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	ISOLATOR	METERING	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	BATTERY CURATIVE DISCHARGE FEEDER	220V DC BATTERY BANK-2	220V DC INCOMER FROM BATTERY CHARGER-2	MAIN BUSBAR CONTROL FEEDER 220V DCDB-2	--	765kV RELAY PANEL 701	765kV RELAY PANEL 703 (F)	765kV RELAY PANEL 704	765kV RELAY PANEL 706 (F)
POWER CABLE SIZE (AL PVC)	2X1CX150 Sqmm.	2X1CX150 Sqmm.	2X1CX150 Sqmm.	--	--	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

	04.	-	DRAWN	MP	
	03.	-	CHKD.	VDP	
	02.	-	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM		JOB NO. 1241A
TITLE	220V DC DISTRIBUTION BOARD-2(2D)(MCRB)		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED	CONTRACTOR:-	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-206		SH. NO.:- 01 OF 05

1 2 3 4 5 6 7 8 9



FEEDER NUMBER	3F3	3F4	3F5	3F6	3F7	3F8	1R1	1R2	1R3	1R4
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	765kV RELAY PANEL 707	765kV RELAY PANEL 709	765kV RELAY PANEL 710	765kV RELAY PANEL 712	765kV RELAY PANEL 713	765kV RELAY PANEL 715	765kV RELAY PANEL 716	765kV RELAY PANEL 718	765kV RELAY PANEL 719 (F)	765kV RELAY PANEL 721 (F)
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

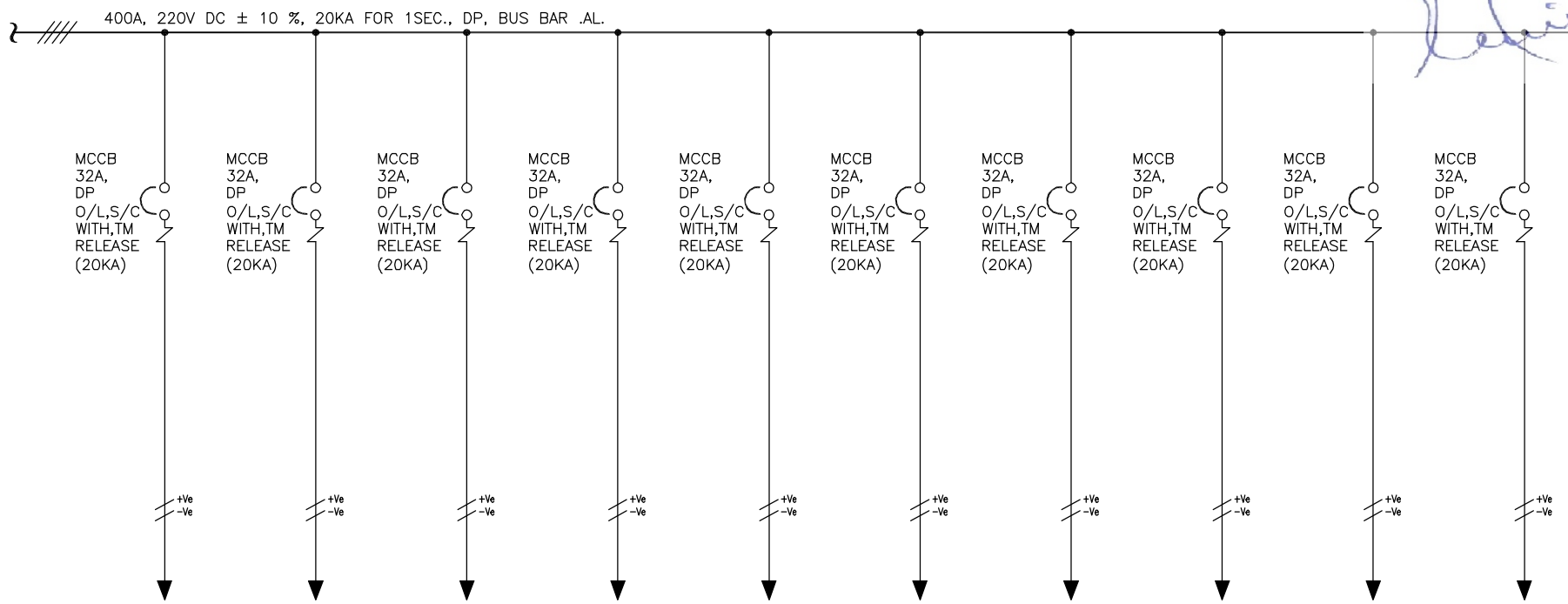
DRAWING	SINGLE LINE DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD-2(2D)(MCRB)
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER-III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:-
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024-2025/1241A-206 | SH. NO.:- 02 OF 05



FEEDER NUMBER	1R5	1R6	2R1	2R2	2R3	2R4	2R5	2R6	2R7	2R8
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	765kV RELAY PANEL 722 (F)	765kV RELAY PANEL 724 (F)	765kV RELAY PANEL 725 (F)	765kV RELAY PANEL 727 (F)	765kV RELAY PANEL BUSBAR	NETWORK PANEL	DC SUPPLY FOR FF DCDB	DC SUPPLY FOR DC LIGHTING PANEL	DC SUPPLY FOR MSB–1A	DC SUPPLY FOR MSB–2A
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

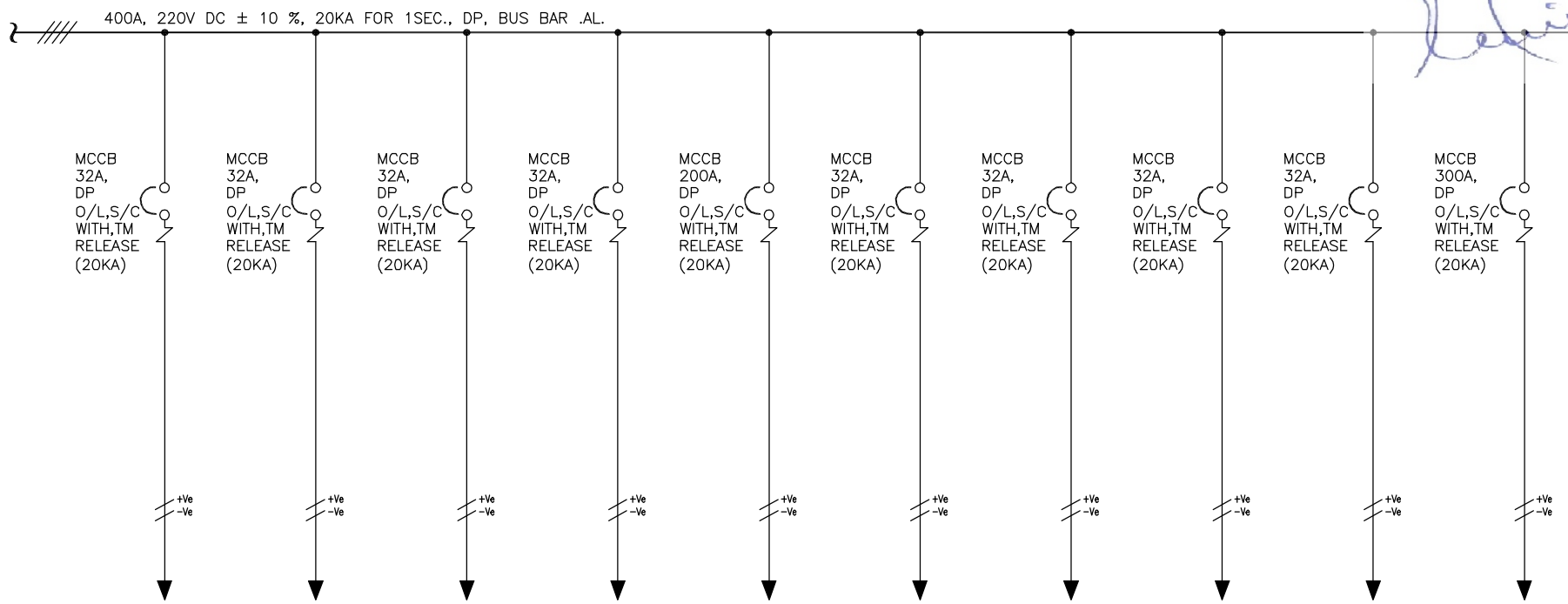
DRAWING	SINGLE LINE DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD–2(2D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–206 | SH. NO.:– 03 OF 05



FEEDER NUMBER	3R1	3R2	3R3	3R4	1F2	3R5	3R6	3R7	3R8	1F1
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	200A	32A	32A	32A	32A	300A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	DC SUPPLY FOR INVERTER–1	DC SUPPLY FOR ELECTRONIC TEST LAB	DC SUPPLY FOR AUX. BCU PANEL	DC SUPPLY FOR MLDB	OUTGOING FEEDER TO 400&220kV DCDB	STATION HMI	SPARE–5	SPARE–6	SPARE–7	SPARE–8
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	2X1CX150Sqmm.	1X4CX16 Sqmm.	––	––	––	––

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	––	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD–2(2D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

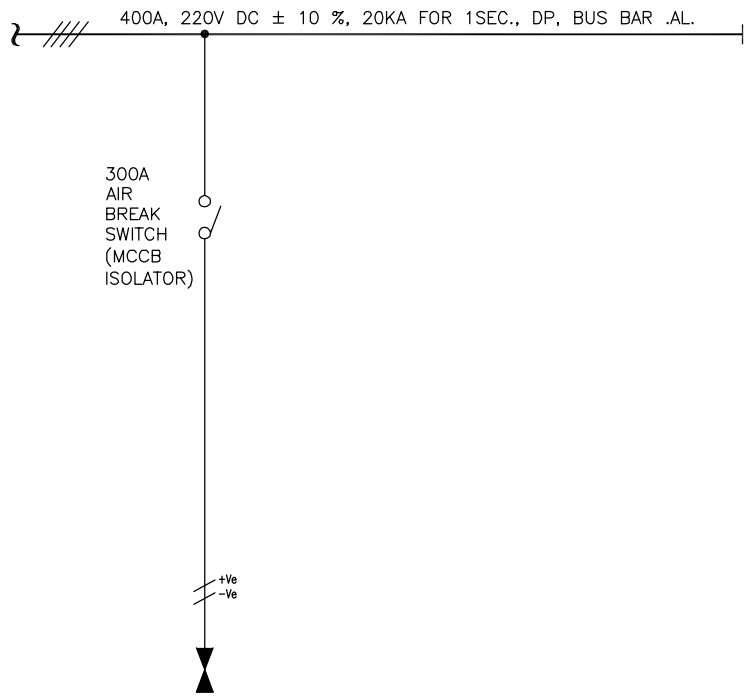
JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–206 SH. NO.:– 04 OF 05

1 2 3 4 5 6 7 8 9



FEEDER NUMBER	1F3
MODULE TYEP	H1
FEEDER RATING	300A
FEEDER TYPE	ISOLATOR
DESCRIPTION	TO 220V DCDB–1
POWER CABLE SIZE (AL PVC)	2X1CX150 Sqmm.

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD–2(2D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

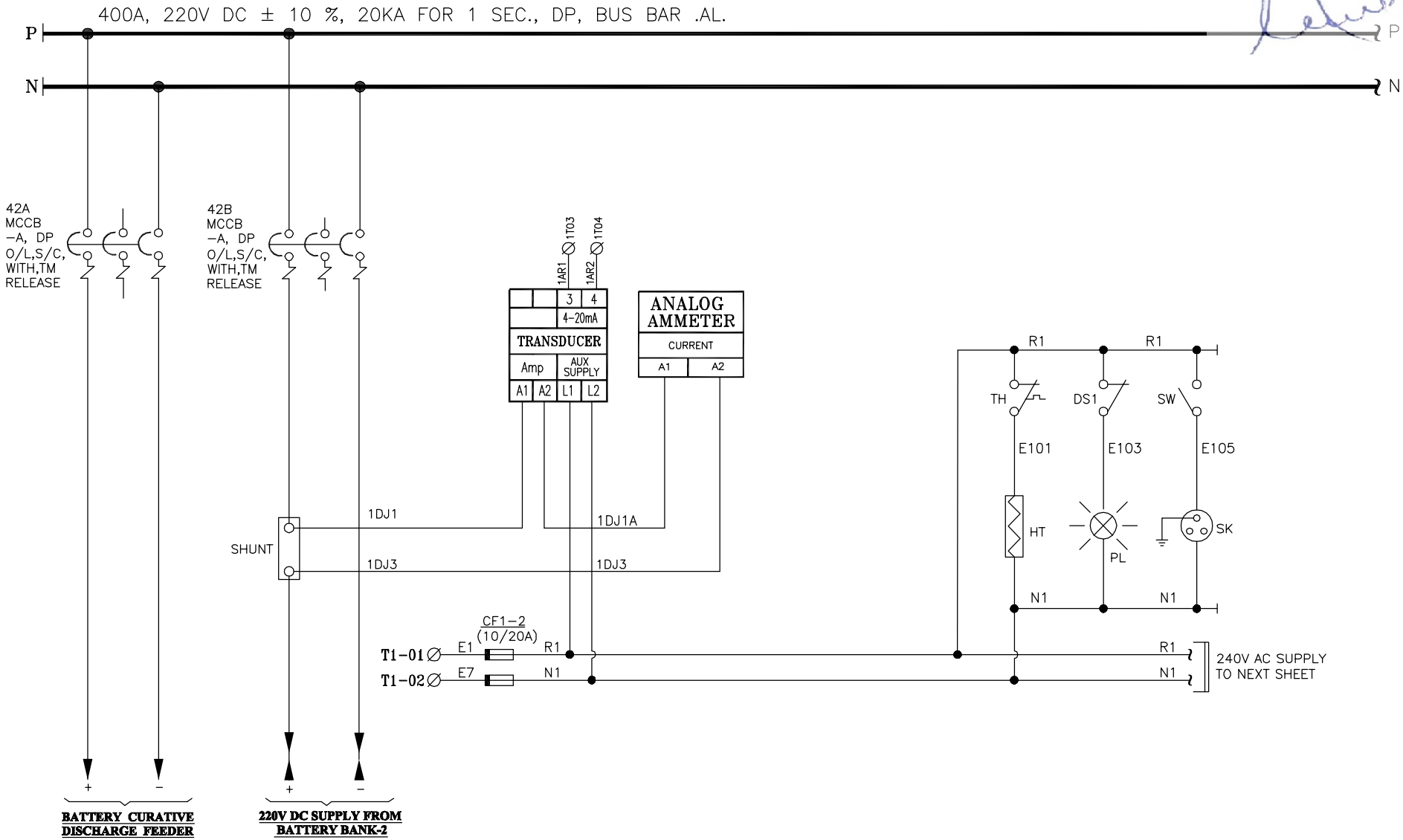
JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–206 SH. NO.:– 05 OF 05

1 2 3 4 5 6 7 8 9



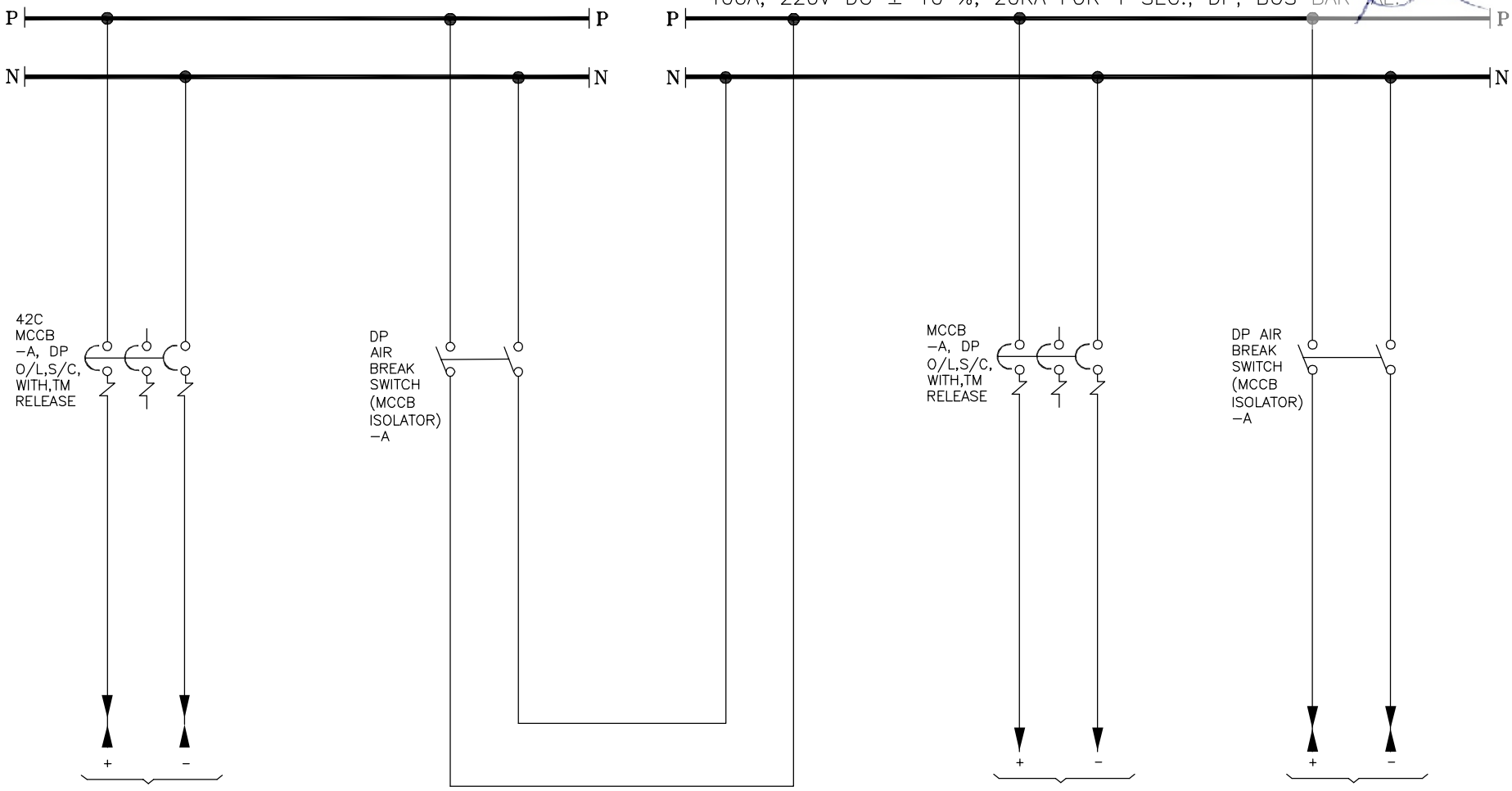
	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SCHEMATIC DIAGRAM		JOB NO. 1241A
TITLE	220V DC DISTRIBUTION BOARD–2(2D)(MCRB)		
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER–III POOLING STATION		
CLIENT: POWER GRID CORPORATION OF INDIA LIMITED		CONTRACTOR:– BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–506		SH. NO.:– 01 OF 03

1 2 3 4 5 6 7 8 9

400A, 220V DC ± 10 %, 20KA FOR 1 SEC., DP, BUS BAR AL.



	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SCHEMATIC DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD–2(2D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

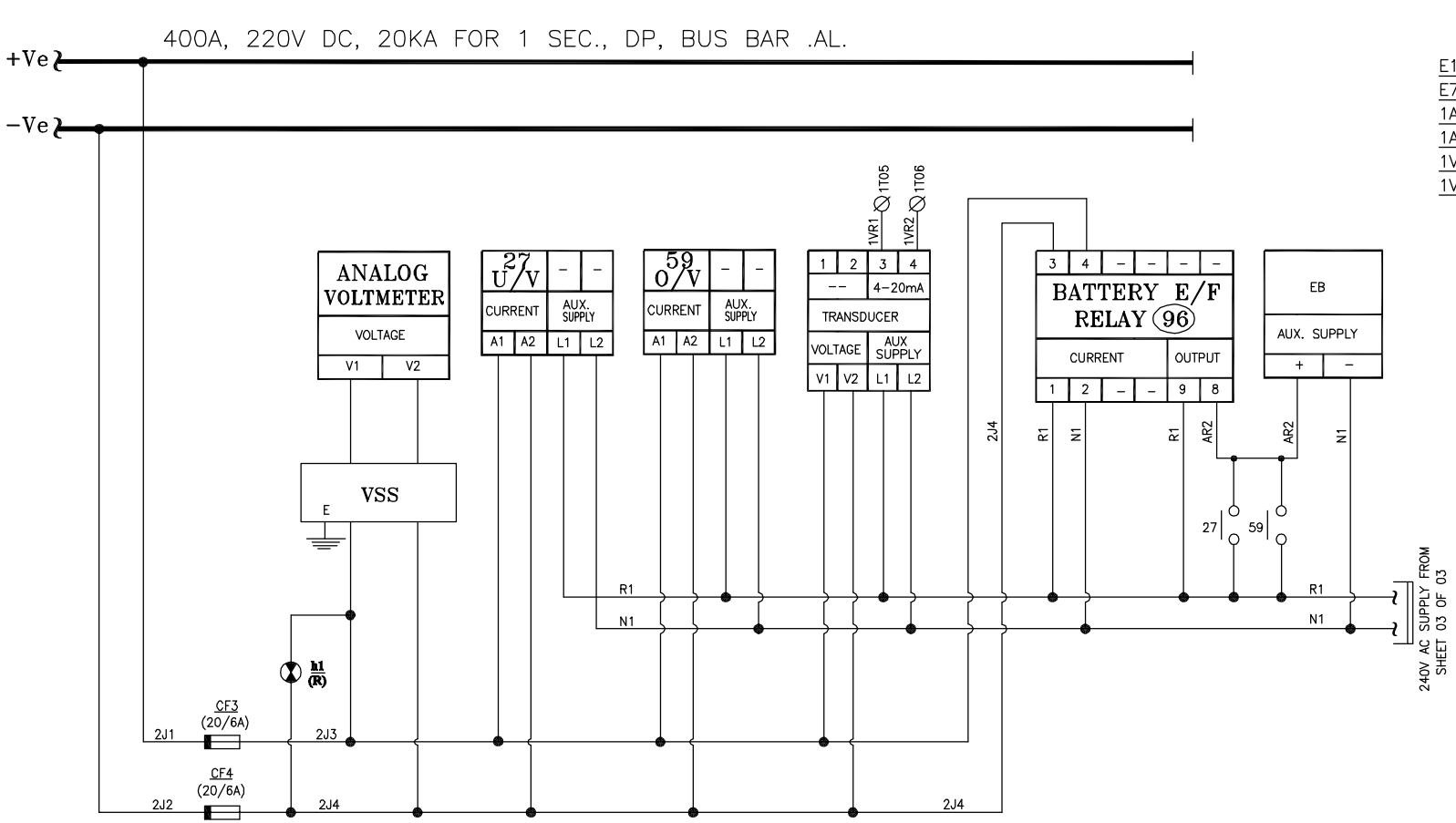
JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–506 SH. NO.:– 02 OF 03

1 2 3 4 5 6 7 8 9



TERMINAL DETAIL

	1T	
E1	1	240V AC SUPPLY FROM CUSTOMER SCOPE
E7	2	
1AR1	3	4−20mA OUTPUT FROM CURRENT TRANSDUCER
1AR2	4	
1VR1	5	4−20mA OUTPUT FROM VOLTAGE TRANSDUCER
1VR2	6	
	7	SPARE
	8	

NO.		DESCRIPTION
04.	–	
03.	–	
02.	–	
01.		
00.	29.01.2025	FIRST SUBMISSION FOR APPROVAL
No.	DATE	REVISIONS DESCRIPTION

DRAWN MP | CHKD. VDP | APPD. –– | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SCHEMATIC DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD−2(2D)(MCRB)
CA NO.	CC/T/W−AIS/DOM/A10/23/01956/NOA−1/24−102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER−III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:−	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024−2025/1241A−506

JOB NO. 1241A

SH. NO.:− 03 OF 03

BILL OF MATERIAL FOR 220V DC DISTRIBUTION BOARD-2(2D)(MCRB)

S.NO.	ITEM CODE	DESCRIPTION	MAKE	RATING	QTY.
A	**BILL OF MATERIAL FOR MODULE - (DC)**				**1 No.**
1	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER LINK, ROTARY OPERATING MECHANISM (ROM), ICS = 100% ICU	L&T/C&S/HAVELLS	300A, 20kA, 220V DC	03
2	**A1**	DC ANALOG AMMETER, 96 X 96 Sq MM, WITH 0–75mV SHUNT	AE/RISHAB/NEWTEK/SECURE	90–0–400A	01
3	**Ct**	DC CURRENT TRANSDUCER , SINGLE OUTPUT–4–20mA, WITH 0–75mV SHUNT, AUX. SUPPLY 240V AC	AE/RISHAB/SECURE	0–400A	01
B	**BILL OF MATERIAL FOR MODULE (H1)**				**2 Nos.**
1	**MCCB ISOLATOR**	DOUBLE POLE SINGLE THROUGH TYPE ON/OFF AIR BREAK SWITCH (MCCB ISOLATOR), WITH DOOR INTERLOCKING AND PAD LOCKING FACILITY	L&T/C&S/HAVELLS	300A, 220V DC	01
0	––	MECHANICAL LOCK 2 LOCK 1–KEY FOR 300A AIR BREAK SWITCH	PGCIL APPROVED	––	1–SET
C	**BILL OF MATERIAL FOR MODULE (X)**				
1	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER & ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	300A, 20kA, 220V DC	01
2	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER & ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	200A, 20kA, 220V DC	01
3	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	32A, 20kA, 220V DC	32
D	**BILL OF MATERIAL FOR MODULE - (S1)**				**1 No.**
1	**27**	DC INSTANTANEOUS UNDER VOLTAGE RELAY WITH 95% OF 220V DC. THE RESETTING RATIO OF RELAY OF RELAY SHOULD NOT BE MORE THAN 1.25. THE RELAY SHALL BE PROVIDED WITH A SERIES RESISTOR AND A PUSH BUTTON ACROSS IF FOR RESETTING (PICK UP) THE RELAY AT ABOUT 105% OF THE DROP OUT VOLTAGE, FLUSH MOUNTED, AUX. SUPPLY 240V AC	C&S/JVS/ASHIDHA/PROCOM	NOMINAL VOLTAGE–220V DC	01
2	**59**	DC INSTANTANEOUS OVER VOLTAGE RELAY WITH SETTING RANGE OF 110% OF 220V DC. THE RESETTING RATIO OF RELAY SHOULD NOT BE LESS THAN 0.8. THE RELAY SHALL HAVE A PUSH BUTTON IN SERIES OF RESETTING THE RELAY AT ABOUT 95% OF THE OPERATING VOLTAGE, FLUSH MOUNTED, AUX. SUPPLY 240V AC	C&S/JVS/ASHIDHA/PROCOM	NOMINAL VOLTAGE–220V DC	01
3	**96**	DC EARTH LEAKAGE RELAY ONLY FOR 220V DC SYSTEM HAVING ADJUSTABLE PICK UP RANGE BETWEEN 3 TO 7 MILLIAMPS, FLUSH MOUNTED, AUX. SUPPLY 240V AC	C&S/JVS/ASHIDHA/PROCOM	NOMINAL VOLTAGE–220V DC	01
4	**V**	DC ANALOG VOLTMETER 96 X 96 Sq MM	AE/RISHAB/NEWTEK/SECURE	300–0–300V	01
5	**VSS**	VOLTAGE SELECTOR SWITCH,3POSITION (+VE/–VE, +VE/EARTH, –VE/EARTH), CAM TYPE, 2POLE, THREE WAY WITH OFF,	SALZER/KAYCEE	6A	01
6	**h1**	'DC SUPPLY ON' INDICATION LAMP, 22.5 Sq. mm. DIA ,LED TYPE, RED	ESBEE/VAISHNO/C&S	220V DC	01
7	**EB**	ELECTRONIC BUZZER, 220V DC	SECO	––	01
8	**CF3-4**	HRC FUSE BASE	L&T/C&S/HAVELLS	20A	02
9	**CF3-4**	HRC FUSE LINK	L&T/C&S/HAVELLS	6A	02
10	**Vt**	DC VOLTAGE TRANSDUCER, SINGLE OUTPUT–4–20mA,CL–1.0, AUX. SUPPLY 240V AC	AE/RISHAB/SECURE	220V DC	01

NOTE:– ALL COMPONENTS SHALL BE POWER GRID (QA&I) APPROVED MAKE

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	––	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	BILL OF MATERIAL
TITLE	220V DC DISTRIBUTION BOARD–2(2D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–706

JOB NO. 1241A

SH. NO.:– 01 OF 02

BILL OF MATERIAL FOR 220V DC DISTRIBUTION BOARD-2(2D)(MCRB)

S.NO.	ITEM CODE	DESCRIPTION	MAKE	RATING	QTY.
E	**BILL OF MATERIAL FOR MISC.**				
1	**CF1-2**	HRC FUSE BASE	L&T/C&S/HAVELLS	20A	02
2	**CF1-2**	HRC FUSE LINK	L&T/C&S/HAVELLS	10A	02
3	**DS**	DOOR SWITCH, 1C/O	SURAJ	--	02
4	**PL**	PANEL ILLUMINATION LIGHT, 240V AC	HAVELLS	5W	02
5	**SH**	SPACE HEATER, 240V AC	HOTWEL	60W	02
6	**TH**	THERMOSTATE, 240V AC	ELCON	30 – 85°C	02
7	**SW - SOCKET**	5/15A SWITCH SOCKET	ANCHOR	--	01

NOTE:– ALL COMPONENTS SHALL BE POWER GRID (QA&I) APPROVED MAKE

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. -- | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	BILL OF MATERIAL
TITLE	220V DC DISTRIBUTION BOARD–2(2D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–706 | SH. NO.:– 02 OF 02

ENGINEERING DRAWING DETAILS FOR

48V DC DISTRIBUTION BOARD-1(3D)(MCRB)

PROJECT :- 765/400/220kV BIKANER-III POOLING STATION

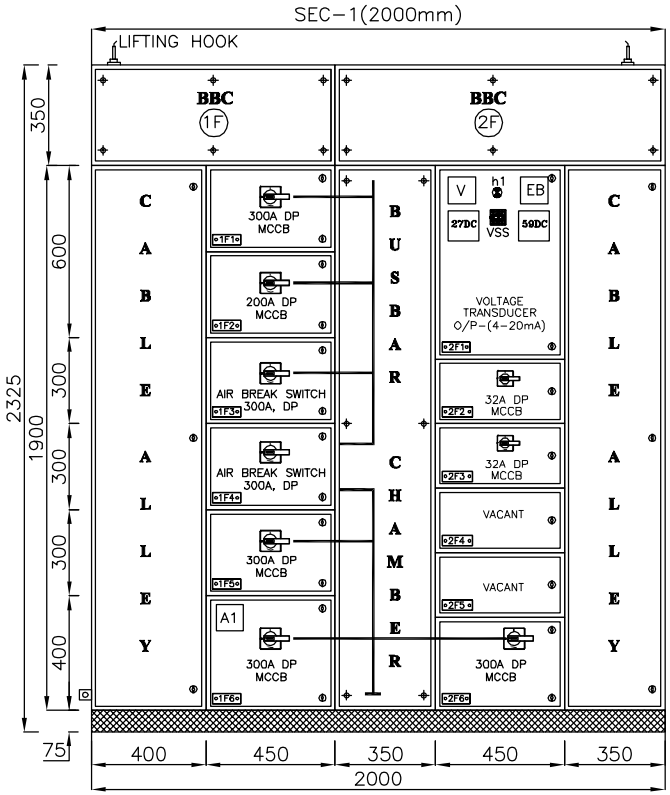
CLIENT :- POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR :- BHARAT HEAVY ELECTRICAL LIMITED (BHEL)
TRANSMISSION PROJECTS DIVISION

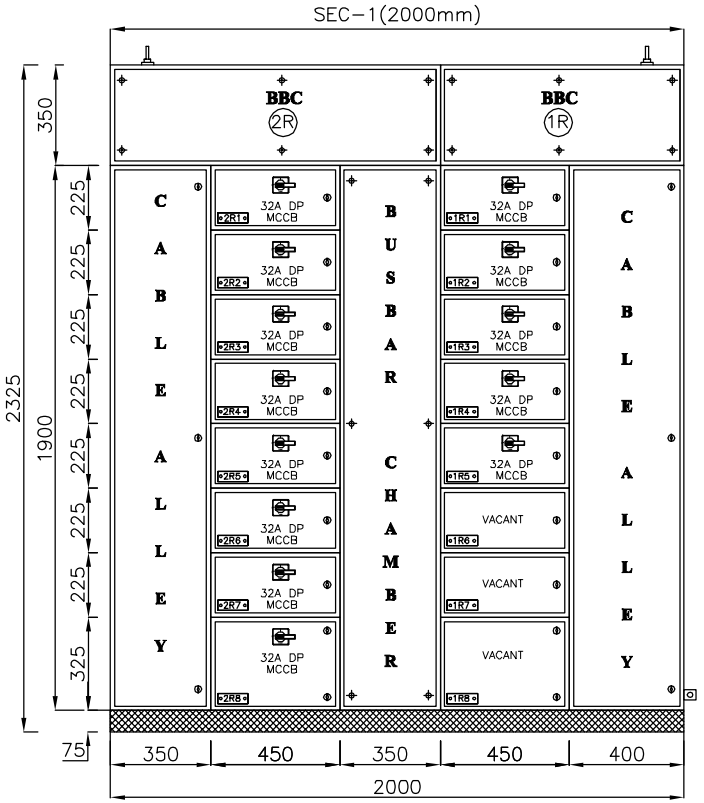
	04.	-	DRAWN	MP	
	03.	-	CHKD.	VDP	
	02.	-	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

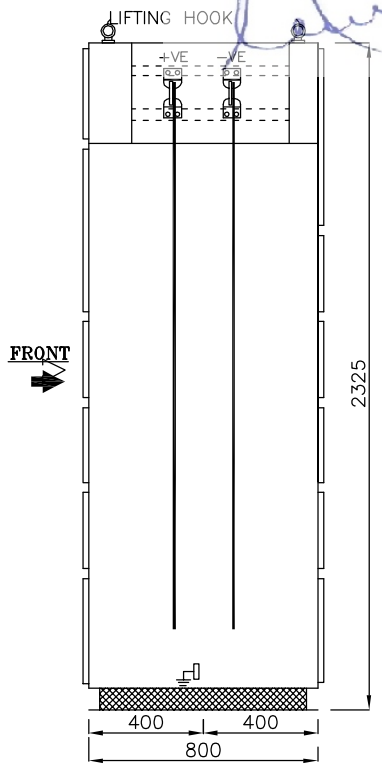
DRAWING	COVER PAGE	JOB NO. 1241A
TITLE	48V DC DISTRIBUTION BOARD-1(3D)(MCRB)	
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024	
PROJECT	765/400/220kV BIKANER-III POOLING STATION	
CLIENT: POWER GRID CORPORATION OF INDIA LIMITED	CONTRACTOR:- BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-007	SH. NO. 01 OF 01



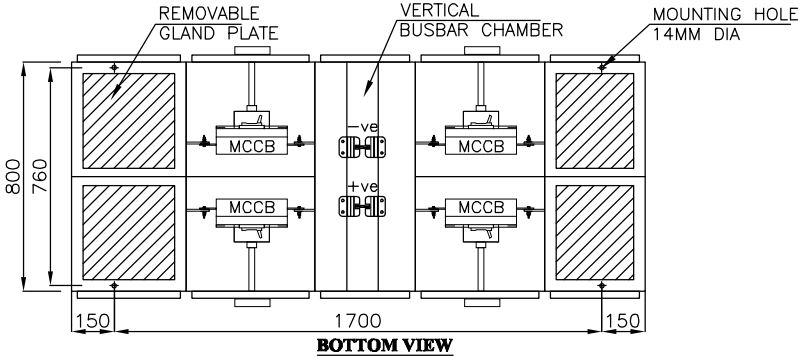
FRONT VIEW



REAR VIEW



SIDE VIEW(HORIZONTAL BUS BARS ALONG WITH DETAILS OF BUS BAR SUPPORTS.)



BOTTOM VIEW

PANEL DIMENSIONS

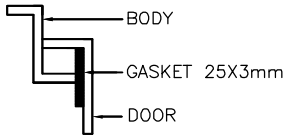
HEIGHT : 2325 mm.
WIDTH : 2000 mm.
DEPTH : 800 mm.

BUS BAR SIZE :-

POSITIVE : 1x40x10 Sq.mm Alu.
NEGATIVE : 1x40x10 Sq.mm Alu.
EARTH : 1x40X05 Sq.mm GS.

LEGEND DETAILS

A1 = ANALOG DC AMMETER
V = ANALOG DC VOLT METER
27DC = DC UNDER VOLTAGE RELAY
59DC = DC OVER VOLTAGE RELAY
EB = ELECTRONIC BUZZER



DETAIL-'A'

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	GENERAL ARRANGEMENT DRAWING
TITLE	48V DC DISTRIBUTION BOARD–1(3D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

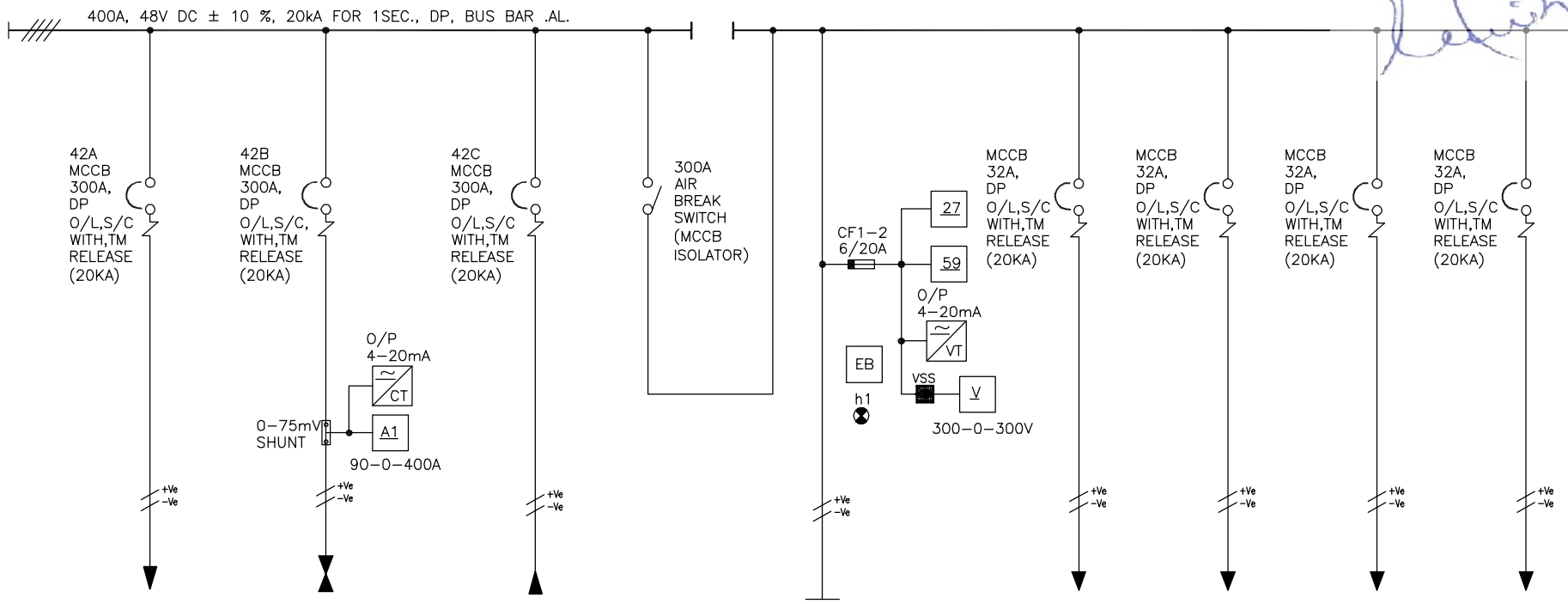
JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–107 SH. NO. 01 OF 01

1 2 3 4 5 6 7 8 9



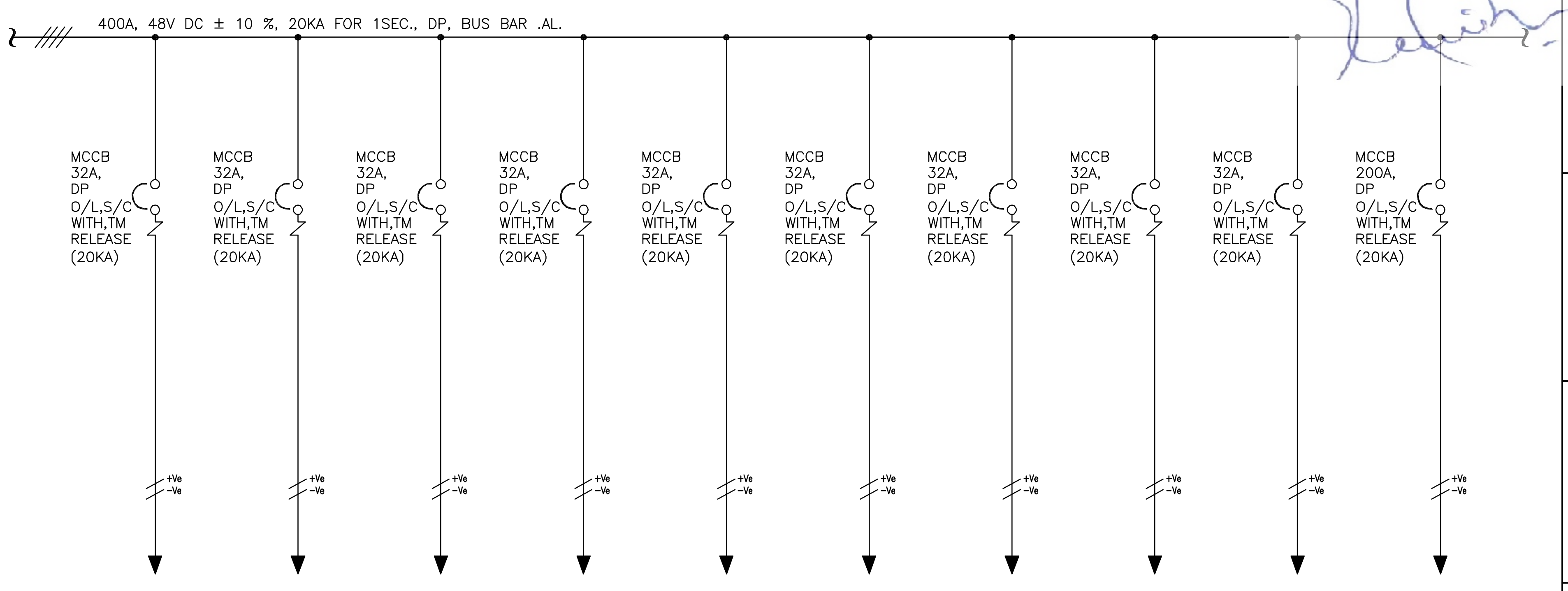
FEEDER NUMBER	2F6	1F6	1F5	1F4	2F1	2F2	2F3	1R1	1R2
MODULE TYEP	DC	DC	DC	H1	S1	X	X	X	X
FEEDER RATING	300A	300A	300A	300A	--	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	ISOLATOR	METERING	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	BATTERY CURATIVE DISCHARGE FEEDER	48V DC BATTERY BANK-1	48V DC INCOMER FROM BATTERY CHARGER-1	MAIN BUSBAR CONTROL FEEDER 48V DCDB-1	--	EPAX PANEL	765kV PLCC PANEL 703 (F)	765kV PLCC PANEL 706 (F)	765kV PLCC PANEL 709
POWER CABLE SIZE (AL PVC)	2X1CX150 Sqmm.	2X1CX150 Sqmm.	2X1CX150 Sqmm.	--	--	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

	04.	-	DRAWN	MP	
	03.	-	CHKD.	VDP	
	02.	-	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM		JOB NO. 1241A
TITLE	48V DC DISTRIBUTION BOARD-1(3D)(MCRB)		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT: POWER GRID CORPORATION OF INDIA LIMITED		CONTRACTOR:- BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-207		SH. NO.:- 01 OF 03

1 2 3 4 5 6 7 8 9



FEEDER NUMBER	1R3	1R4	1R5	2R1	2R2	2R3	2R4	2R5	2R6	1F2
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	200A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	765kV PLCC PANEL 712	765kV PLCC PANEL 721 (F)	765kV PLCC PANEL 724(F)	765kV PLCC PANEL 725 (F)	765kV PLCC PANEL 727 (F)	FOTE–1	FOTE–2	FOTE–3	FOTE–4	OUTGOING FEEDER TO AUX. BUILDING
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	2X1CX150Sqmm.

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

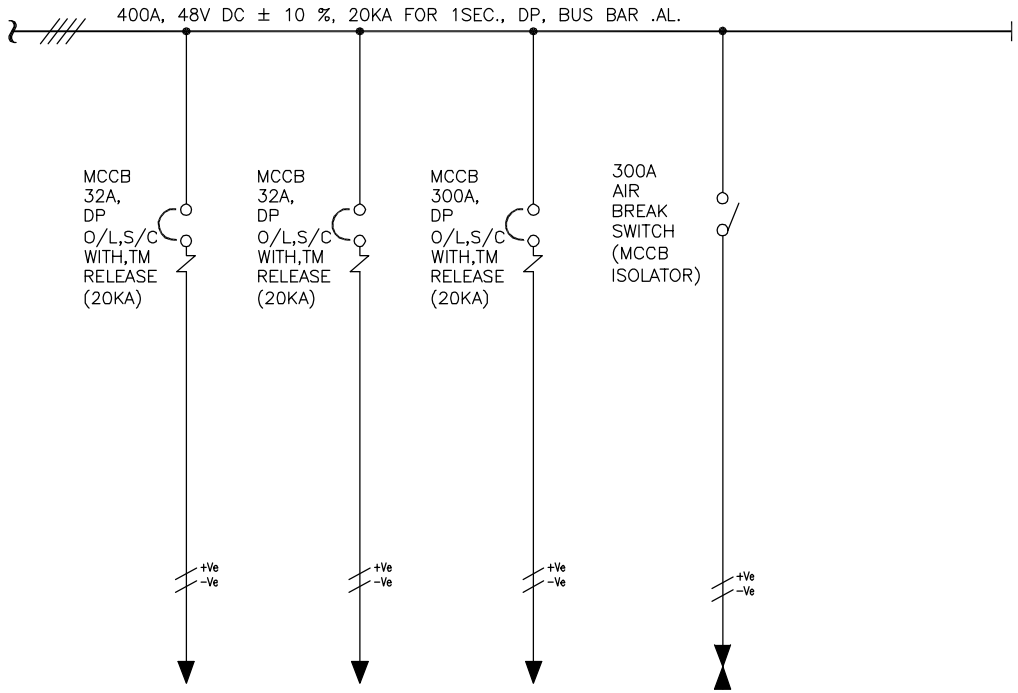
DRAWN: MP
CHKD.: VDP
APPD.: ––
ALL DIMENSIONS IN mm. SIGN.
TOLERANCE 5%
REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM	JOB NO. 1241A
TITLE	48V DC DISTRIBUTION BOARD–1(3D)(MCRB)	
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024	
PROJECT	765/400/220kV BIKANER–III POOLING STATION	

CLIENT: POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:– BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–207
SH. NO.:– 02 OF 03



FEEDER NUMBER	2R7	2R8	1F1	1F3
MODULE TYEP	X	X	X	H1
FEEDER RATING	32A	32A	300A	300A
FEEDER TYPE	MCCB	MCCB	MCCB	ISOLATOR
DESCRIPTION	SPARE–1	SPARE–2	SPARE–3	TO 48V DCDB–2
POWER CABLE SIZE (AL PVC)	--	--	--	2X1CX150 Sqmm.

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

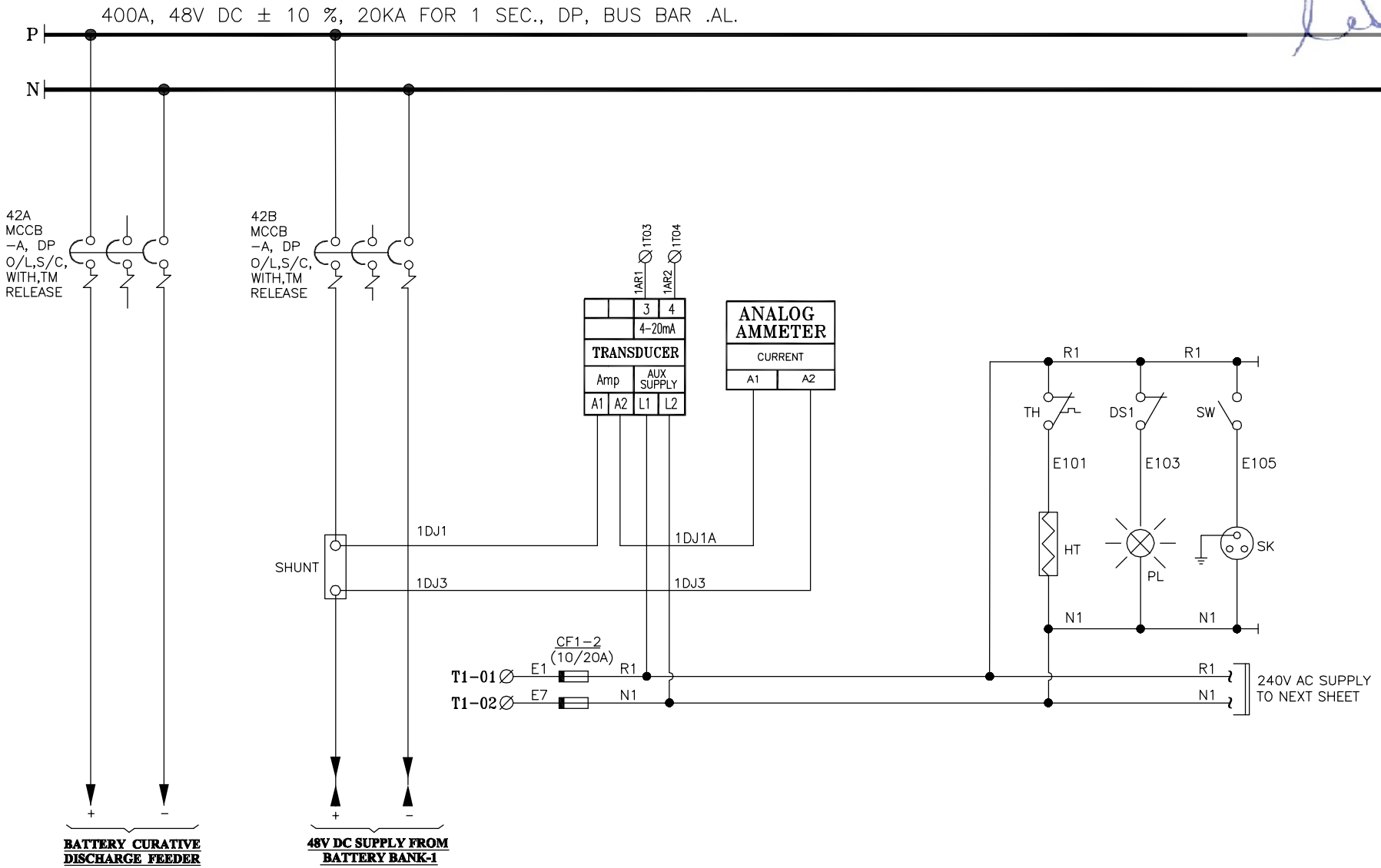
DRAWING	SINGLE LINE DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD–1(3D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–207 SH. NO.:– 03 OF 03



	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SCHEMATIC DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD–1(3D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

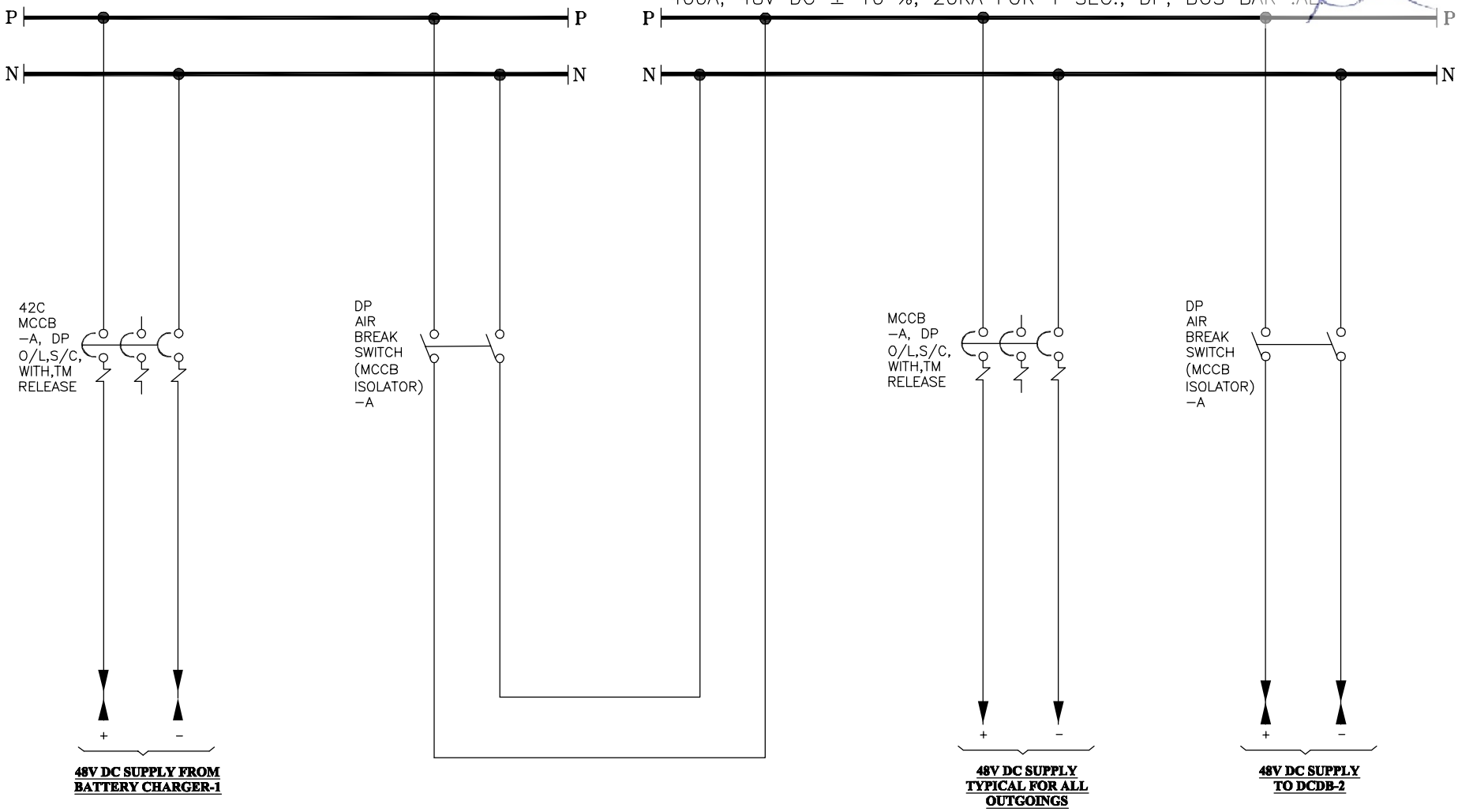
CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–507	SH. NO.:– 01 OF 03

1 2 3 4 5 6 7 8 9

400A, 48V DC ± 10 %, 20KA FOR 1 SEC., DP, BUS BAR .AL



	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER

ULTIMA® SWITCHGEARS LTD.

UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - **247667, INDIA,** TEL : 01332-235043 FAX : 01332-235042

UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) **INDIA**

E-mail : info@ultimaswitchgear.com

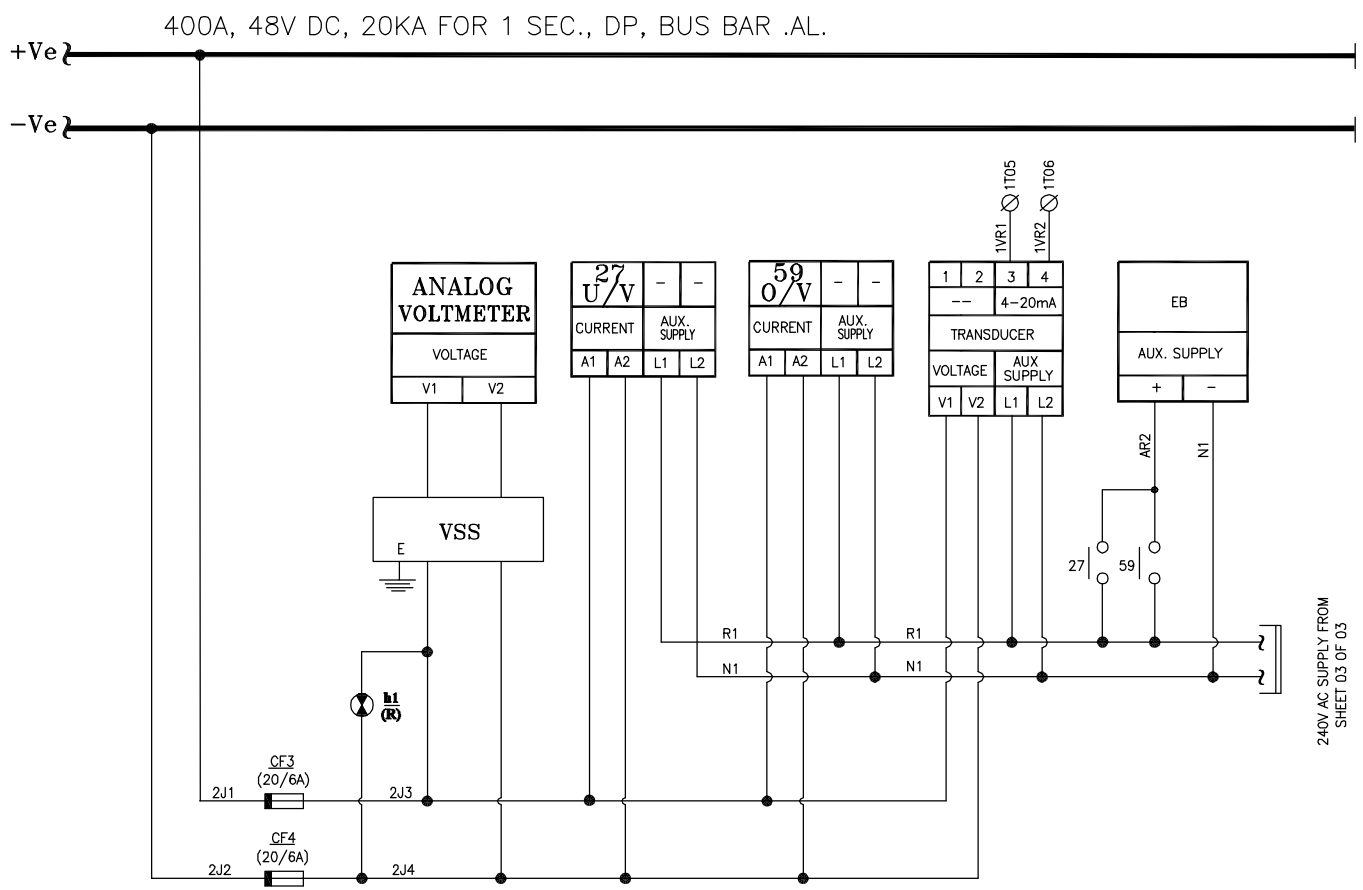
DRAWING	SCHEMATIC DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD–1(3D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–507 SH. NO.:– 02 OF 03



TERMINAL DETAIL

	1T	
E1	1	240V AC SUPPLY FROM CUSTOMER SCOPE
E7	2	
1AR1	3	4−20mA OUTPUT FROM CURRENT TRANSDUCER
1AR2	4	
1VR1	5	4−20mA OUTPUT FROM VOLTAGE TRANSDUCER
1VR2	6	
	7	SPARE
	8	

DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00	TOLERANCE 5%	ALL DIMENSIONS IN mm.	SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL			DRAWN MP	
	01.				CHKD. VDP	
	02.	–			APPD. ––	
	03.	–				
	04.	–				

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SCHEMATIC DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD−1(3D)(MCRB)
CA NO.	CC/T/W−AIS/DOM/A10/23/01956/NOA−1/24−102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER−III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:−	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024−2025/1241A−507

JOB NO. 1241A

SH. NO.:− 03 OF 03

BILL OF MATERIAL FOR 48V DC DISTRIBUTION BOARD-1(3D)(MCRB)

S.NO.	ITEM CODE	DESCRIPTION	MAKE	RATING	QTY.
A	**BILL OF MATERIAL FOR MODULE - (DC)**				**1 No.**
1	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER LINK, ROTARY OPERATING MECHANISM (ROM), ICS = 100% ICU	L&T/C&S/HAVELLS	300A, 20kA, 48V DC	03
2	**A1**	DC ANALOG AMMETER, 96 X 96 Sq MM, WITH 0–75mV SHUNT	AE/RISHAB/NEWTEK/SECURE	90–0–400A	01
3	**Ct**	DC CURRENT TRANSDUCER , SINGLE OUTPUT–4–20mA, WITH 0–75mV SHUNT, AUX. SUPPLY 240V AC	AE/RISHAB/SECURE	0–400A	01
B	**BILL OF MATERIAL FOR MODULE (H1)**				**2 Nos.**
1	**MCCB ISOLATOR**	DOUBLE POLE SINGLE THROUGH TYPE ON/OFF AIR BREAK SWITCH (MCCB ISOLATOR), WITH DOOR INTERLOCKING AND PAD LOCKING FACILITY	L&T/C&S/HAVELLS	300A, 48V DC	01
0	––	MECHANICAL LOCK 2 LOCK 1–KEY FOR 300A AIR BREAK SWITCH	PGCIL APPROVED	––	1–SET
C	**BILL OF MATERIAL FOR MODULE (X)**				
1	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER & ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	300A, 20kA, 48V DC	01
2	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER & ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	200A, 20kA, 48V DC	01
3	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	32A, 20kA, 48V DC	15
D	**BILL OF MATERIAL FOR MODULE - (S1)**				**1 No.**
1	**27**	DC INSTANTANEOUS UNDER VOLTAGE RELAY WITH 95% OF 48V DC. THE RESETTING RATIO OF RELAY OF RELAY SHOULD NOT BE MORE THAN 1.25. THE RELAY SHALL BE PROVIDED WITH A SERIES RESISTOR AND A PUSH BUTTON ACROSS IF FOR RESETTING (PICK UP) THE RELAY AT ABOUT 105% OF THE DROP OUT VOLTAGE, FLUSH MOUNTED, AUX. SUPPLY 240V AC	C&S/JVS/ASHIDHA/PROCOM	NOMINAL VOLTAGE–48V DC	01
2	**59**	DC INSTANTANEOUS OVER VOLTAGE RELAY WITH SETTING RANGE OF 110% OF 48V DC. THE RESETTING RATIO OF RELAY SHOULD NOT BE LESS THAN 0.8. THE RELAY SHALL HAVE A PUSH BUTTON IN SERIES OF RESETTING THE RELAY AT ABOUT 95% OF THE OPERATING VOLTAGE, FLUSH MOUNTED, AUX. SUPPLY 240V AC	C&S/JVS/ASHIDHA/PROCOM	NOMINAL VOLTAGE–48V DC	01
3	**V**	DC ANALOG VOLTMETER 96 X 96 Sq MM	AE/RISHAB/NEWTEK/SECURE	300–0–300V	01
4	**VSS**	VOLTAGE SELECTOR SWITCH,3POSITION (+VE/–VE, +VE/EARTH, –VE/EARTH), CAM TYPE, 2POLE, THREE WAY WITH OFF,	SALZER/KAYCEE	6A	01
5	**h1**	'DC SUPPLY ON' INDICATION LAMP, 22.5 Sq. mm. DIA ,LED TYPE, RED	ESBEE/VAISHNO/C&S	48V DC	01
6	**EB**	ELECTRONIC BUZZER, 48V DC	SECO	––	01
7	**CF3-4**	HRC FUSE BASE	L&T/C&S/HAVELLS	20A	02
8	**CF3-4**	HRC FUSE LINK	L&T/C&S/HAVELLS	6A	02
9	**Vt**	DC VOLTAGE TRANSDUCER, SINGLE OUTPUT–4–20mA,CL–1.0, AUX. SUPPLY 240V AC	AE/RISHAB/SECURE	48V DC	01

NOTE:– ALL COMPONENTS SHALL BE POWER GRID (QA&I) APPROVED MAKE

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	––	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	BILL OF MATERIAL
TITLE	48V DC DISTRIBUTION BOARD–1(3D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
JOB NO.	1241A
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–707
SH. NO.:–	01 OF 02

BILL OF MATERIAL FOR 48V DC DISTRIBUTION BOARD-1(3D)(MCRB)

S.NO.	ITEM CODE	DESCRIPTION	MAKE	RATING	QTY.
E	**BILL OF MATERIAL FOR MISC.**				
1	**CF1-2**	HRC FUSE BASE	L&T/C&S/HAVELLS	20A	02
2	**CF1-2**	HRC FUSE LINK	L&T/C&S/HAVELLS	10A	02
3	**DS**	DOOR SWITCH, 1C/O	SURAJ	--	02
4	**PL**	PANEL ILLUMINATION LIGHT, 240V AC	HAVELLS	5W	02
5	**SH**	SPACE HEATER, 240V AC	HOTWEL	60W	02
6	**TH**	THERMOSTATE, 240V AC	ELCON	30 – 85°C	02
7	**SW - SOCKET**	5/15A SWITCH SOCKET	ANCHOR	--	01

NOTE:– ALL COMPONENTS SHALL BE POWER GRID (QA&I) APPROVED MAKE

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. -- | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	BILL OF MATERIAL
TITLE	48V DC DISTRIBUTION BOARD–1(3D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–707 | SH. NO.:– 02 OF 02

ENGINEERING DRAWING DETAILS FOR

48V DC DISTRIBUTION BOARD-2(4D)(MCRB)

PROJECT :- 765/400/220kV BIKANER-III POOLING STATION

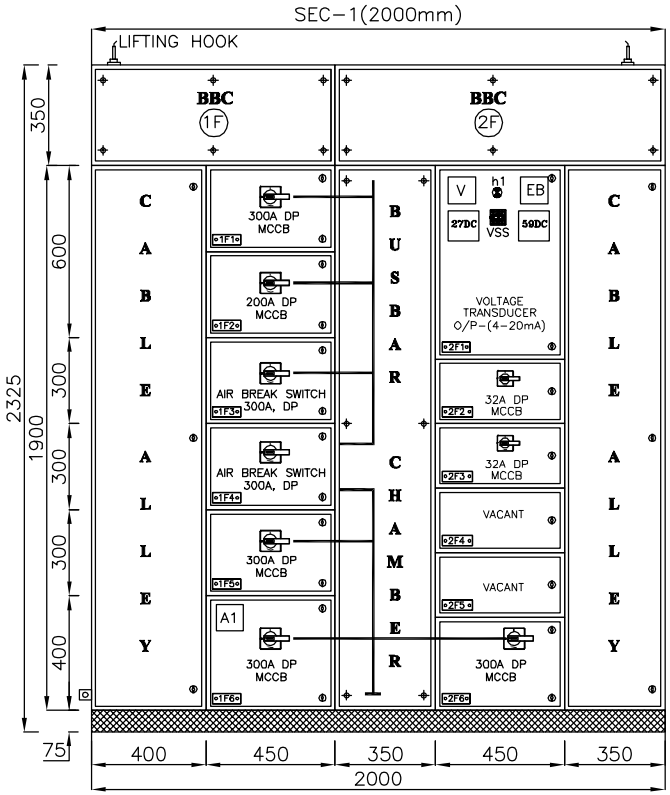
CLIENT :- POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR :- BHARAT HEAVY ELECTRICAL LIMITED (BHEL)
TRANSMISSION PROJECTS DIVISION

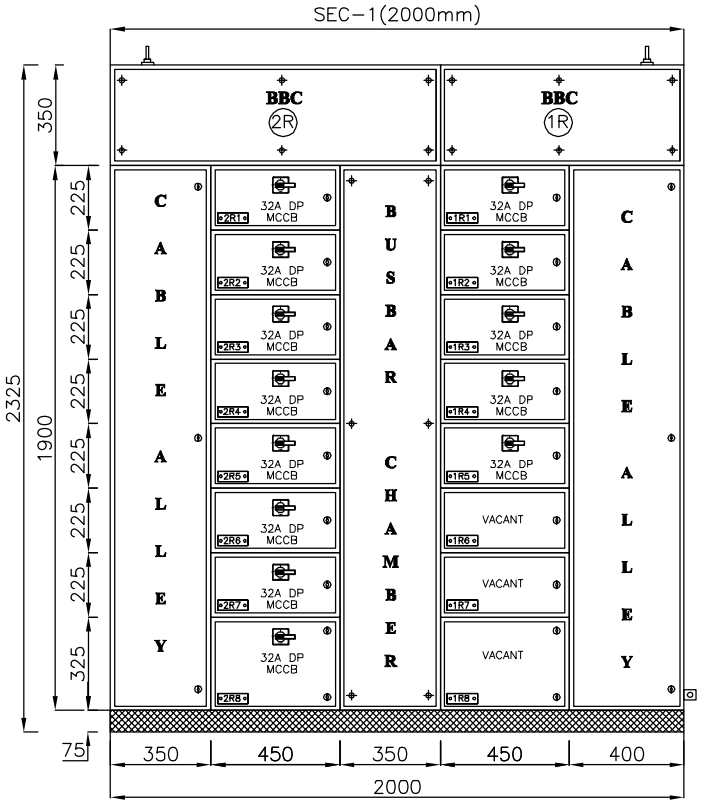
	04.	-	DRAWN	MP	
	03.	-	CHKD.	VDP	
	02.	-	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

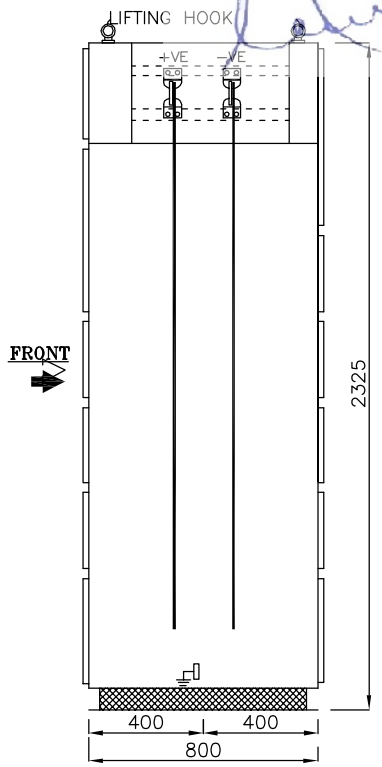
DRAWING	COVER PAGE	JOB NO. 1241A
TITLE	48V DC DISTRIBUTION BOARD-2(4D)(MCRB)	
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024	
PROJECT	765/400/220kV BIKANER-III POOLING STATION	
CLIENT: POWER GRID CORPORATION OF INDIA LIMITED	CONTRACTOR:- BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-008	SH. NO. 01 OF 01



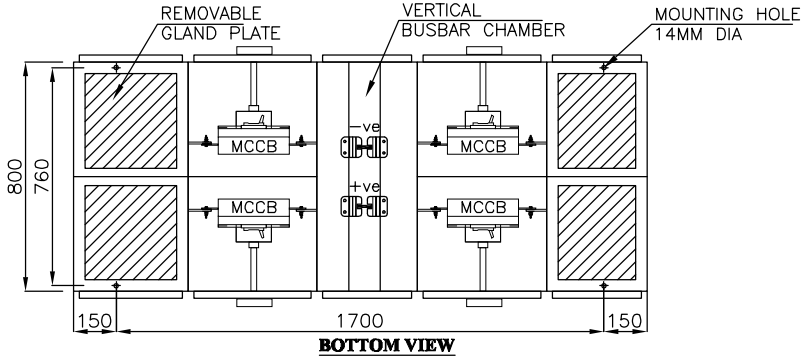
FRONT VIEW



REAR VIEW



SIDE VIEW(HORIZONTAL BUS BARS ALONG WITH DETAILS OF BUS BAR SUPPORTS.)



BOTTOM VIEW

PANEL DIMENSIONS

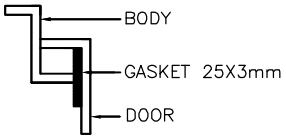
HEIGHT : 2325 mm.
WIDTH : 2000 mm.
DEPTH : 800 mm.

BUS BAR SIZE :-

POSITIVE : 1x40x10 Sq.mm Alu.
NEGATIVE : 1x40x10 Sq.mm Alu.
EARTH : 1x40X05 Sq.mm GS.

LEGEND DETAILS

A1 = ANALOG DC AMMETER
V = ANALOG DC VOLT METER
27DC = DC UNDER VOLTAGE RELAY
59DC = DC OVER VOLTAGE RELAY
EB = ELECTRONIC BUZZER



DETAIL-'A'

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

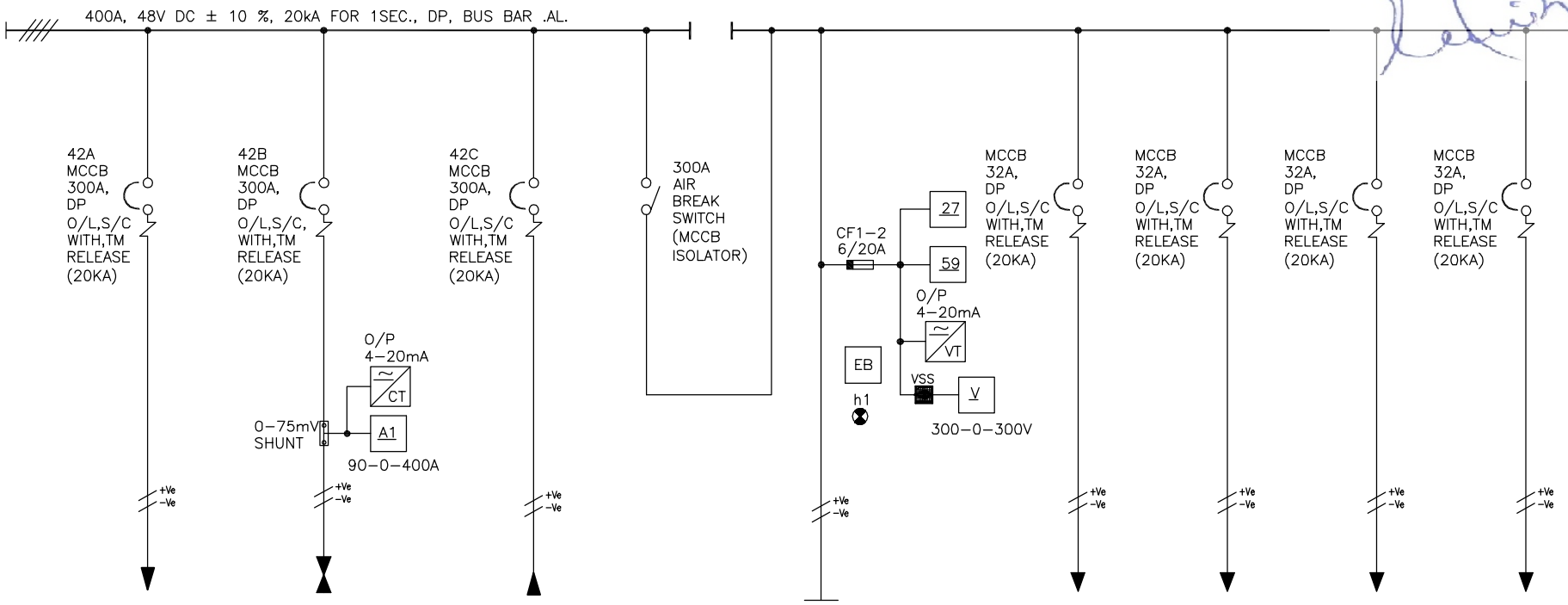
MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	GENERAL ARRANGEMENT DRAWING
TITLE	48V DC DISTRIBUTION BOARD–2(4D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–108

JOB NO. 1241A

SH. NO. 01 OF 01

1 2 3 4 5 6 7 8 9



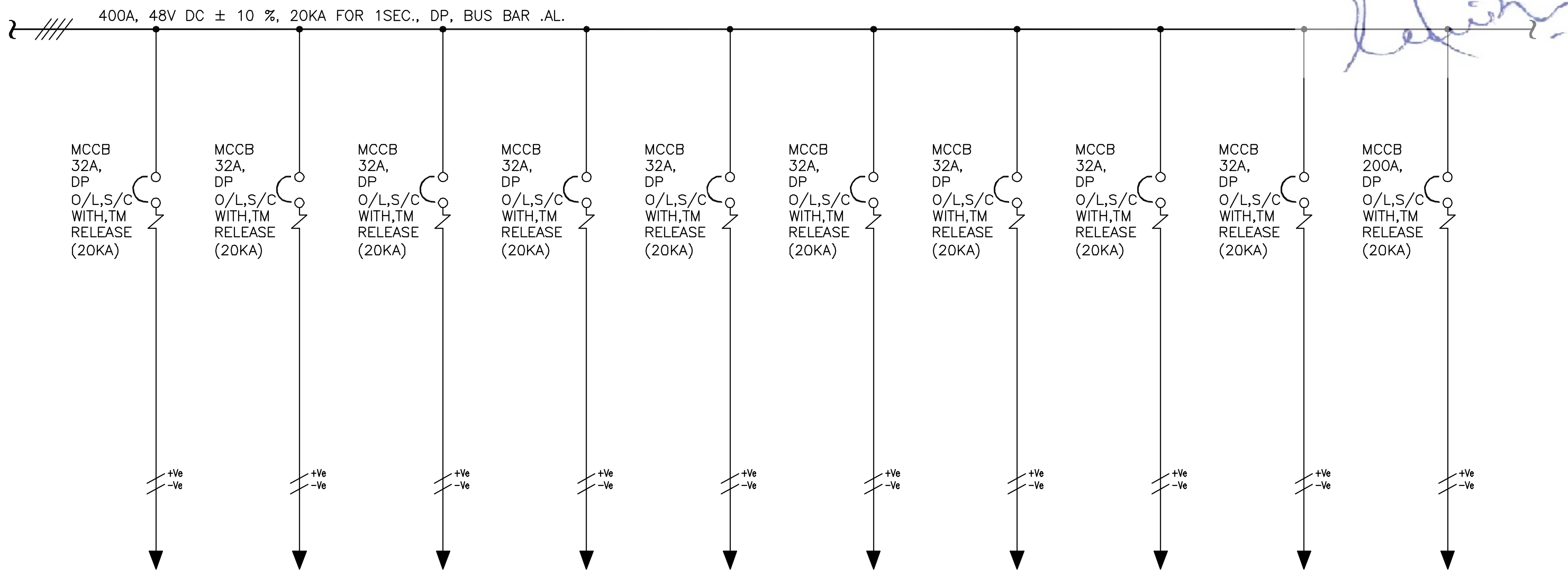
FEEDER NUMBER	2F6	1F6	1F5	1F4	2F1	2F2	2F3	1R1	1R2
MODULE TYEP	DC	DC	DC	H1	S1	X	X	X	X
FEEDER RATING	300A	300A	300A	300A	--	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	ISOLATOR	METERING	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	BATTERY CURATIVE DISCHARGE FEEDER	48V DC BATTERY BANK-2	48V DC INCOMER FROM BATTERY CHARGER-2	MAIN BUSBAR CONTROL FEEDER 48V DCDB-2	--	EPAX PANEL	765kV PLCC PANEL 703 (F)	765kV PLCC PANEL 706 (F)	765kV PLCC PANEL 709
POWER CABLE SIZE (AL PVC)	2X1CX150 Sqmm.	2X1CX150 Sqmm.	2X1CX150 Sqmm.	--	--	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

	04.	-	DRAWN	MP	
	03.	-	CHKD.	VDP	
	02.	-	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM		JOB NO. 1241A
TITLE	48V DC DISTRIBUTION BOARD-2(4D)(MCRB)		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED	CONTRACTOR:-	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-208		SH. NO.:- 01 OF 03

1 2 3 4 5 6 7 8 9



FEEDER NUMBER	1R3	1R4	1R5	2R1	2R2	2R3	2R4	2R5	2R6	1F2
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	200A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	765kV PLCC PANEL 712	765kV PLCC PANEL 721 (F)	765kV PLCC PANEL 724(F)	765kV PLCC PANEL 725 (F)	765kV PLCC PANEL 727 (F)	FOTE-1	FOTE-2	FOTE-3	FOTE-4	OUTGOING FEEDER TO AUX. BUILDING
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	2X1CX150Sqmm.

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN	MP
CHKD.	VDP
APPD.	--
ALL DIMENSIONS IN mm.	SIGN.
TOLERANCE 5%	
REVISIONS : 00	

MANUFACTURER

ULTIMA SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

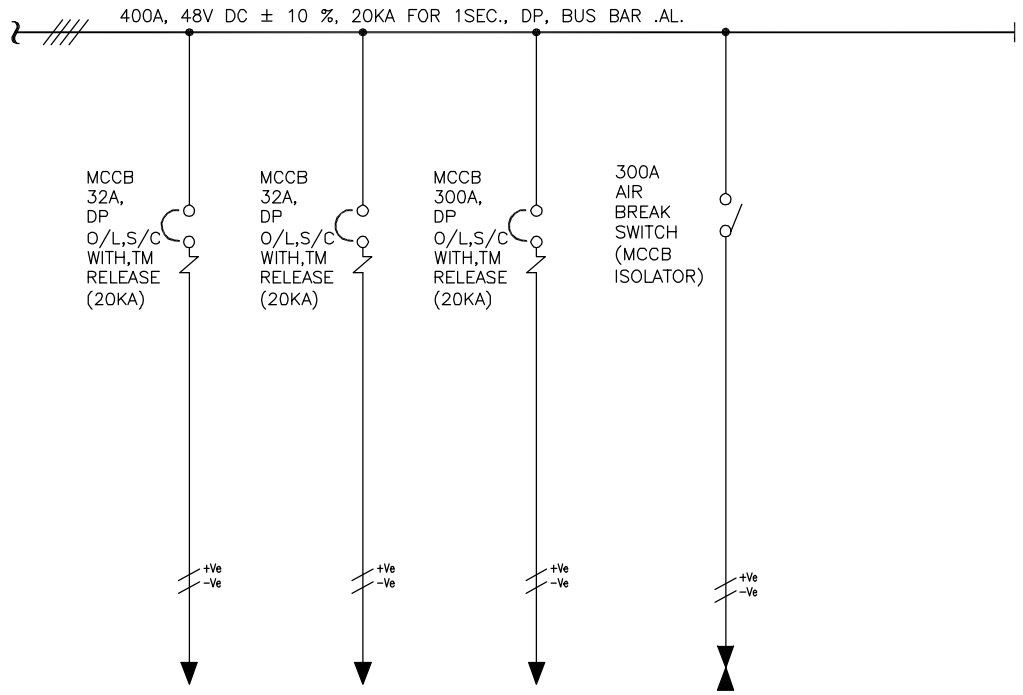
DRAWING	SINGLE LINE DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD-2(4D)(MCRB)
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER-III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:-
BHARAT HEAVY ELECTRICAL LIMITED (BHEL)
TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024-2025/1241A-208 | SH. NO.:- 02 OF 03



FEEDER NUMBER	2R7	2R8	1F1	1F3
MODULE TYEP	X	X	X	H1
FEEDER RATING	32A	32A	300A	300A
FEEDER TYPE	MCCB	MCCB	MCCB	ISOLATOR
DESCRIPTION	SPARE–4	SPARE–5	SPARE–6	TO 48V DCDB–1
POWER CABLE SIZE (AL PVC)	--	--	--	2X1CX150 Sqmm.

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

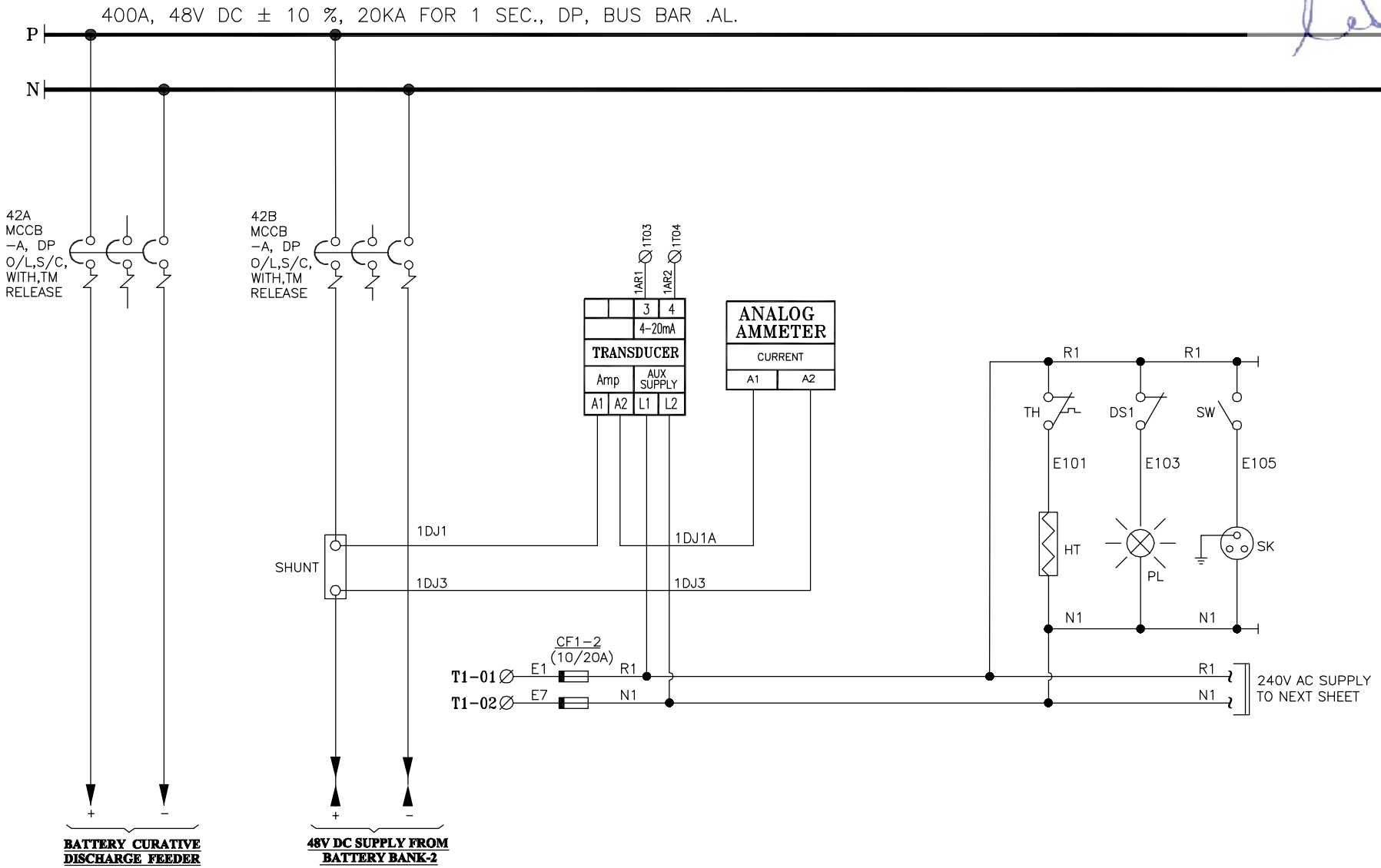
DRAWING	SINGLE LINE DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD–2(4D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–208 SH. NO.:– 03 OF 03



	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SCHEMATIC DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD–2(4D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

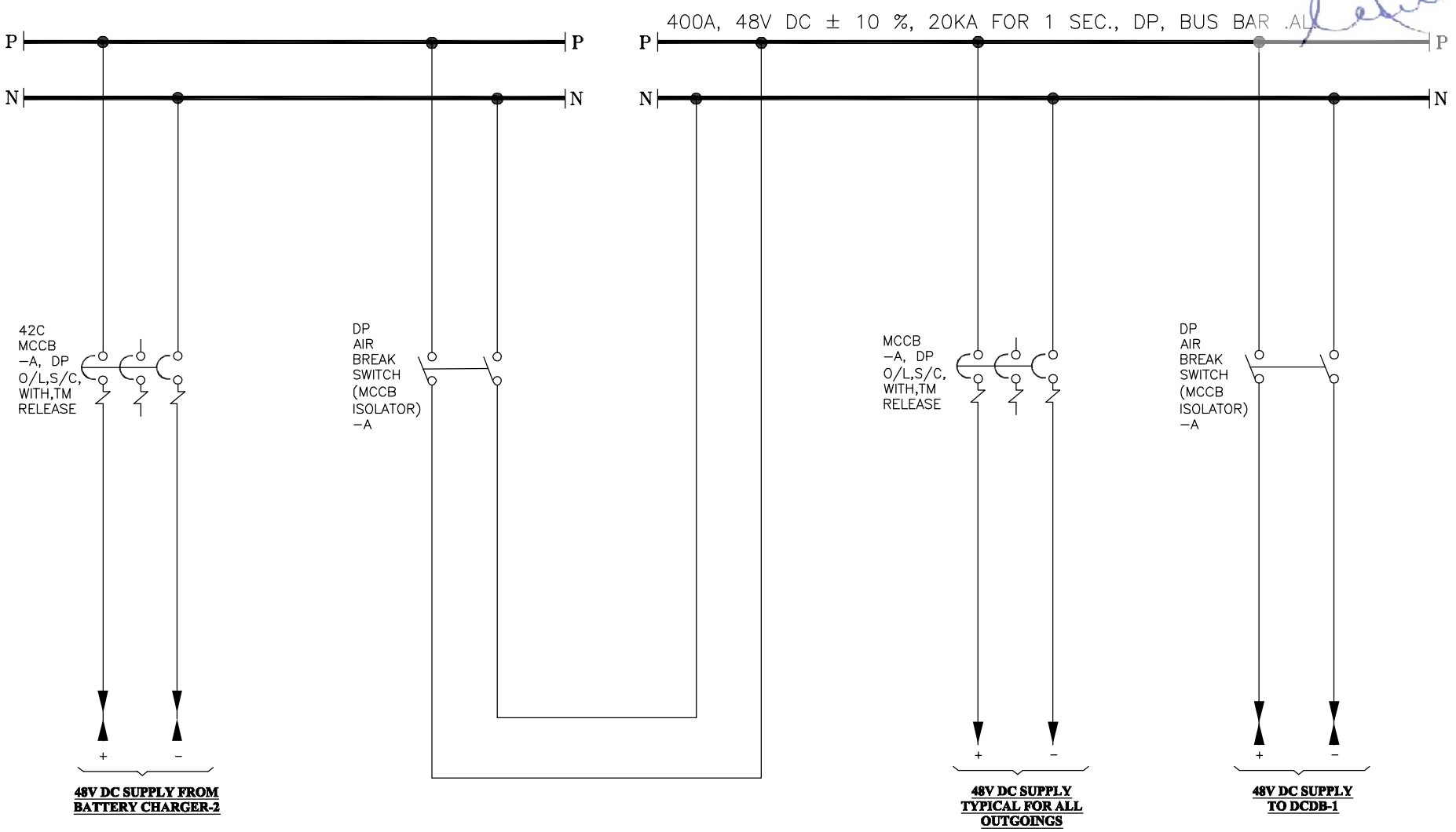
JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–508	SH. NO.:– 01 OF 03

1 2 3 4 5 6 7 8 9



	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	––	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

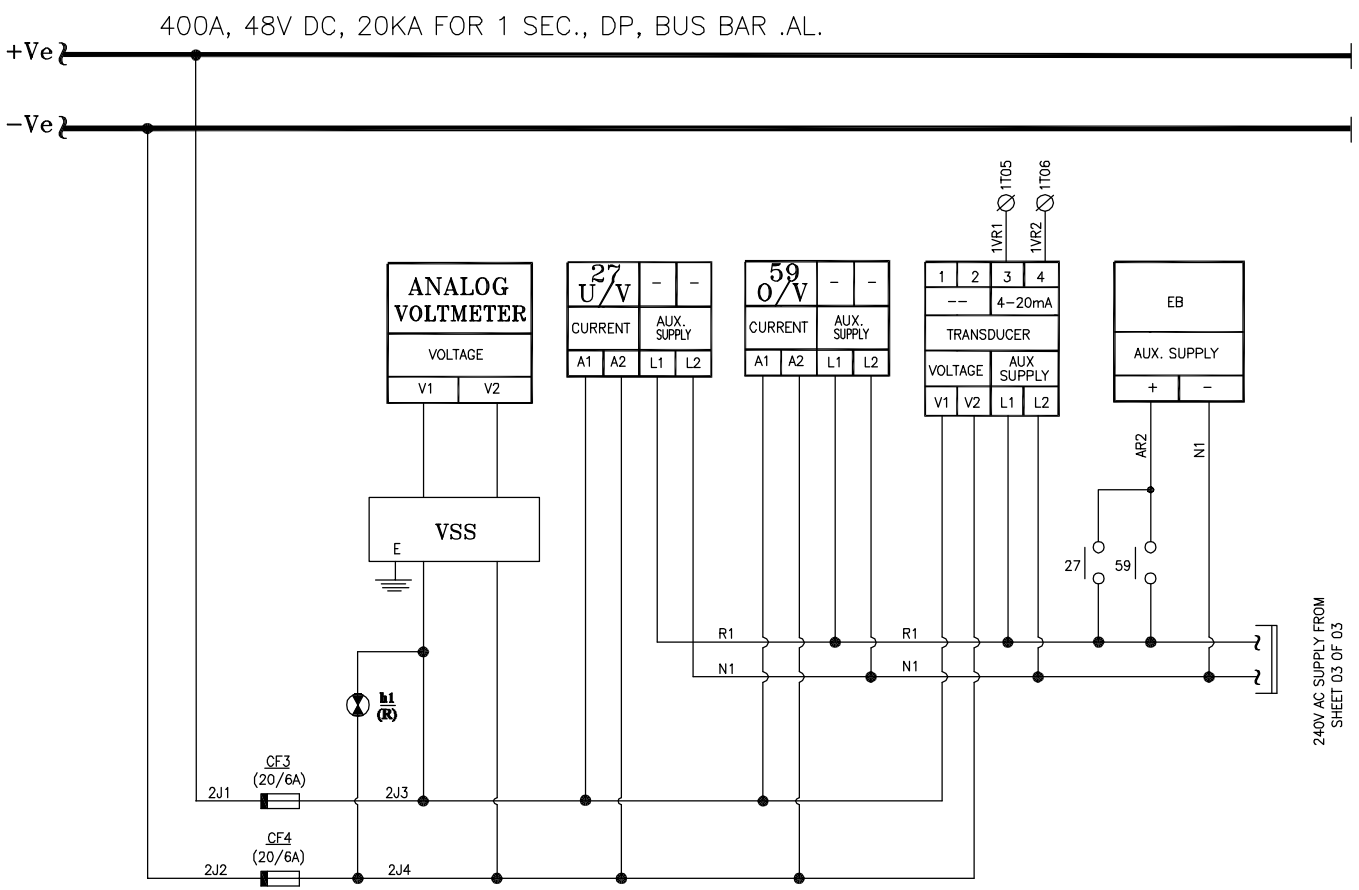
DRAWING	SCHEMATIC DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD–2(4D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–508 SH. NO.:– 02 OF 03



TERMINAL DETAIL

	1T	
E1	1	240V AC SUPPLY FROM CUSTOMER SCOPE
E7	2	
1AR1	3	4−20mA OUTPUT FROM CURRENT TRANSDUCER
1AR2	4	
1VR1	5	4−20mA OUTPUT FROM VOLTAGE TRANSDUCER
1VR2	6	
	7	SPARE
	8	

DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00	TOLERANCE 5%	ALL DIMENSIONS IN mm.	SIGN.
	01.				DRAWN MP	
	02.	–			CHKD. VDP	
	03.	–			APPD. --	
	04.	–				
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL				

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SCHEMATIC DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD−2(4D)(MCRB)
CA NO.	CC/T/W−AIS/DOM/A10/23/01956/NOA−1/24−102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER−III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:−
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024−2025/1241A−508 SH. NO.:− 03 OF 03

BILL OF MATERIAL FOR 48V DC DISTRIBUTION BOARD-2(4D)(MCRB)

S.NO.	ITEM CODE	DESCRIPTION	MAKE	RATING	QTY.
A	**BILL OF MATERIAL FOR MODULE - (DC)**				**1 No.**
1	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER LINK, ROTARY OPERATING MECHANISM (ROM), ICS = 100% ICU	L&T/C&S/HAVELLS	300A, 20kA, 48V DC	03
2	**A1**	DC ANALOG AMMETER, 96 X 96 Sq MM, WITH 0–75mV SHUNT	AE/RISHAB/NEWTEK/SECURE	90–0–400A	01
3	**Ct**	DC CURRENT TRANSDUCER , SINGLE OUTPUT–4–20mA, WITH 0–75mV SHUNT, AUX. SUPPLY 240V AC	AE/RISHAB/SECURE	0–400A	01
B	**BILL OF MATERIAL FOR MODULE (H1)**				**2 Nos.**
1	**MCCB ISOLATOR**	DOUBLE POLE SINGLE THROUGH TYPE ON/OFF AIR BREAK SWITCH (MCCB ISOLATOR), WITH DOOR INTERLOCKING AND PAD LOCKING FACILITY	L&T/C&S/HAVELLS	300A, 48V DC	01
0	––	MECHANICAL LOCK 2 LOCK 1–KEY FOR 300A AIR BREAK SWITCH	PGCIL APPROVED	––	1–SET
C	**BILL OF MATERIAL FOR MODULE (X)**				
1	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER & ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	300A, 20kA, 48V DC	01
2	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER & ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	200A, 20kA, 48V DC	01
3	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	32A, 20kA, 48V DC	15
D	**BILL OF MATERIAL FOR MODULE - (S1)**				**1 No.**
1	**27**	DC INSTANTANEOUS UNDER VOLTAGE RELAY WITH 95% OF 48V DC. THE RESETTING RATIO OF RELAY OF RELAY SHOULD NOT BE MORE THAN 1.25. THE RELAY SHALL BE PROVIDED WITH A SERIES RESISTOR AND A PUSH BUTTON ACROSS IF FOR RESETTING (PICK UP) THE RELAY AT ABOUT 105% OF THE DROP OUT VOLTAGE, FLUSH MOUNTED, AUX. SUPPLY 240V AC	C&S/JVS/ASHIDHA/PROCOM	NOMINAL VOLTAGE–48V DC	01
2	**59**	DC INSTANTANEOUS OVER VOLTAGE RELAY WITH SETTING RANGE OF 110% OF 48V DC. THE RESETTING RATIO OF RELAY SHOULD NOT BE LESS THAN 0.8. THE RELAY SHALL HAVE A PUSH BUTTON IN SERIES OF RESETTING THE RELAY AT ABOUT 95% OF THE OPERATING VOLTAGE, FLUSH MOUNTED, AUX. SUPPLY 240V AC	C&S/JVS/ASHIDHA/PROCOM	NOMINAL VOLTAGE–48V DC	01
3	**V**	DC ANALOG VOLTMETER 96 X 96 Sq MM	AE/RISHAB/NEWTEK/SECURE	300–0–300V	01
4	**VSS**	VOLTAGE SELECTOR SWITCH,3POSITION (+VE/–VE, +VE/EARTH, –VE/EARTH), CAM TYPE, 2POLE, THREE WAY WITH OFF,	SALZER/KAYCEE	6A	01
5	**h1**	'DC SUPPLY ON' INDICATION LAMP, 22.5 Sq. mm. DIA ,LED TYPE, RED	ESBEE/VAISHNO/C&S	48V DC	01
6	**EB**	ELECTRONIC BUZZER, 48V DC	SECO	––	01
7	**CF3-4**	HRC FUSE BASE	L&T/C&S/HAVELLS	20A	02
8	**CF3-4**	HRC FUSE LINK	L&T/C&S/HAVELLS	6A	02
9	**Vt**	DC VOLTAGE TRANSDUCER, SINGLE OUTPUT–4–20mA,CL–1.0, AUX. SUPPLY 240V AC	AE/RISHAB/SECURE	48V DC	01

NOTE:– ALL COMPONENTS SHALL BE POWER GRID (QA&I) APPROVED MAKE

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. –– | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	BILL OF MATERIAL
TITLE	48V DC DISTRIBUTION BOARD–2(4D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
JOB NO.	1241A
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–708
SH. NO.:–	01 OF 02

BILL OF MATERIAL FOR 48V DC DISTRIBUTION BOARD-2(4D)(MCRB)

S.NO.	ITEM CODE	DESCRIPTION	MAKE	RATING	QTY.
E	**BILL OF MATERIAL FOR MISC.**				
1	**CF1-2**	HRC FUSE BASE	L&T/C&S/HAVELLS	20A	02
2	**CF1-2**	HRC FUSE LINK	L&T/C&S/HAVELLS	10A	02
3	**DS**	DOOR SWITCH, 1C/O	SURAJ	--	02
4	**PL**	PANEL ILLUMINATION LIGHT, 240V AC	HAVELLS	5W	02
5	**SH**	SPACE HEATER, 240V AC	HOTWEL	60W	02
6	**TH**	THERMOSTATE, 240V AC	ELCON	30 – 85°C	02
7	**SW - SOCKET**	5/15A SWITCH SOCKET	ANCHOR	--	01

NOTE:– ALL COMPONENTS SHALL BE POWER GRID (QA&I) APPROVED MAKE

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. -- | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	BILL OF MATERIAL
TITLE	48V DC DISTRIBUTION BOARD–2(4D)(MCRB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–708 | SH. NO.:– 02 OF 02

ENGINEERING DRAWING DETAILS FOR

415V AC DISTRIBUTION BOARD (5A) (AB)

PROJECT :- 765/400/220kV BIKANER-III POOLING STATION

CLIENT :- POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR :- BHARAT HEAVY ELECTRICAL LIMITED (BHEL)
TRANSMISSION PROJECTS DIVISION

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN	MP		
CHKD.	VDP		
APPD.	--		
ALL DIMENSIONS IN mm.		SIGN.	
TOLERANCE 5%			
REVISIONS : 00			

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	COVER PAGE	JOB NO.	1241A
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED	CONTRACTOR:-	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-009	SH. NO.	01 OF 01

-: GUARANTEED TECHNICAL PARTICULARS/GENERAL NOTES :-

1. TYPE OF PRODUCT : FLOOR MOUNTED FIXED TYPE, COMPARTMENTALIZED AND DOUBLE FRONT
2. CABLE ENTRY : BOTTOM
3. DEGREE OF PROTECTION : IP–53
   (AS PER IS : IS/IEC: 60947, 60529 FOR ENCLOSURE ONLY)
4. SUPPLY VOLTAGE
   a) POWER VOLTAGE : 415V ±10%, 3 PHASE, 4 WIRE
   b) CONTROL VOLTAGE : 240V AC
      220V DC
5. FABRICATION
   a) ENCLOSURE : 2.0MM CRCA
   b) DOORS/COVERS : 1.6MM CRCA
   c) BASE CHANNEL : 75MM ISMC
   d) GLAND PLATE : 3.0MM CRCA IN ALL CASES & 4.0MM THICKNESS NON MAGNETIC MATERIAL FOR SINGLE CORE POWER CABLE (REMOVABLE TYPE AS PER TS)
6. PAINTING
   a) PRETREATMENT : 9 TANK PROCESS
   b) PAINT TYPE : POWDER COATING
   c) PAINT SHADE : SMOKE GREY (SHADE NO 692 OF IS:5)
   d) PAINT THICKNESS : AS PER MQP
7. BUSBAR
   a) MAIN BUSBAR MATERIAL : ALUMINUM E91E GRADE (IS–5082)
   b) SLEEVE : HEAT SHRINKABLE PVC SLEEVES WITH RED, YELLOW, BLUE BLACK, GREEN COLORS
8. BUSBAR SUPPORTS : SMC/DMC
9. EARTH BUS BAR : SUITABLE SIZE OF GS THROUGH OUT THE PANEL AND HAVING TWO HOLES ON EACH AND FOR EARTH CONNECTION (AS PER GA DRAWING)
10. MINIMUM BUSBAR CLEARANCES (MAIN BUSBARS) :–
    (a) PHASE TO PHASE : 25.00 mm
    (b) PHASE TO NEUTRAL & POSITIVE TO NEGATIVE : 25.00 mm
    (c) PHASE/NEUTRAL TO EARTH : 25.00 mm
11. DOORS.
    FEEDER DOORS : HINGED AND LOCKABLE
    BUSBAR CHAMBERS : BOLTED
12. CONTROL WIRING : STANDARD PVC FLEXIBLE FR CU WIRE 1100V GRADE
    CT CIRCUIT : 2.5 SQ. MM RED, YELLOW, BLUE COLOR
    AC VOLTAGE CIRCUIT : 1.5 SQ. MM RED, YELLOW, BLUE COLOR
    AC CIRCUIT : 1.5 SQ. MM BLACK COLOR
    DC CIRCUIT : 1.5 SQ. MM GREY FOR +VE AND WHITE FOR –VE COLOR
    EARTHING : 2.5 SQ. MM GREEN COLOR
13. POWER WIRE : PVC FLEXIBLE FR CU WIRE 1100V GRADE (COLOR – R,Y,B, BLACK)
    POWER CIRCUIT UP TO 20A : 4 Sq. MM
    POWER CIRCUIT 21 TO 32A : 6 Sq. MM
    POWER CIRCUIT 33 TO 40A : 10 Sq. MM
    POWER CIRCUIT 40 TO 63A : 16 Sq. MM
    ABOVE 63A : SOLID ALUMINUM LINK (@ 1.0A/Sqmm)
14. CURRENT DENSITY : SOLID ALUMINUM LINK @ 1.0A/Sqmm
15. SPACE HEATER : SPACE HEATER SHALL BE PROVIDED AT EACH CABLE ALLEY & ACB FEEDER
16. NAME PLATE : NAME PLATE SHALL BE OF NON–RUSTING METAL OR 3PLY LAMICOID WITH WHITE ENGRAVED LETTERING ON BLACK BACKGROUND
17. DANGER PLATE : PRINTED DANGER PLATE ON THE EACH HORIZONTAL/ VERTICAL BUSBAR CHAMBER SHALL BE PROVIDE
18. GASKETS : NEOPRENE RUBBER GASKETS TYPE–II CLASS 2A AS PER IS : 11149 SHALL BE PROVIDED AT ALL REMOVABLE DOORS & COVERS TO MAKE THE PANEL DUST & VERMIN PROOF
19. SHROUDING : ALL LIVE PART SHALL BE SHROUDED WITH 2MM THICK HYLEM/ACRYLIC SHEET.
20. ALL HINGED FRONT DOORS & COVERS SHALL BE PROVIDED WITH SUITABLE FLEXIBLE COPPER EARTHING CONNECTIONS..
21. CABLE SIZE AS PER APPROVED LT SLDs FOR POWER & CONTROL CABLE/PGCIL TS
22. ALL FUSES SHALL BE HRC TYPE WITH SHORT CIRCUIT LEVEL AS PER TS .
23. MANUFACTURING TOLERANCE TO BE AS PER IS :
    i) UP TO 50MM– ± 3% ii) 51 TO 100MM– ± 2%
    iii) 101 TO 300MM– ± 1% iii) ABOVE 300MM– ± 0.5%
24. TEMPERATURE RISE OF HORIZONTAL & VERTICAL BUSBAR SHALL IN NO CASE EXCEED 55 DEG.C WITH SILVER PLATED JOINTS & 40 DEG. C WITH ALL OTHER JOINTS OVER AN OUTSIDE AMBIENT TEMERATURE OF 50 DEG C.
25. CROSS SECTION OF ALL HORIZONTAL & VERTICAL BUS BAR SHALL BE UNIFORM THROUGH OUT THEIR LENGTH
26. ALL ITEMS SHALL BE POWERGRID QA&I APPROVED
27. SWITCHBOARD SHALL BE EXTENDIBLE ON BOTH SIDES BY ADDITION OF VERTICAL SECTIONS AFTER REMOVING THE END COVER.
28. ALL POWER TERMINAL SHALL BE STUD TYPE
29. PANEL SHALL BE EXTENDABLE FROM BOTH SIDES
30. AMBIENT TEMPERATURE CONSIDERED IS 50°C
31. MEGGAR/INSULATION VOLTAGE TEST– IR–500V DC
    HV TEST –2.5KV FOR ONE MINUTE
32. IN ALL CIRCUIT BREAKER PANELS AT LEAST 10% SPARE TERMINALS FOR EXTERNAL CONNECTIONS SHALL BE PROVIDED AND THESE SPARE TERMINALS SHALL BE UNIFORMLY DISTRIBUTED ON ALL TERMINAL BLOCKS. SPACE FOR ADDING ANOTHER 10% SPARE TERMINALS SHALL ALSO BE AVAILABLE
33. TERMINAL BLOCKS FOR CT AND VT SECONDARY LEADS SHALL BE PROVIDED WITH TEST LINKS AND ISOLATING FACILITIES. CT SECONDARY LEADS SHALL BE PROVIDED WITH SHORT CIRCUITING AND EARTHING FACILITIES. IT SHALL BE SIMILAR TO 'ELEM.' 'CATD' – TYPE.
34. TERMINAL BLOCKS SHALL BE OF 750 VOLTS GRADE AND HAVE CONTINUOUS RATING TO CARRY THE MAXIMUM EXPECTED CURRENT ON THE TERMINALS.
35. TERMINAL BLOCKS SHALL BE ARRANGED WITH AT LEAST 100 MM CLEARANCE BETWEEN TWO SETS OF TERMINAL BLOCK. THE MINIMUM CLEARANCE BETWEEN THE FIRST ROW OF TERMINAL BLOCK AND THE ASSOCIATED CABLE GLAND PLATE SHALL BE 250 MM

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. -- | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	GENERAL TECHNICAL SPECIFICATION
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL)
TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–900 | SH. NO. 01 OF 01

-: SYMBOLS :-

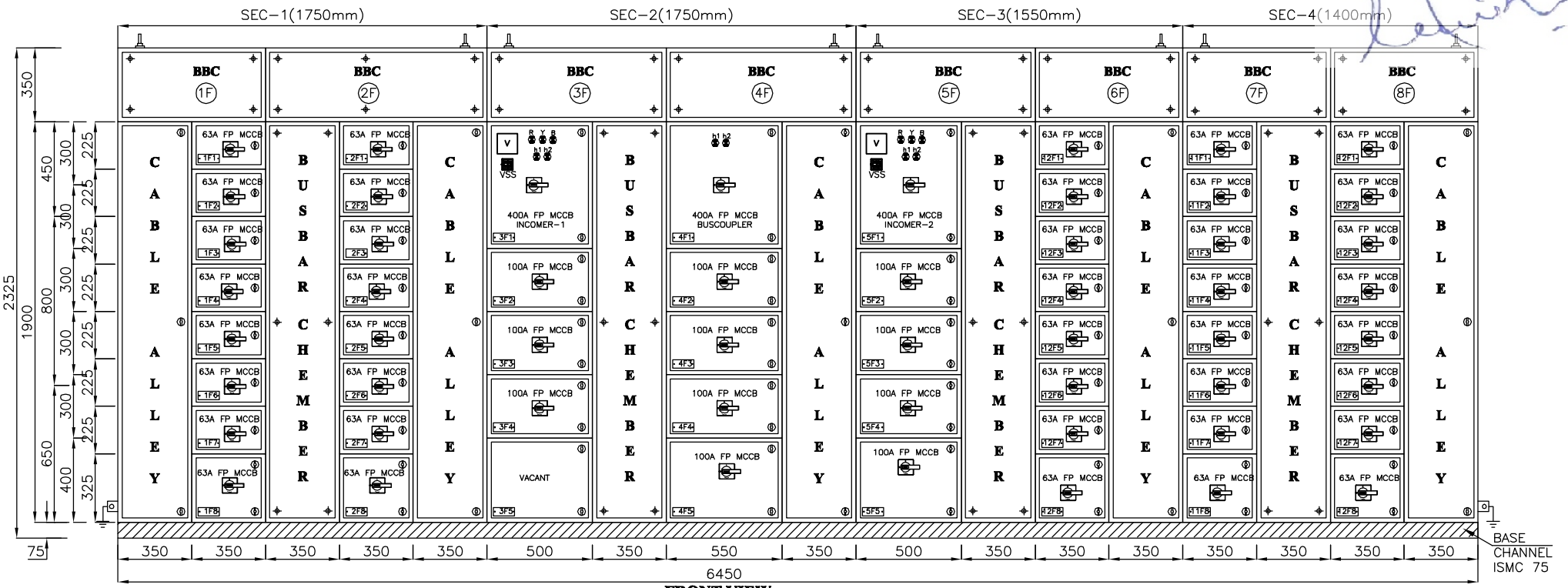
SR. NO.	DESCRIPTION	SYMBOL	SR. NO.	NAME	SYMBOL	SR. NO.	NAME	SYMBOL	SR. NO.	NAME	SYMBOL
1	CURRENT TRANSFORMER		13	CLOSING COIL	CC	25	DRAW OUT TERMINAL POWER		37	PROTECTION RELAY	
2	NEUTRAL LINK		14	SHUNT TRIP COIL	ST	26	DRAW OUT TERMINAL CONTROL		38	EARTHING	E
3	THERMOSTAT	Th.	15	FUSE		27	ISOLATOR		39	EARTHING BOLT	
4	CHANGE OVER SWITCH		16	DIGITAL AMMETER	A	28	FUSE SWITCH UNIT		40	SPACE HEATER	SH
5	NO CONTACT		17	AMMETER SELECTOR SWITCH	ASS	29	TERMINAL		41	D/O ACB	
6	NC CONTACT		18	DIGITAL VOLTMETER	V	30	TERMINAL		42	ELECTRIC BELL	EB
7	MCCB (MOULDEDCASE CIRCUIT BREAKER)		19	VOLTMETER SELECTOR SWITCH	VSS	31	TERMINAL		43	ANALOG AMMETER	A
8	MINIATURE CIRCUIT BREAKER (MCB)		20	KILOWATT HOUR METER	KWH	32	PUSH BUTTON		44	ANALOG VOLTMETER	V
9	PUSH BUTTON SPRING RETURN TYPE WITH NC ELEMENT		21	CONTACTOR COIL		33	INDICATING LIGHT				
10	PUSH BUTTON SPRING RETURN TYPE WITH NO ELEMENT		22	ON DELAY TIMER COIL		35	CAPACITOR				
11	OVERLOAD RELAY (CTRL. CIRCUIT)		23	OFF DELAY TIMER COIL		34	HOOTER/BUZZER	H			
12	OVERLOAD RELAY (POWER CIRCUIT)		24	SWITCH/MCCB/ OPERATING KNOB		36	CONTROL TRANSFORMER				

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

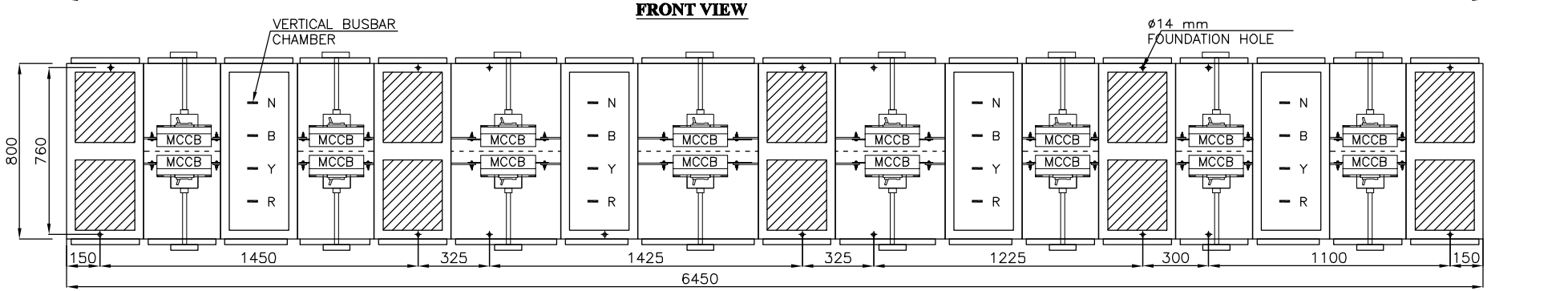
MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	ELECTRICAL SYMBOL		JOB NO. 1241A
TITLE	FOR ALL PANEL		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED	CONTRACTOR:– BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-000-09		SH. NO. 01 OF 01

1 2 3 4 5 6 7 8 9



FRONT VIEW



BOTTOM VIEW

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

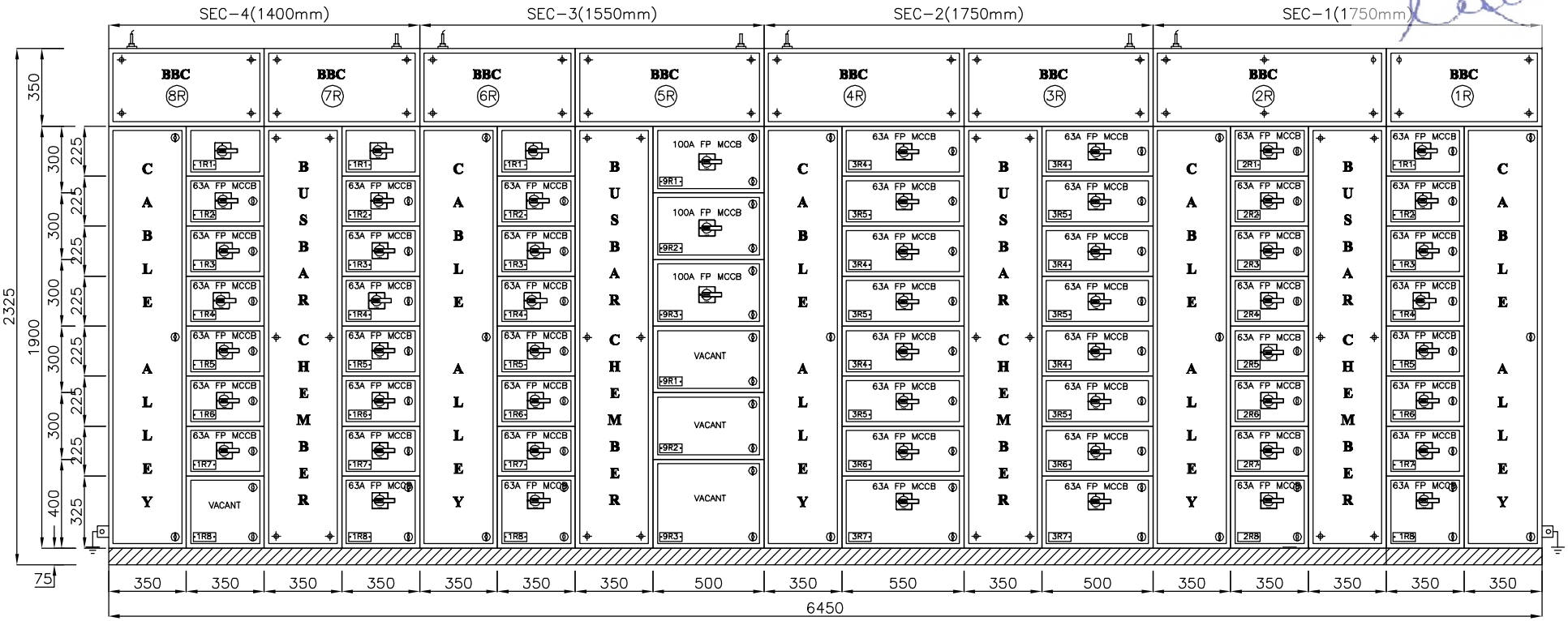
MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	GENERAL ARRANGEMENT DRAWING
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER-III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-109

JOB NO. 1241A

SH. NO. 01 OF 03

1 2 3 4 5 6 7 8 9



REAR VIEW

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

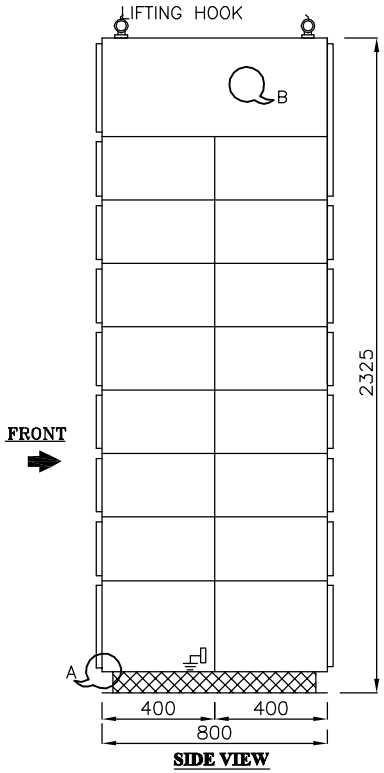
DRAWING	GENERAL ARRANGEMENT DRAWING
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

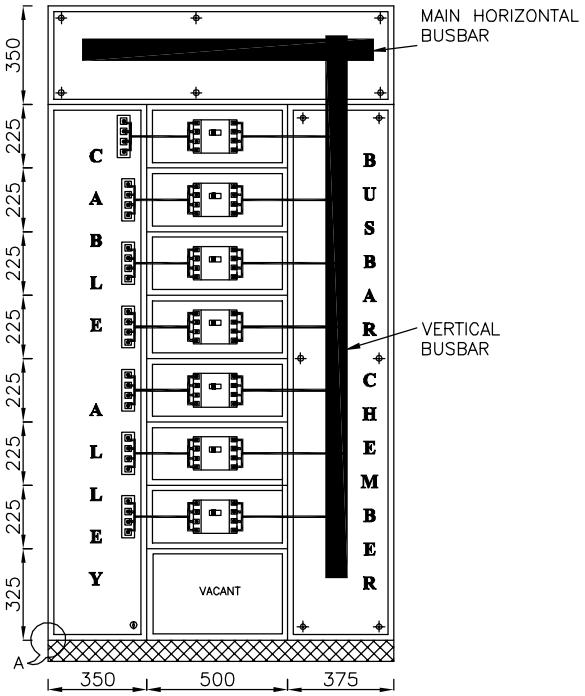
CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL)
TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–109 SH. NO. 02 OF 03



SIDE VIEW



MCCB & BUSBAR SECTION (FRONT VIEW W/O DOOR & COVER)

PANEL DIMENSIONS

HEIGHT 2325 mm.
WIDTH 6450 mm.
DEPTH 800 mm.

CABLE ENTRY

BOTTOM ENTRY

HORIZONTAL BUS BAR SIZE :-

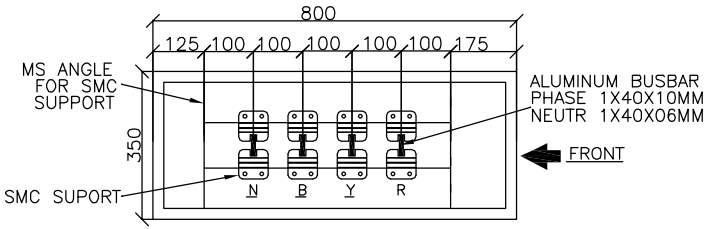
PHASE : 1x40x10 Sq.mm Al. .
NEUTRAL : 1x40x06 Sq.mm Al.
EARTH : 1x40x06 Sq.mm. GS.

VERTICAL BUS BAR SIZE :-

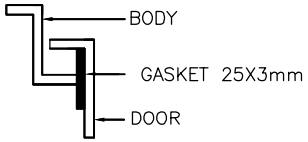
PHASE : 1x40x10 Sq.mm Al. .
NEUTRAL : 1x40x06 Sq.mm Al.

LEGEND DESCRIPTION

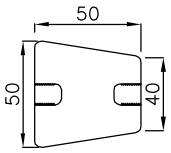
h1 = ON INDICATION RED
h2 = OFF INDICATION GREEN



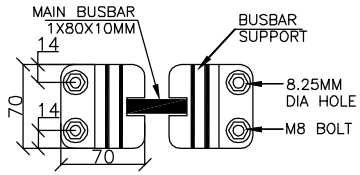
SECTIONAL VIEW AT FOR HORIZONTAL BUSBAR TOLERANCE
DETAIL-B



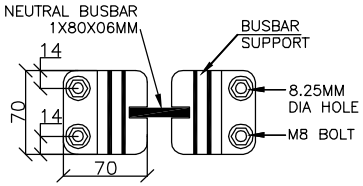
DETAIL-'A'



"DETAIL-E" CONICAL SUPPORT



DETAIL OF PHASE BUSBAR SUPPORT



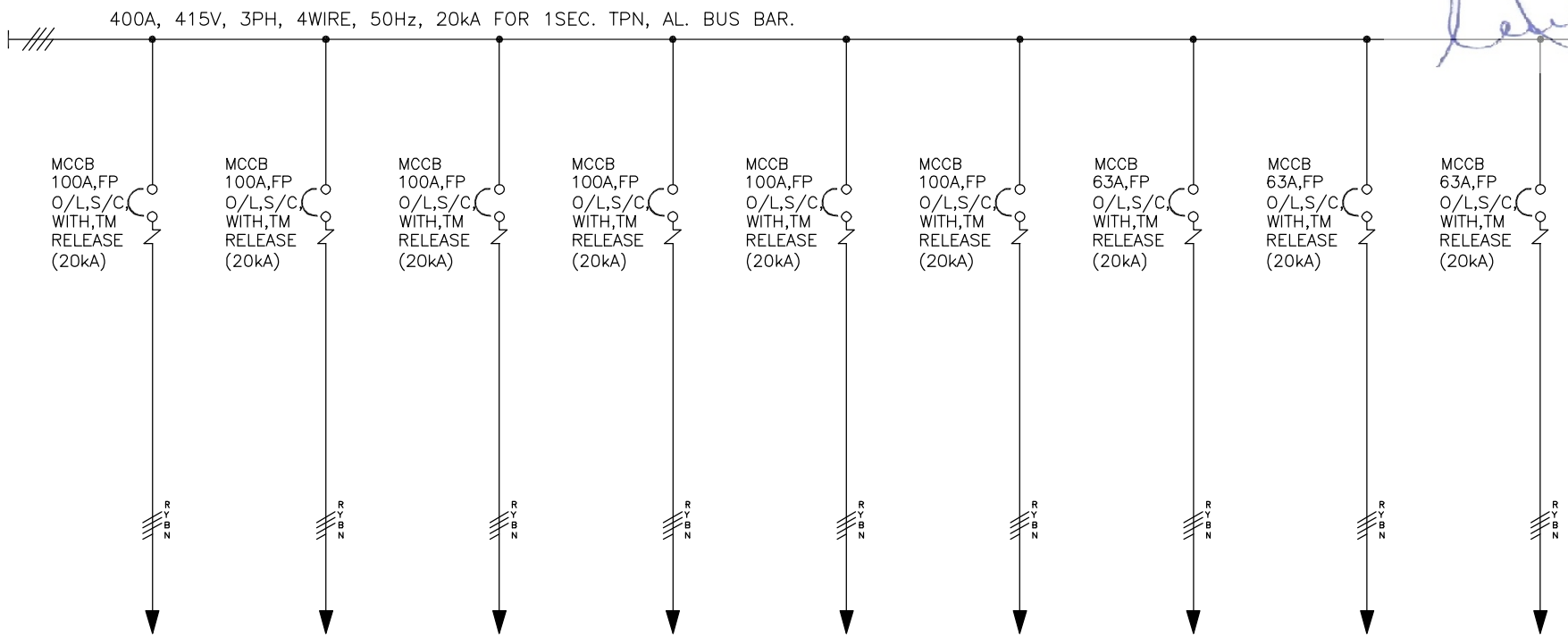
DETAIL OF NEUTRAL BUSBAR SUPPORT

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	GENERAL ARRANGEMENT DRAWING		JOB NO. 1241A
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED	CONTRACTOR:– BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-109		SH. NO. 03 OF 03

1 2 3 4 5 6 7 8 9



FEEDER NUMBER	3F2	3F3	3F4	4F2	4F3	4F4	1F1	1F2	1F3
MODULE TYEP	E	E	E	E	E	E	E	E	E
FEEDER RATING	100A	100A	100A	100A	100A	100A	63A	63A	63A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	400\220 KV AUTO TRANSFORMER-1 MB	400\220 KV AUTO TRANSFORMER-3 MB	400\220 KV AUTO TRANSFORMER-5 MB	400\220 KV AUTO TRANSFORMER-7 MB (F)	400\220 KV AUTO TRANSFORMER-9 MB (F)	COUPLING TRANSFORMER MB (F)	400KV,125MVAR BUS REACTOR-1 MB	400KV,125MVAR BUS REACTOR-1 MB (F)	400KV,125MVAR LINE REACTOR-1 MB (F)
POWER CABLE SIZE	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.

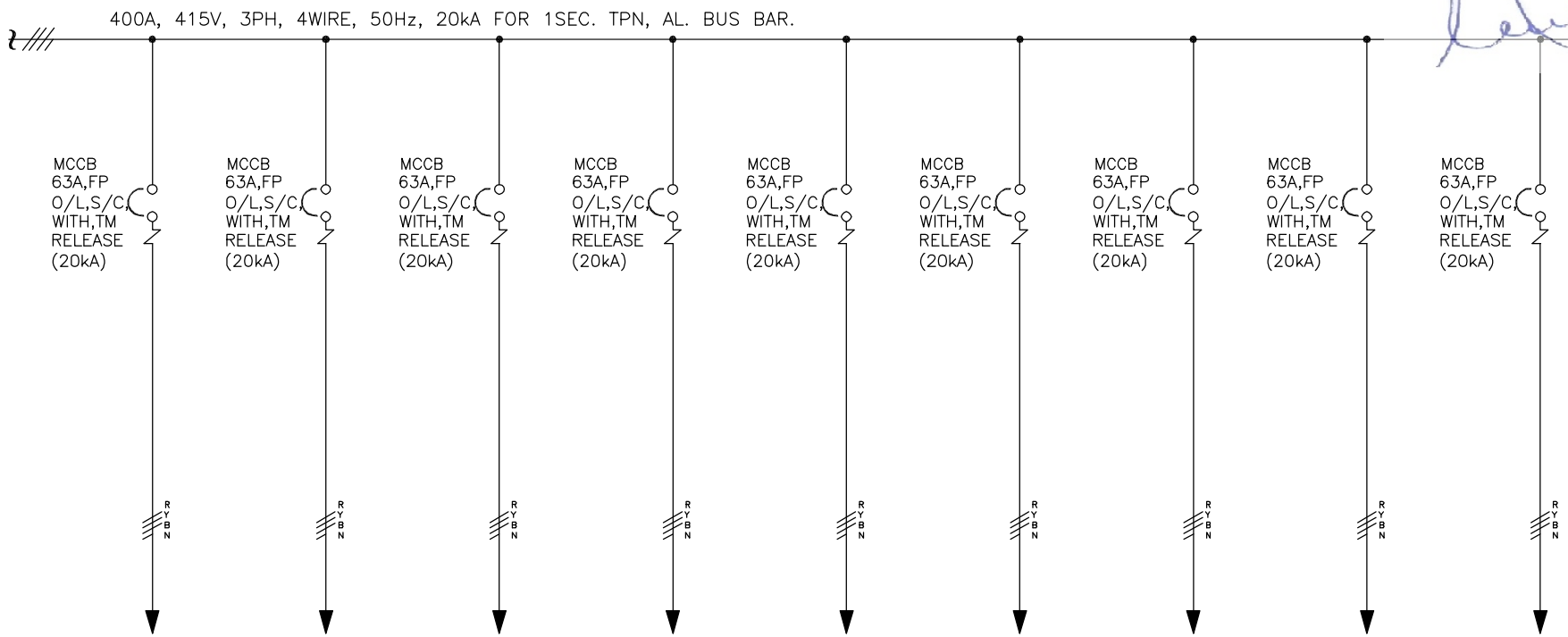
	04.	-	DRAWN	MP	
	03.	-	CHKD.	VDP	
	02.	-	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER-III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:-	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-209

JOB NO. 1241A

SH. NO.:- 01 OF 13



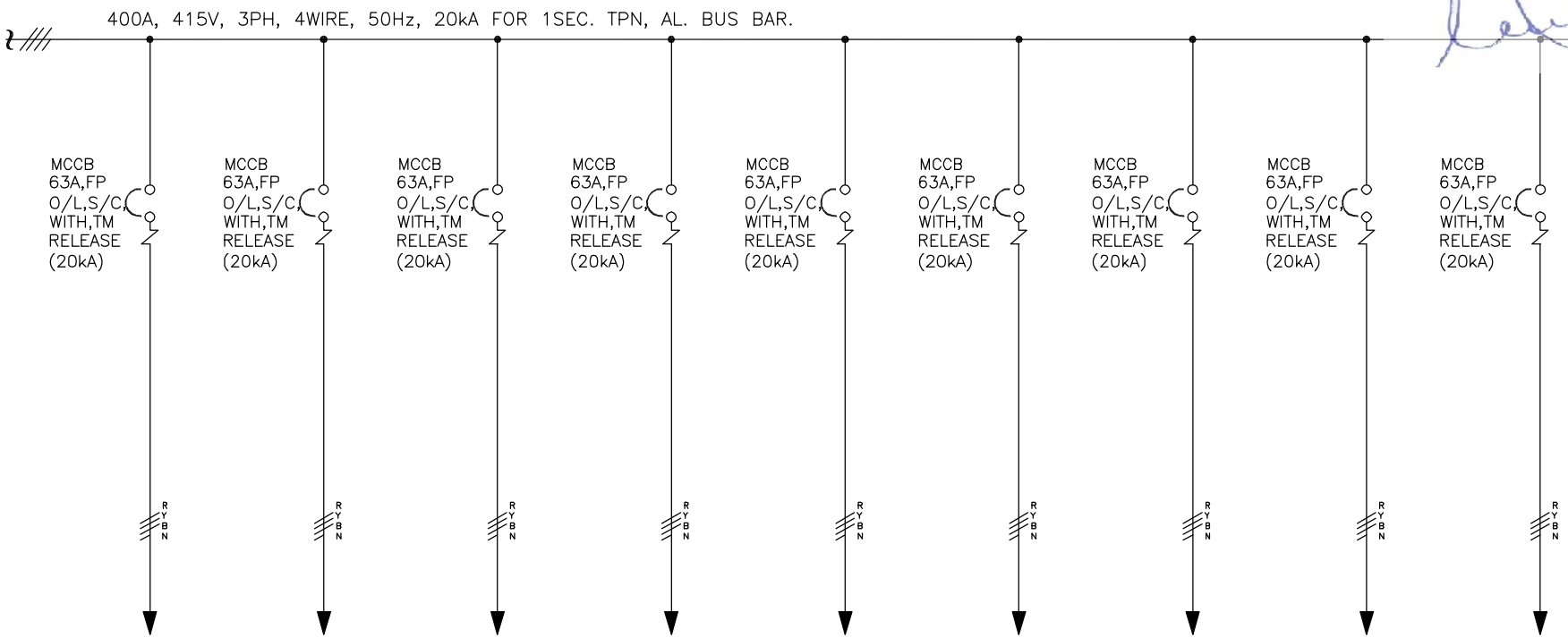
FEEDER NUMBER	1F4	1F5	1F6	1F7	1F8	2F1	2F2	2F3	2F4
MODULE TYEP	E	E	E	E	E	E	E	E	E
FEEDER RATING	63A	63A	63A	63A	63A	63A	63A	63A	63A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	400KV,125MVAR LINE REACTOR-3 MB (F)	BMK-401	BMK-404	BMK-407	BMK-410	BMK-413	BMK-416	BMK-419	BMK-422 (F)
POWER CABLE SIZE	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.

	04.	-	DRAWN	MP	
	03.	-	CHKD.	VDP	
	02.	-	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM		JOB NO. 1241A
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT: POWER GRID CORPORATION OF INDIA LIMITED		CONTRACTOR:- BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-209		SH. NO.:- 02 OF 13

1 2 3 4 5 6 7 8 9



FEEDER NUMBER	2F5	2F6	2F7	2F8	1R1	1R2	1R3	1R4	1R5
MODULE TYEP	E	E	E	E	E	E	E	E	E
FEEDER RATING	63A	63A	63A	63A	63A	63A	63A	63A	63A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	BMK–424	BMK–427	BMK–430	BMK–433 (F)	BMK–436 (F)	BMK–439 (F)	BMK–441 (F)	BMK–444 (F)	BMK–447 (F)
POWER CABLE SIZE	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. -- | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

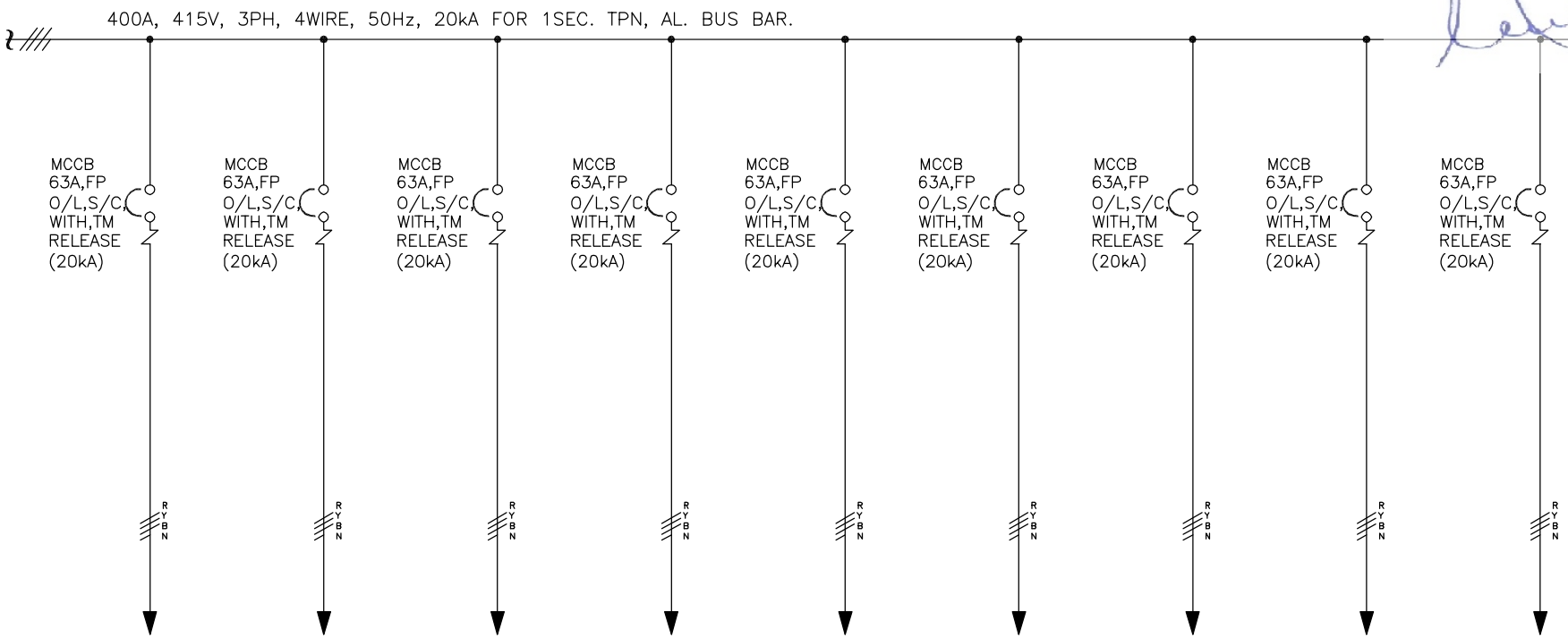
DRAWING	SINGLE LINE DIAGRAM
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–209 | SH. NO.:– 03 OF 13



FEEDER NUMBER	1R6	1R7	1R8	2R1	2R2	2R3	2R4	2R5	2R6
MODULE TYEP	E	E	E	E	E	E	E	E	E
FEEDER RATING	63A	63A	63A	63A	63A	63A	63A	63A	63A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	BMK–450 (F)	BMK–453 (F)	BMK–456 (F)	BMK–201	BMK–203	BMK–205	BMK–207	BMK–209	BMK–211
POWER CABLE SIZE	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. -- | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

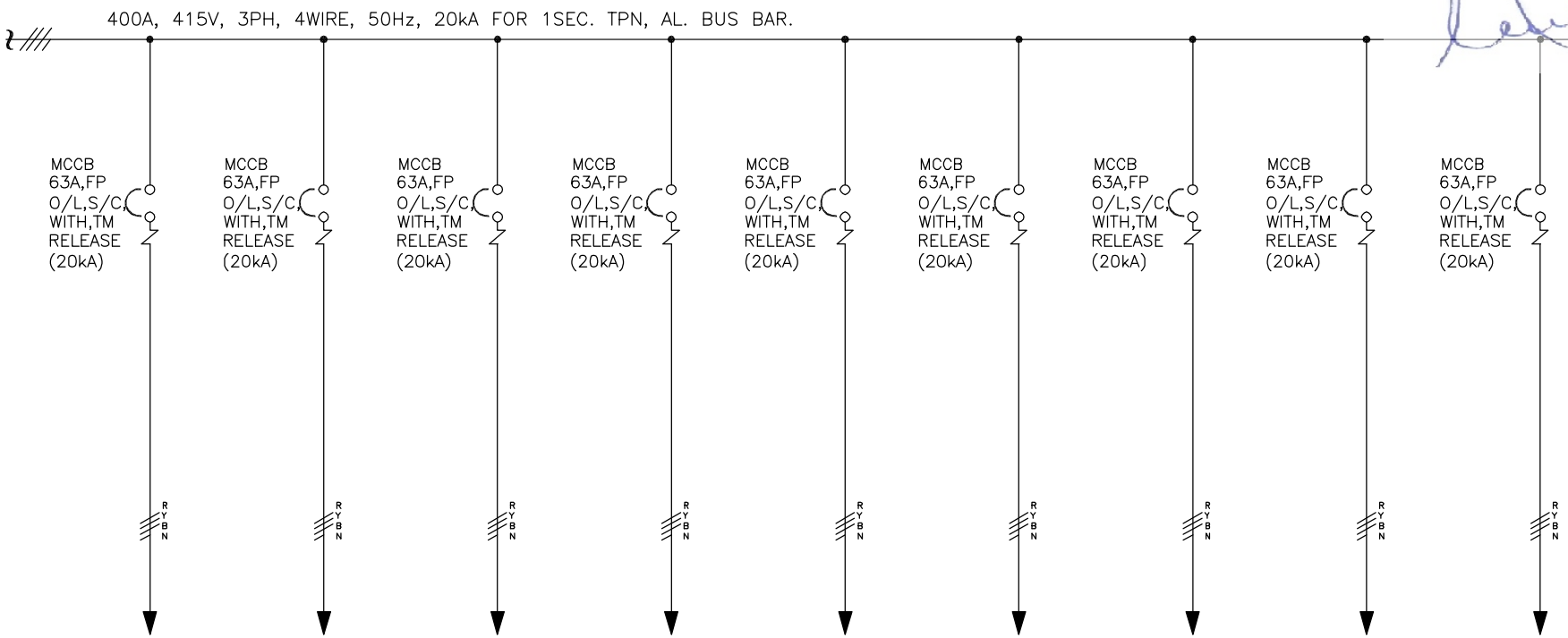
DRAWING	SINGLE LINE DIAGRAM
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–209 | SH. NO.:– 04 OF 13



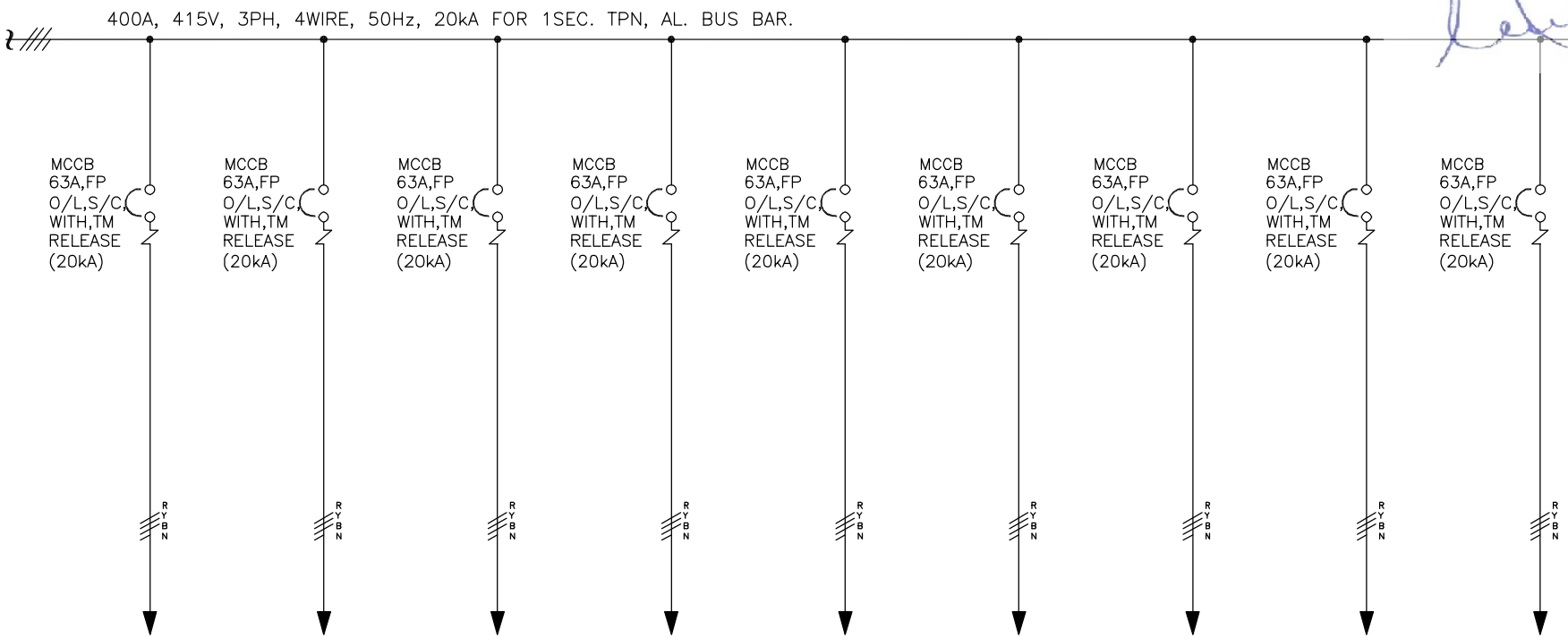
FEEDER NUMBER	2R7	2R8	3R1	3R2	3R3	3R4	3R5	3R6	3R7
MODULE TYEP	E	E	E	E	E	E	E	E	E
FEEDER RATING	63A	63A	63A	63A	63A	63A	63A	63A	63A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	BMK–213	BMK–215	BMK–217 (F)	BMK–219 (F)	BMK–221 (F)	BMK–223 (F)	BMK–225 (F)	BMK–227 (F)	BMK–229 (F)
POWER CABLE SIZE	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM		JOB NO. 1241A
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT: POWER GRID CORPORATION OF INDIA LIMITED		CONTRACTOR:– BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–209		SH. NO.:– 05 OF 13

1 2 3 4 5 6 7 8 9



FEEDER NUMBER	3R8	4R1	4R2	4R3	4R4	4R5	4R6	4R7	4R8
MODULE TYEP	E	E	E	E	E	E	E	E	E
FEEDER RATING	63A	63A	63A	63A	63A	63A	63A	63A	63A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	BMK–231 (F)	BMK–233 (F)	BMK–235 (F)	BMK–237 (F)	SPARE–1	SPARE–2	SPARE–3	SPARE–4	SPARE–5
POWER CABLE SIZE	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	––	––	––	––	––

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	––	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

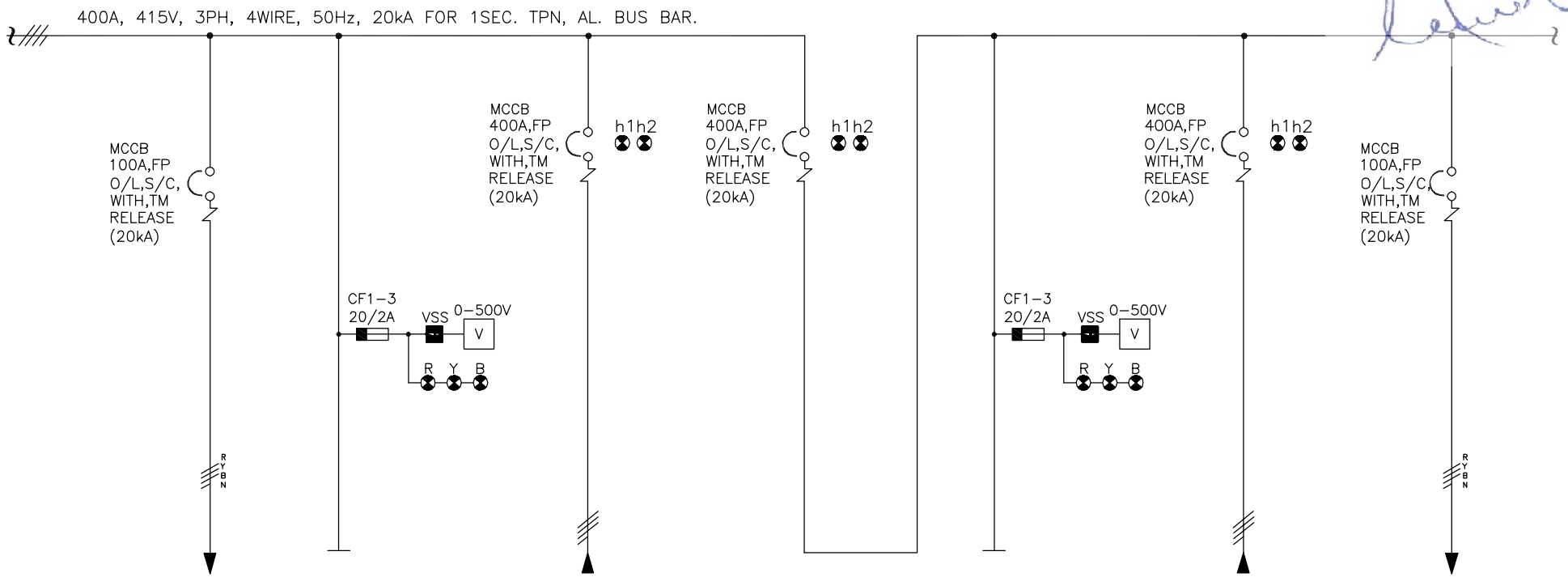
MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–209

JOB NO. 1241A

SH. NO.:– 06 OF 13

1 2 3 4 5 6 7 8 9



FEEDER NUMBER	4F5	3F1		4F1	5F1		5F2
MODULE TYEP	E	G2	E	E	G2	E	E
FEEDER RATING	100A	––	400A	400A	––	400A	100A
FEEDER TYPE	MCCB	METERING	ACB	MCCB	METERING	ACB	MCCB
DESCRIPTION	SPARE–6	––	INCOMER–1 FROM 415V AC DB 2A (CRB)	BUSCOUPLER	––	INCOMER–1 FROM 415V AC DB 2A (CRB)	COUPLING TRANSFORMER MB (F)
POWER CABLE SIZE	––		1X3.5CX300 Sqmm.	––		1X3.5CX300 Sqmm.	1X3.5CX70 Sqmm.

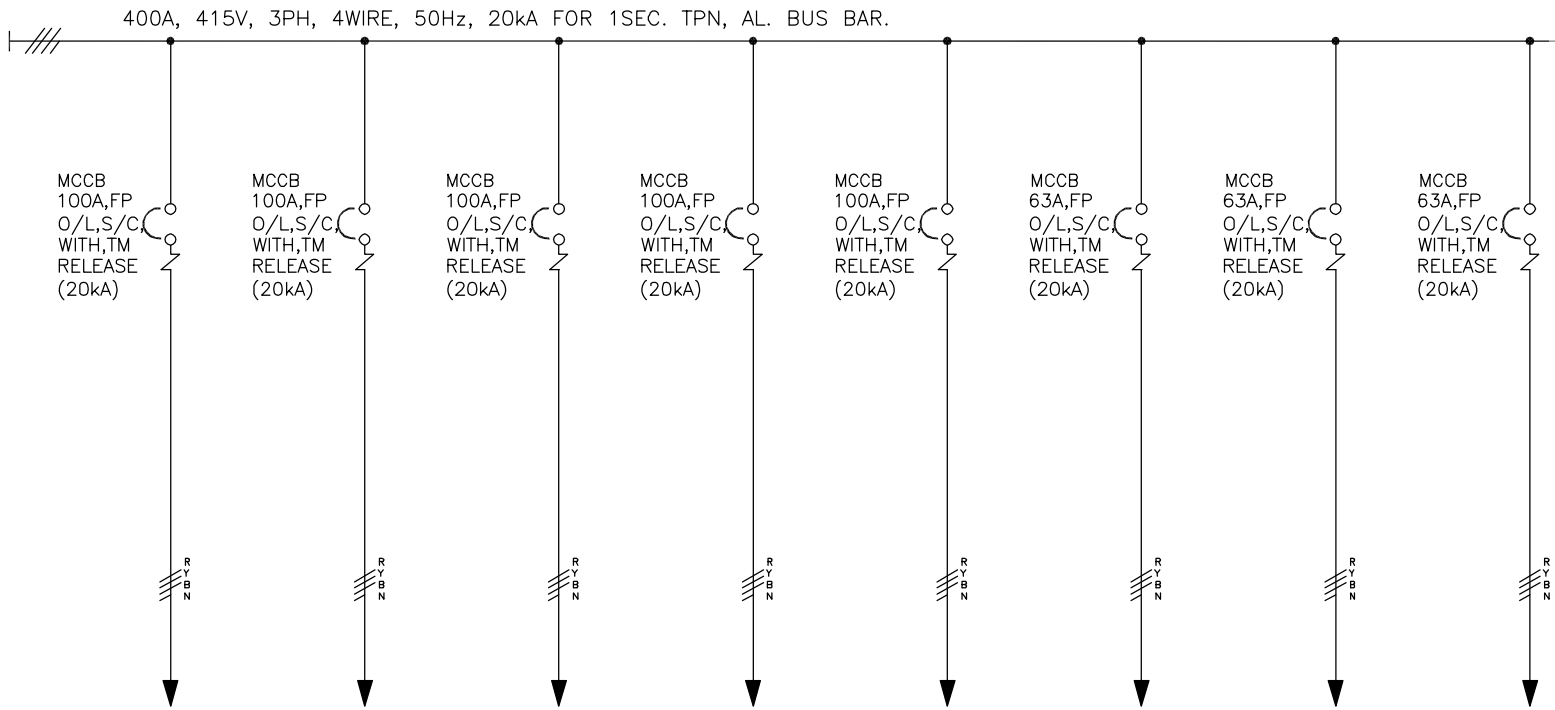
	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	––	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–209

JOB NO. 1241A

SH. NO.:– 07 OF 13



FEEDER NUMBER	5F3	5F4	5F5	5R1	5R2	6F1	6F2	6F3
MODULE TYEP	E	E	E	E	E	E	E	E
FEEDER RATING	100A	100A	100A	100A	100A	63A	63A	63A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	400\220 KV AUTO TRANSFORMER-2 MB	400\220 KV AUTO TRANSFORMER-4 MB	400\220 KV AUTO TRANSFORMER-6 MB (F)	400\220 KV AUTO TRANSFORMER-8 MB (F)	400\220 KV AUTO TRANSFORMER-10 MB (F)	400KV,125MVAR BUS REACTOR-2 MB	400KV,125MVAR BUS REACTOR-3 MB (F)	400KV,125MVAR LINE REACTOR-2 MB (F)
POWER CABLE SIZE	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. -- | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

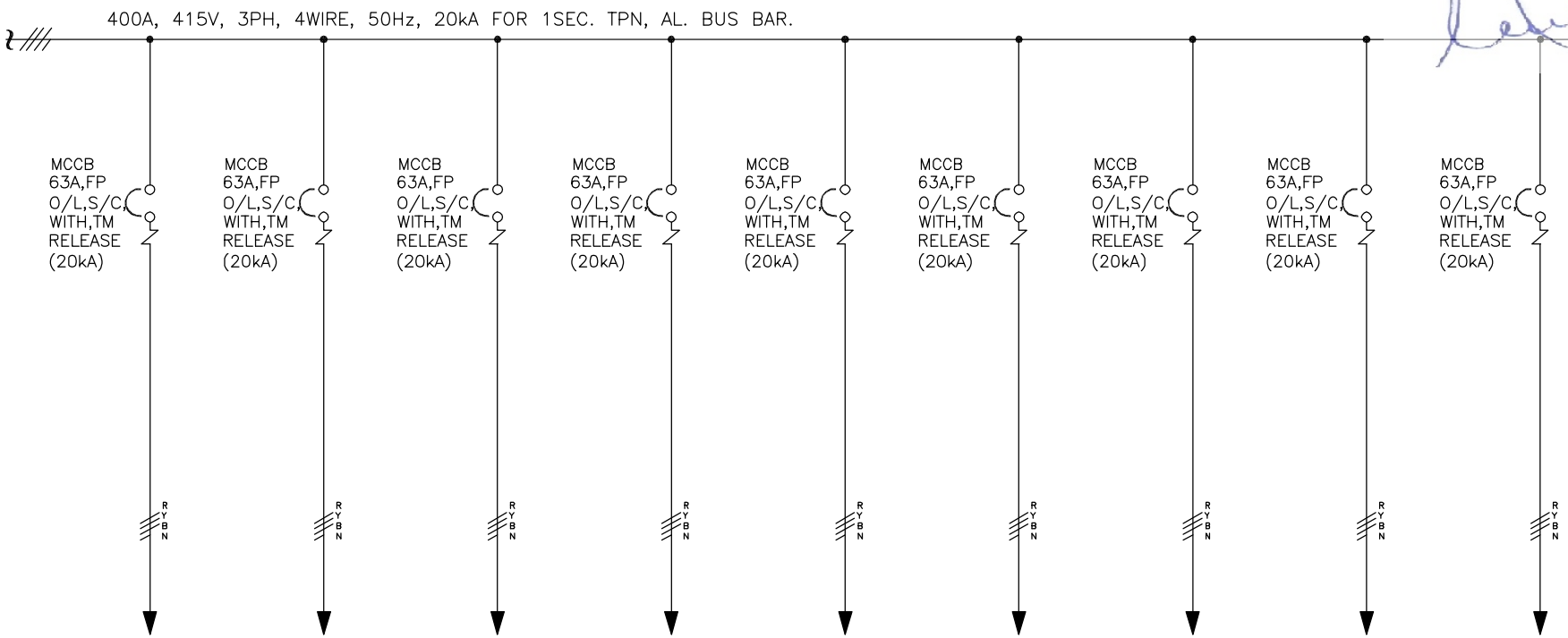
DRAWING	SINGLE LINE DIAGRAM
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER-III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024-2025/1241A-209 | SH. NO.:– 08 OF 13

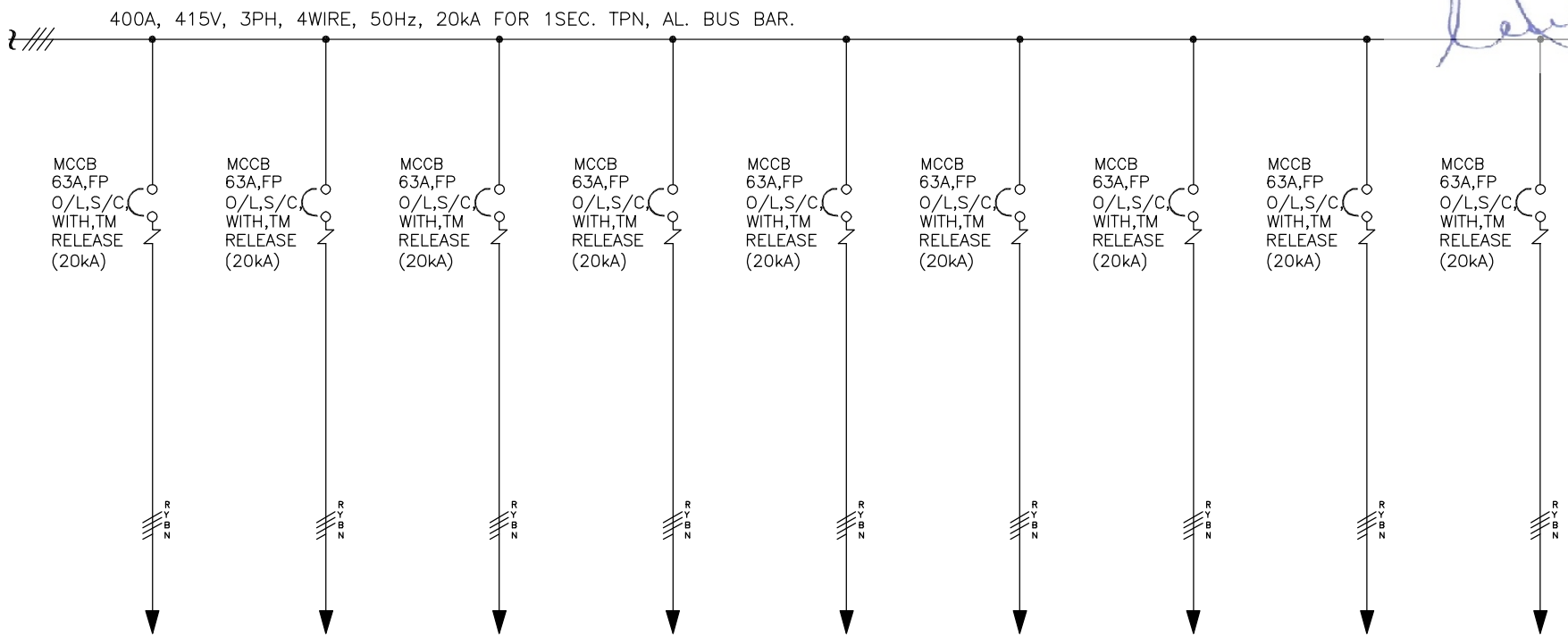


FEEDER NUMBER	6F4	6F5	6F6	6F7	6F8	7F1	7F2	7F3	7F4
MODULE TYEP	E	E	E	E	E	E	E	E	E
FEEDER RATING	63A	63A	63A	63A	63A	63A	63A	63A	63A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	400KV,125MVAR LINE REACTOR-4 MB (F)	BMK-403	BMK-406	BMK-409	BMK-412	BMK-415	BMK-418	BMK-421 (F)	BMK-423 (F)
POWER CABLE SIZE	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM		JOB NO. 1241A
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT: POWER GRID CORPORATION OF INDIA LIMITED		CONTRACTOR:- BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-209		SH. NO.:- 09 OF 13



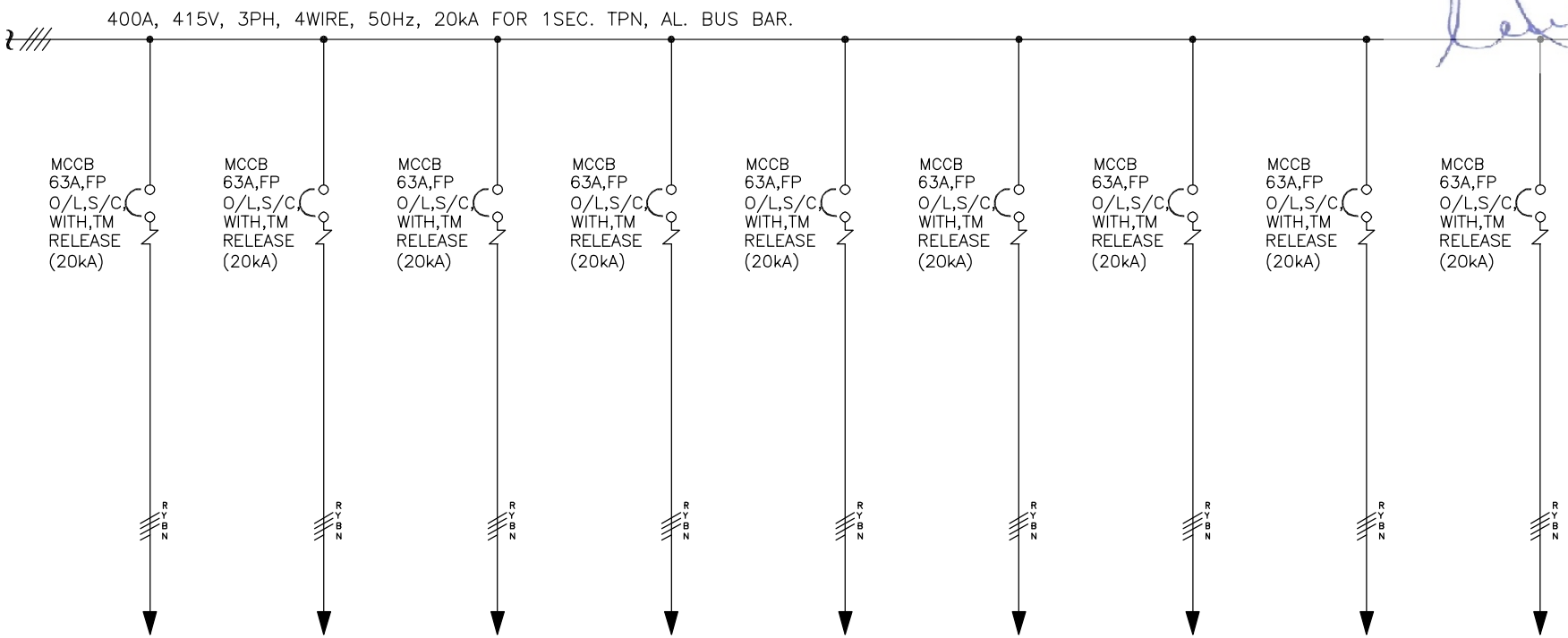
FEEDER NUMBER	7F5	7F6	7F7	7F8	8F1	8F2	8F3	8F4	8F5
MODULE TYEP	E	E	E	E	E	E	E	E	E
FEEDER RATING	63A	63A	63A	63A	63A	63A	63A	63A	63A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	BMK–426	BMK–429	BMK–432	BMK–435 (F)	BMK–438 (F)	BMK–440 (F)	BMK–443 (F)	BMK–446 (F)	BMK–446 (F)
POWER CABLE SIZE	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM		JOB NO. 1241A
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)		
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER–III POOLING STATION		
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED	CONTRACTOR:– BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–209		SH. NO.:– 10 OF 13

1 2 3 4 5 6 7 8 9



FEEDER NUMBER	8F6	8F7	8F8	6R1	6R2	6R3	6R4	6R5	6R6
MODULE TYEP	E	E	E	E	E	E	E	E	E
FEEDER RATING	63A	63A	63A	63A	63A	63A	63A	63A	63A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	BMK–452 (F)	BMK–455 (F)	BMK–458 (F)	BMK–202	BMK–204	BMK–206	BMK–208	BMK–210	BMK–212
POWER CABLE SIZE	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. -- | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

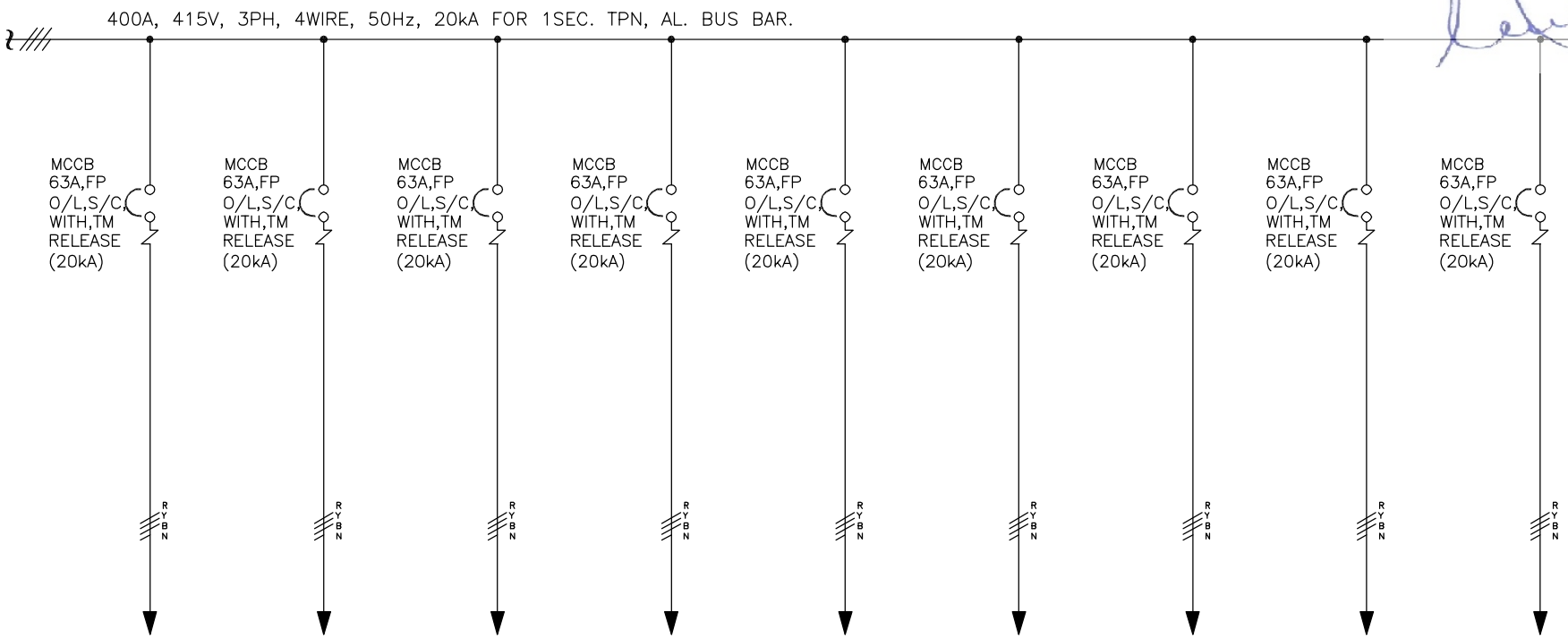
DRAWING	SINGLE LINE DIAGRAM
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–209 | SH. NO.:– 11 OF 13



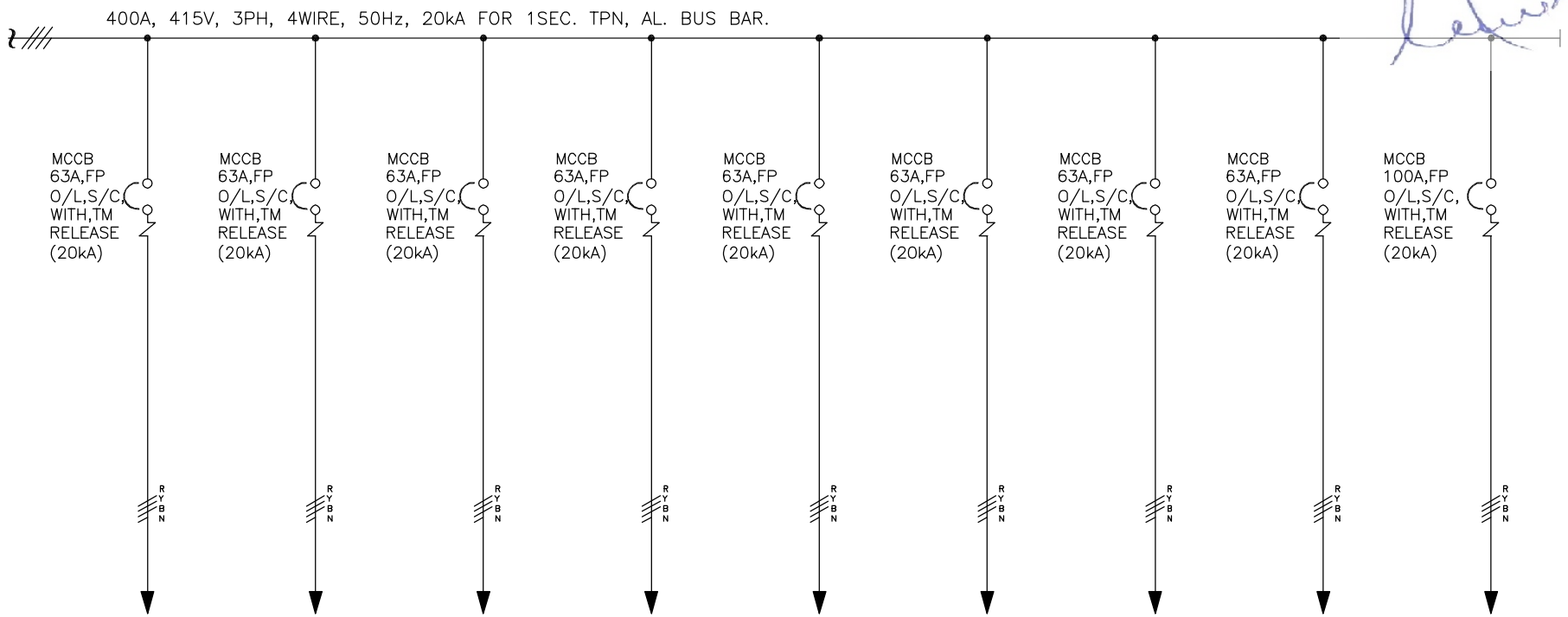
FEEDER NUMBER	6R7	6R8	7R1	7R2	7R3	7R4	7R5	7R6	7R7
MODULE TYEP	E	E	E	E	E	E	E	E	E
FEEDER RATING	63A	63A	63A	63A	63A	63A	63A	63A	63A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	BMK–214	BMK–216	BMK–218 (F)	BMK–220 (F)	BMK–222 (F)	BMK–224(F)	BMK–226 (F)	BMK–228 (F)	BMK–230 (F)
POWER CABLE SIZE	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM		JOB NO. 1241A
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)		
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER–III POOLING STATION		
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED	CONTRACTOR:– BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–209		SH. NO.:– 12 OF 13

1 2 3 4 5 6 7 8 9



FEEDER NUMBER	7R8	8R1	8R2	8R3	8R4	8R5	8R6	8R7	5R3
MODULE TYEP	E	E	E	E	E	E	E	E	E
FEEDER RATING	63A	63A	63A	63A	63A	63A	63A	63A	100A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	BMK–232 (F)	BMK–234 (F)	BMK–236 (F)	SPARE–7	SPARE–8	SPARE–9	SPARE–10	SPARE–11	SPARE-12
POWER CABLE SIZE	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	1X3.5CX70 Sqmm.	––	––	––	––	––	––

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	––	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

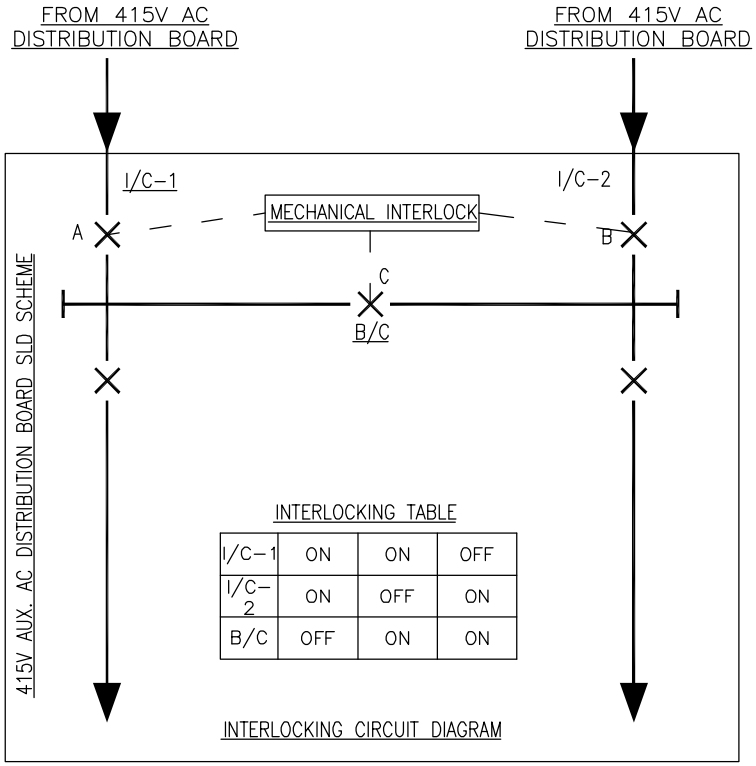
JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–209 SH. NO.:– 13 OF 13

-: KEY LINE DIAGRAM & CONTROL LOGIC FOR AUX. ACDB



INTERLOCKING TABLE

I/C-1	ON	ON	OFF
I/C-2	ON	OFF	ON
B/C	OFF	ON	ON

INTERLOCKING CIRCUIT DIAGRAM

CONTROL LOGIC:-

AS BOTH THE INCOMERS & BUSCOUPLER ARE MECHANICALLY INTERLOCK SO INCOMER & BUSCOUPLER CAN BE OPERATED MANUALY AS PER INTERLOCKING TABLE

DATE	No.	REVISIONS DESCRIPTION
	04.	-
	03.	-
	02.	-
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN	MP
CHKD.	VDP
APPD.	--
ALL DIMENSIONS IN mm.	SIGN.
TOLERANCE 5%	
REVISIONS : 00	

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

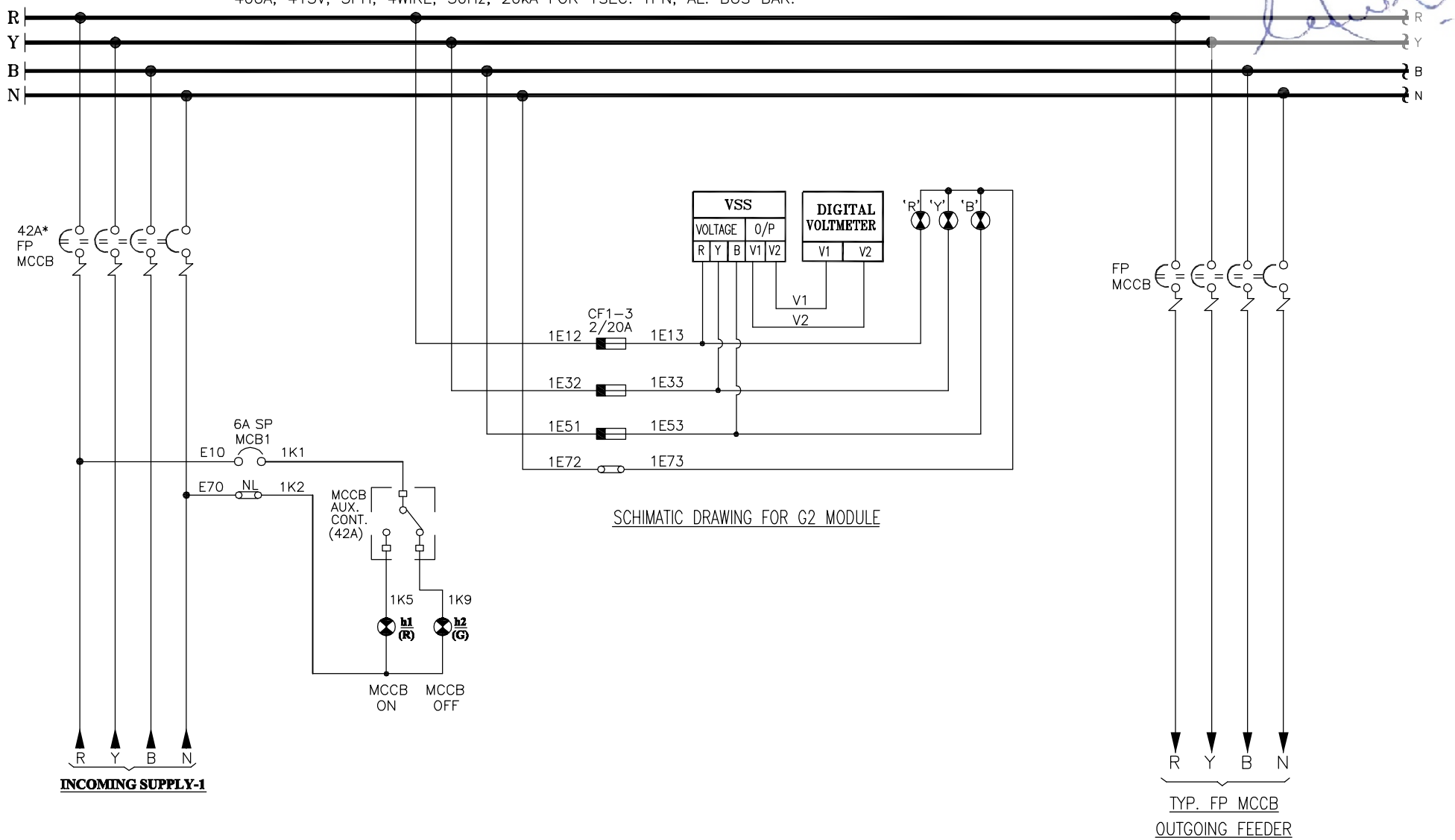
DRAWING	SCHEMATIC DIAGRAM
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER-III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:-
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024-2025/1241A-509-00 | SH. NO.:- 01 OF 01



SCHIMATIC DRAWING FOR G2 MODULE

SCHIMATIC DRAWING FOR INCOMER–1 CONTROL CIRCUIT

* NOTE :– BOTH INCOMER & BUSCOUPLER SHALL BE MECHANICAL INTERLOCKED (3LOCK+2KEY)

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN	MP
CHKD.	VDP
APPD.	––
ALL DIMENSIONS IN mm.	SIGN.
TOLERANCE 5%	
REVISIONS : 00	

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SCHEMATIC DIAGRAM
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

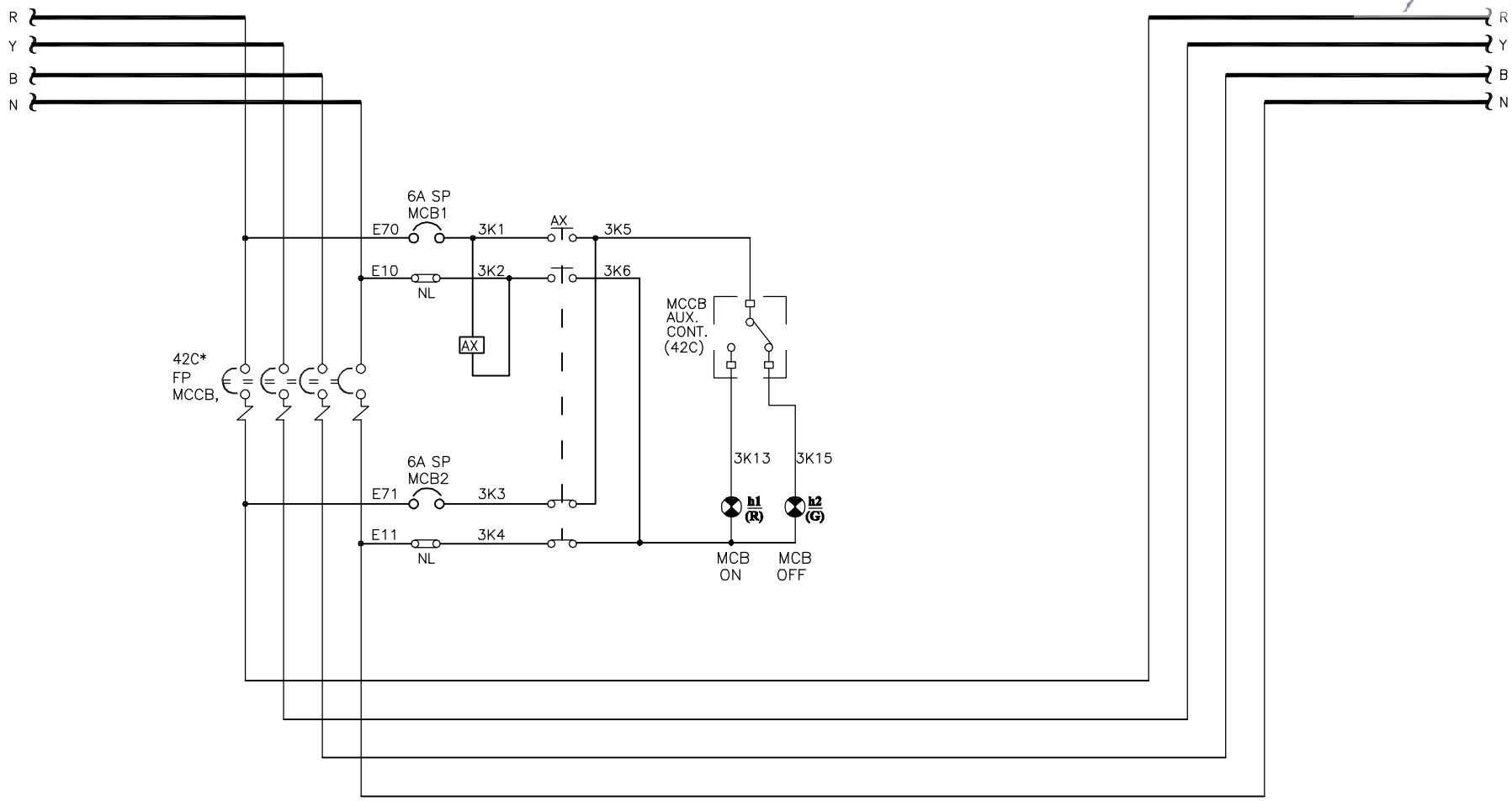
JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–509 | SH. NO.:– 01 OF 03

1 2 3 4 5 6 7 8 9



BUSCOUPLER

* NOTE :- BOTH INCOMER & BUSCOUPLER SHALL BE MECHANICAL INTERLOCKED (3LOCK+2KEY)

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SCHEMATIC DIAGRAM
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER-III POOLING STATION

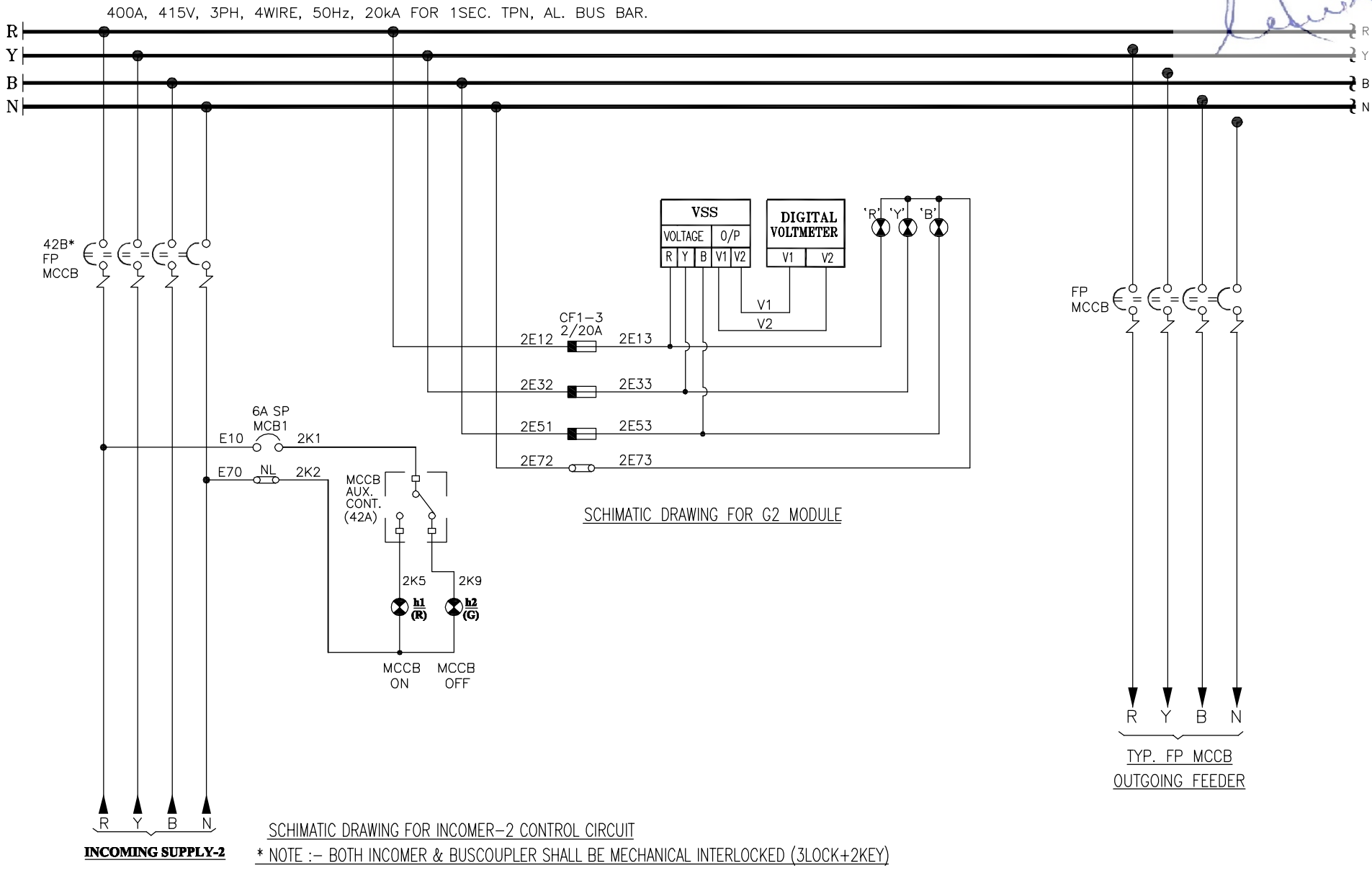
JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:-
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024-2025/1241A-509 SH. NO.:- 02 OF 03

1 2 3 4 5 6 7 8 9



SCHIMATIC DRAWING FOR G2 MODULE

SCHIMATIC DRAWING FOR INCOMER-2 CONTROL CIRCUIT

* NOTE :- BOTH INCOMER & BUSCOUPLER SHALL BE MECHANICAL INTERLOCKED (3LOCK+2KEY)

DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00	SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%	
	01.		ALL DIMENSIONS IN mm.	
	02.	-	APPD.	--
	03.	-	CHKD.	VDP
	04.	-	DRAWN	MP

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SCHEMATIC DIAGRAM
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER-III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:-
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024-2025/1241A-509 SH. NO.:- 03 OF 03

BILL OF MATERIAL FOR 415V AC DISTRIBUTION BOARD (5A) (AB)

S.NO.	ITEM CODE	DESCRIPTION	MAKE	RATING	QTY.
A	**BILL OF MATERIAL FOR MODULE - (E) INCOMER 1&2**				**2 Nos.**
1	**MCCB**	FP MCCB 415V, WITH THERMAL MAGNETIC BASED RELEASE FOR O/L,S/C PROTECTION WITH SPREADER, EXTENDED ROM, 1C/O AUX. CONTACT, Ics = 100% Icu	L&T/C&S/HAVELLS	400A, 20kA	01
2	**MCB**	SP MINIATURE CIRCUIT BREAKER, 'C' CURVE	L&T/C&S/HAVELLS	6A, 10kA	01
3	**h1**	'ON' INDICATION LAMP, 22.5 Sq. mm. DIA ,LED TYPE, RED	ESBEE/VAISHNO/C&S	240V AC	01
4	**h2**	'OFF' INDICATION LAMP, 22.5 Sq. mm. DIA ,LED TYPE, GREEN	ESBEE/VAISHNO/C&S	240V AC	01
B	**BILL OF MATERIAL FOR MODULE - (E) BUSCOUPLER**				**1 Nos.**
1	**MCCB**	FP MCCB 415V, WITH THERMAL MAGNETIC BASED RELEASE FOR O/L,S/C PROTECTION WITH SPREADER, EXTENDED ROM, 1C/O AUX. CONTACT, Ics = 100% Icu	L&T/C&S/HAVELLS	400A, 20kA	01
2	--	MECHANICAL LOCK 3 LOCK 2-KEY FOR 400A FP MCCB	PGCIL APPROVED	--	1-SET
3		AUX. CONTACTOR RELAY, COIL VOLTAGE 240V AC WITH 2NO+2NC AUX. CONTACT	L&T	--	01
4	**MCB**	SP MINIATURE CIRCUIT BREAKER, 'C' CURVE	L&T	6A, 10kA	02
5	**h1**	'ON' INDICATION LAMP, 22.5 Sq. mm. DIA ,LED TYPE, RED	ESBEE/VAISHNO/C&S	240V AC	01
6	**h2**	'OFF' INDICATION LAMP, 22.5 Sq. mm. DIA ,LED TYPE, GREEN	ESBEE/VAISHNO/C&S	240V AC	01
C	**BILL OF MATERIAL FOR MODULE - (G2)**				**2 Nos.**
1	**CF1-3**	HRC FUSE BASE	L&T/C&S/HAVELLS	20A	03
2	**CF1-3**	HRC FUSE LINK	L&T/C&S/HAVELLS	2A	03
3	**V**	ANALOG VOLTMETER, SINGLE PHASE, SIZE-96X96 Sq. mm, CL-1.0, PTR-415AC	AE/RISHAB/NEWTEK/SECURE	0-500V	01
4	**VSS**	FOUR POSITION VOLTMETER SELECTOR SWITCH, ROTARY TYPE	SALZER/KAYCEE	6A	01
5	**R-PHASE**	'R' INDICATION LAMP, 22.5 Sq. mm. DIA ,LED TYPE, RED	ESBEE/VAISHNO/C&S	240V AC	01
6	**Y-PHASE**	'Y' INDICATION LAMP, 22.5 Sq. mm. DIA ,LED TYPE, YELLOW	ESBEE/VAISHNO/C&S	240V AC	01
7	**B-PHASE**	'B' INDICATION LAMP, 22.5 Sq. mm. DIA ,LED TYPE, BLUE	ESBEE/VAISHNO/C&S	240V AC	01
D	**BILL OF MATERIAL FOR MODULE - (E) FOR OUTGOINGS**				
1	**MCCB**	FP MCCB 415V, WITH THERMAL MAGNETIC BASED RELEASE FOR O/L,S/C PROTECTION WITH SPREADER & EXTENDED ROM, Ics = 100% Icu	L&T/C&S/HAVELLS	100A, 20kA	14
2	**MCCB**	FP MCCB 415V, WITH THERMAL MAGNETIC BASED RELEASE FOR O/L,S/C PROTECTION WITH EXTENDED ROM, Ics = 100% Icu	L&T/C&S/HAVELLS	63A, 20kA	95

NOTE:- ALL COMPONENTS SHALL BE POWER GRID (QA&I) APPROVED MAKE

	04.	-	DRAWN	MP	
	03.	-	CHKD.	VDP	
	02.	-	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	BILL OF MATERIAL		JOB NO. 1241A
TITLE	415V AC DISTRIBUTION BOARD (5A) (AB)		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT: POWER GRID CORPORATION OF INDIA LIMITED		CONTRACTOR:- BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-709		SH. NO.:- 01 OF 01

ENGINEERING DRAWING DETAILS FOR

220V DC DISTRIBUTION BOARD-1(5D) & 2(6D) (AB)

PROJECT :- 765/400/220kV BIKANER-III POOLING STATION

CLIENT :- POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR :- BHARAT HEAVY ELECTRICAL LIMITED (BHEL)
TRANSMISSION PROJECTS DIVISION

	04.	-	DRAWN	MP	
	03.	-	CHKD.	VDP	
	02.	-	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	COVER PAGE		JOB NO. 1241A
TITLE	220V DC DISTRIBUTION BOARD-1(5D) & 2(6D) (AB)		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT: POWER GRID CORPORATION OF INDIA LIMITED		CONTRACTOR:- BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-010		SH. NO. 01 OF 01

-: GUARANTEED TECHNICAL PARTICULARS/GENERAL NOTES :-

1. TYPE OF PRODUCT : FLOOR MOUNTED FIXED TYPE, COMPARTMENTALIZED & DOUBLE FRONT
2. CABLE ENTRY : BOTTOM
3. DEGREE OF PROTECTION : IP–53
   (AS PER IS : IS/IEC: 60947, 60529 FOR ENCLOSURE ONLY)
4. SUPPLY VOLTAGE
   a) POWER VOLTAGE : 220V DC, 2 WIRE
   b) CONTROL VOLTAGE : 240V AC
   220V DC
5. FABRICATION
   a) ENCLOSURE : 2.0MM CRCA
   b) DOORS/COVERS : 1.6MM CRCA
   c) BASE CHANNEL : 75MM ISMC
   d) GLAND PLATE : 3.0MM CRCA IN ALL CASES & 4.0MM THICKNESS NON MAGNETIC MATERIAL FOR SINGLE CORE POWER CABLE (REMOVABLE TYPE AS PER TS)
6. PAINTING
   a) PRETREATMENT : 9 TANK PROCESS
   b) PAINT TYPE : POWDER COATING
   c) PAINT SHADE : SMOKE GREY (SHADE NO 692 OF IS:5)
   d) PAINT THICKNESS : AS PER MQP
7. BUSBAR
   a) MAIN BUSBAR MATERIAL : ALUMINUM E91E GRADE (IS–5082)
   b) SLEEVE : HEAT SHRINKABLE PVC SLEEVES WITH RED, YELLOW, BLUE BLACK, GREEN COLORS
8. BUSBAR SUPPORTS : SMC/DMC
9. EARTH BUS BAR : SUITABLE SIZE OF GS THROUGH OUT THE PANEL AND HAVING TWO HOLES ON EACH AND FOR EARTH CONNECTION (AS PER GA DRAWING)
10. MINIMUM BUSBAR CLEARANCES (MAIN BUSBARS) :–
    (a) PHASE TO PHASE : 25.00 mm
    (b) PHASE TO NEUTRAL & POSITIVE TO NEGATIVE : 25.00 mm
    (c) PHASE/NEUTRAL TO EARTH : 25.00 mm
11. DOORS.
    FEEDER DOORS : HINGED AND LOCKABLE
    BUSBAR CHAMBERS : BOLTED
12. CONTROL WIRING : STANDARD PVC FLEXIBLE CU WIRE 1100V GRADE
    AC CIRCUIT : 1.5 SQ. MM BLACK COLOR
    DC CIRCUIT : 1.5 SQ. MM GREY FOR +VE AND WHITE FOR –VE COLOR
    EARTHING : 2.5 SQ. MM GREEN COLOR
13. POWER WIRE : PVC FLEXIBLE FR CU WIRE 1100V GRADE (COLOR – R,Y,B, BLACK)

    POWER CIRCUIT UP TO 20A : 4 Sq. MM
    POWER CIRCUIT 21 TO 32A : 6 Sq. MM
    POWER CIRCUIT 33 TO 40A : 10 Sq. MM
    POWER CIRCUIT 40 TO 63A : 16 Sq. MM
    ABOVE 63A : SOLID ALUMINUM LINK (@ 1.0A/Sqmm)
14. CURRENT DENSITY : SOLID ALUMINUM LINK @ 1.0A/Sqmm
15. SPACE HEATER : SPACE HEATER SHALL BE PROVIDED AT EACH CABLE ALLEY
16. NAME PLATE : NAME PLATE SHALL BE OF NON–RUSTING METAL OR 3PLY LAMICOID WITH WHITE ENGRAVED LETTERING ON BLACK BACKGROUND
17. DANGER PLATE : PRINTED DANGER PLATE ON THE EACH HORIZONTAL/ VERTICAL BUSBAR CHAMBER SHALL BE PROVIDE
18. GASKETS : NEOPRENE RUBBER GASKETS TYPE–II CLASS 2A AS PER IS : 11149 SHALL BE PROVIDED AT ALL REMOVABLE DOORS & COVERS TO MAKE THE PANEL DUST & VERMIN PROOF
19. SHROUDING : ALL LIVE PART SHALL BE SHROUDED WITH 2MM THICK HYLEM/ACRYLIC SHEET
20. ALL HINGED FRONT DOORS & COVERS SHALL BE PROVIDED WITH SUITABLE FLEXIBLE COPPER EARTHING CONNECTIONS..
21. CABLE SIZE AS PER APPROVED LT SLDs FOR POWER & CONTROL CABLE/PGCIL TS
22. ALL FUSES SHALL BE HRC TYPE WITH SHORT CIRCUIT LEVEL AS PER TS.
23. MANUFACTURING TOLERANCE TO BE AS PER IS :
    i) UP TO 50MM– ± 3% ii) 51 TO 100MM– ± 2%
    iii) 101 TO 300MM– ± 1% iii) ABOVE 300MM– ± 0.5%
24. ALL POWER TERMINAL SHALL BE STUD TYPE
25. PANEL SHALL BE EXTENDABLE FROM BOTH SIDES
26. AMBIENT TEMPERATURE CONSIDERED IS 50°C
27. MEGGAR/INSULATION VOLTAGE TEST– IR–500V DC
    HV TEST –2.5KV FOR ONE MINUTE
28. IN ALL CIRCUIT BREAKER PANELS AT LEAST 10% SPARE TERMINALS FOR EXTERNAL CONNECTIONS SHALL BE PROVIDED AND THESE SPARE TERMINALS SHALL BE UNIFORMLY DISTRIBUTED ON ALL TERMINAL BLOCKS. SPACE FOR ADDING ANOTHER 10% SPARE TERMINALS SHALL ALSO BE AVAILABLE
29. TERMINAL BLOCKS FOR CT AND VT SECONDARY LEADS SHALL BE PROVIDED WITH TEST LINKS AND ISOLATING FACILITIES. CT SECONDARY LEADS SHALL BE PROVIDED WITH SHORT CIRCUITING AND EARTHING FACILITIES. IT SHALL BE SIMILAR TO 'ELEM.' 'CATD' – TYPE.
30. TERMINAL BLOCKS SHALL BE OF 750 VOLTS GRADE AND HAVE CONTINUOUS RATING TO CARRY THE MAXIMUM EXPECTED CURRENT ON THE TERMINALS.
31. TERMINAL BLOCKS SHALL BE ARRANGED WITH AT LEAST 100 MM CLEARANCE BETWEEN TWO SETS OF TERMINAL BLOCK. THE MINIMUM CLEARANCE BETWEEN THE FIRST ROW OF TERMINAL BLOCK AND THE ASSOCIATED CABLE GLAND PLATE SHALL BE 250 MM

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	GENERAL TECHNICAL SPECIFICATION		JOB NO. 1241A
TITLE	220V DC DISTRIBUTION BOARD–1(5D) & 2(6D) (AB)		
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER–III POOLING STATION		
CLIENT: POWER GRID CORPORATION OF INDIA LIMITED		CONTRACTOR:– BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–1000		SH. NO. 01 OF 01

1 2 3 4 5 6 7 8 9

-: SYMBOLS :-

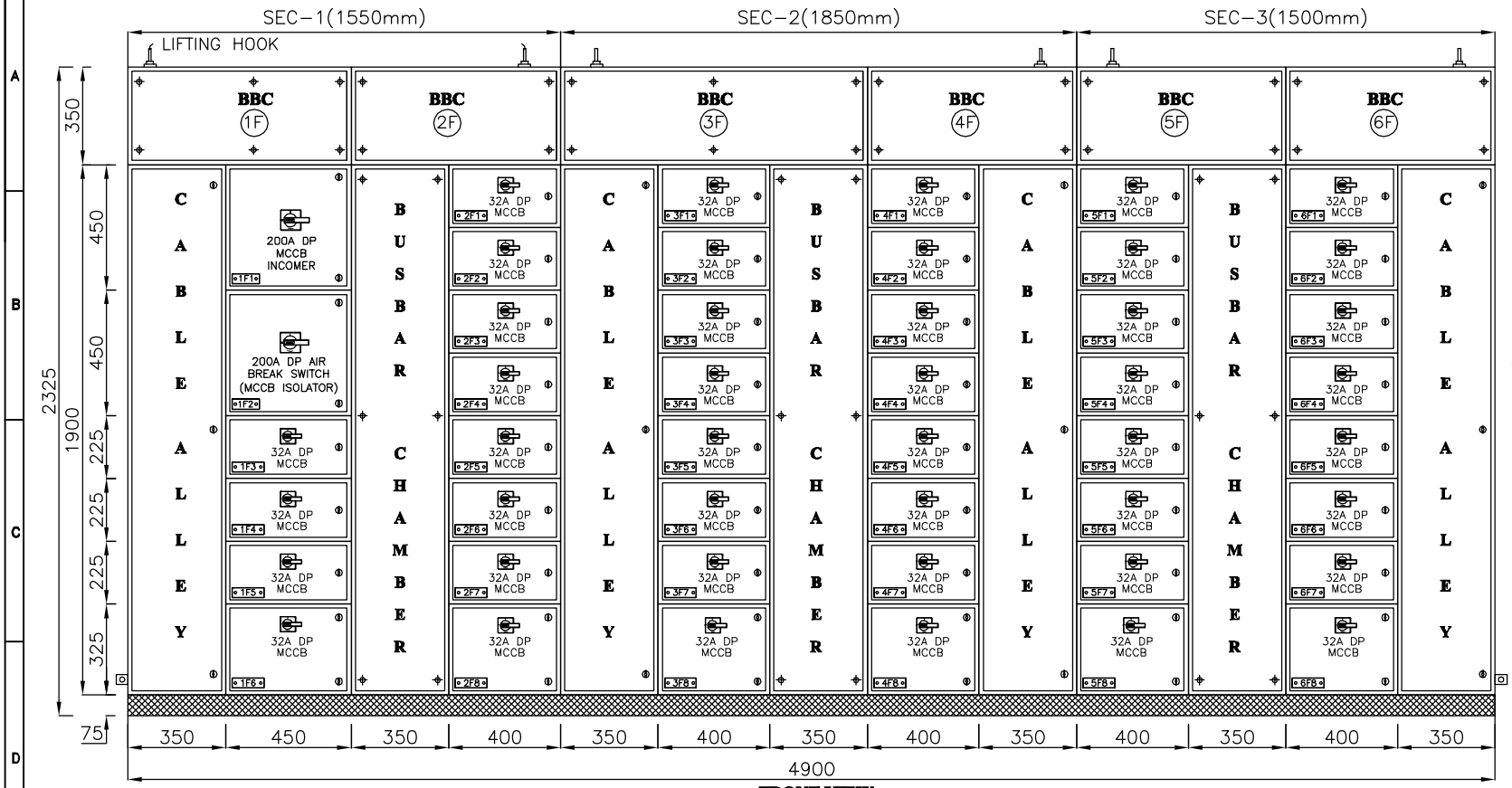
SR. NO.	DESCRIPTION	SYMBOL	SR. NO.	NAME	SYMBOL	SR. NO.	NAME	SYMBOL	SR. NO.	NAME	SYMBOL
1	CURRENT TRANSFORMER		13	CLOSING COIL	CC	25	DRAW OUT TERMINAL POWER		37	PROTECTION RELAY	
2	NEUTRAL LINK		14	SHUNT TRIP COIL	ST	26	DRAW OUT TERMINAL CONTROL		38	EARTHING	E
3	THERMOSTAT	Th.	15	FUSE		27	ISOLATOR		39	EARTHING BOLT	
4	CHANGE OVER SWITCH		16	DIGITAL AMMETER	A	28	FUSE SWITCH UNIT		40	SPACE HEATER	SH
5	NO CONTACT		17	AMMETER SELECTOR SWITCH	ASS	29	TERMINAL		41	D/O ACB	
6	NC CONTACT		18	DIGITAL VOLTMETER	V	30	TERMINAL		42	ELECTRIC BELL	EB
7	MCCB (MOULDEDCASE CIRCUIT BREAKER)		19	VOLTMETER SELECTOR SWITCH	VSS	31	TERMINAL		43	ANALOG AMMETER	A
8	MINIATURE CIRCUIT BREAKER (MCB)		20	KILOWATT HOUR METER	KWH	32	PUSH BUTTON		44	ANALOG VOLTMETER	V
9	PUSH BUTTON SPRING RETURN TYPE WITH NC ELEMENT		21	CONTACTOR COIL		33	INDICATING LIGHT				
10	PUSH BUTTON SPRING RETURN TYPE WITH NO ELEMENT		22	ON DELAY TIMER COIL		35	CAPACITOR				
11	OVERLOAD RELAY (CTRL. CIRCUIT)		23	OFF DELAY TIMER COIL		34	HOOTER/BUZZER	H			
12	OVERLOAD RELAY (POWER CIRCUIT)		24	SWITCH/MCCB/ OPERATING KNOB		36	CONTROL TRANSFORMER				

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

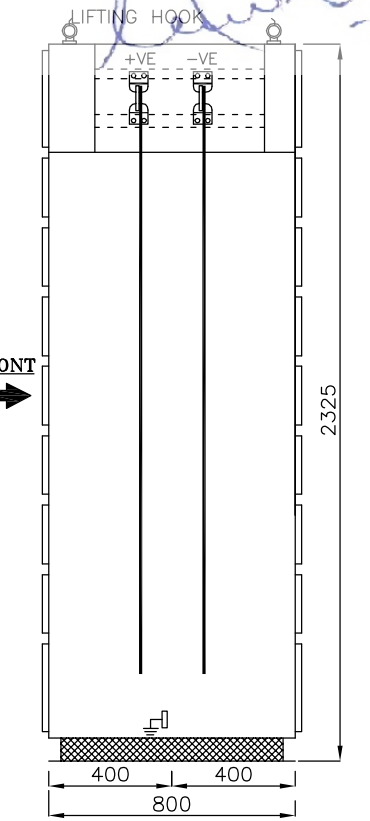
MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	ELECTRICAL SYMBOL		JOB NO. 1241A
TITLE	FOR ALL PANEL		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED	CONTRACTOR:– BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-000-10		SH. NO. 01 OF 01

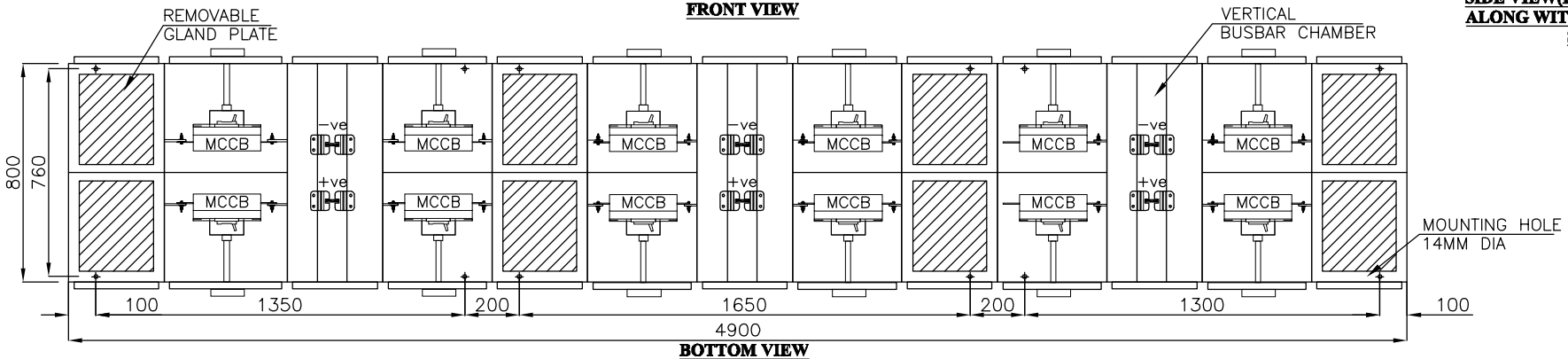
1 2 3 4 5 6 7 8 9



FRONT VIEW



SIDE VIEW(HORIZONTAL BUS BARS ALONG WITH DETAILS OF BUS BAR SUPPORTS.)



BOTTOM VIEW

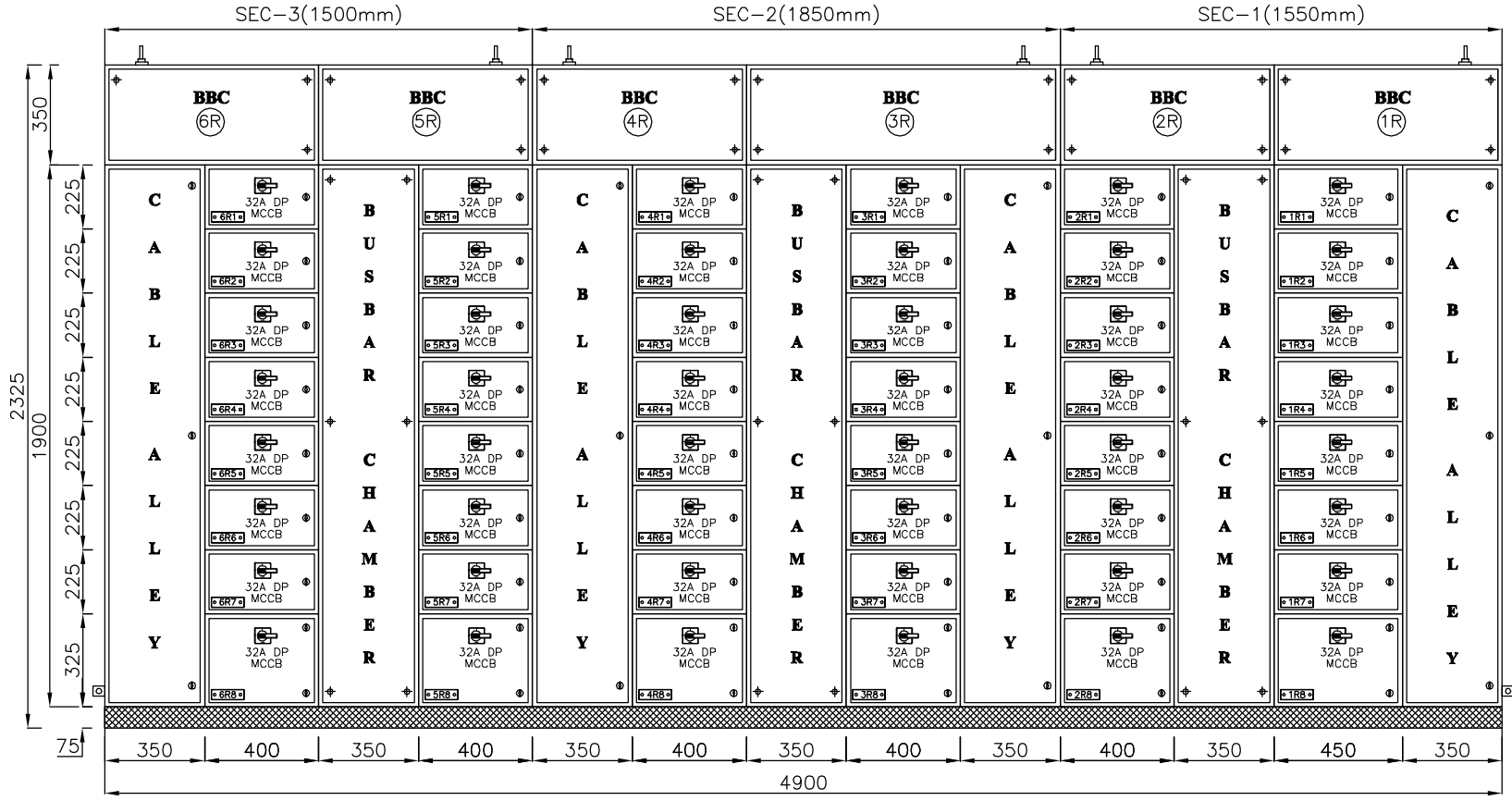
	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER

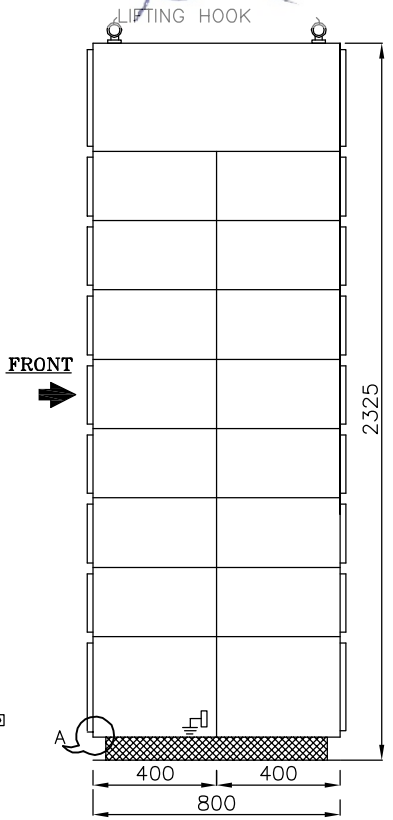
ULTIMA® SWITCHGEARS LTD.

UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	GENERAL ARRANGEMENT DRAWING		JOB NO. 1241A
TITLE	220V DC DISTRIBUTION BOARD–1(5D) & 2(6D) (AB)		
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER–III POOLING STATION		
CLIENT: POWER GRID CORPORATION OF INDIA LIMITED		CONTRACTOR:– BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–110		SH. NO. 01 OF 02



REAR VIEW



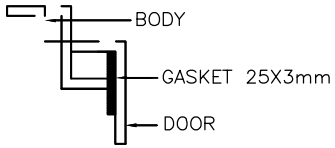
SIDE VIEW

PANEL DIMENSIONS

HEIGHT : 2325 mm.
WIDTH : 4900 mm.
DEPTH : 800 mm.

BUS BAR SIZE :- (HOR./VER.)

POSITIVE : 1x40x10 Sq.mm Alu.
NEGATIVE : 1x40x10 Sq.mm Alu.
EARTH : 1x40X05 Sq.mm GS.



DETAIL-'A'

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

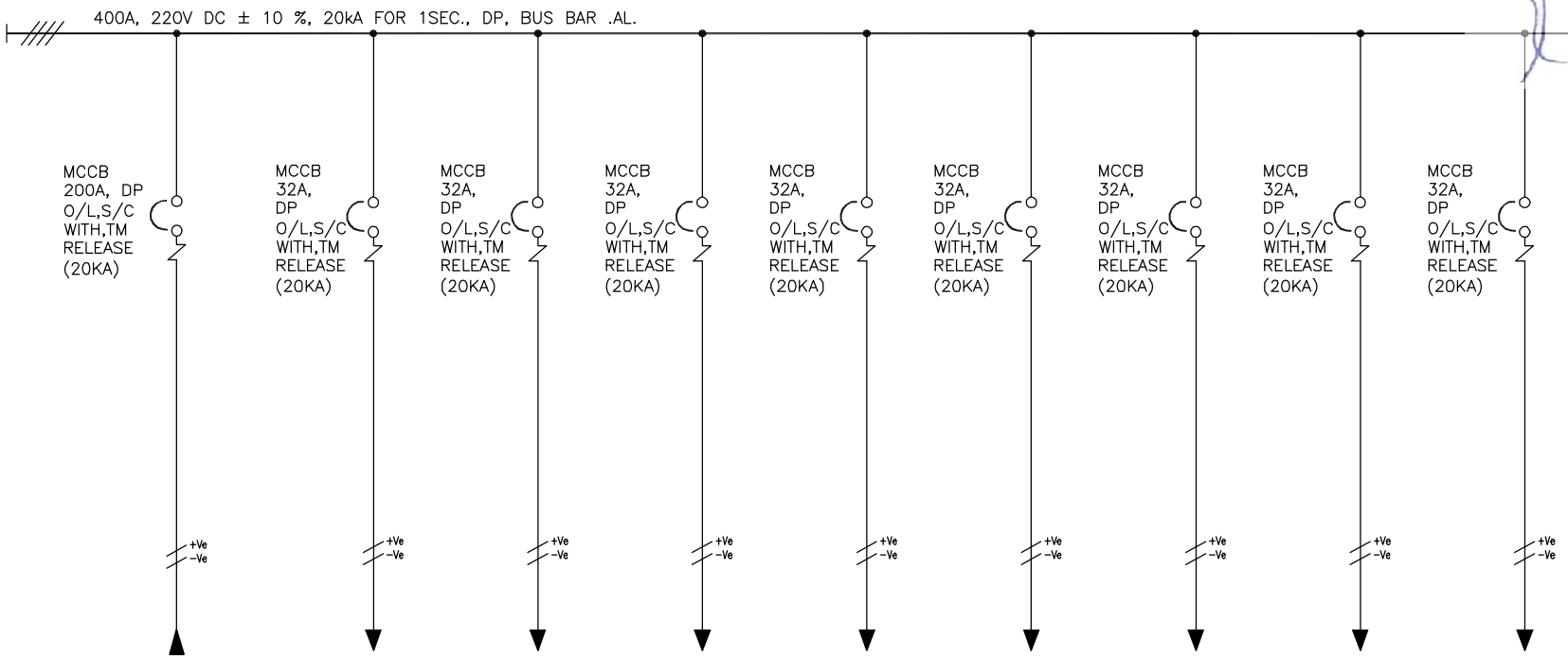
DRAWING	GENERAL ARRANGEMENT DRAWING
TITLE	220V DC DISTRIBUTION BOARD–1(5D) & 2(6D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL)
TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–110 SH. NO. 02 OF 02



FEEDER NUMBER	1F1	1F3	1F4	1F5	1F6	2F1	2F2	2F3	2F4
MODULE TYEP	DC	X	X	X	X	X	X	X	X
FEEDER RATING	200A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	INCOMER	400 kV RELAY PANEL 401	400 kV RELAY PANEL 403	400 kV RELAY PANEL 404	400 kV RELAY PANEL 406	400 kV RELAY PANEL 407	400 kV RELAY PANEL 409	400 kV RELAY PANEL 410	400 kV RELAY PANEL 412
POWER CABLE SIZE (AL PVC)	2X1CX150 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. -- | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

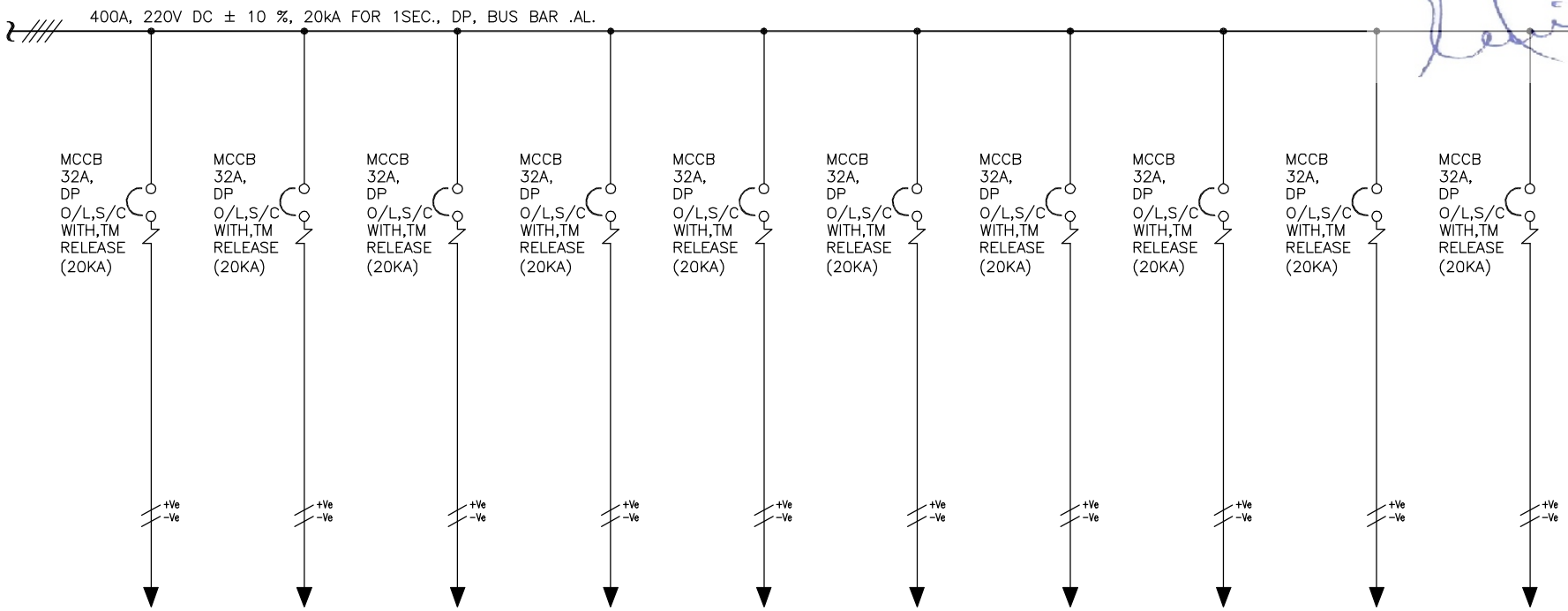
MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD–1(5D) & 2(6D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–210

JOB NO. 1241A

SH. NO.:– 01 OF 10

1 2 3 4 5 6 7 8 9



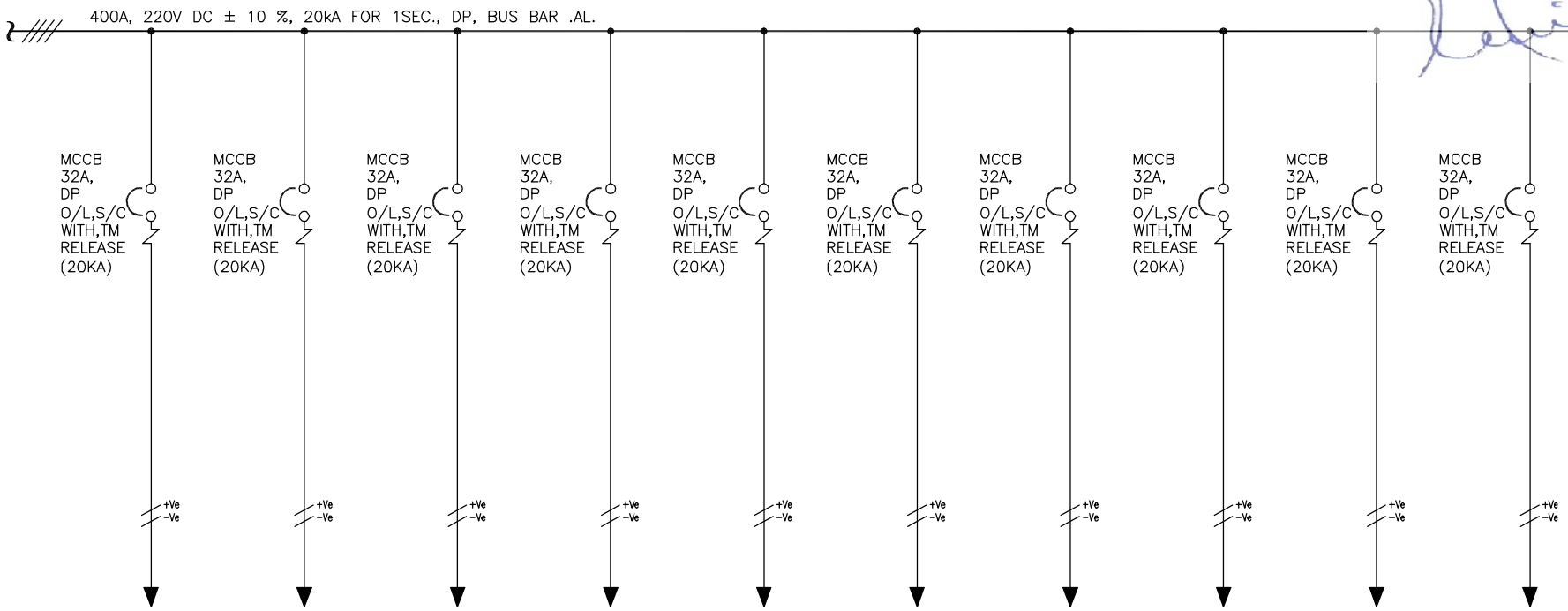
FEEDER NUMBER	2F5	2F6	2F7	2F8	3F1	3F2	3F3	3F4	3F5	3F6
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	400 kV RELAY PANEL 413	400 kV RELAY PANEL 415	400 kV RELAY PANEL 416	400 kV RELAY PANEL 418	400 kV RELAY PANEL 419	400 kV RELAY PANEL 421 (F)	400 kV RELAY PANEL 422 (F)	400 kV RELAY PANEL 423 (F)	400 kV RELAY PANEL 424	400 kV RELAY PANEL 426
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM		JOB NO. 1241A
TITLE	220V DC DISTRIBUTION BOARD–1(5D) & 2(6D) (AB)		
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER–III POOLING STATION		
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED	CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–210		SH. NO.:– 02 OF 10

1 2 3 4 5 6 7 8 9



FEEDER NUMBER	3F7	3F8	4F1	4F2	4F3	4F4	4F5	4F6	4F7	4F8
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	400 kV RELAY PANEL 427	400 kV RELAY PANEL 429	400 kV RELAY PANEL 430	400 kV RELAY PANEL 432	400 kV RELAY PANEL 433 (F)	400 kV RELAY PANEL 435 (F)	400 kV RELAY PANEL 436 (F)	400 kV RELAY PANEL 438 (F)	400 kV RELAY PANEL 439 (F)	400 kV RELAY PANEL 441 (F)
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

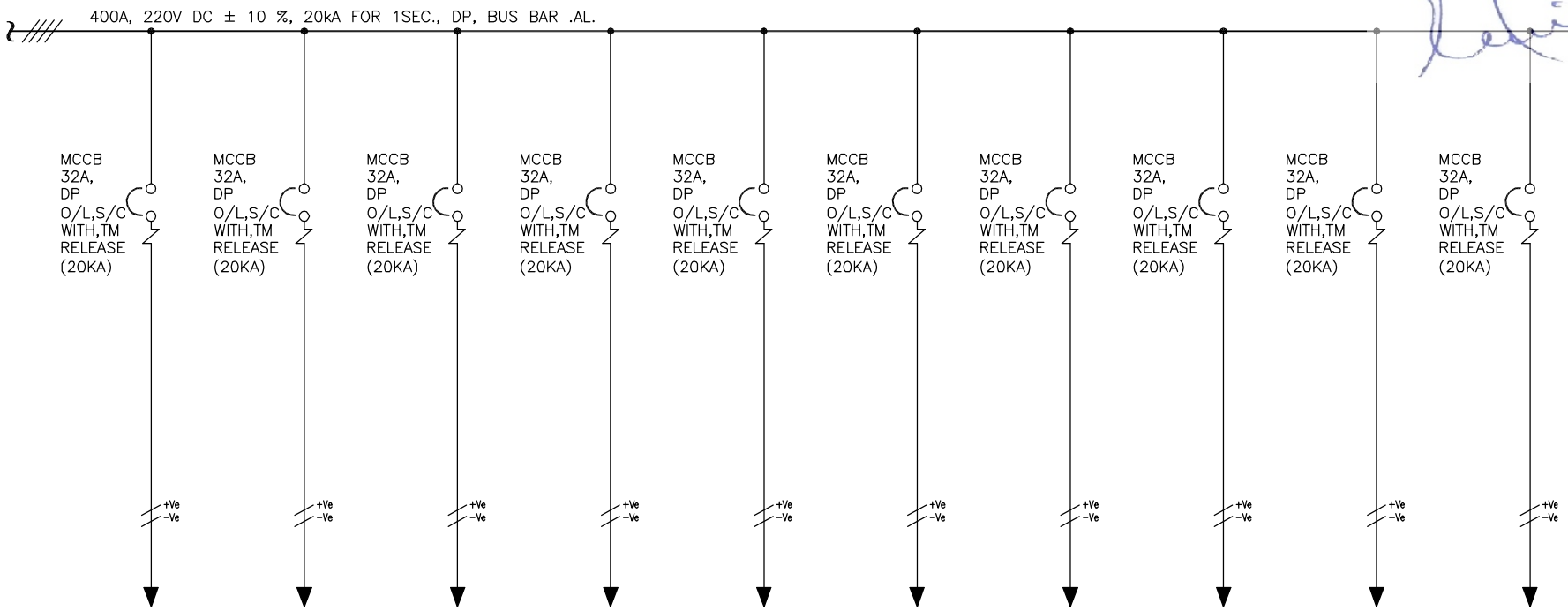
	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD–1(5D) & 2(6D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–210

JOB NO. 1241A

SH. NO.:– 03 OF 10



FEEDER NUMBER	5F1	5F2	5F3	5F4	5F5	5F6	5F7	5F8	6F1	6F2
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	400 kV RELAY PANEL 443 (F)	400 kV RELAY PANEL 444 (F)	400 kV RELAY PANEL 445 (F)	400 kV RELAY PANEL 447 (F)	400 kV RELAY PANEL 449 (F)	400 kV RELAY PANEL 450 (F)	400 kV RELAY PANEL 452 (F)	400 kV RELAY PANEL 453 (F)	400 kV RELAY PANEL 455 (F)	400 kV RELAY PANEL 456 (F)
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

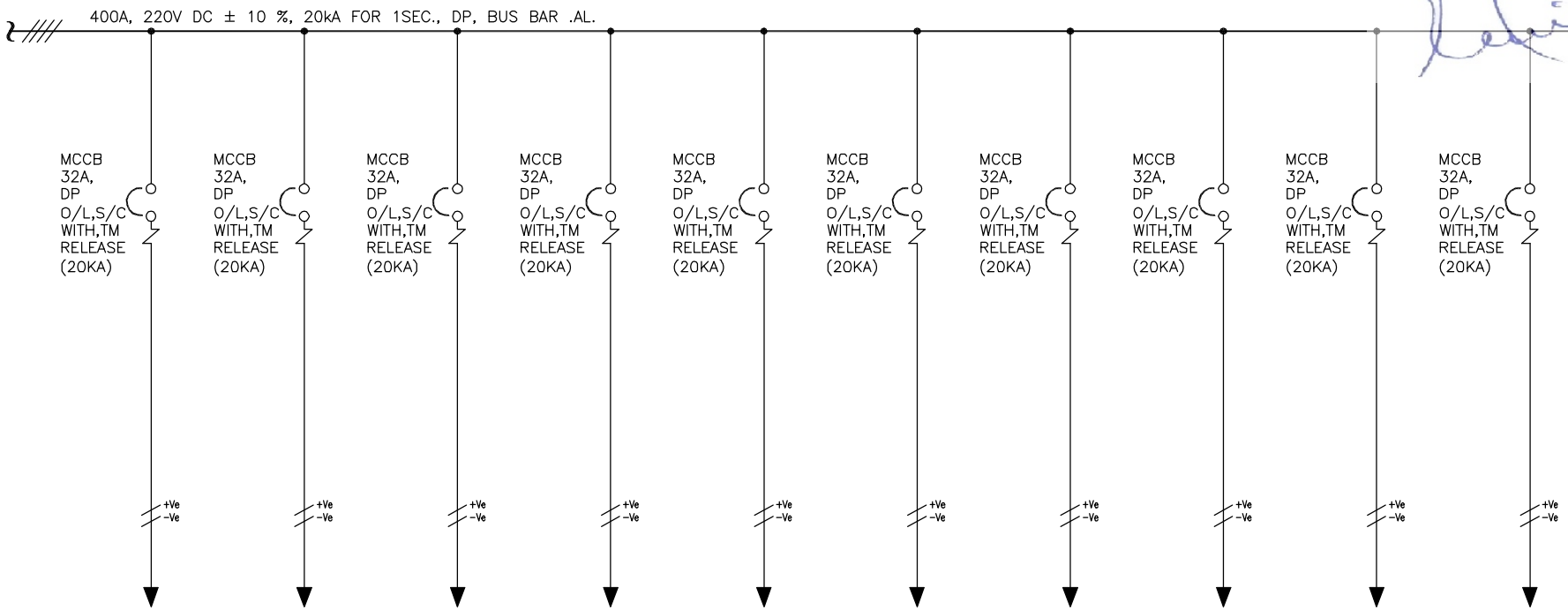
DRAWING	SINGLE LINE DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD–1(5D) & 2(6D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–210 SH. NO.:– 04 OF 10



FEEDER NUMBER	6F3	6F4	6F5	6F6	6F7	6F8	1R1	1R2	1R3	1R4
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	400 kV RELAY PANEL 458 (F)	400 kV RELAY PANEL BUSBAR	400 kV RELAY PANEL BUSBAR	400 kV RELAY PANEL BUSBAR	220 kV RELAY PANEL 201	220 kV RELAY PANEL 202	220 kV RELAY PANEL 203	220 kV RELAY PANEL 204	220 kV RELAY PANEL 205	220 kV RELAY PANEL 206
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

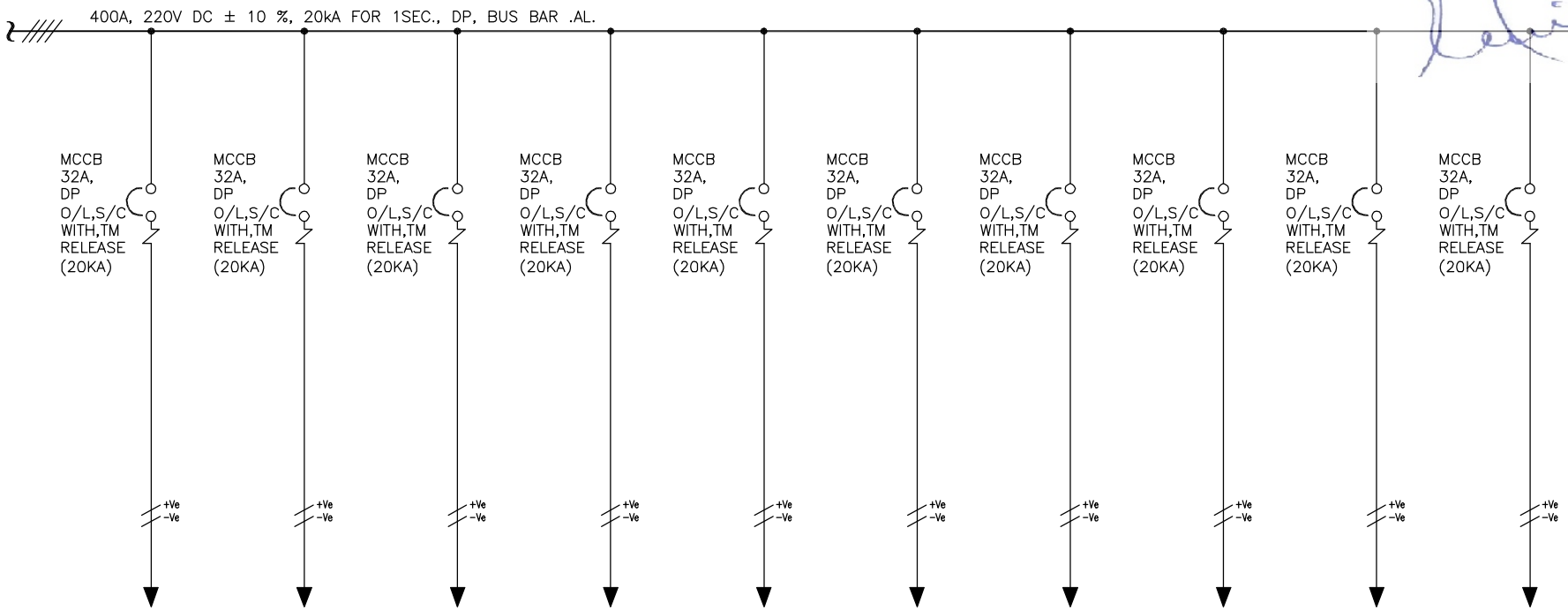
	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD–1(5D) & 2(6D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–210

JOB NO. 1241A

SH. NO.:– 05 OF 10



FEEDER NUMBER	1R5	1R6	1R7	1R8	2R1	2R2	2R3	2R4	2R5	2R6
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	220 kV RELAY PANEL 207	220 kV RELAY PANEL 208	220 kV RELAY PANEL 209	220 kV RELAY PANEL 210	220 kV RELAY PANEL 211	220 kV RELAY PANEL 212	220 kV RELAY PANEL 213	220 kV RELAY PANEL 214	220 kV RELAY PANEL 215	220 kV RELAY PANEL 216
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

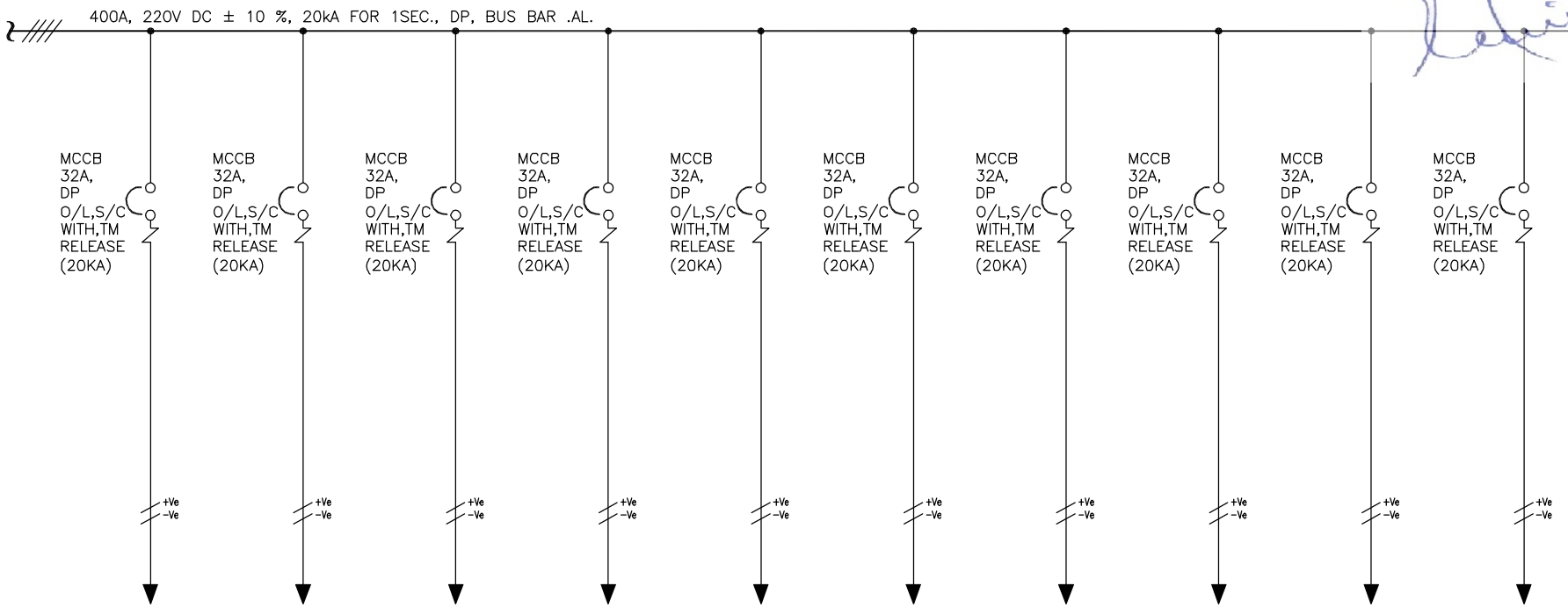
	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD–1(5D) & 2(6D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–210

JOB NO. 1241A

SH. NO.:– 06 OF 10



FEEDER NUMBER	2R7	2R8	3R1	3R2	3R3	3R4	3R5	3R6	3R7	3R8
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	220 kV RELAY PANEL 217 (F)	220 kV RELAY PANEL 218 (F)	220 kV RELAY PANEL 219 (F)	220 kV RELAY PANEL 220 (F)	220 kV RELAY PANEL 221 (F)	220 kV RELAY PANEL 222 (F)	220 kV RELAY PANEL 223 (F)	220 kV RELAY PANEL 224 (F)	220 kV RELAY PANEL 225 (F)	220 kV RELAY PANEL 226 (F)
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

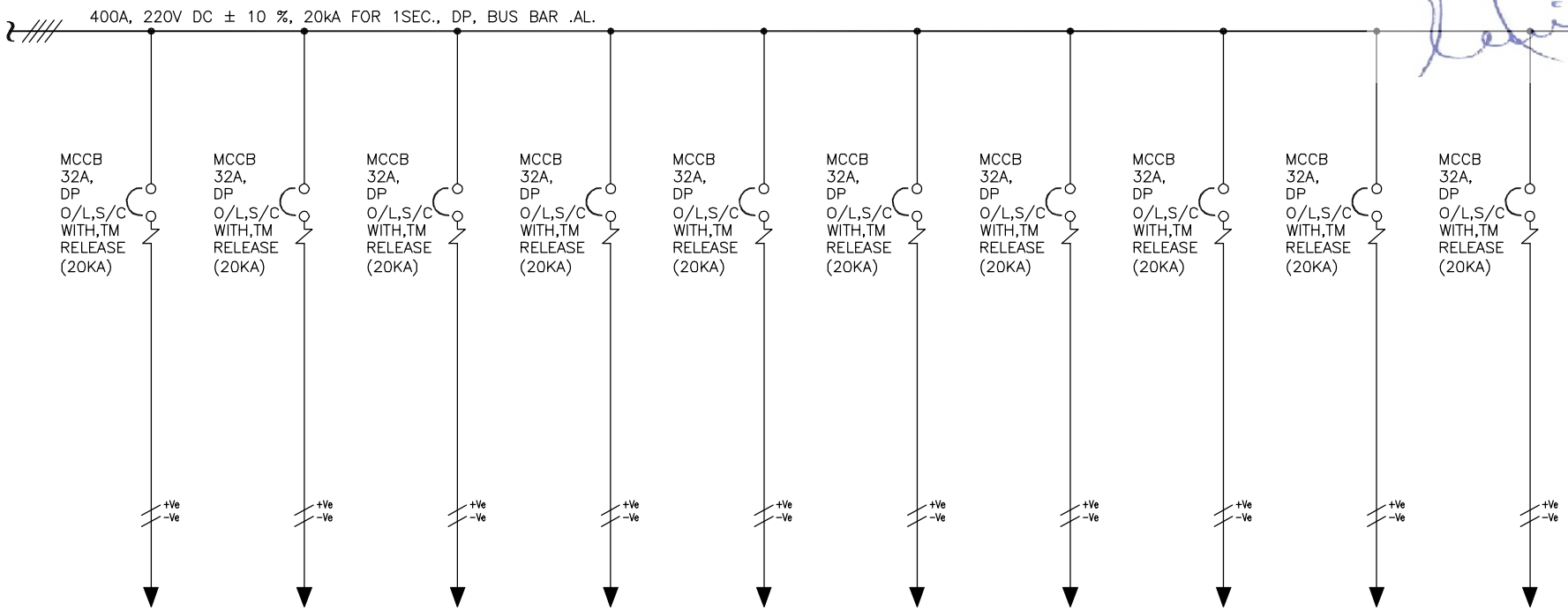
DRAWING	SINGLE LINE DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD–1(5D) & 2(6D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–210

JOB NO. 1241A

SH. NO.:– 07 OF 10

1 2 3 4 5 6 7 8 9

A B C D E F



FEEDER NUMBER	4R1	4R2	4R3	4R4	4R5	4R6	4R7	4R8	5R1	5R2
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	220 kV RELAY PANEL 227 (F)	220 kV RELAY PANEL 228 (F)	220 kV RELAY PANEL 229 (F)	220 kV RELAY PANEL 230 (F)	220 kV RELAY PANEL 231 (F)	220 kV RELAY PANEL 232 (F)	220 kV RELAY PANEL 233 (F)	220 kV RELAY PANEL 234 (F)	220 kV RELAY PANEL 235 (F)	220 kV RELAY PANEL 236 (F)
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

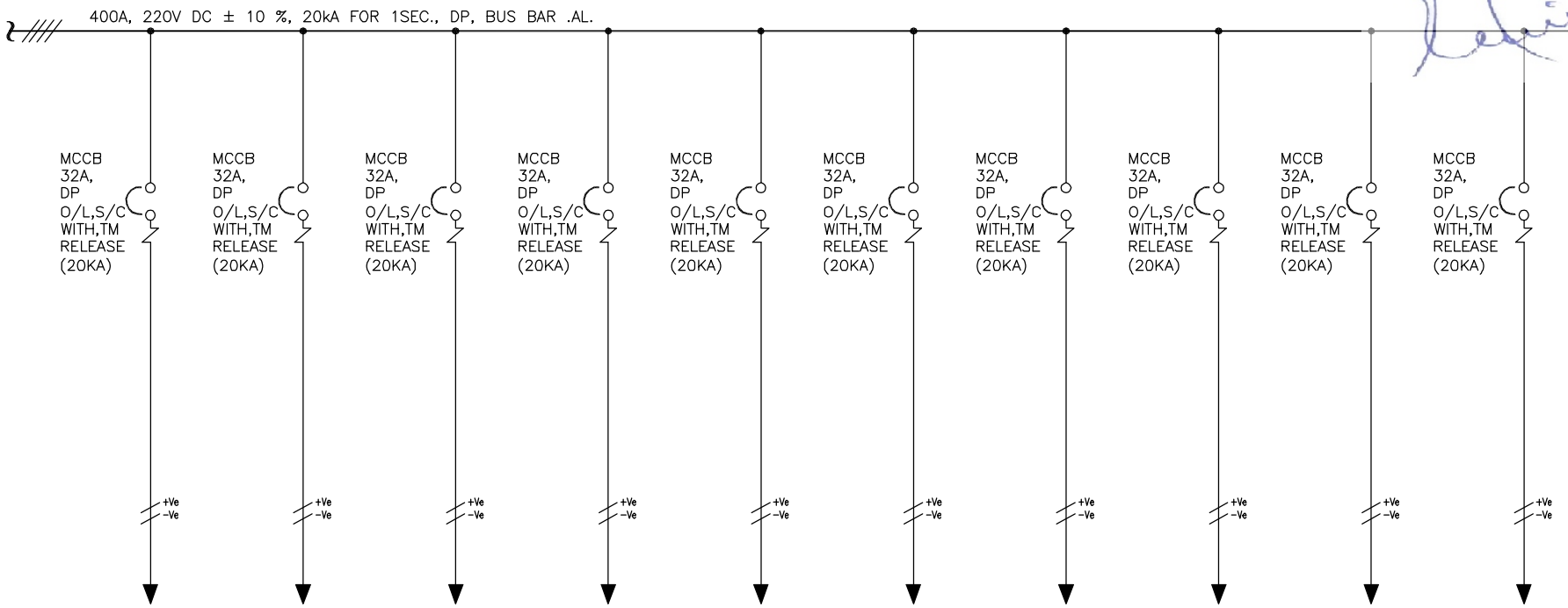
	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD–1(5D) & 2(6D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–210

JOB NO. 1241A

SH. NO.:– 08 OF 10



FEEDER NUMBER	5R3	5R4	5R5	5R6	5R7	5R8	6R1	6R2	6R3	6R4
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	220 kV RELAY PANEL 237 (F)	220 kV RELAY PANEL BUSBAR (F)	220 kV RELAY PANEL BUSBAR (F)	220 kV RELAY PANEL BUSBAR (F)	220 kV RELAY PANEL BUSBAR (F)	DC SUPPLY FOR ACDB-2A	SPARE-1	SPARE-2	SPARE-3	SPARE-4
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	--	--	--	--

	04.	-	DRAWN	MP	
	03.	-	CHKD.	VDP	
	02.	-	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

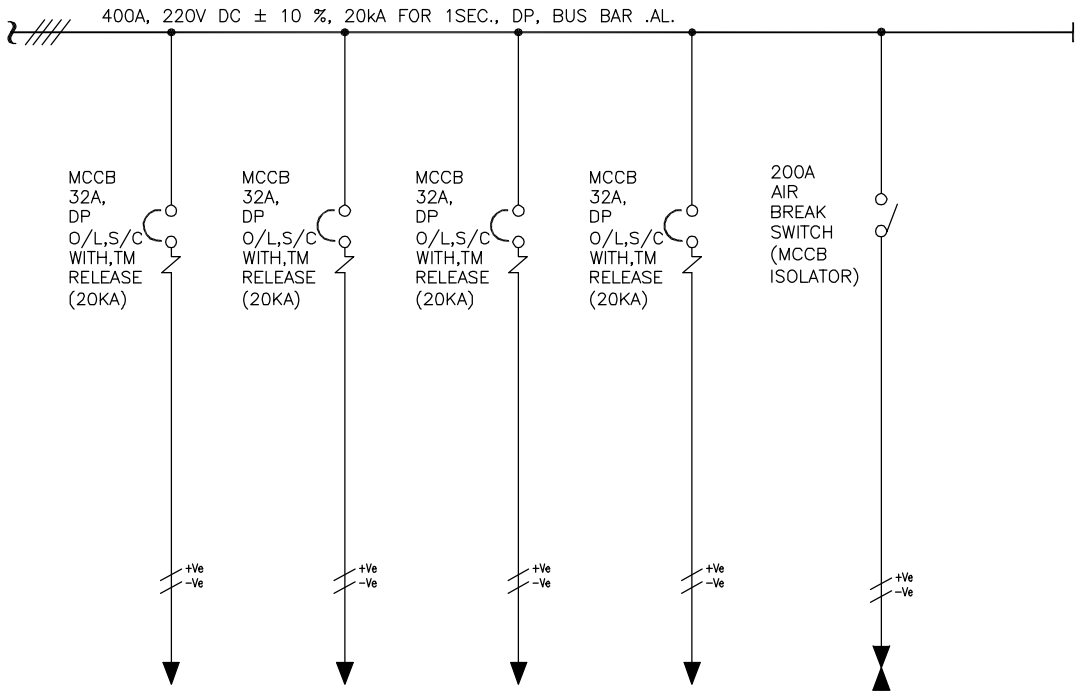
DRAWING	SINGLE LINE DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD-1(5D) & 2(6D) (AB)
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER-III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:-
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024-2025/1241A-210 SH. NO.:- 09 OF 10



FEEDER NUMBER	6R5	6R6	6R7	6R8	1F2
MODULE TYEP	X	X	X	X	H1
FEEDER RATING	32A	32A	32A	32A	200A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB ISOLATOR
DESCRIPTION	SPARE–5	SPARE–6	SPARE–7	SPARE–8	TO 220V DCDB–1
POWER CABLE SIZE (AL PVC)	--	--	--	--	2X1CX150 Sqmm.

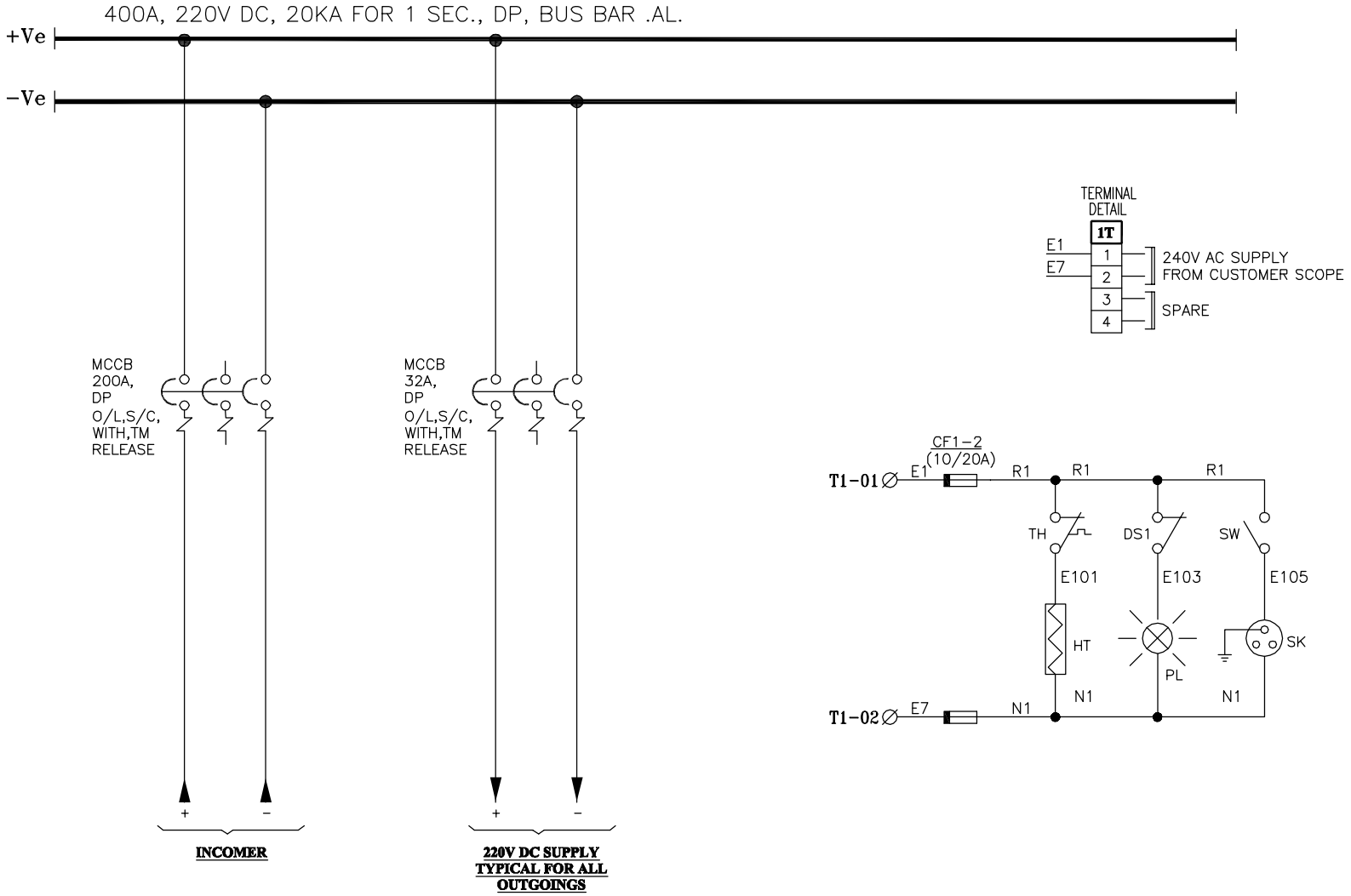
	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD–1(5D) & 2(6D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–210

JOB NO. 1241A

SH. NO.:– 10 OF 10



	04.	−	DRAWN	MP	
	03.	−	CHKD.	VDP	
	02.	−	APPD.	−−	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SCHEMATIC DIAGRAM
TITLE	220V DC DISTRIBUTION BOARD−1(5D) & 2(6D) (AB)
CA NO.	CC/T/W−AIS/DOM/A10/23/01956/NOA−1/24−102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER−III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:−	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024−2025/1241A−510

JOB NO. 1241A

SH. NO.:− 01 OF 01

BILL OF MATERIAL FOR 220V DC DISTRIBUTION BOARD-1(5D) & 2(6D) (AB)

S.NO.	ITEM CODE	DESCRIPTION	MAKE	RATING	QTY.
A	**BILL OF MATERIAL FOR INCOMER**				**1 No.**
1	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER LINK, ROTARY OPERATING MECHANISM (ROM), ICS = 100% ICU	L&T/C&S/HAVELLS	200A, 20kA, 220V DC	01
B	**BILL OF MATERIAL FOR MODULE (X)**				
1	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	32A, 20kA, 220V DC	92
C	**BILL OF MATERIAL FOR MODULE (H1)**				**1 No.**
1	**MCCB ISOLATOR**	DOUBLE POLE SINGLE THROUGH TYPE ON/OFF AIR BREAK SWITCH (MCCB ISOLATOR), WITH DOOR INTERLOCKING AND PAD LOCKING FACILITY	L&T/C&S/HAVELLS	200A, 220V DC	01
D	**BILL OF MATERIAL FOR MISC.**				
1	**CF1-2**	HRC FUSE BASE	L&T/C&S/HAVELLS	20A	08
2	**CF1-2**	HRC FUSE LINK	L&T/C&S/HAVELLS	10A	08
3	**DS**	DOOR SWITCH, 1C/O	SURAJ	––	04
4	**PL**	PANEL ILLUMINATION LIGHT, 240V AC	HAVELLS	5W	04
5	**SH**	SPACE HEATER, 240V AC	HOTWEL	60W	04
6	**TH**	THERMOSTATE, 240V AC	ELCON	30 – 80°C	04
7	**SW - SOCKET**	5/15A SWITCH SOCKET	ANCHOR	––	01

NOTE:– ALL COMPONENTS SHALL BE POWER GRID (QA&I) APPROVED MAKE

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. –– | ALL DIMENSIONS IN mm. | TOLERANCE 5% | REVISIONS : 00 | SIGN.

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	BILL OF MATERIAL
TITLE	220V DC DISTRIBUTION BOARD–1(5D) & 2(6D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–710

JOB NO. 1241A | SH. NO.:– 01 OF 01

ENGINEERING DRAWING DETAILS FOR

48V DC DISTRIBUTION BOARD-1(7D) & 2(8D) (AB)

PROJECT :- 765/400/220kV BIKANER-III POOLING STATION

CLIENT :- POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR :- BHARAT HEAVY ELECTRICAL LIMITED (BHEL)
TRANSMISSION PROJECTS DIVISION

	04.	-	DRAWN	MP	
	03.	-	CHKD.	VDP	
	02.	-	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	COVER PAGE	JOB NO. 1241A
TITLE	48V DC DISTRIBUTION BOARD-1(7D) & 2(8D) (AB)	
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024	
PROJECT	765/400/220kV BIKANER-III POOLING STATION	
CLIENT: POWER GRID CORPORATION OF INDIA LIMITED	CONTRACTOR:- BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-011	SH. NO. 01 OF 01

-: GUARANTEED TECHNICAL PARTICULARS/GENERAL NOTES :-

1. TYPE OF PRODUCT : FLOOR MOUNTED FIXED TYPE, COMPARTMENTALIZED & DOUBLE FRONT
2. CABLE ENTRY : BOTTOM
3. DEGREE OF PROTECTION : IP–53
   (AS PER IS : IS/IEC: 60947, 60529 FOR ENCLOSURE ONLY)
4. SUPPLY VOLTAGE
   a) POWER VOLTAGE : 48V DC, 2 WIRE
   b) CONTROL VOLTAGE : 240V AC
      48V DC
5. FABRICATION
   a) ENCLOSURE : 2.0MM CRCA
   b) DOORS/COVERS : 1.6MM CRCA
   c) BASE CHANNEL : 75MM ISMC
   d) GLAND PLATE : 3.0MM CRCA IN ALL CASES & 4.0MM THICKNESS NON MAGNETIC MATERIAL FOR SINGLE CORE POWER CABLE (REMOVABLE TYPE AS PER TS)
6. PAINTING
   a) PRETREATMENT : 9 TANK PROCESS
   b) PAINT TYPE : POWDER COATING
   c) PAINT SHADE : SMOKE GREY (SHADE NO 692 OF IS:5)
   d) PAINT THICKNESS : AS PER MQP
7. BUSBAR
   a) MAIN BUSBAR MATERIAL : ALUMINUM E91E GRADE (IS–5082)
   b) SLEEVE : HEAT SHRINKABLE PVC SLEEVES WITH RED, YELLOW, BLUE BLACK, GREEN COLORS
8. BUSBAR SUPPORTS : SMC/DMC
9. EARTH BUS BAR : SUITABLE SIZE OF GS THROUGH OUT THE PANEL AND HAVING TWO HOLES ON EACH AND FOR EARTH CONNECTION (AS PER GA DRAWING)
10. MINIMUM BUSBAR CLEARANCES (MAIN BUSBARS) :–
    (a) PHASE TO PHASE : 25.00 mm
    (b) PHASE TO NEUTRAL & POSITIVE TO NEGATIVE : 25.00 mm
    (c) PHASE/NEUTRAL TO EARTH : 25.00 mm
11. DOORS.
    FEEDER DOORS : HINGED AND LOCKABLE
    BUSBAR CHAMBERS : BOLTED
12. CONTROL WIRING : STANDARD PVC FLEXIBLE CU WIRE 1100V GRADE
    AC CIRCUIT : 1.5 SQ. MM BLACK COLOR
    DC CIRCUIT : 1.5 SQ. MM GREY FOR +VE AND WHITE FOR –VE COLOR
    EARTHING : 2.5 SQ. MM GREEN COLOR
13. POWER WIRE : PVC FLEXIBLE FR CU WIRE 1100V GRADE (COLOR – R,Y,B, BLACK)

    POWER CIRCUIT UP TO 20A : 4 Sq. MM
    POWER CIRCUIT 21 TO 32A : 6 Sq. MM
    POWER CIRCUIT 33 TO 40A : 10 Sq. MM
    POWER CIRCUIT 40 TO 63A : 16 Sq. MM
    ABOVE 63A : SOLID ALUMINUM LINK (@ 1.0A/Sqmm)
14. CURRENT DENSITY : SOLID ALUMINUM LINK @ 1.0A/Sqmm
15. SPACE HEATER : SPACE HEATER SHALL BE PROVIDED AT EACH CABLE ALLEY
16. NAME PLATE : NAME PLATE SHALL BE OF NON–RUSTING METAL OR 3PLY LAMICOID WITH WHITE ENGRAVED LETTERING ON BLACK BACKGROUND
17. DANGER PLATE : PRINTED DANGER PLATE ON THE EACH HORIZONTAL/ VERTICAL BUSBAR CHAMBER SHALL BE PROVIDE
18. GASKETS : NEOPRENE RUBBER GASKETS TYPE–II CLASS 2A AS PER IS : 11149 SHALL BE PROVIDED AT ALL REMOVABLE DOORS & COVERS TO MAKE THE PANEL DUST & VERMIN PROOF
19. SHROUDING : ALL LIVE PART SHALL BE SHROUDED WITH 2MM THICK HYLEM/ACRYLIC SHEET
20. ALL HINGED FRONT DOORS & COVERS SHALL BE PROVIDED WITH SUITABLE FLEXIBLE COPPER EARTHING CONNECTIONS..
21. CABLE SIZE AS PER APPROVED LT SLDs FOR POWER & CONTROL CABLE/PGCIL TS
22. ALL FUSES SHALL BE HRC TYPE WITH SHORT CIRCUIT LEVEL AS PER TS.
23. MANUFACTURING TOLERANCE TO BE AS PER IS :
    i) UP TO 50MM– ± 3% ii) 51 TO 100MM– ± 2%
    iii) 101 TO 300MM– ± 1% iii) ABOVE 300MM– ± 0.5%
24. ALL POWER TERMINAL SHALL BE STUD TYPE
25. PANEL SHALL BE EXTENDABLE FROM BOTH SIDES
26. AMBIENT TEMPERATURE CONSIDERED IS 50°C
27 MEGGAR/INSULATION VOLTAGE TEST– IR–500V DC
    HV TEST –2.5KV FOR ONE MINUTE
28. IN ALL CIRCUIT BREAKER PANELS AT LEAST 10% SPARE TERMINALS FOR EXTERNAL CONNECTIONS SHALL BE PROVIDED AND THESE SPARE TERMINALS SHALL BE UNIFORMLY DISTRIBUTED ON ALL TERMINAL BLOCKS. SPACE FOR ADDING ANOTHER 10% SPARE TERMINALS SHALL ALSO BE AVAILABLE
29. TERMINAL BLOCKS FOR CT AND VT SECONDARY LEADS SHALL BE PROVIDED WITH TEST LINKS AND ISOLATING FACILITIES. CT SECONDARY LEADS SHALL BE PROVIDED WITH SHORT CIRCUITING AND EARTHING FACILITIES. IT SHALL BE SIMILAR TO 'ELEM.' 'CATD' – TYPE.
30. TERMINAL BLOCKS SHALL BE OF 750 VOLTS GRADE AND HAVE CONTINUOUS RATING TO CARRY THE MAXIMUM EXPECTED CURRENT ON THE TERMINALS.
31. TERMINAL BLOCKS SHALL BE ARRANGED WITH AT LEAST 100 MM CLEARANCE BETWEEN TWO SETS OF TERMINAL BLOCK. THE MINIMUM CLEARANCE BETWEEN THE FIRST ROW OF TERMINAL BLOCK AND THE ASSOCIATED CABLE GLAND PLATE SHALL BE 250 MM

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. -- | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	GENERAL TECHNICAL SPECIFICATION
TITLE	48V DC DISTRIBUTION BOARD–1(7D) & 2(8D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL)
TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–1100 | SH. NO. 01 OF 01

-: SYMBOLS :-

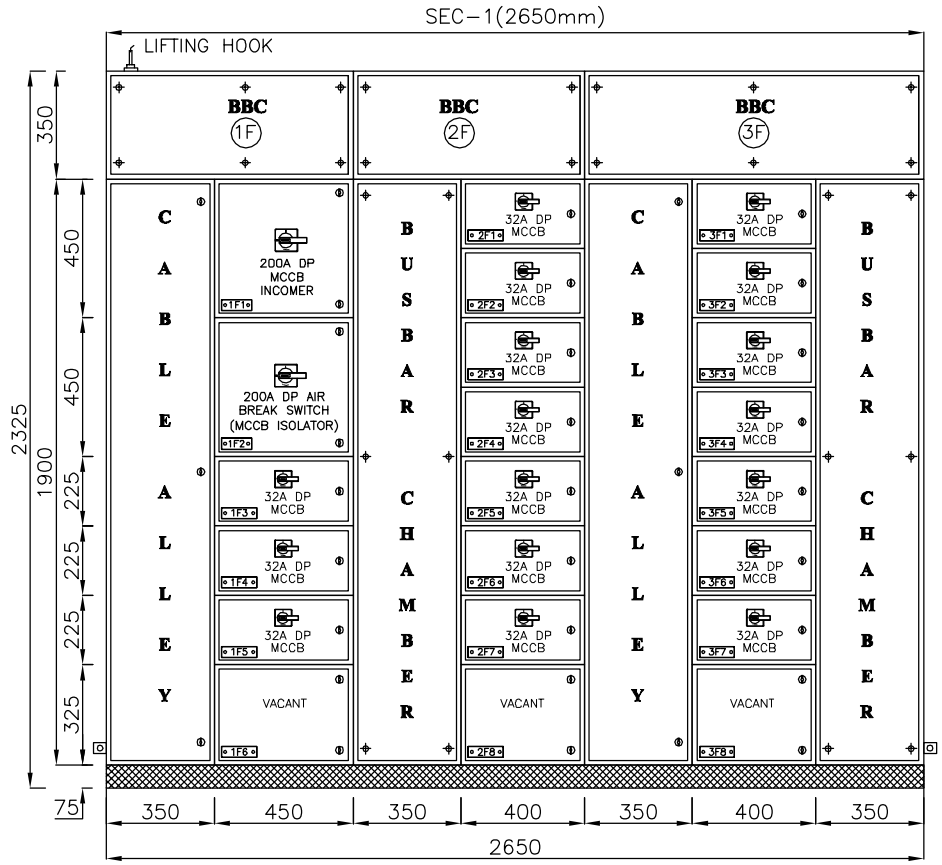
SR. NO.	DESCRIPTION	SYMBOL	SR. NO.	NAME	SYMBOL	SR. NO.	NAME	SYMBOL	SR. NO.	NAME	SYMBOL
1	CURRENT TRANSFORMER		13	CLOSING COIL	CC	25	DRAW OUT TERMINAL POWER		37	PROTECTION RELAY	
2	NEUTRAL LINK		14	SHUNT TRIP COIL	ST	26	DRAW OUT TERMINAL CONTROL		38	EARTHING	E
3	THERMOSTAT	Th.	15	FUSE		27	ISOLATOR		39	EARTHING BOLT	
4	CHANGE OVER SWITCH		16	DIGITAL AMMETER	A	28	FUSE SWITCH UNIT		40	SPACE HEATER	SH
5	NO CONTACT		17	AMMETER SELECTOR SWITCH	ASS	29	TERMINAL		41	D/O ACB	
6	NC CONTACT		18	DIGITAL VOLTMETER	V	30	TERMINAL		42	ELECTRIC BELL	EB
7	MCCB (MOULDEDCASE CIRCUIT BREAKER)		19	VOLTMETER SELECTOR SWITCH	VSS	31	TERMINAL		43	ANALOG AMMETER	A
8	MINIATURE CIRCUIT BREAKER (MCB)		20	KILOWATT HOUR METER	KWH	32	PUSH BUTTON		44	ANALOG VOLTMETER	V
9	PUSH BUTTON SPRING RETURN TYPE WITH NC ELEMENT		21	CONTACTOR COIL		33	INDICATING LIGHT				
10	PUSH BUTTON SPRING RETURN TYPE WITH NO ELEMENT		22	ON DELAY TIMER COIL		35	CAPACITOR				
11	OVERLOAD RELAY (CTRL. CIRCUIT)		23	OFF DELAY TIMER COIL		34	HOOTER/BUZZER	H			
12	OVERLOAD RELAY (POWER CIRCUIT)		24	SWITCH/MCCB/ OPERATING KNOB		36	CONTROL TRANSFORMER				

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

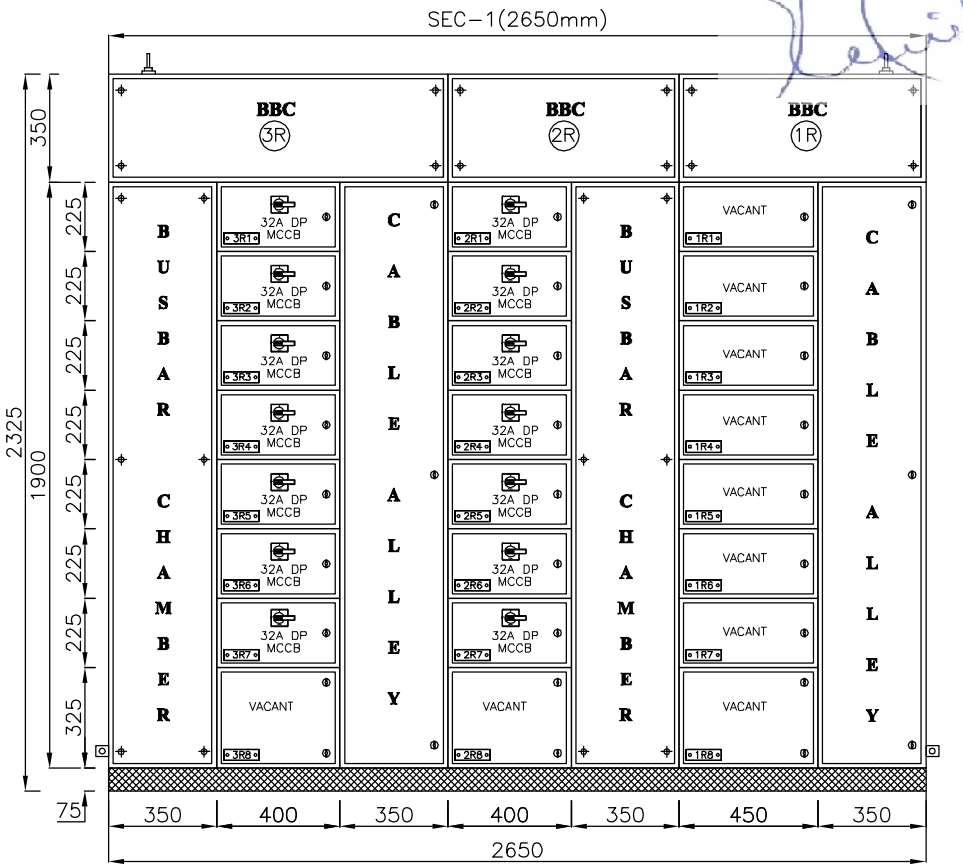
MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	ELECTRICAL SYMBOL		JOB NO. 1241A
TITLE	FOR ALL PANEL		
CA NO.	CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 DATED 23.02.2024		
PROJECT	765/400/220kV BIKANER-III POOLING STATION		
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED	CONTRACTOR:– BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION	
DRG. NO.	USL/PGCIL/BHEL/2024-2025/1241A-000-11		SH. NO. 01 OF 01

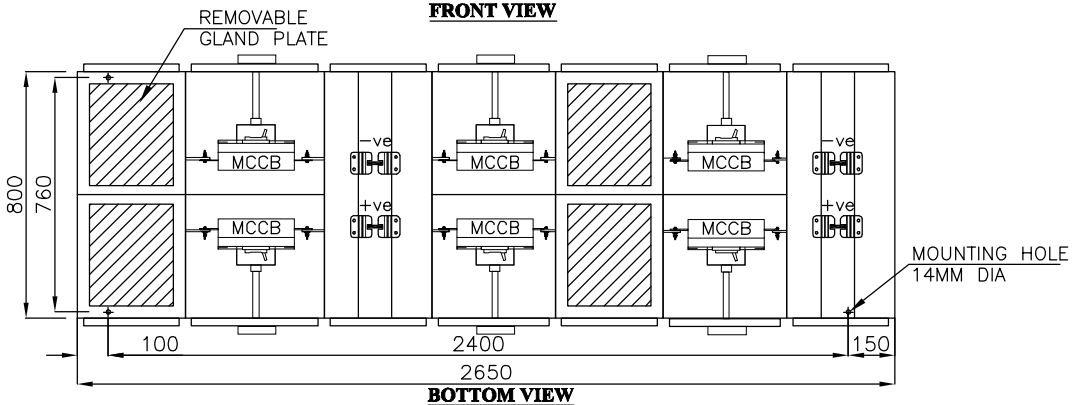
1 2 3 4 5 6 7 8 9



FRONT VIEW



REAR VIEW



BOTTOM VIEW

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

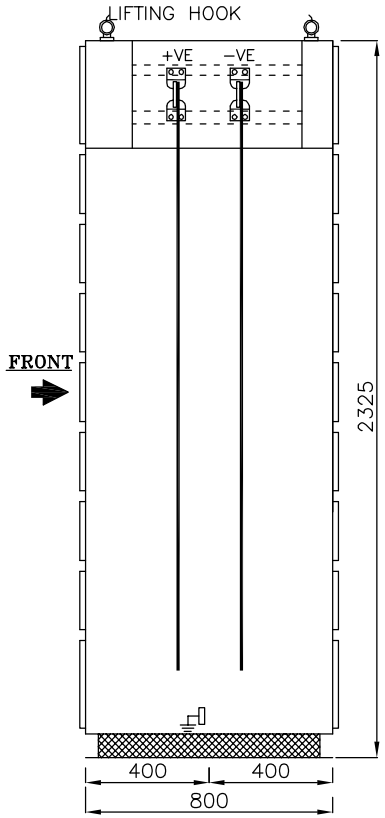
DRAWING	GENERAL ARRANGEMENT DRAWING
TITLE	48V DC DISTRIBUTION BOARD–1(7D) & 2(8D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

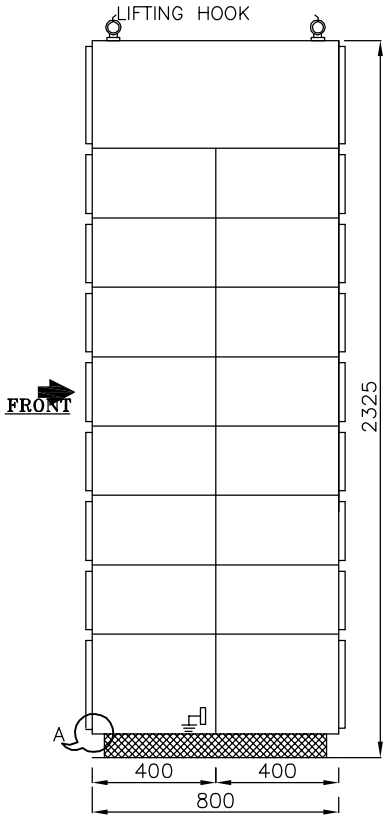
CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–111 SH. NO. 01 OF 02



SIDE VIEW(HORIZONTAL BUS BARS ALONG WITH DETAILS OF BUS BAR SUPPORTS.)



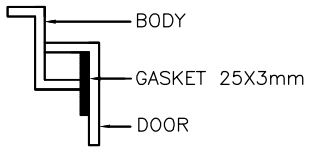
SIDE VIEW

PANEL DIMENSIONS

HEIGHT : 2325 mm.
WIDTH : 2650 mm.
DEPTH : 800 mm.

BUS BAR SIZE :- (HOR./VER.)

POSITIVE : 1x40x10 Sq.mm Alu.
NEGATIVE : 1x40x10 Sq.mm Alu.
EARTH : 1x40X05 Sq.mm GS.



DETAIL-'A'

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

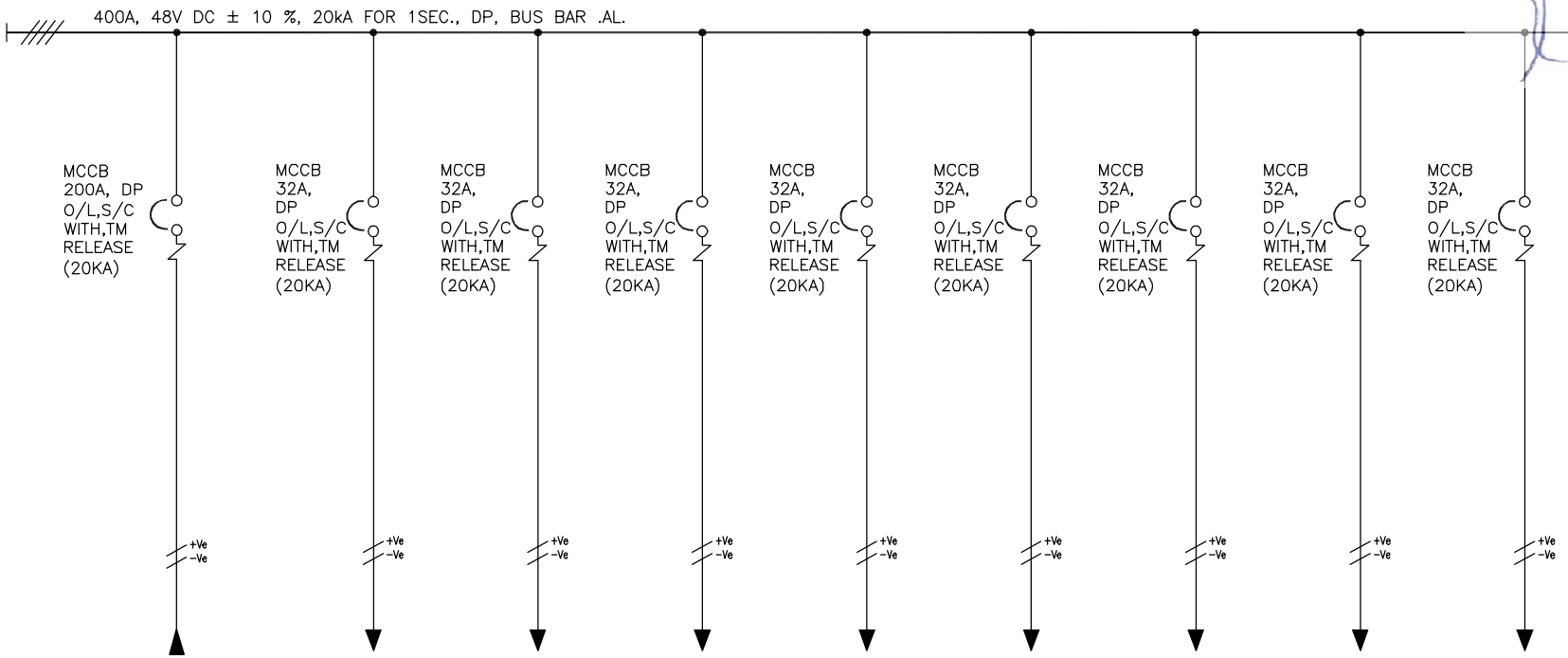
DRAWING	GENERAL ARRANGEMENT DRAWING
TITLE	48V DC DISTRIBUTION BOARD–1(7D) & 2(8D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–111 SH. NO. 02 OF 02



FEEDER NUMBER	1F1	1F3	1F4	1F5	2F1	2F2	2F3	2F4	2F5
MODULE TYEP	DC	X	X	X	X	X	X	X	X
FEEDER RATING	200A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	INCOMER	400 kV PLCC PANEL 401	400 kV PLCC PANEL 403	400 kV PLCC PANEL 404	400 kV PLCC PANEL 406	400 kV PLCC PANEL 407	400 kV PLCC PANEL 410	400 kV PLCC PANEL 444 (F)	400 kV PLCC PANEL 446 (F)
POWER CABLE SIZE (AL PVC)	2X1CX150 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

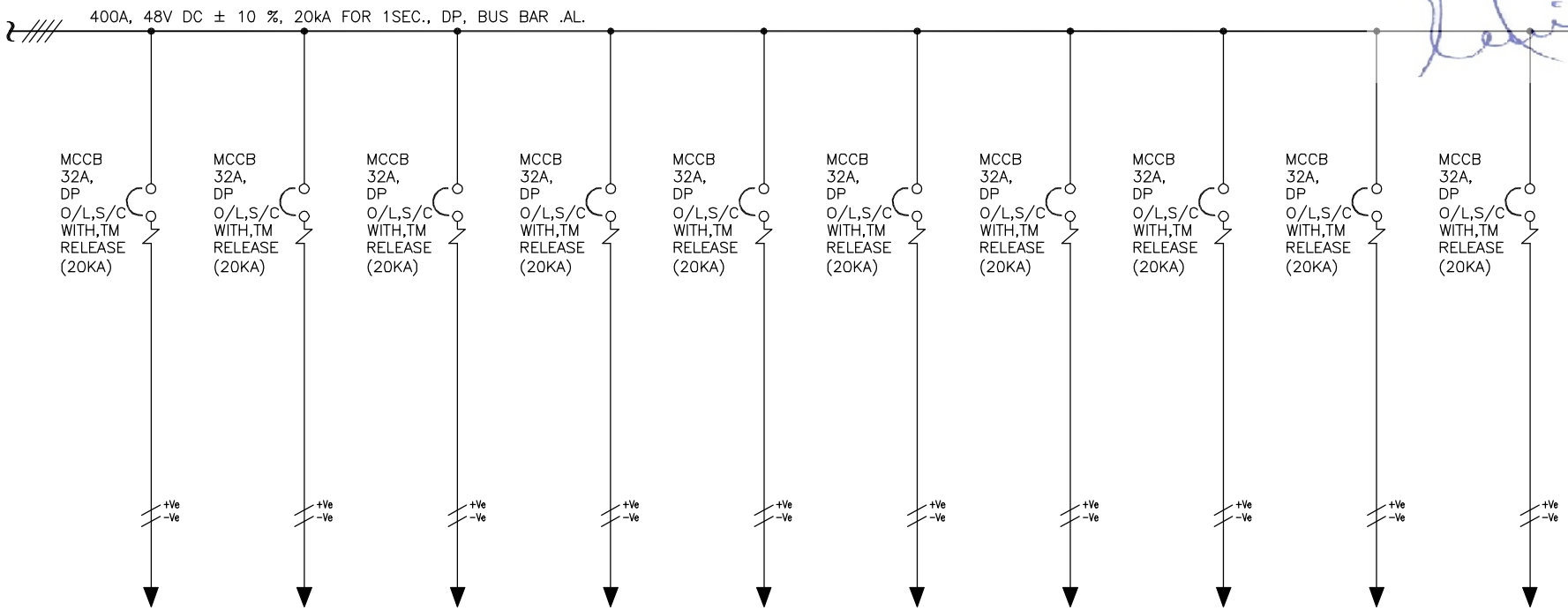
DRAWN MP | CHKD. VDP | APPD. -- | ALL DIMENSIONS IN mm. | SIGN. | TOLERANCE 5% | REVISIONS : 00

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD–1(7D) & 2(8D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–211

JOB NO. 1241A

SH. NO.:– 01 OF 04



FEEDER NUMBER	2F6	2F7	3F1	3F2	3F3	3F4	3F5	3F6	3F7	2R1
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	400 kV PLCC PANEL 449 (F)	400 kV PLCC PANEL 450 (F)	400 kV PLCC PANEL 452 (F)	400 kV PLCC PANEL 453 (F)	400 kV PLCC PANEL 455 (F)	400 kV PLCC PANEL 456 (F)	400 kV PLCC PANEL 458 (F)	220 kV PLCC PANEL 201	220 kV PLCC PANEL 203	220 kV PLCC PANEL 205
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

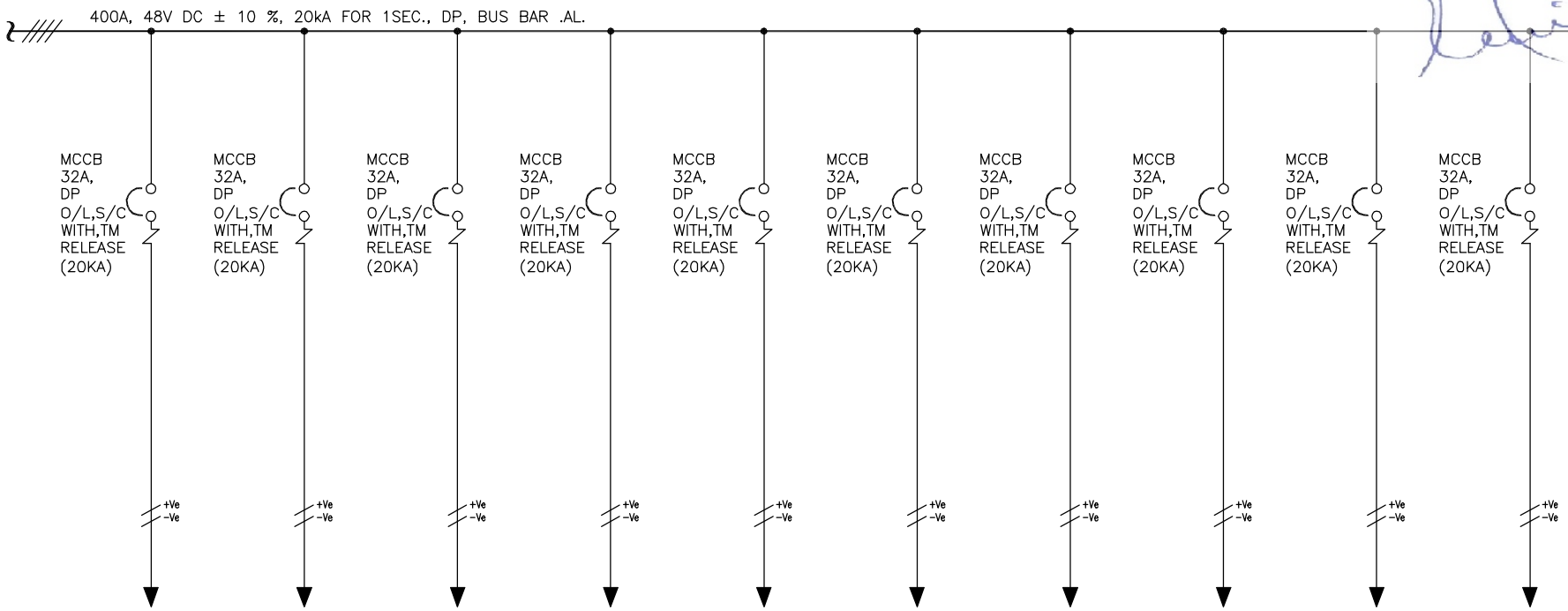
	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD–1(7D) & 2(8D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–211

JOB NO. 1241A

SH. NO.:– 02 OF 04



FEEDER NUMBER	2R2	2R3	2R4	2R5	2R6	2R7	3R1	3R2	3R3	3R4
MODULE TYEP	X	X	X	X	X	X	X	X	X	X
FEEDER RATING	32A	32A	32A	32A	32A	32A	32A	32A	32A	32A
FEEDER TYPE	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB	MCCB
DESCRIPTION	220 kV PLCC PANEL 211	220 kV PLCC PANEL 213	220 kV PLCC PANEL 217 (F)	220 kV PLCC PANEL 220 (F)	220 kV PLCC PANEL 222 (F)	220 kV PLCC PANEL 224 (F)	220 kV PLCC PANEL 226 (F)	220 kV PLCC PANEL 228 (F)	220 kV PLCC PANEL 232 (F)	220 kV PLCC PANEL 234 (F)
POWER CABLE SIZE (AL PVC)	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.	1X4CX16 Sqmm.

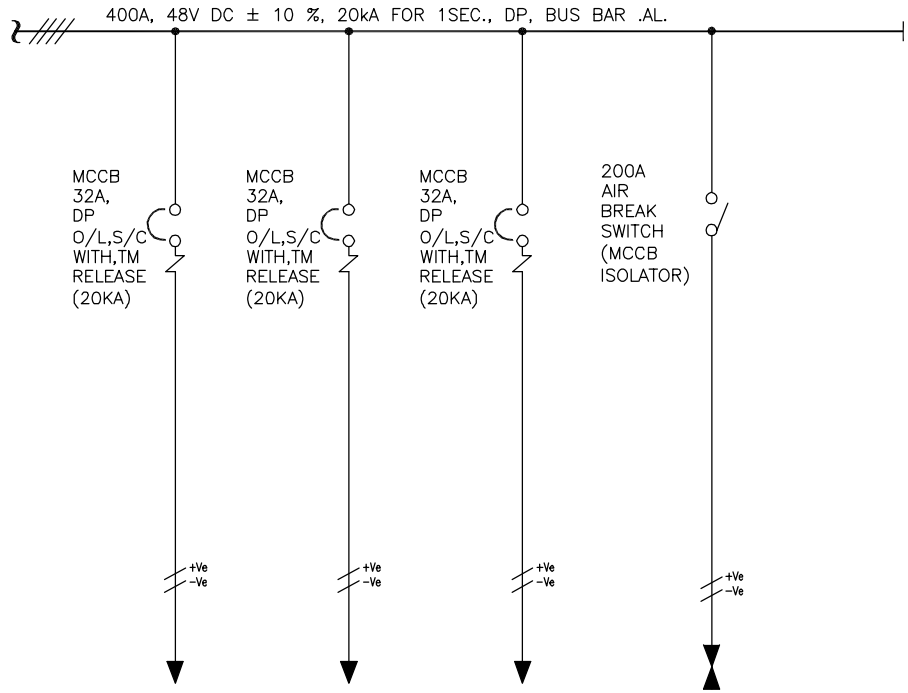
	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SINGLE LINE DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD–1(7D) & 2(8D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–211

JOB NO. 1241A

SH. NO.:– 03 OF 04



FEEDER NUMBER	3R5	3R6	3R7	1F2
MODULE TYEP	X	X	X	H1
FEEDER RATING	32A	32A	32A	200A
FEEDER TYPE	MCCB	MCCB	MCCB	ISOLATOR
DESCRIPTION	SPARE FEEDER–1	SPARE FEEDER–1	SPARE FEEDER–1	TO 48V DCDB–1
POWER CABLE SIZE (AL PVC)	--	--	--	2X1CX150 Sqmm.

	04.	–	DRAWN	MP	
	03.	–	CHKD.	VDP	
	02.	–	APPD.	--	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

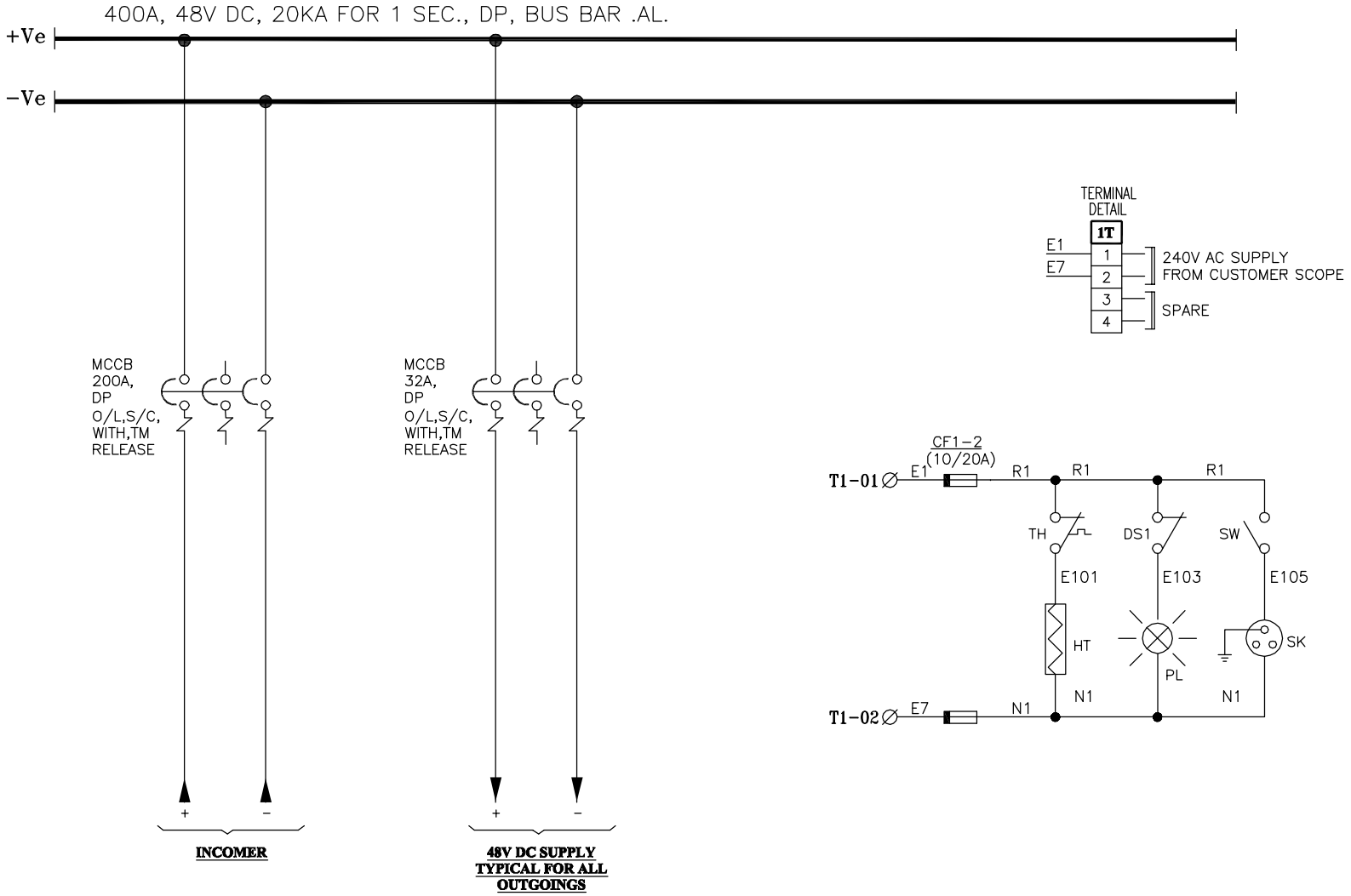
DRAWING	SINGLE LINE DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD–1(7D) & 2(8D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION

JOB NO. 1241A

CLIENT
POWER GRID CORPORATION OF INDIA LIMITED

CONTRACTOR:–
BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION

DRG. NO. USL/PGCIL/BHEL/2024–2025/1241A–211 SH. NO.:– 04 OF 04



	04.	−	DRAWN	MP	
	03.	−	CHKD.	VDP	
	02.	−	APPD.	−−	
	01.		ALL DIMENSIONS IN mm.		SIGN.
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL	TOLERANCE 5%		
DATE	No.	REVISIONS DESCRIPTION	REVISIONS : 00		

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	SCHEMATIC DIAGRAM
TITLE	48V DC DISTRIBUTION BOARD−1(7D) & 2(8D) (AB)
CA NO.	CC/T/W−AIS/DOM/A10/23/01956/NOA−1/24−102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER−III POOLING STATION
CLIENT	**POWER GRID CORPORATION OF INDIA LIMITED**
CONTRACTOR:−	**BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION**
DRG. NO.	USL/PGCIL/BHEL/2024−2025/1241A−511

JOB NO. 1241A

SH. NO.:− 01 OF 01

BILL OF MATERIAL FOR 48V DC DISTRIBUTION BOARD-1(7D) & 2(8D) (AB)

S.NO.	ITEM CODE	DESCRIPTION	MAKE	RATING	QTY.
A	**BILL OF MATERIAL FOR INCOMER**				**1 No.**
1	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH SPREADER LINK, ROTARY OPERATING MECHANISM (ROM), ICS = 100% ICU	L&T/C&S/HAVELLS	200A, 20kA, 48V DC	01
B	**BILL OF MATERIAL FOR MODULE (X)**				
1	**MCCB**	DP MCCB, WITH THERMAL MAGNETIC BASED RELEASE FOR 80–100 % O/L, S/C PROTECTION WITH ROTARY OPERATING MECHANISM (ROM)	L&T/C&S/HAVELLS	32A, 20kA, 48V DC	92
C	**BILL OF MATERIAL FOR MODULE (H1)**				**1 No.**
1	**MCCB ISOLATOR**	DOUBLE POLE SINGLE THROUGH TYPE ON/OFF AIR BREAK SWITCH (MCCB ISOLATOR), WITH DOOR INTERLOCKING AND PAD LOCKING FACILITY	L&T/C&S/HAVELLS	200A, 48V DC	01
D	**BILL OF MATERIAL FOR MISC.**				
1	**CF1-2**	HRC FUSE BASE	L&T/C&S/HAVELLS	20A	08
2	**CF1-2**	HRC FUSE LINK	L&T/C&S/HAVELLS	10A	08
3	**DS**	DOOR SWITCH, 1C/O	SURAJ	––	04
4	**PL**	PANEL ILLUMINATION LIGHT, 240V AC	HAVELLS	5W	04
5	**SH**	SPACE HEATER, 240V AC	HOTWEL	60W	04
6	**TH**	THERMOSTATE, 240V AC	ELCON	30 – 80°C	04
7	**SW - SOCKET**	5/15A SWITCH SOCKET	ANCHOR	––	01

NOTE:– ALL COMPONENTS SHALL BE POWER GRID (QA&I) APPROVED MAKE

DATE	No.	REVISIONS DESCRIPTION
	04.	–
	03.	–
	02.	–
	01.	
29.01.2025	00.	FIRST SUBMISSION FOR APPROVAL

DRAWN MP | CHKD. VDP | APPD. –– | ALL DIMENSIONS IN mm. | TOLERANCE 5% | REVISIONS : 00 | SIGN.

MANUFACTURER
ULTIMA® SWITCHGEARS LTD.
UNIT-I KHASRA NO. 215, IND. AREA, VILLAGE RAIPUR (BHAGWANPUR), TEHSIL - ROORKEE, DISTRICT HARIDWAR (UTTRAKHAND) - 247667, INDIA, TEL : 01332-235043 FAX : 01332-235042
UNIT-II F-6 & F-7, SITE-C, UPSIDC, SURAJPUR INDUSTRIAL AREA, GREATER NOIDA - 201306 G. B. NAGAR (U.P.) INDIA
E-mail : info@ultimaswitchgear.com

DRAWING	BILL OF MATERIAL
TITLE	48V DC DISTRIBUTION BOARD–1(7D) & 2(8D) (AB)
CA NO.	CC/T/W–AIS/DOM/A10/23/01956/NOA–1/24–102643/01 & 02 DATED 23.02.2024
PROJECT	765/400/220kV BIKANER–III POOLING STATION
JOB NO.	1241A
CLIENT	POWER GRID CORPORATION OF INDIA LIMITED
CONTRACTOR:–	BHARAT HEAVY ELECTRICAL LIMITED (BHEL) TRANSMISSION PROJECTS DIVISION
DRG. NO.	USL/PGCIL/BHEL/2024–2025/1241A–711
SH. NO.:–	01 OF 01

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.

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.

Procedure for transformer / Reactor Installation , Testing and Commissioning

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS GROUP- NORTHERN SECTOR

Rev.0

Procedure for transformer / Reactor Installation , Testing and Commissioning

Sl no.	Description	Remarks
A.	**On Arrival of Transformer Tank**	
A.1	Checking of Pressure, Dew point , IR of CC- CL - Tank	Record the values If tank pressure is zero then reports to Bhopal
A.2	Removal of Impact Recorder after placement on Plinth	Sent to Bhopal for review
A3	Before signing LR on receipt of material - Transformer shall be physically checked for any damage /physical abrasion during transportation	Remarks to be mentioned on the LR .
B.	**Installation work**	
B.1	Drum oil test - BDV, PPM, Tan Delta, Resistivity and IFT	Number of sample to be tested as per customer standard procedure.
B.2	Ensure the availability of drawing (OGA, Assembly drawing like cooler bank, aux system and other piping work, Part List etc.)	
B.3	Material Verification	Shortages to be reported to BHEL prior installation of work.
B.4	Turret CT and Bushing to be tested, Dry Air Generator Dew point level to be examined before raise the call for internal inspection	Bushing to be tested on variable frequency upto 391Hz. Reports to be submitted for clearance. PS class CT's ratio error@ 100%rating to be <0.25%
B.5	Internal inspection and Bushing erection a. Ensure crane availability b. Ensure Dry air generator to achieve dew point -60 c. Dew point measurement kit (Vaisala Make kit) d. Ensure CT ratio measurement kit for internal CT test	23T capacity crane or last boom capacity 2T and minimum 60 feet boom length)
B6	Transformer GT/ICT /ST /UAT / Reactor to be examined for any loose earthing / core locking arrangement /Wall shunts / clearance between the Tanks and Bushing leads . Transformer should be flushed with Hot oil and thoroughly cleaned before Boxing up of Transformer.	Any abnormality may please be reported to the Manufacturing BHEL Unit
B.6	**TESTING AFTER ERECTION - BEFORE DRYOUT** Testing of WRM and Turn Ratio (HV/IV, HV/LV, IV/LV at all taps - applicable for transformer)and SFRA	Reactor- WRM and SFRA ICT - WRM & Turn ratio and SFRA for Transformer Acceptance Limit - error should be less than 0.5% for turn ratio and WRM <2.5%
C	**PREPARATION BEFORE START OF ERECTION**	
1	**PIPEWORKS** -All pipe works shall be checked as per checklist before start of the work . Pipe work be thoroughly cleaned before Erection and if required flushed with oil	Cleaning and Flushing of the pipe work to be ensured before Erection
2	**CONSERVATOR** - Air cell of the conservator to be tested for leak test at 1 PSI / 0.07kg/cm2 for 1 hrs . Conservator without Air cell may be checked for 2 PSI for a period of 1 hr .After successful testing of Air cell and Conservator and MOG and changing the inspection cover "O Ring " - Erection of Conservator to be carried out .	In case of the any leakage noticed , concerned OEM Unit to be informed .
3	**RADIATORS/ COOLER BANKS** - All Radiator to be mounted are to be leakage tested as per BHEL standard protocol through Air pressure of 2 psi for 15 min (time span for soap solution test). This is followed by Flushing of each radiator for 15min with the Transformer oil as provided by BHEL Engineer in charge at site	Details to be filled as per standard protocol
C.	**Dry out of Transformer- (once WRM & turn ratio in Limit)**	
C.1	Cooling bank & Conservator must be isolated from main tank	
C.2	Leakage test at pressure upto 5 PSI for Main Tank after complete Box up of Transformer .	If test is cleared go for the next cycle of vacuum test .

Sl no.	Description	Remarks
C.3	Vacuum Test to be performed after successful leakage Test at vacuum (500-700mmHG)	Check for any leakage after 1 hrs and subsequent 0.5 hrs in 2 intervals .
C.4	Leakage test at vacuum (L1 & L2 method) between 1 to 2 torr in McLeod gauge	for PGCIL project . Calculate leakage rate (L2-L1)volume/Time) L1 is reading at start and L2 is reading at time duration. Leakage should be less than <100
C.5	1st Vacuum cycle for 72 hour after reaching 0.5 torr vacuum in McLeod Gauge	Continuous running of vacuum pump for 72 Hour
C.6	After 72 hour vacuum - fill the **N2/dry air cylinder** (prefably Nitrogen from cylinders) **of Dew point better than -60** at 0.25 to 0.35 kg / sq cm (3.5 to 5 PSI)	
C.7	Check the Dew point after 24 hour of N2 filling	Record the values, If dew point is -20 or below. Process of Heating +vacuum of main tank to be done.
C.8	2nd cycle of Vacuum for 48 hour after reaching 0.5 torr vacuum in McLeod Gauge	
C.9	After 48 hour vacuum - fill the **N2/dry air cylinder** (prefably Nitrogen from cylinders) **of Dew point better than -60** at 0.25 to 0.35 kg / sq cm (3.5 to 5 PSI)	
C.10	Check the Dew point after 24 hour of N2 filling	Acceptable value of dew point is -36 **(0.5 RH)** or better. If desired dew point not obtained then go for 3rd cycle of 48 hrs (depend on the 2nd cycle test results). Dry out cycle to be repeated till achieving Main Tank - active part dew point -36 **(0.5 RH)** or better.
D.	**Oil Filling and Filtration**	
D.1	Provision for Storage capcity of complete required oil to be filled in Transformer Tank in one go to be maintained. Oil of each storage Tank to be tested at Power grid Lab. Complete oil to be made ready before oil filling .	BDV, PPM, Tan Delta @90, Interfacial tension & Resistivity. BDV value -75 (Min) and PPM<5
D.2	Oil filling in the ICT / Reactor Tank to be done under vacuum to be maintained for 24-48 hrs prior to oil filling . Oil to be inside the Tank shall be at temp 40-50 degree . Complete oil fillingto be done in one go after achieving the required parameters	Before filling, oil to be tested for each storage tank in PGCIL approved Lab. BDV - 75 (min) and PPM <5
D.3	OLTC to be filled through Main tank and after filling equalizing link atatched during entire process may be removed.	After OLTC filling upto tank level. Equalising pipe to be remove and connect all pipe of OLTC
D.4	Remove the Dummy plate between cooling bank and main tank under B/F in closed condition	
D.5	Oil filling in cooling to be filled through bottom pipe line through main tank or cooling to be filled separately .	Oil to be filled under open condition of air plug in header pipe and all B/F of cooling bank.
D.6	Fill the Oil in conservator to be done as per standard comissioning process after completion of HOC process .	Follow OEM instruction for Conservator commissioning .
E	**Filtration and HOT Oil Circulation**	
E.1	Closed the B/F valve of Top/Bottom pipe of cooling bank if opened	
E.2	HOC to be done for min period of 72 Hour or more till achieving the PI value . Time of HOC shall be considered after reaching outlet oil temperature from ICT Tank /OTI/WTI Temp (60 degree) or as per recommendation of OEM. HOC period will be extended if PI value does not reach.	Ensure filter M/C outlet pipe (heated oil pipe) must be connected at bottom valve of main tank. PI to be taken in last 24 Hour. Inlet and outlet temperature to be recorded. Following PI to be measured at Regular interval of 4 hour. a. HV+IV+N /E+LV : PI >1.75 b. HV+IV+N/LV : PI>1.75 c. LV/E+ HV+IV+N: PI> 1.75

Sl no.	Description	Remarks
E.3	After clearance of HOC . Each Cooling bank to be filtered separately with minor opening of B/F of top pipe line to ensure breathing of oil through conservator. Minimum 8 Hour	Local BDV (>75) & PPM (<5) to be checked. Minimum 4 rotation of oil (calculation based on with 50% capacity of Filter M/C)
E.4	After completion of filtration of cooling bank, oil to be mixed with main tank. Filtration to be done for minimum 24 hours	All B/F of Top and Bottom to be opened.
E.5	Particle count test to be done when the Transformer oil is completely mixed and under motion .Fine filtration carried out with Filter Machine of 0.3-0.5 micron filters . While carrying out particle count Filter machine to be kept under throughout during the process of Particle count .	Under running condition of cooling bank pump. Particle count must be **maximum 4 micron, 10,000 particle count per liter** (i.e. ISO 10) Minimum three sample to be tested. For measurement (Oil qty 100mL in each measurement) to be taken under each sample with test duration of 4.5- 5min.
E.6	Complete Electrical test to be done. A. WRM & Turn Ratio as per factory test b. Bushing at variable freq & Winding Tan Delta Test c. Magnetic Balance /Vector group d. Magnetizing current e. SFRA test f. IR test of winding g. Short circuit impedance calculation . h. Floating point voltage calculation . i. Meaurement of Vibration in case of Reactor after charging g. Other Balance test as per PGCIL.	Testing kit with Calibration certificate is required. Test to be performed under electrical operation of OLTC tab.
E.7	Following oil Test to be done : sample to be taken from Tank Bottom & Tank Top 1. BDV , PPM, Tan Delta@90, DGA, IFT & resistivity 2. Any other test as per Power Grid contract	

CONTENTS

SECTION 2
INSTALLATION

2. INSTALLATION

2.1 RECEPTION AND ASSEMBLING OF TRANSFORMER / REACTOR DESPATCHED PARTLY DISMANTLED AND FILLED WITH NITROGEN.

To ensure that a Transformer will function satisfactorily it is important that handling, lifting, storing and assembling are carried out with great care and cleanliness by experienced personnel who know the various working operations very well.

This section gives instructions how handling, lifting, storing and assembling should be carried out. For large Transformers it is recommended that the work is done by BHEL or is under supervision by experts from BHEL.

2.1.1 INSPECTION

In connection with receiving and unloading at site, and at the final storing place before assembling, the transformers shall be inspected carefully. External visible damages as dents, paint damages etc. may imply that the transformer has been subjected to careless handling during transport and/or re-loadings, and a careful investigation is therefore justified.

After the arrival of the material at receiving points, the customer should, in case of possible damage/loss of any component, make the necessary claims with the contractors representatives under intimation to BHEL so that such claims can be registered with the transport agents. Before unloading, the condition of packing and of the visible parts should be checked and possible traces of leaks verified (condenser bushings). If necessary, appropriate statements and claims should be made.

Drums containing oil which have been dispatched separately should be examined carefully for leaks or any sign of tampering. All drums are dispatched filled up to their capacity and any shortage should be reported.

In order to protect the active part against moisture, the transformer tank is filled with nitrogen during transport at an over pressure of 0.17 kg/ sq.cm (2.5 psi) approximately at room temperature.

Check immediately the gas pressure at the arrival. A positive pressure indicates that the tank and the transformer components respectively are tight, and that the active part including the insulation materials is dry.

If there is no positive gas-pressure, transformer should be immediately filled with dry Nitrogen gas at a pressure of 0.17 kg/cm^2 (2.5 psi) without loss of time as per instructions given para 1.2.3

Otherwise, it should be checked if the core isolation is satisfactory and that accessories packed separately have not been damaged during the transport. Instructions for checking of the core isolation are given in clause 2.10

2.1.2 UNLOADING

Typical unloading arrangement of the transformer is shown in fig 2.1.

Whenever rollers/trolleys are supplied with transformer, movement of transformer at site is carried out by mounting these rollers/trolleys. For mounting of rollers refer roller mounting drawing included in Vol.I.

Alternatively for movement of transformer from loading bay to actual site of the equipment, skidding on greased rails etc. can also be resorted to.

2.1.3 STORING

Dismantled equipment and components are packed to be protected against normal handling and transport stresses. The instructions for lifting given on the packages, must be complied with to avoid damages. Goods stored outdoors must not be placed directly on the ground, and should be covered carefully with tarpaulin or similar material. Oil drums should be stored in horizontal (lying) position with both the bungs also in horizontal position.

2.1.4 LIFTING

Lifting devices on the transformer tank are dimensioned for lifting of the complete transformer filled with oil. The positioning of the lifting devices, permissible lifting angles, minimum height to crane hook and transformer weight, appear from the OGA drawings. Check at lifting of complete transformer that the lifting wires/ropes are not in contact with bushing or other components on the cover. For lifting with hydraulic jacks, the transformer is provided with jacking pads dimensioned for lifting of complete transformer filled with oil. The positions of the pads appear on the OGA drawings. If active part is to be lifted refer instructions given in clause 2.7.

2.1.5 LOCATION AND SITE PREPARATION

a) Reactor shall always be placed on concrete plinth without rollers as per foundation plan drawing whereas transformer may be even placed with rollers. Therefore it is very important to refer foundation drawing before placing the transformer/reactor on final location.

b) Transformer/reactor should be placed on the foundation so that easy access is available all around and diagram plates, thermometers, valves, oil gauges, etc. can be easily reached or read. Adequate electrical clearances are also to be provided from various live points of the transformer to earthed parts.

c) ONAN type transformers/reactors depend entirely upon the surrounding air for carrying away the heat generated due to losses. For indoor installation, therefore, the room must be well ventilated so that the heated air can escape readily and be replaced by cool air . Air inlets and outlets should be of sufficient size and number to pass adequate air to cool the transformer. The inlets should be as near the floor as possible and outlets as high as the building will allow. Where necessary, exhaust fans can be installed for the purpose.

d) The transformers should always be separated from one another and from all walls and partitions to permit free circulation of air. In this connection reference is also drawn to IS: 10028 (Part II).

e) Where rollers are not fitted, level concrete plinth with bearing plates of sufficient size and strength can be adopted for outdoor transformers. To prevent the formation of rust, it is essential to avoid presence of air and water in the space between the plinth and the base of the transformer by use of cretex or similar bituminous compound.

f) Where rollers are fitted, suitable rails or tracks should be used and the wheels locked to prevent accidental movement of the transformer. Where walls are provided, it should be ensured that the transformer gets a good ventilation as mentioned above for indoor transformers. Provision should be made for the emergency drainage of the oil from the transformers (e.g. in case of fire in neighboring apparatus or bushing or the transformer tank), by surrounding the transformer plinth with sump filled with small pebbles.

2.1.6 INTERNAL INSPECTION AND CHECK POINTS FOR ASSEMBLING THE TRANSFORMER/REACTOR

(a) Check-points before starting assembly:

1. Conditions of leads.
2. Bracing, clamping of leads.
3. Connections.
4. Tap changer checks.
5. General conditions of insulation.
6. Core check that it has not moved in transit.
7. Core-ground; this is checked with the megger after removing earth connection.
8. CTs, including the secondary leads and their passage through metal parts.
9. Check that shipping frame for bushings have been removed.
10. Check that coil position has not moved in transit.
11. Check for dirt, metal swarf, moisture.
12. Check that the bushing leads set without being too close to ground or other points of different potential.

(b) Check-points during Assembly

By means of the Part list and the transformer/reactor OGA, the assembling of a fully completed transformer is carried out according to the following instructions. The following precautions are to be taken:

1. Fire-fighting equipment shall be available at the oil-treatment equipment as well as at work on and adjacent to the transformer.
2. Welding work on or adjacent to the transformer shall be avoided, but if this is not possible, the work shall be supervised by fire-protection personnel.
3. Smoking on or near the transformer shall not be allowed.
4. Transformer tank, control cabinet etc. as well as assembling and oil treatment equipment shall be connected with the permanent earthing system of the station.
5. Check that there is no overpressure in the transformer when blanking plates or connection lids are to be opened.
6. All loose objects, tools, screws, nuts etc., shall be removed from the transformer cover before opening the connection and blanking lids.
7. All loose objects (tools, pencils, spectacles etc.,) shall be removed from the boiler-suit pockets etc. before starting the work through man holes.
8. Tools to be used inside the transformer/reactor -e.g. for tightening of screw-joints- shall be fastened to the wrist or another fixed point by means of cotton tape or string.
9. Tools with loose sleeves and tools with catches must not be used at work inside the transformer.
10. Greatest possible cleanliness shall be observed at work inside the transformer/reactor, and at handling of parts to be mounted inside the transformer.
11. Fibrous cleaning material should not be used as it can deteriorate oil when mixed with it.
12. All components dispatched separately should be cleaned inside and outside before being fitted.
13. A transformer/reactor is best protected from damp hazard by circulating warm, dry, de-aerated oil through it until it temperature is 5 °C to 100 °C above ambient. This should be done before allowing external excess to the interior of the tank. The warm oil should be circulated all the time transformer is open to atmosphere,
14. Oil pump & all joints in the oil pipe work should be airtight to avoid entrance of air through leakage joints.

15. The active part (core and winding) should be exposed to the surrounding air as short time as possible. Open therefore only one blanking plate or connection lid at a time for remounting of bushings, valves etc.
16. Objects which-despite all precaution are dropped inside transformer/reactor, must absolutely be brought up from the equipment.
17. Check that the oxygen content inside the transformer tank is minimum 20% if a person is to enter the tank.

2.1.7 ASSEMBLY OF WHEELS

Mounting of wheels under reactor/transformer is to be done as per roller arrangement drawing. The reactor however in service, is to be placed on plinth with anti-earthquake fastening without rollers. Transformer placement can be with or without rollers as per applicable OGA/foundation drawing.

2.1.8 ASSEMBLY OF BUSHINGS

In case the bushings are mounted on turrets on the transformer/reactor cover, they are either delivered mounted on their turret or -in case of large bushings dismantled from the turrets. The turrets are often individually adapted; check therefore that they are re-mounted in correct places, which appear from the OGA drawing and ,part list.

Assembling of bushings is carried out according to bushings installation manual available. In case of draw rod / lead connection of bushing with transformer lead, half connector joint to be insulated with 3 layers of crepe paper after making proper connection.

2.1.9 ASSEMBLY OF VALVES

Valves which may affect the loading gauge, or will be subjected to damages, should be dismounted before delivery. Re-mount the valves as per the positioning appear from the OGA drawing and part list. The gasketting surfaces shall be cleaned well and new gaskets fitted. Check that all valves are closed.

2.1.10 ASSEMBLY OF COOLING DEVICES

Valves which are not dismantled like shut-off valves for radiators, coolers and possible headers shall be provided with blanking plates during the transport. Remove the blanking plates when the assembling of the coolers is to be started. Check first that the valves are closed. Check that each radiator and possible header is assembled in the correct positions according to OGA drawing. In case of OFAF or OFWF cooler mounting shall be done as per the relevant leaflet given in Vol.I

The shut-off valves against the transformer tank shall be closed until the oil-filling is started.

2.1.11 ASSEMBLY OF OIL CONSERVATOR

The conservator, which may be with or without aircell is assembled either on the transformer, or on a separate frame. Before the conservator is assembled it shall be checked that belonging equipment -e.g. Oil-level indicator -functions satisfactorily.

The breather is connected to the oil conservator, and it is very important that joints and couplings in the pipe between breather and conservator are air tight. Refer Clause 2.6 for detailed instruction for oil filling.

2.1.12 ASSEMBLY OF PIPE WORK

Pipes with flanges for connection of conservator, radiators, as well as pipes for equalizing of turrets etc. are mostly delivered completely ready for assembling according to OGA & part list. In certain cases -e.g. at a separately assembled oil conservator –certain fitting and welding of pipes and flanges on site is however required. Instruction for such assembly of external pipes is given in Clause 2.3. Before assembly, all associated pipework for cooler system/radiators to be physically inspected for the presence of any dirt/dust etc. and all visible dirt/dust to be thoroughly cleaned with clean cloth. Individual radiator/cooler and pipework to be flushed with compressed air followed by carrying out Pressure test on individual radiator/cooler Bank to check any leakages/damages before start of Erection at site

2.1.13 FLANGES, BLANKING PLATES

When re-mounting blanking plates, connection flanges etc., the gasketting surface shall be cleaned well and new gaskets fitted.

2.1.14 ACCESSORIES

Accessories like cooling fans, pumps, OLTC and components for supervision and control, oil-level indicator, flow indicators, gauges, Buchholz relay, PRV, thermometers etc. are assembled according to leaflet/description valid for the components (refer Vol. I).

2.1.15 CONTROL CABLING

Re-assemble the control cables according to the drawing of wiring system and connect the cable ends to terminal blocks in instruments, terminal boxes, junction boxes and control cabinets according to valid connection diagram.

2.1.16 GASKETS

The sealing system normally used against oil and gas in BHEL's transformers and belonging components has rubber gaskets in grooves and nitrile rubber bonded cork gaskets at other places. Refer clause 2.8 for general information and assembly instructions for gasket mounting.

2.1.17 OIL FILLING

The completely mounted Transformer is oil-filled according to directions in Clause 2.5 & 2.6. The oil shall be treated according to Clause 2.4. The lower and upper shut-off valves for radiators/coolers and possible headers shall be open during evacuation and oil-filling. If coolers are placed on suspension beams, which are mounted at right angle to the tank, the suspension beams shall be supported against the ground during the evacuation. Also radiators mounted on the tank wall shall be supported in a similar way. The hose for filling of oil is connected to the bottom valve of the transformer which must not be opened until the hose has been de-aerated and completely filled with oil.

2.1.18 CLEANING & PAINTING

The transformer and its equipment are cleaned carefully from dirt, oil, lubricating grease, and damaged surfaces are touch-up painted with the primer paints and finish paints delivered as per clause 2.11.

2.1.19 EXCHANGE OF BUSHING

When it is required at site to replace the Bushing (HV/ IV/ LV/ Neutral) due to reasons associated with the deviation in test results from the standard acceptable values or any other reason, following process to be adopted –

Close the Gate valve and Butterfly valve provided in the pipeline (80 NB) between Transformer / Reactor Main Tank and Conservator .

Drain out the oil from Transformer Main tank into the storage Tank up to the level of stress shield.

Fill the Transformer Tank with Dry Nitrogen, UHP grade of Dew point less than -50 or better, if the replacement is not planned to be carried out immediately after draining out of oil from Main Tank up to the required level.

While carrying out the replacement, release the filled in Dry Nitrogen inside the Main Tank (as mentioned in step 3 of replacement procedure). During replacement of Bushing keep the Transformer tank pressurized from continuous flow of Dry air of UHP grade of Dew point less than -50 or better in order to avoid the ingress of moisture.

Before replacement of the Bushing, carry out IR, Tan Delta and capacitance measurement test on the new Bushing's to be replaced. Replacement of the bushing shall be carried out after clearance of pre-erection test results from concerned Division.

Carry out the replacement of bushing as per BHEL standard procedure, in case of replacement of 400 KV HV bushing having half connector joint between bushing and winding lead at Turret level care shall be taken that hardware used should be of appropriate length and after connection the bolt used in connection shall not be protruded from profile of half connector.

During replacement the half connector joint between Bushing and winding lead shall be wrapped by three layer of Crepe paper with half overlap.

Carry out the profile inspection of winding lead entering inside the bottom of stress shield of Bushing replaced. Also take the photographs of winding lead profile after replacement for record purpose. In case of any doubt during bushing replacement contact concerned Service division.

All Nitrile rubber cord of the inspection cover opened during the bushing replacement needs to be replaced by new Nitrile rubber cord.

After replacement of bushing, apply vacuum in the Main Tank and start filling the filtered oil (as per BHEL standard) in the main Tank under vacuum .

Equalize the Main Tank and Conservator after opening the valves in the pipeline between Main tank and Conservator of Transformer (as mentioned in step 1 of the process).

Carry out the de aeration from Turrets, Bushing and Main Tank, cooler bank and if required carry out conservator commissioning as per site requirement.

After replacement carry out the Tan Delta and Capacitance measurement of the bushing replaced and provide the test results to BHEL.

2.2 STORING OF TRANSFORMER/REACTOR DESPATCHED FILLED WITH NITROGEN

2.2.1 STORING BEFORE COMPLETE ASSEMBLING

The storing place should be easily accessible for inspection and maintenance of the transformer. The bedding for the equipment should be larger than its bottom surface and dimensioned for the load. The transformer is placed on boardings or beams so that good ventilation is obtained underneath the transformer bottom.

Before storing, the transformer is inspected according to directions in Clause 2.1 "Reception and assembling of transformer/reactors dispatched partly dismantled and filled with nitrogen".

A transformer without remarks may be stored up to 6 months after arrival at the site without oil-filling. During the storing time, the inert gas (nitrogen) filling shall be maintained and pressure regulated, so that exposure of active part to atmosphere is avoided. If the storage time is judged to exceed 6 months, the transformer should be provided with oil conservator including oil-level indicator and breather, and oil-filled according to Clause 2.5. "Oil filling under vacuum". Certain valves must be re-mounted to enable the oil-filling being carried out. Furthermore, at the time at oil-filling of a completely assembled transformer, certain rules in Clause 2.5 & 2.6 must be complied with absolutely.

The oil quality should also be periodically monitored. If for some reason, oil filling cannot be carried out after a storage period longer than 6 months, the nitrogen pressure shall be maintained and supervised carefully. If the storage time without oil exceeds 18 months BHEL should be consulted about measures to be taken.

Wherever it is desired to keep the transformer energized at a low voltage so that its temperature is higher than the ambient temperature, the low voltage may be applied to LV winding with other winding in open circuit or short circuit conditions depending upon the current to be fed. However, before energizing the transformer, protection system of transformer (including electrical protection) must be checked. It may also be ascertained whether partial cooling is required in this case.

2.2.2 STORING OF COMPONENTS AND ACCESSORIES BEFORE COMPLETE ASSEMBLING

Independent of the duration of the storing time, the directions below apply for dismounted components and accessories, as well as for material to be used in connection with the assembling work.

(a) Storing indoors

In such a room, the following articles should be stored:

1. Insulation material as paper, pressboard, Bakelite, wood, cotton tape etc.
2. Insulated details as paper-insulated conductors, pressboard insulated shielding bodies etc.
3. Chemicals as solvents, glues, varnishes, hardeners etc.
4. Breathers, drying agents.
5. Terminal boxes, connection boxes, control cabinets.
6. Gas relays, oil-level indicators, thermometers, pressure valves etc.
7. M Box, OLTC motor drive, Fans, Pumps, Instruments & fittings. (Heating elements provided shall be connected to supply)
8. Online DGA, Online moisture removal system, sudden pressure relay, Conservator isolation valve

(b) Storing outdoors

The below components may be stored outdoors. They should be placed above ground and covered with tarpaulin etc.

1. Oil-conservator with blanking plates for all openings.
2. Radiators and coolers with blanking plates for all openings.
3. Structures, A frames, Pipe supports, Supports for oil-conservators, radiators, control cabinets etc.

2.2.3 SUPERVISION

During the storing time, the storing place, transformer/reactor components and accessories are inspected regularly. Tap changer if provided should be operated at 6 monthly intervals. Two or three runs from one end of the range to the other and back are sufficient. Observations, readings, measures and dates should be noted and BHEL should be contacted for directions about possible measures. Check at even intervals -and further more at weather changes as rain, storm, frost or thawing the foundation material (boardings, beams etc.) and the condition of the ground.

Inspect the transformer/reactor periodically with regard to possible external faults and/or rust-damage.

Check also that screws and nuts in sealing joints (covers, lids etc.) are tightened. Check every second week that the connected-in heating elements in control cabinets function.

If the Transformer is inert gas filled, one shall check every second week the overpressure or inert gas consumption.

2.3.7 RADIATORS/COOLERS

The positioning of the radiators/coolers is indicated on OGA drawing. These are positioned so that the highest point of the oil-pipe system is always positioned below the bottom level of the conservator.

The pipe system is provided with filter valves at the start and finish to enable pumping the oil through the system.

All places where air may be collected are provided with air release plugs/ valves.

2.3.8 RADIATORS/COOLERS PIPES

The pipe having dimensions as per OGA drawing and may be provided with weld-flanges, expansion joints. No pipe part is allowed to be so long that internal inspection and cleaning will be difficult.

The pipes shall be placed so that air release plugs will be positioned at the highest point of the pipe part. The pipes shall be painted internally with a yellow, oil-resistant paint and externally according to the paint as per specification.

2.3.9 SHORTING LINKS / EARTHING STRIPS

All shorting links on tanks, turrets and fittings to be provided as per OGA

Note – 2: The documents, relevant to Oil, are prepared based on the IEC standard applicable as on October-2016. If user wants to refer the latest standard applicable, the confirmation shall be obtained from manufacturer.

Note - 3: For Mixing of oil, please refer IEC: 60296. Please ask the OEM, before mixing the oil.

2.4.3 HANDLING

Transformer oil should be carefully handled at site to ensure satisfactory service. Drums used for transport and storage should be kept under cover. In practice owing to contamination in the containers, difficulty may be experienced in maintaining the purity of the oil when it is transferred from one vessel to another, and once a vessel or drum has been filled with moist oil it is extremely difficult to clean. Drums should be clearly marked to indicate whether they are for clean or for dirty oil and should be reserved for the type indicated.

Oil drums should be stored at site preferably on pallets or Bricks layer, in horizontal position, with both the bung closures horizontally opposite (in 3 & 9 o'clock position) so that ingress of moisture is prevented. It is always recognized that storage of oil in drums is not always satisfactory, particularly when oil is stored in drums which have been bent or otherwise damaged in transit or storage, and the transfer of oil from such containers to electrical equipment should normally be through a suitable treatment plant.

In substations with fixed oil handling equipment like oil storage tank, the pipe work from the clean oil tank to the electrical apparatus should be kept clean and free from moisture. Where portable oil handling equipment is used, flexible pipe work and hand pump should be carefully inspected to ensure that they are free from dirt and water and should be flushed with clean oil before use. If the clean oil is being used from drums, it should have been recently tested and filling orifices of the drums should be clean. Hoses used for clean oil and dirty oil should be clearly marked and provided with plugs for sealing the ends when not in use.

Special care must be taken for oil filtration machine, which is used during treatment of oil. It is to be ensured that there is on residual quantity of oil left in oil filtration machine. The paper filters or centrifuges used with filtration machine shall be cleaned or replaced periodically as per supplier's recommendation. The pipe/hoses used with filtration machine should be properly blanked after use.

Before using oil tankers and filtration plant for handling of oil, the internals/chambers need to be thoroughly cleaned using good transformer oil so that the residual of earlier used chemical/oil is removed totally.

2.4.4 RECONDITIONING

Transformer oil is usually contaminated during handling, transport and storage due to ingress of moisture and solid impurities. Hence, oil shall be vacuum filtered separately at 50^0C to 60^0C using a suitable filtration machine and a spare clean tank before filling in the transformer. Details of filtration are given in Clause 11 of IEC: 60422-2013. Oil treatment shall be terminated when the following parameters are attained.

Table 2.1

Sl. no.	KV Class of the transformer	Recommended Permissible limit	
		Electrical strength (BDV) in kV (min)	Moisture content ppm (Max)
1	Upto 170 kV	65	15
2	245	70	10
3	420 to 765 kV	70	05

Storage Tank oil shall be tested for Electrical strength (BDV)/ Moisture content and Tan delta from NABL accredited lab / CPRI / ERDA/NETRA . Test Results carried out on Units mounted on filtration Machine will not be acceptable. Storage tank shall be as per typical arrangement shown in Fig 2.2 Electric strength and moisture content shall be determined following the test procedure of IEC: 60296-2012.Final oil test also needs to be carried out through NABL accredited lab / CPRI / ERDA

2.4.5 Evaluation of mineral insulating oil in new equipment

After reconditioning, Insulating Oil is filled into Transformer/ Reactor. As the oil comes into contact with insulating and other materials, it can no longer be considered as “unused oil” as defined in IEC 60296-2012. Therefore its properties are regarded as those applicable to oil in service, even though the electrical equipment itself may not have been energized. Oil properties should be appropriate to the category and functions of the equipment (see Annexure- 4.3).

The extent of the changes in properties may vary with the type of equipment due to the different types of material and ratios of liquid-to-solid insulation, and should be within the limits of Annexure- 4.3. Properties not included in Annexure- 4.3 (with the exception of oxidation stability for which no in-service limits have been established) should be within the limits of IEC 60296-2012.

2.5 OIL FILLING UNDER VACUUM

2.5.1 APPLICATION

Transformers and Reactors with vacuum-proof tanks shall be filled with oil according to this method.

2.5.2 STORING TIME

Generally it applies that Transformers and reactors which during transport are filled with dry nitrogen on arrival at the site shall be evacuated and oil filled. Before storing, the equipment shall be inspected according to the directions given in Clause 2.1 "Reception and assembling of transformer/reactor dispatched partly dissembled and filled with nitrogen". During the storing time, overpressure shall be maintained, and nitrogen consumption checked according Clause 2.2.

2.5.3 FLOW CHART FOR HANDLING

In Annexure 2.1 is given a flow chart of handling procedures. The pressure should be measured at different times. The pressure is OK if it is maintained according to instructions given in Clause 2.2. Reference is also drawn to para 9.0 of IS: 1866 regarding handling and filling of oil.

2.5.4 UNITS

Annexure 2.1 gives the relation between different units.

2.5.5 PROCEDURE OF DRY OUT BY N2 / ASSOCIATED HEATING METHOD

For effective and faster removal of moisture from Transformer / Reactor, method of dry out by vacuuming followed by N2 filling and if required heating is to be adopted. The detail procedure are as under

2.5.5.1 FIRST CYCLE

(i) Blank all the openings on the Transformer / Reactor Main Tank. Transformer / Reactor Main Tank is than subjected to vacuum up to 1.00 torr (1 mm of Hg) to be pulled and maintained for 72 hrs duration. During this first dry out cycle leakages if any observed in the system to be attended and rectified in this cycle.

(ii) After vacuum cycle Dry Nitrogen of dew point more than -60°C or of UHP grade (purity 99.9999%) to be pushed in Main Tank under vacuum till Min. pressure of 2.0 psi is achieved in Transformer Main tank. The Transformer Tank is to be kept pressurized for a duration of 24 hrs.

(iii) At the end of Nitrogen pressure cycle of 24 hrs, measure dew point values and recorded as dry out values of first dry out cycle. Moistened N2 inside transformer tank will be removed during second dry out vacuuming cycle.

2.5.5.2 SECOND CYCLE

(i) Again start vacuuming of Transformer Main Tank up to 1.00 torr (1 mm of Hg) and vacuum is to be maintained for 48 hrs in second dry out cycle.

(ii) Dry Nitrogen of dew point more than -60°C dew point or nitrogen of UHP grade (purity 99.9999%) is again pushed inside Main Tank under vacuum till pressure of Min. 2.0 psi is achieved in Transformer Main Tank. The Transformer Tank is to be kept pressurized for a duration of 24 hrs.

(iii) Measure dew point after 24 hrs in second N2 cycle and record these dew point values as dew point values of second dry out cycle and refer these values with BHEL standard norms or contact concerned Services Deptt..

(iv) If the dew point values of second cycle is in line with the BHEL Standard norms, Transformer is cleared for further vacuuming followed by filling of filtered oil under vacuum and carrying out Hot Oil Circulation process.

(v) In case desired value of dew point is not achieved than Transformer tank is to be again subjected for vacuum pulling for 24 hrs, followed by N2 filling for duration of 24 hrs. After each dry out cycle measure the Dew point values and compare with BHEL standard norms.

As per BHEL standard norm's minimum 2 Dry out cycle of Transformer has to be carried out before filling of filtered oil under vacuum in Transformer Main Tank.

Note: If the dew point values were not achieved as per BHEL standard norms in 2 dry out cycle and higher content of moisture was noticed as per Dry out process carried out in 2 cycle, than further Dry out process shall be carried out in consultation with BHEL Transformer Services Deptt.

However for improving Dry out values it is suggested that Nitrogen Dry out cycle associated with heating cycle shall be carried out. In this process after vacuuming cycle pressurized Dry Nitrogen in Main Transformer Tank shall be heated externally to raise the temperature of Transformer upto 55-65°C during 24 hours duration followed by measurement of Dew point after completion of heated Nitrogen Dry out process. These Dew point values shall be compared with BHEL standard norms and the process of vacuum followed by insertion of Dry Nitrogen and heating is to be repeated till the dew point values were not achieved as per BHEL standards.

The equipment required for vacuum treatment and oil-filling under vacuum should generally be as per Annexure 2.2. The transformer tank and electrical terminals shall be earthed for safety reasons.

No electrical test on the Transformer is permitted during the evacuation.

Fig. 2.3 shows a typical example of pipe work and valve positioning.

2.5.6 OIL FILLING

2.5.6.1 OIL QUALITY

The transformer/reactor shall be filled under vacuum with oil which has been purified and degassed according to Clause 2.4

2.5.6.2 OIL FILLING IN MAIN TANK

For main tank, the oil shall be heated to a temperature of 50°- 60°C measured at the filter outlet valve. The pressure during the filling shall be max. 1 torr. During the oil-filling, a transparent plastic tube (5) can be used as an oil-level gauge. The tube which

should be a wall thickness of 5-8 mm, may be connected to a top and a bottom valve on the transformer.

Oil-filling of the tank is done through valve (12) at a low level on the transformer and at a maximum rate of 4-5 kL/hour. The pressure in the oil pipes shall be kept positive and shall be checked by a manometer 13 (if provided).Oil filling to be done as per cl. 2.6.9.

For oil filling in diverter switch assembly of an OLTC refer leaflet (Vol.1).

Separate vacuum-proof cooler system/radiators can be evacuated for about 1-2 hours and filled separately with purified and degassed oil. The oil is then circulated through the vacuum filter at least twice via drain valves as near as possible to the transformer. Oil circulation is considered completed until the oil parameters as per table 2.3 is achieved. Care should be taken to keep all air release plugs and valves open to allow escape of trapped air during oil filling operation. These valves/plugs should be closed after completion of oil filling.

2.5.7 HOT OIL CIRCULATION/ DRYING OUT, OIL RINSING, PARTICLE REDUCTION AND PARTCLE COUNTING

To facilitate oil-penetration and absorption of possible gas bubbles, the temperature of transformer shall-after completed oil-filling-be increased by circulating the oil through the vacuum filter and with circulation direction according to Fig. 2.4.

The oil will be circulated through a high vacuum filter machine at 57 °C to 60 °C of transformer oil temperature for minimum 3 days. The start time for hot oil circulation is considered after achieving the stabilized temperature of oil i.e. Inlet and out let oil temp difference should not be more than 3 degree and the Oil temperature to be achieved in the process is between 57- 60 degree centigrade and record the IR value at an interval of 4 hrs after achieving the stabilized oil temperature values. Also record the IR value along with temperature, vacuum of M/c & IR value till oil parameter achieved as per table 2.3. Polarisation Index should be preferably more than 1.75. Other than this limit please refer the case to BHEL Bhopal.

TABLE 2.3

kV Class of Transformer	Recommended Permissible Limits			
	Electric Strength (BDV) in kV (min)	Moisture Content ppm (Max)	Resistivity * at 90°C (Ohm-cm)	Tan delta* at 90°C
Upto 170	60	15	$1x10^{12}$	0.005
245	70	10	$1x10^{12}$	0.005
420 & above	70	5	$1x10^{12}$	0.005

* Subject to availability of testing facility at site.

Method of test for Electric Strength and moisture content shall be as per IS: 335. / IEC-60296

CAUTION:

The temperature during oil circulation should not increase beyond 70°C otherwise this may cause oxidation of oil.

For transformer & reactor of 400 kV class or above, after completion of the hot oil circulation in main tank and cooler/radiator system separately, the valves between main tank and cooler/radiator system to be opened to allow the mixing of oil. The oil rinsing shall be carried out by connecting transformer/reactor to the oil rinsing plant connected with particle counter. Initially the oil inlet is connected to the lower portion of the tank and the outlet to the upper portion and start rinsing plant for circulation and creating turbulence of oil for approx. 1 hour. Thereafter the connection to be reversed (Oil inlet to the top of tank and oil outlet to the bottom of tank) and start rinsing plant. This process to be continued till the 3 consecutive readings at the interval of 1 hour of particle content of the insulation oil is achieved as per below:

If measured with particle counter which works on ISO 4402 and ISO 4406:1987	≥ 2 microns cumulative particle count should be <10000 particle/litre
If measured with particle counter which works on ISO 11171 and ISO 4406:1999	≥ 4 microns cumulative particle count should be <15000 particle/litre

Relevant ISO count for 4 Micron particle is in the range of 10.

2.5.7.1 SAMPLING

Oil sampling at various stages shall be done in accordance with IS: 6855 / IEC-60475. When samples are taken from transformer tank, oil will be drawn from Top & bottom of the tank. When it is desired to know gas content and composition of dissolved gases in transformer oil before commissioning for reference purposes (required for interpretation of Dissolved Gas Analysis results during service), sampling shall be done as per IS 9434 / IEC: 60567.

2.5.8 STANDING TIME

Standing time is the time between 'finished oil circulation' and 'energization'. The time appears from table 2.2.

2.5.9 FINAL OIL FILLING OF TRANSFORMERS/REACTORS DESPATCHED OIL FILLED.

Smaller transformers/reactors are often factory-filled with degassed oil up to about 10% below the cover and transported in this condition. The final filling up to the correct level in the conservator is made at site.

2.5.9.1 TRANSFORMERS / REACTORS WITH SYSTEM VOLTAGE < 36 KV

Previously degassed oil (e.g., at the factory) stored in tight drums may be used for the filling. Check the dielectric strength of the oil which should be as per Clause 2.4.4. If accepted, the oil is pumped into the conservator and in this way fed into the transformer / reactor. To prevent any free water in the drums from entering the

transformer / reactor the opening of the suction tube must lie 0.1 m above the lowest point in the drum. A suitable valve on the cover and/or valves or upper tightening nuts at the bushings have to be opened for complete removal of air below the cover and in the bushings. When the oil is seeping out at these points, shut the valves and tighten the nuts at the bushings.

2.5.9.2 TRANSFORMERS/REACTORS WITH SYSTEM VOLTAGE > 36 KV

The filling is performed as described above, but at least a paper filter must be used for drying the oil.

2.6 OIL FILLING INSTRUCTIONS FOR CONSERVATORS WITH AIR CELL

2.6.1 INTRODUCTION

In all transformers specially in high voltage class, maintenance of insulating oil notably its dielectric property forms one of the determining factors of reliability of equipment in service. Oxidation and contamination of transformers/reactor oil can be avoided in a simple and effective way by use of above oil preservation system. The complete system is known as "Conservator with Air Cell". In this oil preservation system a flexible air cell made of oil resistant

Nitrile rubber is placed inside the conservator and floats on the oil surface. The air cell inflates or deflates as the oil level in the conservator falls or rises depending on the ambient temperature and load on the reactor. The inside of the rubber bag (Air Cell) is put into communication with atmosphere by means of a silica gel breather which ensures dry atmosphere inside the air cell. In addition to the above this system provides following advantages.

i. It avoids saturation of absorbed gases.

ii. As no gas is used in this system, which operates at constant pressure, this formation of gas bubbles at low ambient temperature and load is eliminated. The system thus preserves the oil quality particularly its dielectric properties.

The conservator with air cell is provided with a magnetic oil gauge having one electrical contact. The indication shown on the dial physically corresponds to the oil level in the conservator which is due to balance of static pressure between the oil of the conservator and the atmospheric air inside the air cell. This system is also provided sometimes with a set of pressure and vacuum valves. These valves operate to pass either oil or air in the event of over filling or under filling the conservator during installation.

When oil is to be filled by taking vacuum through conservator refer section 2.6.9 whereas when conservator is to be isolated during oil filling in transformer refers section 2.6.2. For deciding the applicability of either process consult OGA drawing / BHEL representative

2.6.2 DESCRIPTION OF OPERATION

Figure 2.5 indicates the general arrangement of oil preservation system. The oil connection between conservator and transformer tank is made through Buchholz relay and valves are provided in between.

The flexible air cell is connected to the top of the conservator through gasket joint. Under normal condition air cell is completely surrounded by oil and floats in the conservator. The air cell inflates/deflates as the oil volume changes. The float of the MOG which is always in contact with under side of the air cell moves up and down and indicates the oil level. The cell will sink in the remote event if it is damaged and MOG alarm will operate. The conservator then functions as a conventional conservator without affecting the performance of the transformers/reactor.

2.6.3 INSTALLATION

This system is shipped separately from main tank. The air cell is shipped fitted in the conservator. A low positive pressure of less than .07 kg/sq.cm (1 psi) is maintained to avoid excessive movement of air cell in the conservator during transit. MOG is also shipped fitted on the conservator. Install the conservator and associate parts except breather as per transformers/reactor outline drawings and assemble oil pipe work.

2.6.4 OIL FILLING

The following procedure is recommended.

i. Close and blank the valve (14) to isolate the conservator from main tank. Fill the oil in transformer under vacuum upto Buchholz level as per instructions given elsewhere. '

ii. After filling the oil in transformer and breaking the vacuum, oil can be filled in the conservator either through reactor or by drain valve (4).

iii. Remove the inspection cover (11) provided on the side of the conservator and check the air cell assuring that it is inflated. The air cell must remain in fully inflated condition during oil filling operation. If the air cell is found deflated fit the inspection cover and inflate the air cell with dry air/nitrogen gas to 0.035 kg/sq.cm max. through connection (8). A gauge may be put by removing plug (10). After filling close these connections.

iv. Remove air release plugs (5) (6) and (7) provided on top of the conservator.

v. Slowly pump the oil through the main reactor/drain valve (4). Temporarily stop filling operation when oil starts coming from opening (5) and (6) after ensuring that no air bubbles come out through these air release holes. Fit the two air release plugs.

vi. Continue oil filling till oil start coming from air release plug (7) stop oil after ensuring that no air bubbles come out. Fit the plug (7).

vii. Now release the air pressure held inside the air cell from point (8) and continue oil filling until magnetic oil gauge (3) indicates 35°C level.

viii. Remove oil pump and connect air cell to breather (9) from point (8). Also remove pressure gauge and put plug (10).

ix. The system is now properly filled. Air release plugs (5), (6) and (7) are fitted in normal operation.

2.6.5 PRECAUTIONS

i. Oil filling in the conservator and also draining whenever required must be done very slowly. During oil filling, pressure in the air cell should not exceed 0.1kg/sq.cm (1.5 psi).

ii. If a pressure or vacuum is ever applied to the main reactor tank the conservator must be disconnected and a blanking plate fitted on shut off valve.

iii. Do not weld on conservator to avoid damage to the air cell.

iv. Once all the air has been driven out during oil filling in the conservator do not remove air release plugs (5), (6) and (7). Otherwise air will be sucked inside the conservator.

2.6.6 MAINTENANCE

Little maintenance work will normally be required except routine visual inspection. However, it is desirable to check the breather opening to ensure it is not blocked. Further silica gel should be regenerated/replaced when its colour changes from blue to pink.

2.6.7 AIR CELL

Air cell is made from Nylon fabric coated with Nitrile rubber, In the event it becomes necessary to replace or test the air cell for leaks the following method is recommended.

i. De-energise the transformers/reactor.

ii. Isolate the conservator by closing the valves (14).

iii. Drain the oil from the conservator through the valve (4) by removing air release plugs (5) and (6).

iv. Remove inspection cover (11) if necessary, Install the pressure gauge on point (10).

v. Pressurize the air cell (2) by dry air/nitrogen to a max. pressure of 1.5 psi and seal. Check the pressure for 6 hours.

vi. If leaks are found, air cell to be repaired by patching or replaced by a new air cell.

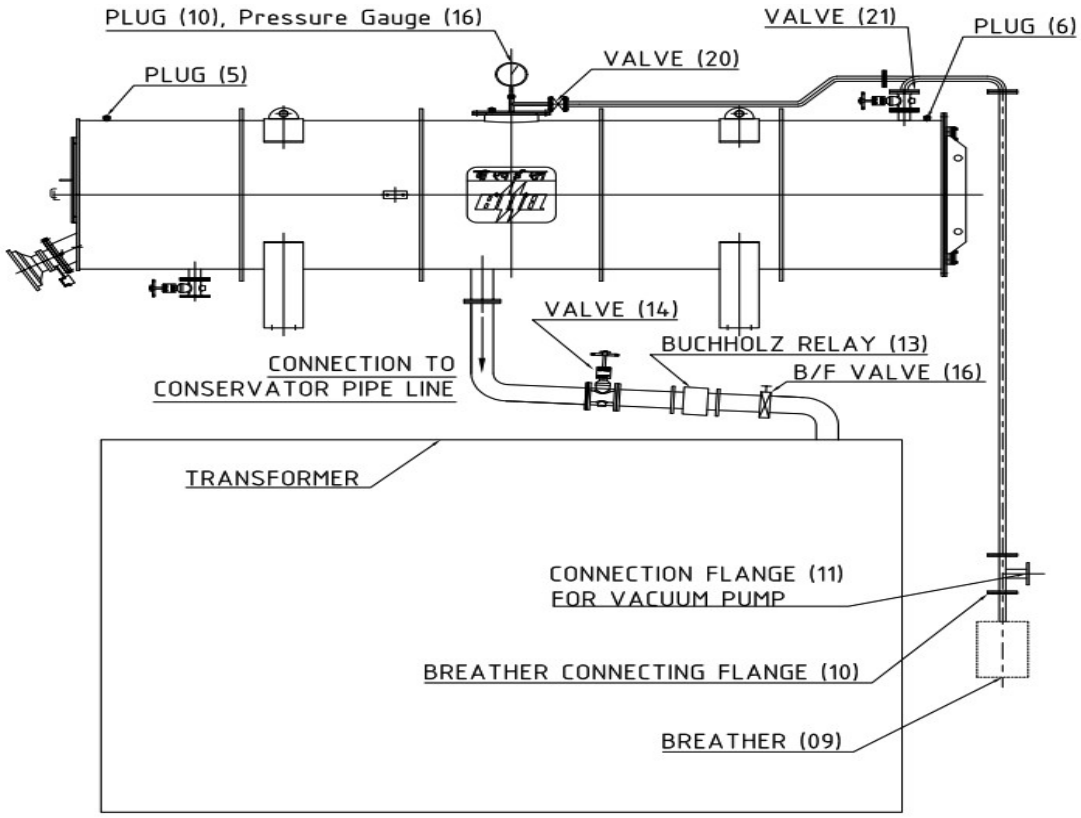
vii. For taking out the air cell from conservator, remove the air cell flange and loops from hooks provided on inside of the conservator top. Collapse the air cell slowly and fold, remove it from conservator very carefully.

viii. In the event air cell is not available immediately, conservator may be used as a conventional conservator.

2.6.8 OIL PRESSURE TEST

Oil pressure test on fully erected Transformer / Reactor to be conducted as per annexure 2.3 before hot oil circulation.

2.6.9 INSTRUCTION FOR EVACUATING OF THE TRANSFORMER / REACTOR VIA THE CONSERVATOR FOR FILLING OIL.



1. Release the overpressure in the Air cell by unscrewing the Plug (10). Open the plug (5) and (6) on the top of the conservator and blow dry compressed air for a short while, to relieve the air cell from the walls of the conservator. Wait for at least an hour to allow the Air cell to collapse completely. Tighten the plug (10) and close plug (5) and (6).
2. Remove the breather (09) and blank the flange (10).
3. Open the shut off valve (14) and (16) between conservator and transformer. Open the bypass pipe valve (20) between conservator and Air cell and valve (21). Connect the Vacuum pump to pipe flange (11) hanging down from conservator.
4. Filling of the oil through the tank can start when vacuum has reached below 1 torr. When the oil level reaches the Buchholz relay in the pipe between tank and conservator, the Shut off valve (14) located in same pipe to be closed.
5. End the vacuum and close the bypass pipe valve (20) between conservator and Air cell and open the plug 5 and 6 on top of conservator.

6. Open the Plug (10) provided on top of conservator.
7. Mount the pressure gauge (16) in position of plug (10) and close the valve (21).
8. Fill the Air in Air cell by opening valve (20) up to 1.5 PSI and close the Valve (20) when pressure reached.
9. Open the Shut off valve (14) between conservator and transformer and press up oil slowly.
10. Continue the Oil flow until oil flows from the plug (5) and (6).
11. Close the Shut off valve (14) and the plug (5) and (6), open the valve (20) and breather flange (9) to release air from Air cell.
12. When the pressure in the Air cell has decreased to atmospheric pressure, the pressure gauges (16) shows no detection open the Shut off valve (14) again and continue oil filling until the oil level specified has been reached and MOG shows 35 °C reading.
13. Connect the Breather (09) to flange (10) and blank flange (11) .

Note: The above Oil Filling under Vacuum to be followed for 765 kV & above transformers /reactors in case of specific requirement.

2.7 UNTANKING OF ACTIVE PART

2.7.1 GENERAL

If for some reason it becomes necessary to un-tank the active part (core and windings) of a large reactor/transformer, it ought to be done under supervision by BHEL erectors. Universal instruction for the un tanking procedure cannot be given, as the design practices of large equipment vary. The following general directions are, however, applicable in most cases.

The un tanking must be done indoors. If there is no suitable hall available, lifting can be done in the temporarily arranged room. e.g. a tent. The oil & the internal parts of the transformer must not in any case be exposed to rain or humidity.

In case of bell shaped transformer, only bell cover is lifted for access to active part.

2.7.2 OIL DRAINAGE

Drain off the oil from the transformers/reactor either partly or completely.

2.7.3 DISCONNECTING

Open all inspection covers for observation. Disconnect leads to bushings, current transformers, winding temperature devices, Oil temperature devices and earthing leads (common CC-CL-G) between active part and cover or tank side from earthing terminal board and any other connections like fiber optic probes from feed through plate welded on tank wall. Disconnections mentioned above can usually be made through hand holes in cover or tank side.

2.7.4 REMOVAL

Remove all large bushings, tank cover or top tank mounted conservator, lightning arrestors (if provided), thermo siphon (if provided), PRV pipe work, heavy gate valves (150 NB, 200 NB, 250 NB), neutral grounding arrangement : post insulator, copper strips & connectors (if provided). Break all connections between tank cover or top tank and tank-piping to oil conservator and cooler thermometers etc.

Remove the cover bolts. If the cover is welded to the tank flange, free the cover according to directions given in Clause 2.9.

2.7.4.1 COVER OR TOP TANK

Before lifting tank cover or top tank, refer the instructions given in outline general arrangement and on lifting bollard on tank wall. When lifting the cover or top tank use the cover-lifting eyes or lifting bollard which are designed for a minimum angle of 60 degrees between sling branches and the horizontal plane. The length of the sling should therefore be sufficient for at least this angle. Wall shunts with press board barriers (if provided) and tap changer should be properly mounted on tank wall and on tap changer mounting bracket welded on end frame or stool locked on bottom tank respectively. HV, IV, tapping & neutral leads should be properly clamped with supporting cleats provided with Terminal gear. to avoid damage.

Place the cover on suitable wooden supports and in such a way that thermometer pockets, small bushing etc. underneath the cover are not damaged.

No grinding or cleaning up of the tank flange is to be carried out before the active part is lifted out of the tank.

2.7.4.2 UNTANKING

Loosen locking devices, if any, between top core clamps and tank side.

Refer instructions given in outline general arrangement before lifting. Lift the active part by means of lifting eyes or lifting lugs provided on the top core clamps. To avoid damages on the active part it is important that it is centered carefully in the tank during lifting procedure.

After un-tanking, place the active part on a horizontal foundation.

2.7.5 RE-TANKING

Grinding or/and cleaning up of the tank flange has to be done before the active part is lowered into the tank. Check that the tank inside is free from contaminations.

Re-tanking is then done in the reverse order that is outlined above. Note that guiding pins or blocks are welded to the tank bottom to prevent the active part from moving in the tank. When lowering the active part, check that it fits exactly the guiding pins or blocks.

2.7.6 REASSEMBLING

Wipe the underside of the cover free from any dirt or foreign matter before lifting it into correct position above the reactor tank. Lower the cover the last few inches exactly into position without sliding on the gaskets.

Reassemble bolts nuts of supporting devices. Weld the cover when the welded construction is used. Reassemble Bushings, conservator etc., and reconnect pipings, leads to bushings, current transformers, etc. Reassemble inspection covers.

After the transformer is completely assembled, it may be necessary to dry it before oil fining- see clause 2.5.

2.8 MOUNTING OF GASKETS

2.8.1

The gaskets have a circular/flat cross-section and are made of oil and heat- resistant synthetic nitrile rubber/nitrile rubber bonded cork. For small gaskets, O-rings are used with diameter 3,5.0 or 8.0 mm, while round rubber cords with diameters 8,12 or 19 mm are used for large gaskets.

The groove is normally milled or turned, but for large flanges the groove is created by means of steel bars welded on top of the flange. The width of the groove is slightly smaller than the cross-section diameter of the gasket in order to keep the gasket in position during the assembling work.

Opened sealing joints may be sealed again using the new gasket. When handling and lifting flange, cover etc. with gasket grooves, care should be taken when using tools and lifting devices to avoid that the grooves getting damaged or deformed.

Before assembling of groove gaskets, it is checked that the grooves and contact-surface in the joint are free from foreign particles and that the paint is free from thick coatings, trickles and drops.

When assembling the rubber cord in the groove, the cord length shall be continuous. The gasket is given a small surplus length to compensate for shrinkage.

The gasket is pressed down into the groove without stretching or slackening.

To prevent the gasket from falling from the groove on vertical surfaces, the gasket may necessarily be spot-glued to the bottom of the groove.

The screws in the sealing joint shall be tightened so that an even pressure is obtained on the gasket. This is obtained preferably by means of a moment spanner. Rubber gaskets in grooves need not normally be re-tightened.

Above description is followed generally for turrets, inspection cover etc. For main tank rim joint, LV turrets of Generator Transformers where metallic stops are provided, nitrile rubber bonded cork is used, for which following instructions shall apply.

2.8.2

i. Gaskets when supplied loose, have no bolt holes in them. They are usually cut to the size and shape required, although they may be supplied as straight, angled pieces from which complete gaskets can be built up.

ii. Scarfed joints should be used. A 40 mm scarf in 5 mm thick material is recommended. Joints should be located away from corners and bolt holes, and should be well bonded, smooth and free from local thickening. Neoprene solution is used as an adhesive for joints.

iii. Gaskets are best stored in hermetically sealed containers in a cool place. They must be protected from damp, oil and grease-

iv. To make a gasket joint, first clean the metal surfaces by thinner to ensure that they are free from oil, rust, scale etc. Using one of the flanges as a template, punch the necessary bolt holes. Insert the bolts and tighten the bolts sequentially, a little every time so that uniform pressure is exerted on the gasket until the gasket is compressed to about 2/3 of its original thickness. Joints should not be subjected to pressure until tightening is complete. If care is taken in making joints, and in handling the gasket, it is possible to break and remake a joint several times, using the same gasket.

v. For making leak proof and good gasket joints, it is necessary that uniform pressure is achieved all over the gasket after matching rims/ flanges have been clamped with bolts/studs.

Following instructions be followed for proper tightening of bolts/studs.

a) Tighten lightly the bolts/studs diagonally in the sequence as shown in the fig. 2.6.

b) Tighten again bolts/studs in the same sequence with the torque given below :

Bolt Stud Size	Max Toque in Kg.m		
	IS 1367 Cl. 4.6	IS 1367 Cl. 8.8	IS 1367 Cl. 12.9
M 10	3	5	8
M 12	5	9	14
M 16	12	23	35
M 20	12	47	69
M 24	17	81	119
M 27	23	117	172
M 30	28	160	234

In case of metallic stoppers tighten until metal to metal contact is achieved.

c) Do not overtighten, otherwise gasket will get crushed.

2.9 WELDED COVER (IF APPLICABLE)

In order to obtain a good sealing between the transformer tank and the cover a welded joint is recommended. The welding is performed in a certain way to permit opening and new welding repeated a number of times. The chiselling up and re-welding will take about the same time as dismantling and reassembling of bolted cover.

If the welded cover for any reason has to be removed proceed as follows:

2.9.1 OPENING THE COVER

When opening the cover the welding joint should be removed by a suitable grinding wheel. The cover should be clamped to the frame by means of G-clamps to prevent iron chips from penetrating into the tank. Any parts of the weld which may possibly remain on the tank flange should be removed by a chisel to enable a good result of the re-welding.

2.9.2 RE-ASSEMBLY

When fitting the cover again cork-rubber gaskets, 25 x 5 or as specified are fitted on the tank flange, see fig. 2.7.

The gaskets are kept in the correct position with glue base on rubber base. The cover should be clamped to the tank flange by means of G-clamps evenly distributed along the flange with about 600 mm spacing. Tack welding is carried out with about 100 mm spacing. An extra G-clamp is used during the tack welding and is moved along the flange during the progress of the work. The continuous weld is then applied. Finally the weld should be cleaned and painted.

WARNING

When welding, a fire-extinguishing equipment should be available, and the work supervised by fire-protection personnel.

2.10 EARTHING OF ACTIVE PART AND CORE INSULATION TEST

2.10.1 REACTORS

The ground-connection terminals for the reactor active part are located in a box at the tank end, close to the bottom. Please see fig. 2.8.

The terminals are protected by a cover. The cover can be removed with the tank oil-filled.

The terminal box contains a terminal block with three terminals.

- The terminal marked CL is connected to the core laminations.
- The terminal marked CC is connected to the core clamps.
- The terminal marked G is connected to ground (the tank).

For the core-insulation test, remove the cover. Disconnect the closing link that connects the two terminals CL-G. Use preferably 1000V mega direct voltage between CL and CC + G. The tank shall be grounded during the test. The insulation value after

1 min. test- time shall be minimum 1000 k-ohms. There is no general requirement on the insulation level CC-G .

2.10.2 TRANSFORMERS

For checking core insulation in case of transformers refer Fig. 2.9 for connection details.

2.11 TOUCH-UP PAINTING

2.11.1 PURPOSE

A basic principle at touch-up painting should be to restore a damaged paint coat on a surface to the same quality and finish as of the surrounding surface. The touch-up painting should be limited to a surface as small as possible.

2.11.2 CLEANING

Both damaged and surrounding surface should be cleaned so that all grease, dust and other impurities will be removed.

2.11.3 GRINDING OF DAMAGES

Large damages and defects are ground by means of a coarse abrasive paper, e.g. No.100. The surface is then ground with a finer paper in connection with the damage, e.g. 150 or 180. Damages that are limited to the paint coat only should be ground off completely at which glazing can be avoided.

2.11.4 FINISHING PAINT

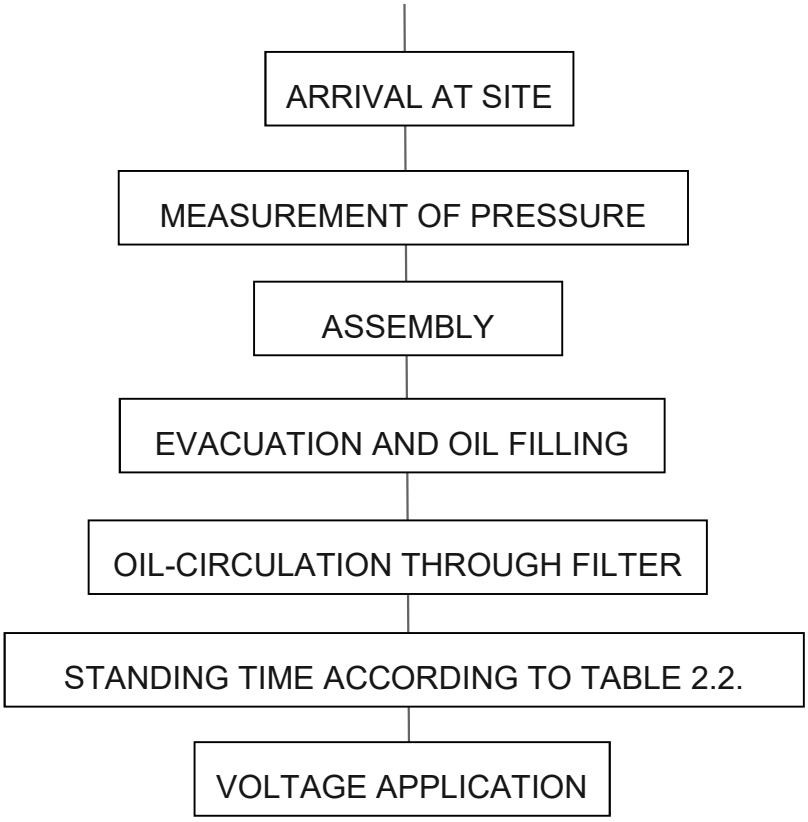
Two coats of finishing paint should be applied as per specification which is generally light grey shade No.631 of IS: 5. Please refer Table 2.4 for suppliers reference.

TABLE 2.4

Paint Make	Internal Surface	External Surface		
Asian	APCODUR CF699 WHITE	APCODUR RAPID RECOAT ZP PRIMER GRAY	APCODUR RAPID RECOAT HB MIO	APCOTHANE CF678
Akzo Nobel	INTERLINE 1012 WHITE	INTERGUARD 251	INTERGUARD 966	INTERTHANE 990
Jotun	PENGUARD HB WHITE	PENGUARD HSP ZP	PENGUARD MID COAT MIO	HARD TOP XP
Ching	CHING EP EMC 182 WHITE	CHING EP PRIMER EMD 183	CHING EP MIO EMD 30	CHING EP TOP COAT ADD47

ANNEXURE 2.1

FLOW CHART FOR HANDLING



Relationship between different units

1 bar = 10^5 Pa = 750 Torr = 14.5 psi = 1.02 kg/sq.cm

1 Torr = 1.33 mbar = 0.133 kPa

1 kPa = 10^3 Pa = 10 mbar = 7.501 Torr

1 MPa = 10^6 Pa

Force

1 kp = 9.807 N

Volume

1Liter = 0.26 US gallons

1 US gallon = 3.781Liters

1Liter = 0.22 Imp gallons

1 Imp gallon = 4.551Litres

Temperature

C = 5 x (F-32)/9

F = 9 x (C+32)/5

ANNEXURE 2.2

EQUIPMENT FOR OIL-FILLING UNDER VACUUM

i. High-vacuum 2 stage oil filtration plant provided with thermostat controlled

ii. oil heaters and vacuum-proof hoses with independent vacuum pumping system for tank evacuation. Capacity: 6000 LPH

iii. Oil-storage tanks provided with silica-gel breathers and inlet/outlet valves for oil circulation. Recommended capacity 20 kL -30 kL (Clause2.4)

iv. Vacuum gauges provided in filtration plant.

v. Equipment for measurement of electric strength (BDV) of oil- 100 kV set.

vi. Equipment for moisture content of oil.

vii. Equipment for measurement of Resistivity and Tan delta at 90°C .

viii. Oil-sampling cans or bottles.

ix. Transparent vacuum-proof tubes for checking of oil-level during oil filling.

x. Valves, fittings, gaskets etc.

xi. Dry nitrogen cylinders.

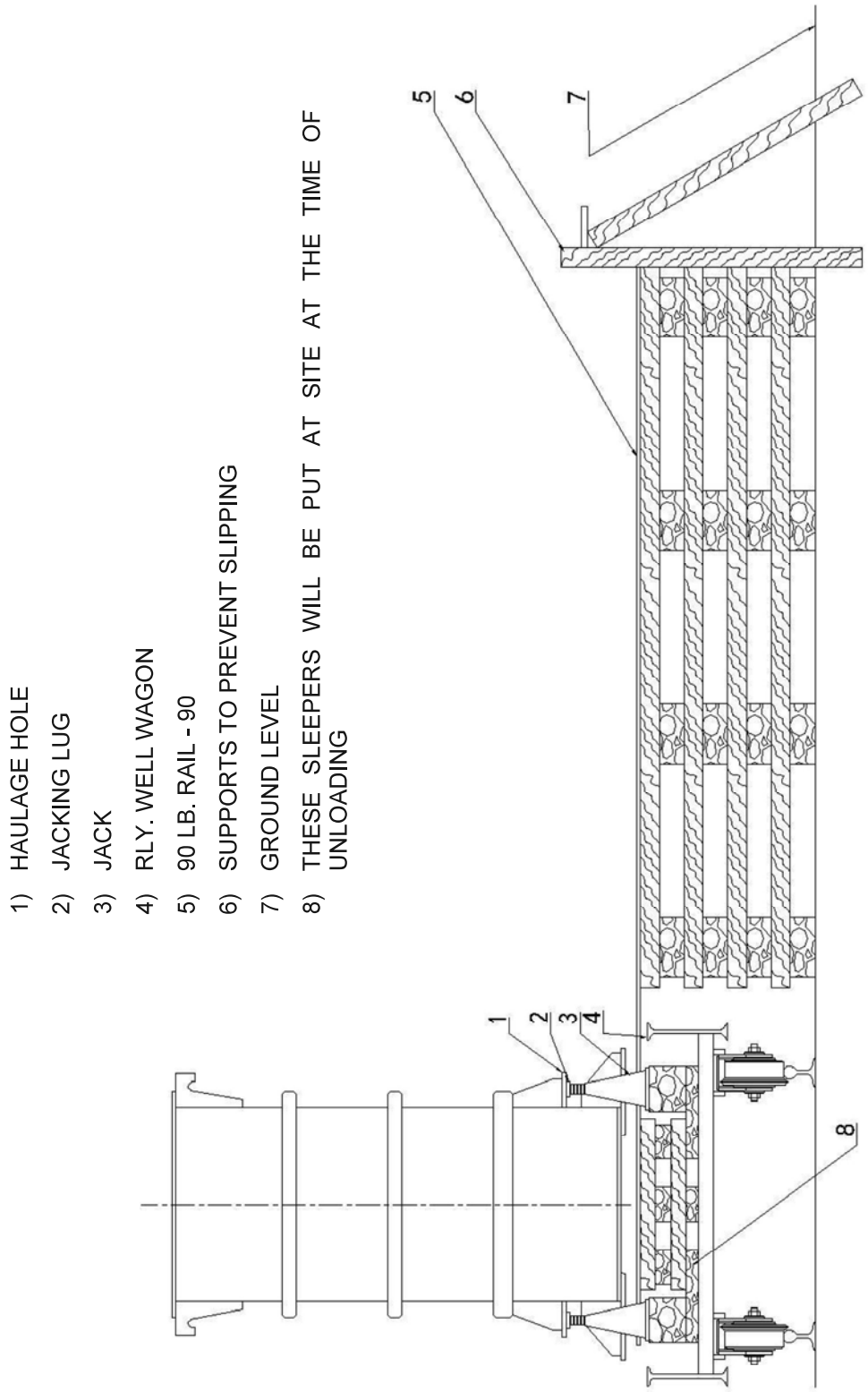


Fig. 2.1 Typical Unloading Arrangement of the Transformer

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

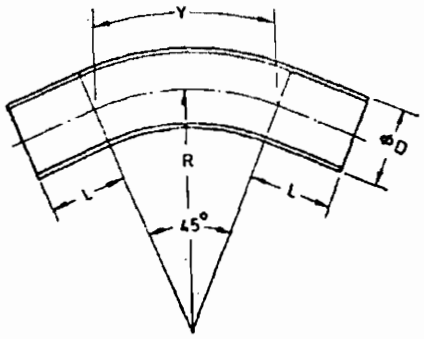


FIG. 1 45° BEND

*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 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		

पावरग्रिड
POWERGRID

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उपक्रम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

संदर्भ/Ref : CC-ENGG-TB202359-1002269-SI3480-SS-SLD

Date : 23/04/2024

From : Atul Mathur
DGM

To : Bharat Heavy Electricals Limited
Plot No.-7, Sector-142 Noida 201305
201305

Cc :

Subject : Substation Package SS-01 for (i) Establishment of 765/400/220kV Bikaner-III (New) Pooling Station including 400kV class Bus Reactor at Bikaner-III S/s; (ii) Extension of 765kV Neemrana-II S/s for termination of 765 kV D/c line Neemrana-II–Bikaner-III T/L and (iii) Extension of 400kV Bikaner-II S/s for termination of 400kV Bikaner-II Bikaner-III T/L under "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-1) (Bikaner Complex): PART-A"

LOA Ref : CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 Dated 23/02/2024

Please find enclosed following drawings/ documents for necessary action at your end.

Vendor Drg. No.	:	TB-1-424-510-101
Orgn. Drg. No.	:	TB202359-1002269-SI3480-SS-SLD
Revision No.	:	01
Drg. Title	:	Bikaner II- SINGLE LINE DIAGRAM
App. Category	:	CAT-I
Release Date	:	23/04/2024

Scan to verify

Comments : Generally in order.

अनुमोदित श्रेणी/App. Category:

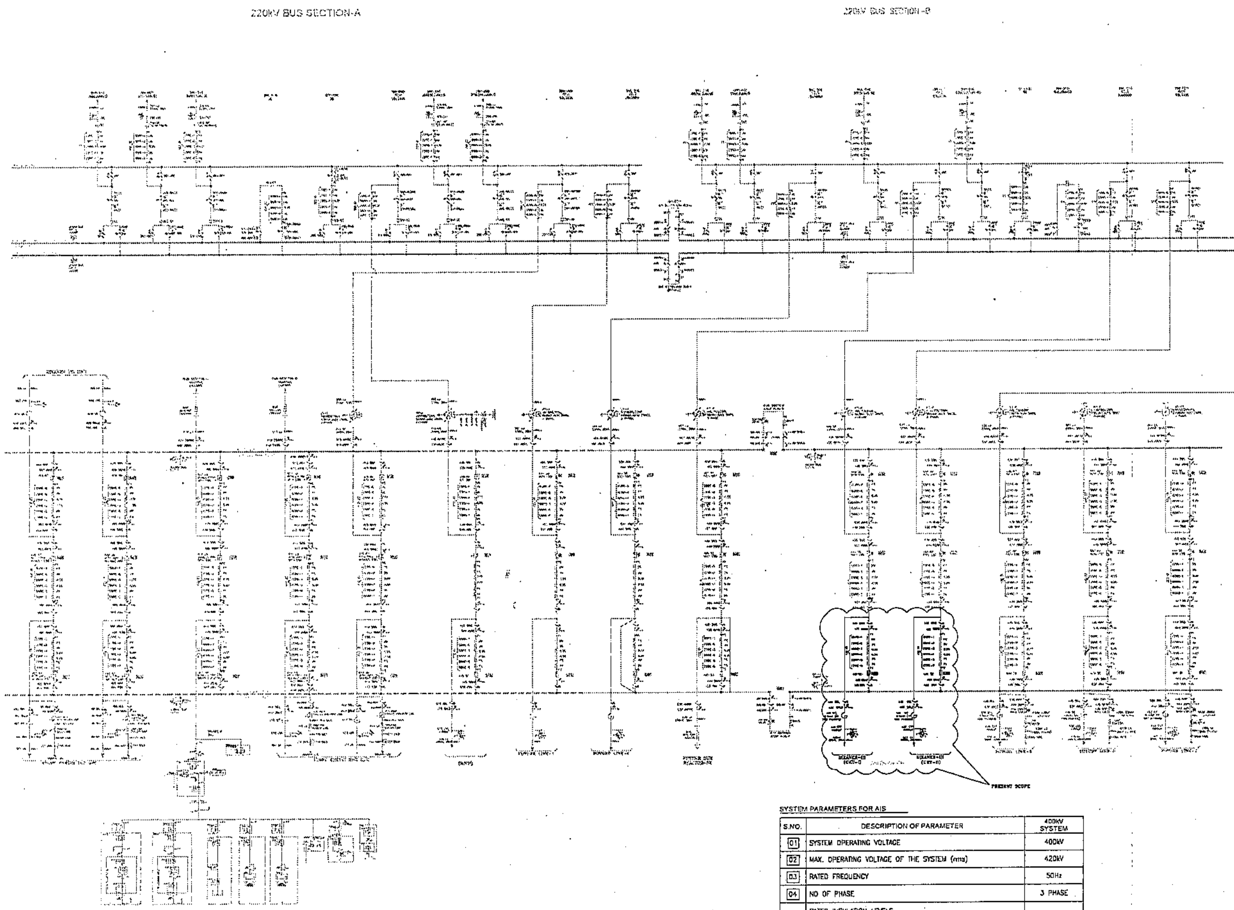
I.	फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु जारी। **Approved/released for fabrication/construction.**
II.	फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु अनुमोदित/जारी बशर्ते दिए गए टिप्पणियाँ एवं आशोधनों की सम्मिलित किया जाये। कृपया रिवाइजड दस्तावेज अनुमोदनार्थ प्रस्तुत करें। **Approved/released for fabrication/ construction subject to incorporation of comments and modification as noted. Revised drawing required for approval.**
III.	टिप्पणियाँ सम्मिलित करने के उपरांत दस्तावेज को अनुमोदनार्थ प्रस्तुत करें। **To be resubmitted for approval after incorporating the comments.**
IV.	सूचनार्थ एवं रिकार्ड हेतु। **For information and record.**
CATREL/ REL-CON	निर्माण हेतु जारी। **Released for construction.**

नोट/Note:

1. Approval/Comments conveyed herein neither relieve the contractor of his contractual obligations and his responsibilities, weights, quantities, design details assemble fits, performance particulars and conformity of the supplies with the Indian Statutory Laws as may be applicable, nor does it limits the purchaser's right under the contract.
2. The approval conveyed vide this letter does not cover the approval of make for sub-vendor items.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRG. NO. TB-1-424-510-101



SYSTEM PARAMETERS FOR AIS

S.NO.	DESCRIPTION OF PARAMETER	400kV SYSTEM
01	SYSTEM OPERATING VOLTAGE	400kV
02	MAX. OPERATING VOLTAGE OF THE SYSTEM (rms)	420kV
03	RATED FREQUENCY	50Hz
04	NO OF PHASE	3 PHASE
05	RATED INSULATION LEVELS	
	(i) FULL WAVE LIGHTNING IMPULSE WITHSTAND VOLTAGE (1.2 / 50micro sec.) - TRANSFORMER AND REACTORS - FOR OTHER EQUIPMENT - FOR INSULATOR STRING	±1300kVp ±1425kVp ±1550kVp
	(ii) SWITCHING IMPULSE WITHSTAND VOLTAGE (250 / 2500micro sec.) DRY & WET	±1050kVp
	(iii) ONE MINUTE POWER FREQUENCY WITHSTAND VOLTAGE (rms)	±630kVp
	(iv) ONE MINUTE POWER FREQUENCY DRY & WET WITHSTAND VOLTAGE (rms)	(-)
06	CORONA EXTINCTION VOLTAGE	320kV
07	MAX. RADIO INTEREFERENCE VOLTAGE LEVEL	1000 micro volts at 268kV rms
08	(i) MINIMUM CREEPAGE DISTANCE INSULATOR STRING/LONGROD INSULATORS/OUTDOOR BUSHINGS (ii) MINIMUM CREEPAGE DISTANCE FOR OTHER SWITCHYARD EQUIPMENT	13020 MM (31mm/kV) 10500 MM (25mm/kV)
09	RATED SHORT CIRCUIT CURRENT FOR 1 SEC. DURATION	63kA
10	SYSTEM NEUTRAL EARTHING	EFFECTIVELY EARTHED
11	MINIMUM CLEARANCE i) PHASE TO PHASE ii) PHASE TO EARTH iii) SECTIONAL CLEARANCE	4000MM 3500MM 6500MM

BILL OF QTY. FOR 400kV MAIN EQUIPMENTS (BHEL'S SCOPE):

SL.NO.	DESCRIPTION	RATING	S. C. RATING	SLD QTY. (NO.)	NOA QTY. (NO.)	SYMBOL	LEGEND	MAKE
1	SF6 CIRCUIT BREAKER WITHOUT CR (3-PH)	3150A	63 KA FOR 1 S.	02	02		52	MAKE TO BE INDICATED IN FINAL AS BUILT DRAWING
2	ISOLATOR WITH ONE E/S (3 PH) DOUBLE BREAK TYPE	3150A	63 KA FOR 1 S.	06	06		89/89E	
3	CURRENT TRANSFORMER (1 PH.) WITH 120% EXTENDED CURRENT RATING.	3000A	63 KA FOR 1 S.	06	06		CT	
4	CVT (1 PH.)	4400pF		06	06		CVT	
5	LINE TRAP (1 PH.)	0.5mH 3150A	63 KA FOR 1 S.	04	04		WT	
6	SURGE ARRESTER (1 PH.)	336 kV		06	06		LA	

NOTES:-
1. SYSTEM
400kV, 63kA FOR 1 SEC., 50Hz, 3Ph, SOLIDLY EARTHED
2. PRESENT ——
FUTURE/EXISTING ----------
3. PHASE LOCATION OF WAVE TRAPS TO BE DECIDED DURING DETAILED ENGINEERING

NOA NO. : CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01

ADDITIONAL INFORMATION W.O.No.	NAME OF CUSTOMER	BIKANER III NEEMRANA TRANSMISSION LIMITED
	NAME OF CONSULTANT	POWERGRID CORPORATION OF INDIA LIMITED
STATUS OF DRAWING	NAME OF PROJECT	EXTENTION OF 400kV BIKANER -II S/s FOR TERMINATION OF 400kV BIKANER -II BIKANER - III T/L
DISTRIBUTION OF PRINTS		

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
संचारण परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता./SIGN.	दि./DATE
बनाया DRAWN	SY	-SGD-	04.04.24
जांचा CHECKED	NK	-SGD-	01.04.24
स्वीकृत APPROVED	SKS	-SGD-	01.04.24

विभाग DEPT. | कोड CODE | अनुपात / SCALE | कार्ड कोड CARD CODE

POWERGRID DRAWING NO. TB202359-1002269-SI3480-SS-SLD

शीर्षक/TITLE SINGLE LINE DIAGRAM FOR 400kV BIKANER -II S/S

ड्राइंग.सं./DRAWING NO. TB-1-424-510-101 | पुन:/REV. 01

पृष्ठ सं./SHEET No. 01 | अगला पृष्ठ/NEXT SHEET -

REV.	DATE	ALTERED	CHECKED	APPROVED	ZONE
01	16.04.24	SY	NK	SKS	REVISED AS PER POWERGRID COMMENTS DTD. 12.04.24

COMPUTER DRG. PATH NAME : | REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO

पावरग्रिड
POWERGRID

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED

संदर्भ/Ref : CC-ENGG-TB202359-1002269-SI3480-ELECT-LAYOUT

Date : 01/05/2024

From : Atul Mathur
DGM

To : Bharat Heavy Electricals Limited
Plot No.-7, Sector-142 Noida 201305
201305

Cc :

Subject : Substation Package SS-01 for (i) Establishment of 765/400/220kV Bikaner-III (New) Pooling Station including 400kV class Bus Reactor at Bikaner-III S/s; (ii) Extension of 765kV Neemrana-II S/s for termination of 765 kV D/c line Neemrana-II–Bikaner-III T/L and (iii) Extension of 400kV Bikaner-II S/s for termination of 400kV Bikaner-II Bikaner-III T/L under "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-1) (Bikaner Complex): PART-A"

LOA Ref : CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 Dated 23/02/2024

Please find enclosed following drawings/ documents for necessary action at your end.

Vendor Drg. No.	:	TB-0-424-316-102
Orgn. Drg. No.	:	TB202359-1002269-SI3480-ELECT-LAYOUT
Revision No.	:	02
Drg. Title	:	Bikaner II- ELECTRICAL LAYOUT PLAN & SECTION
App. Category	:	CAT-I
Release Date	:	01/05/2024

Scan to verify

Comments : Generally in order.

अनुमोदित श्रेणी/App. Category:

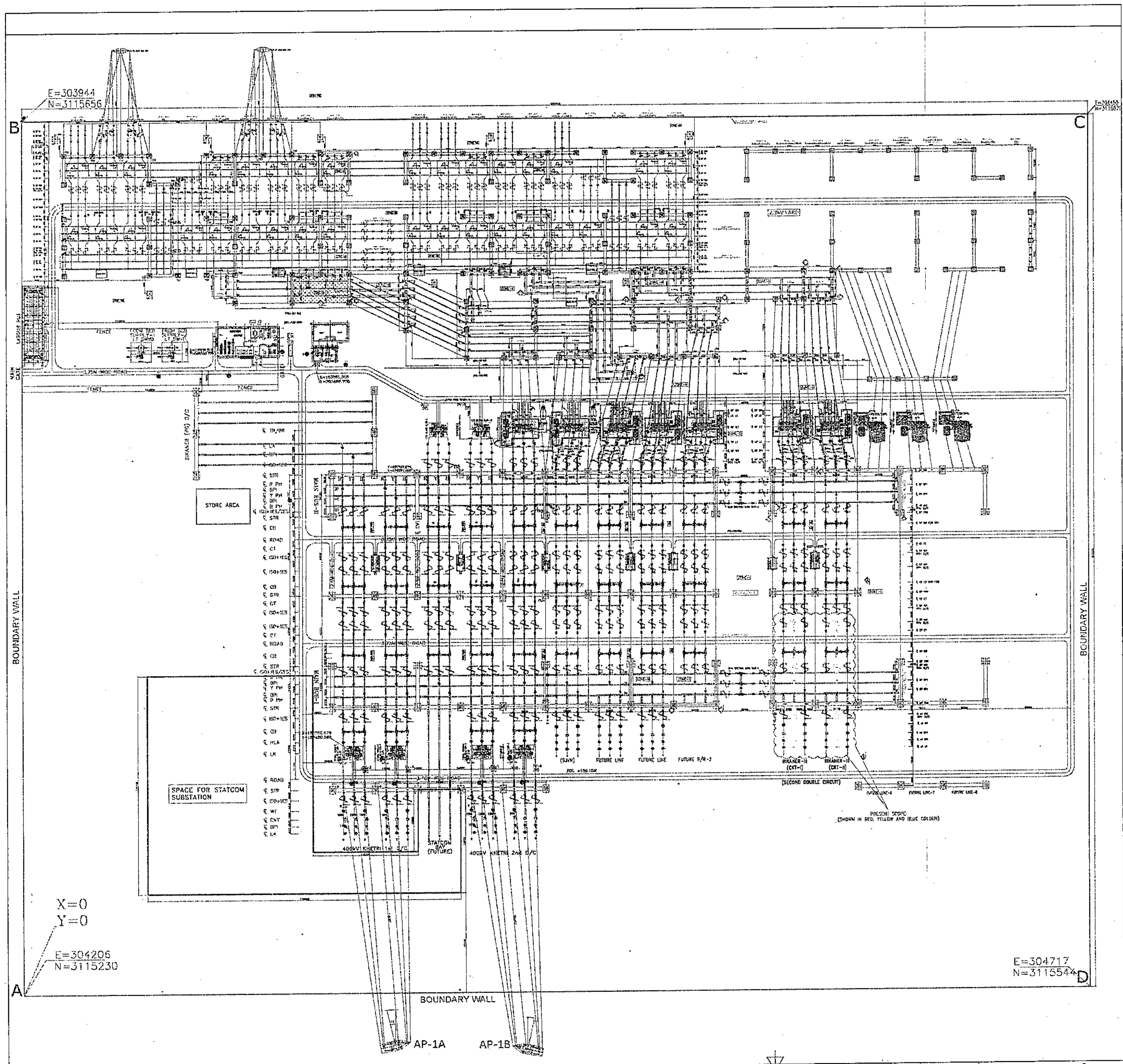
I.	फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु जारी। **Approved/released for fabrication/construction.**
II.	फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु अनुमोदित/जारी बशर्ते दिए गए टिप्पणियाँ एवं आशोधनों की सम्मिलित किया जाये। कृपया रिवाइजड दस्तावेज अनुमोदनार्थ प्रस्तुत करें। **Approved/released for fabrication/ construction subject to incorporation of comments and modification as noted. Revised drawing required for approval.**
III.	टिप्पणियाँ सम्मिलित करने के उपरांत दस्तावेज को अनुमोदनार्थ प्रस्तुत करें। **To be resubmitted for approval after incorporating the comments.**
IV.	सूचनार्थ एवं रिकार्ड हेतु। **For information and record.**
CATREL/ REL-CON	निर्माण हेतु जारी। **Released for construction.**

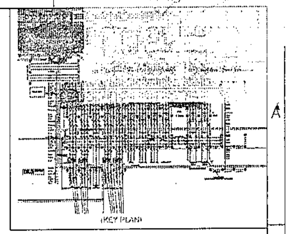
नोट/Note:

1. Approval/Comments conveyed herein neither relieve the contractor of his contractual obligations and his responsibilities, weights, quantities, design details assemble fits, performance particulars and conformity of the supplies with the Indian Statutory Laws as may be applicable, nor does it limits the purchaser's right under the contract.
2. The approval conveyed vide this letter does not cover the approval of make for sub-vendor items.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRG. NO. TB-0-424-316-102





SYSTEM PARAMETERS FOR AIS

S.NO.	DESCRIPTION OF PARAMETER	400kV SYSTEM
01	SYSTEM OPERATING VOLTAGE	400kV
02	MAX. OPERATING VOLTAGE OF THE SYSTEM (rms)	420kV
03	RATED FREQUENCY	50Hz
04	NO OF PHASE	3 PHASE
05	RATED INSULATION LEVELS	
	(i) FULL WAVE LIGHTNING IMPULSE WITHSTAND VOLTAGE (1.2 / 50micro sec.) - TRANSFORMER AND REACTORS - FOR OTHER EQUIPMENT - FOR INSULATOR STRING	±1300kVp ±1425kVp ±1550kVp
	(ii) SWITCHING IMPULSE WITHSTAND VOLTAGE (250 / 2500micro sec.) DRY & WET	±1050kVp
	(iii) ONE MINUTE POWER FREQUENCY WITHSTAND VOLTAGE (rms)	±630kVp
	(iv) ONE MINUTE POWER FREQUENCY DRY & WET WITHSTAND VOLTAGE (rms)	-
06	CORONA EXTINCTION VOLTAGE	320kV
07	MAX. RADIO INTERFERENCE VOLTAGE LEVEL	1000 micro volts at 266kV rms
08	(i) MINIMUM CREEPAGE DISTANCE INSULATOR STRING/LONGROD INSULATORS/OUTDOOR BUSHINGS (ii) MINIMUM CREEPAGE DISTANCE FOR OTHER SWITCHYARD EQUIPMENT	13020 MM (31mm/kV) 10500 MM (25mm/kV)
09	RATED SHORT CIRCUIT CURRENT FOR 1 SEC. DURATION	63kA
10	SYSTEM NEUTRAL EARTHING	EFFECTIVELY EARTHED
11	MINIMUM CLEARANCE i) PHASE TO PHASE ii) PHASE TO EARTH iii) SECTIONAL CLEARANCE	4000MM 3500MM 6500MM

BILL OF QTY. FOR 400kV MAIN EQUIPMENTS (BHEL'S SCOPE):

SL.NO.	DESCRIPTION	RATING	S. C. RATING	SLD QTY. (NO.)	NOA QTY. (NO.)	SYMBOL	MAKE
1	SF6 CIRCUIT BREAKER WITHOUT CR (3-PH)	3150A	63 KA FOR 1 S.	02	02		MAKE TO BE INDICATED IN FINAL AS BUILT DRAWING
2	ISOLATOR WITH ONE E/S (3 PH) DOUBLE BREAK TYPE	3150A	63 KA FOR 1 S.	06	06		
3	CURRENT TRANSFORMER (1 PH.) WITH 120% EXTENDED CURRENT RATING.	3000A	63 KA FOR 1 S.	06	06		
4	CVT (1 PH.)	4400pF		06	06		
5	LINE TRAP (1 PH.)	0.5mH 3150A	63 KA FOR 1 S.	04	04		
6	SURGE ARRESTER (1 PH.)	336 kV		06	06		
7	BUS POST INSULATOR			10	12		

400kV SWITCHYARD CONDUCTOR DETAILS

DESCRIPTION	400kV
EQUIPMENT INTERCONNECTION	4.5" IPS AL. TUBE QUAD BERSIMIS ACSR CONDUCTOR
DROPPERS AND ASSOCIATED EQUIPMENT CONNECTIONS	QUAD BERSIMIS ACSR CONDUCTOR
EARTHWIRE	7/3.66mm GS WIRE (10.98mm DIA)

NOTES

1. ALL DIMENSIONS AND CO-ORDINATES ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. ALL HEIGHTS ARE WITH REFERENCE TO PLINTH LEVEL OF 300MM ABOVE GROUND LEVEL.
3. ALL LINES PHASE SEQUENCE SHALL BE MATCHED BY TRANSMISSION LINE CONTRACTOR & RE-CHECK BY SITE.
4. FGL FOR 400kV PRESENT SCOPE OF WORK SHALL BE PROVIDED BY CUSTOMER.
5. PHASE LOCATION OF WAVE TRAPS TO BE DECIDED DURING DETAILED ENGINEERING
6. FOUNDATION OF LINE SIDE EQUIPMENT SHALL BE CASTED AFTER FINALIZATION OF DEAD-END TOWER.
7. LINE SIDE HARDWARE IS IN SCOPE OF BHEL.

LEGEND
PRESENT SCOPE IS SHOWN IN CLOUDED AREA
-------- EXISTING/ FUTURE

NOA NO. : CC/TW-AIS/DOM/A10/23/01956/NOA-1/24-102043/01

NAME OF CUSTOMER	BIKANER III NEEMRANA TRANSMISSION LIMITED
NAME OF CONSULTANT	POWERGRID CORPORATION OF INDIA LIMITED
NAME OF PROJECT	EXTENTION OF 400KV BIKANER -II S/S FOR TERMINATION OF 400KV BIKANER -II BIKANER - III T/L

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

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	NAME	SIGN.	DATE
DRAWN	SKS	-SGD-	01.04.24
CHECKED	NK	-SGD-	01.04.24
APPROVED	SKS	-SGD-	01.04.24

REV.	DATE	ALTERED	CHECKED	APPROVED
01	23.04.24	SY	NK	SKS

REVISED AS PER POWERGRID COMMENTS DTD.12.04.24

SCALE

POWERGRID DRAWING NO. TB202359-1002269-SI3480-ELECT-LAYOUT

TITLE: 400KV ELECTRICAL LAYOUT PLAN AND SECTIONAL ELEVATION FOR BIKANER (II)

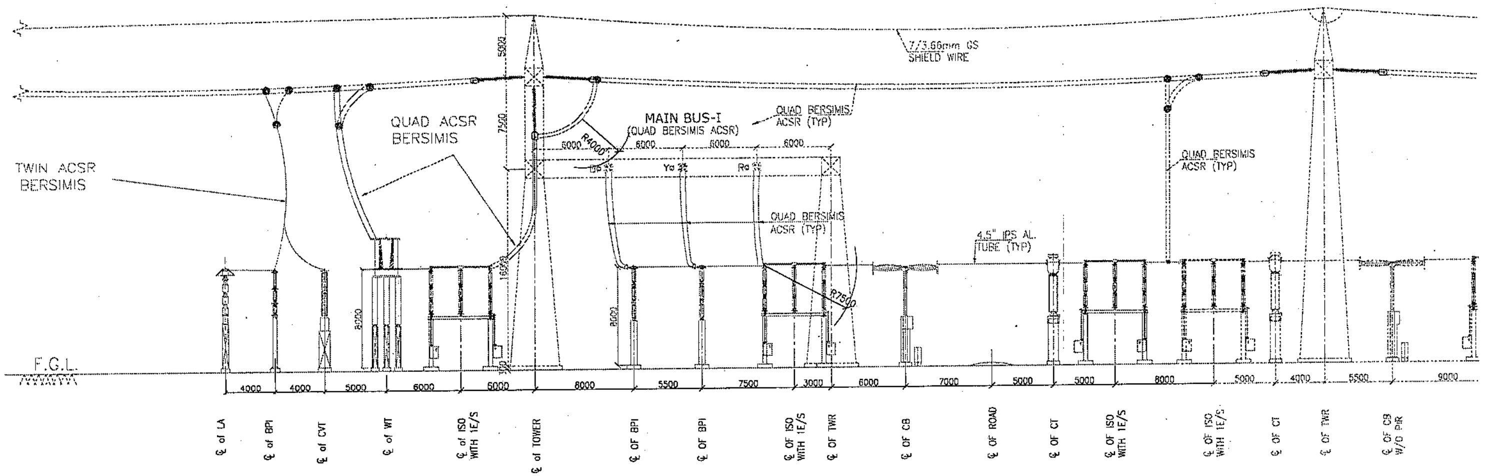
DRAWING NO. TB-0-424-316-102 REV. 01

SHEET No. 01 NEXT SHEET 02

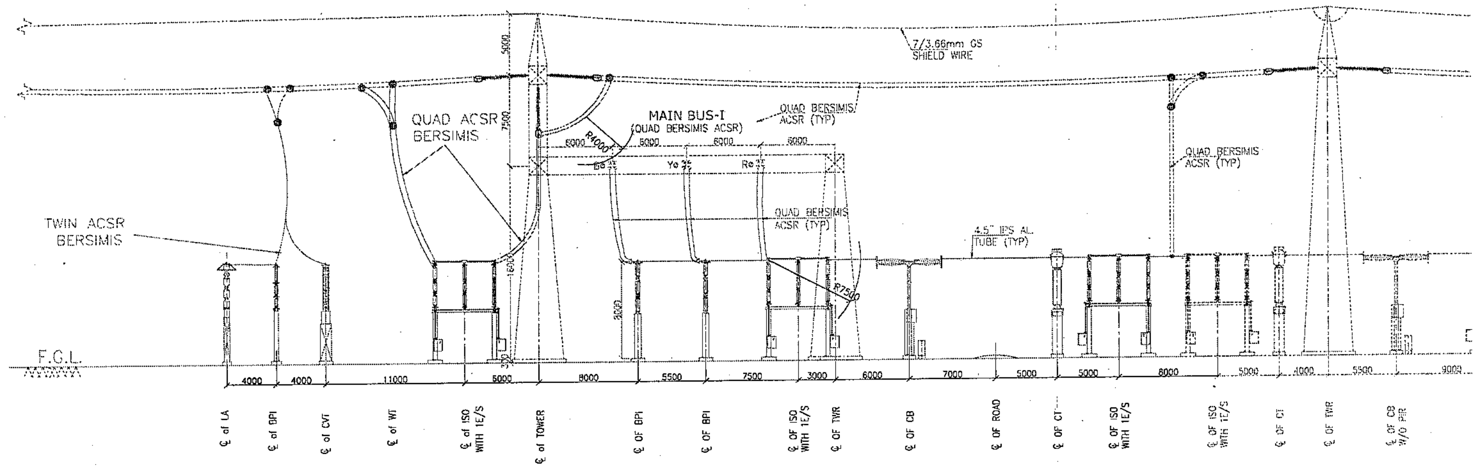
INVENTORY NO. | SIGN. AND DATE | REF. DRG. NO. | COMPUTER DRG. PATH NAME :

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRG. NO. TB-0-424-316-102



400kV SECTION A-A (WITH WAVE TRAP)



400kV SECTION A-A (WITHOUT WAVE TRAP)

NOA NO.: CC/TW-AIS/DOM/A10/23/01856/NOA-1/24-102643/01

NAME OF CUSTOMER	BIKANER III NEEMRANA TRANSMISSION LIMITED
NAME OF CONSULTANT	POWERGRID CORPORATION OF INDIA LIMITED
NAME OF PROJECT	EXTENTION OF 400kV BIKANER -II S/S FOR TERMINATION OF 400kV BIKANER -II BIKANER - III T/L

ADDITIONAL INFORMATION W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
ट्रांसमिशन परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	नाम / NAME	हस्ता. / SIGN.	दि. / DATE
DRAWN	SKS	-SGD-	01.04.24
CHECKED	NK	-SGD-	01.04.24
APPROVED	SKS	-SGD-	01.04.24

REV.	DATE	ALTERED	CHECKED	APPROVED
01	20.04.24	SY	NK	SKS

REVISED AS PER POWERGRID COMMENTS DTD.12.04.24

अनुपात / SCALE

कार्ड कोड CARD CODE

POWERGRID DRAWING NO. TB202359-1002269-SI3480-ELECT-LAYOUT

शीर्षक/TITLE: 400KV ELECTRICAL LAYOUT PLAN AND SECTIONAL ELEVATION FOR BIKANER (II)

ड्राइंग सं./DRAWING NO. TB-0-424-316-102 — REV. 01

पृष्ठ सं./SHEET No. 02

COMPUTER DRG. PATH NAME :
REF. DRG. NO.
SIGN. AND DATE
INVENTORY NO

पावरग्रिड
POWERGRID

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

संदर्भ/Ref : CC-ENGG-TB202359-1002269-SI3480-DSLP-LAYOUT

Date : 08/10/2024

From : Somiran Das
Senior GM

To : Bharat Heavy Electricals Limited
Plot No.-7, Sector-142 Noida 201305
201305

Cc :

Subject : Substation Package SS-01 for (i) Establishment of 765/400/220kV Bikaner-III (New) Pooling Station including 400kV class Bus Reactor at Bikaner-III S/s; (ii) Extension of 765kV Neemrana-II S/s for termination of 765 kV D/c line Neemrana-II–Bikaner-III T/L and (iii) Extension of 400kV Bikaner-II S/s for termination of 400kV Bikaner-II Bikaner-III T/L under "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-1) (Bikaner Complex): PART-A"

LOA Ref : CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 Dated 23/02/2024

Please find enclosed following drawings/ documents for necessary action at your end.

Vendor Drg. No.	:	TB-0-424-316-104
Orgn. Drg. No.	:	TB202359-1002269-SI3480-DSLP-LAYOUT
Revision No.	:	00
Drg. Title	:	Bikaner II- DSLP LAYOUT
App. Category	:	CAT-IV
Release Date	:	08/10/2024

Scan to verify

Comments : Generally in order.

अनुमोदित श्रेणी/App. Category:

I.	फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु जारी। **Approved/released for fabrication/construction.**
II.	फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु अनुमोदित/जारी बशर्ते दिए गए टिप्पणियाँ एवं आशोधनों को सम्मिलित किया जाये। कृपया रिवाइजड दस्तावेज अनुमोदनार्थ प्रस्तुत करें। **Approved/released for fabrication/ construction subject to incorporation of comments and modification as noted. Revised drawing required for approval.**
III.	टिप्पणियाँ सम्मिलित करने के उपरांत दस्तावेज को अनुमोदनार्थ प्रस्तुत करें। **To be resubmitted for approval after incorporating the comments.**
IV.	सूचनार्थ एवं रिकार्ड हेतु। **For information and record.**
CATREL/ REL-CON	निर्माण हेतु जारी। **Released for construction.**

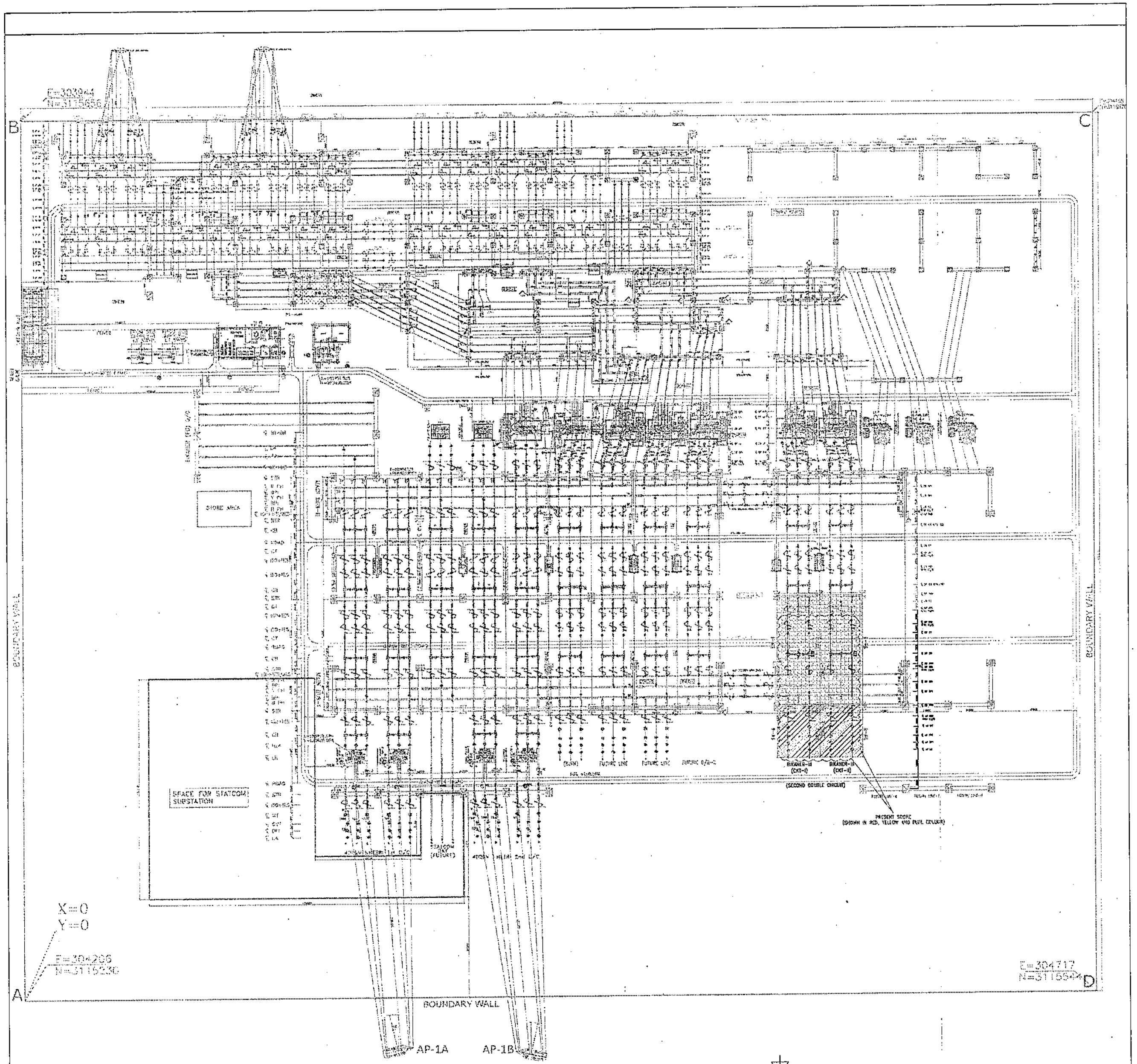
नोट/Note:

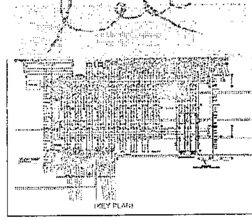
1. Approval/Comments conveyed herein neither relieve the contractor of his contractual obligations and his responsibilities, weights, quantities, design details assemble fits, performance particulars and conformity of the supplies with the Indian Statutory Laws as may be applicable, nor does it limits the purchaser's right under the contract.
2. The approval conveyed vide this letter does not cover the approval of make for sub-vendor items.

TB202359-1002269-SI3480-DSLP-LAYOUT/00/CAT-IV/Page: 1 of 1

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRG. NO. TB-0-424-316-104





ZONE-1

ZONE-2

LEGEND:

SHIELD WIRE (CUSTOMER SCOPE/EXISTING)

NOA NO.: CC/T/W-AIS/DOM/A10/23/01356/NOA-I/24-103143/01	
ADDITIONAL INFORMATION W.O.No.	NAME OF CUSTOMER: BIKANER III NEEMRANA TRANSMISSION LIMITED
STATUS OF DRAWING	NAME OF CONSULTANT: POWERGRID CORPORATION OF INDIA LIMITED
DISTRIBUTION OF PRINTS	NAME OF PROJECT: EXTENTION OF 400kV BIKANER -II S/S FOR TERMINATION OF 400kV BIKANER -II BIKANER - III T/L

भारत हैवी इलेक्ट्रिकल्स लिमिटेड
ट्रांसमिशन परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	NAME	SIGN.	DATE
DRAWN	SY	-SGD-	01.10.24
CHECKED	SS	-SGD-	01.10.24
APPROVED	SKS	-SGD-	01.10.24

REV. | DATE | ALTERED / CHECKED / APPROVED

अनुमाप / SCALE

कार्ड कोड / CARD CODE

POWERGRID DRAWING NO. TB202359-1002269-SI3480-DSLP-LAYOUT

शीर्षक/TITLE: Bikaner II- DSLP LAYOUT

ड्राइंग सं./DRAWING NO. TB-0-424-316-104

REV. 00

SHEET No. 01 | NEXT SHEET --

COMPUTER DRG. PATH NAME :

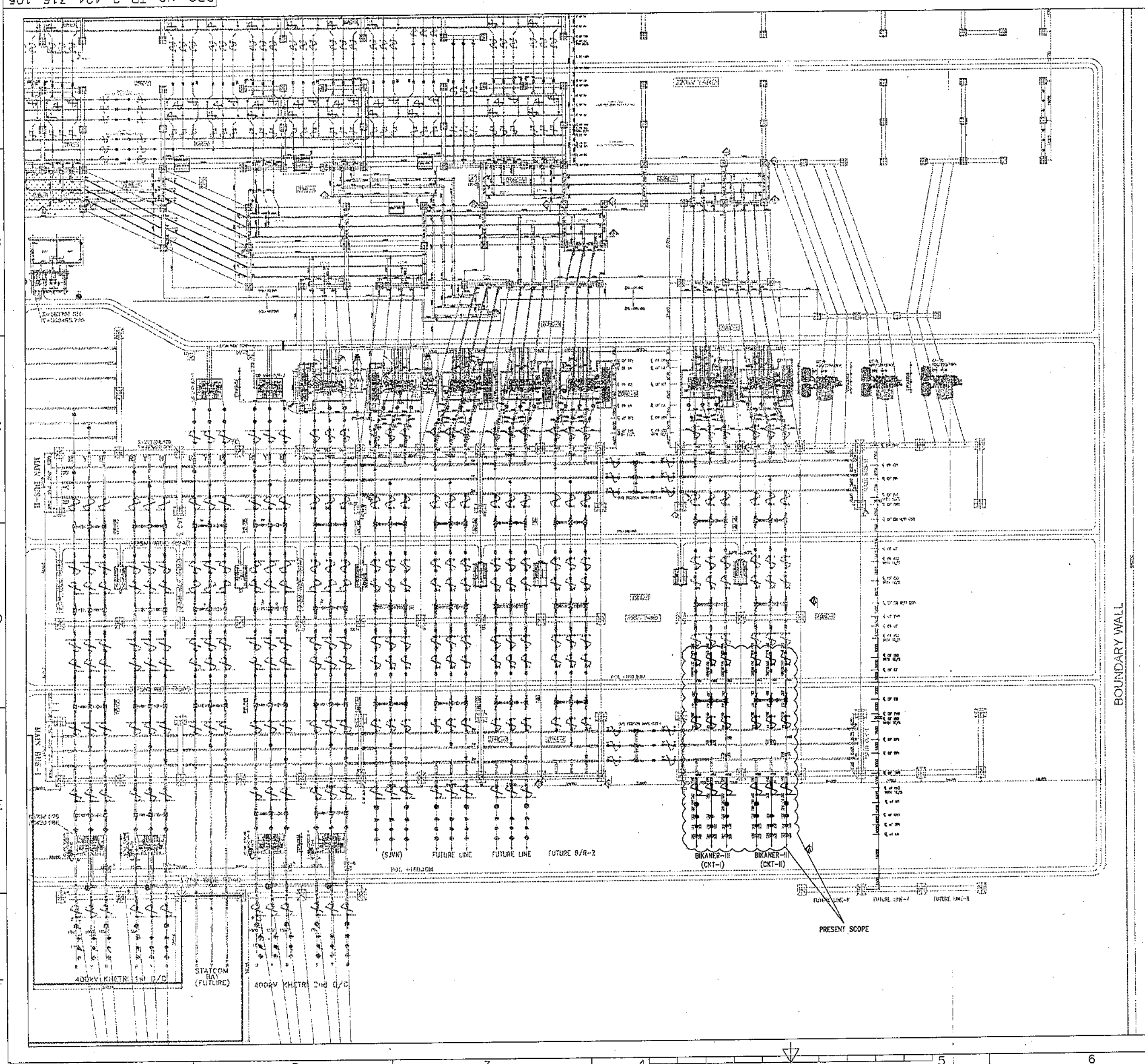
REF. DRG. NO.

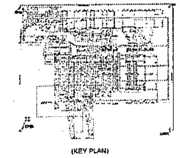
SIGN. AND DATE

INVENTORY NO

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRG. NO. TB-2-424-316-105





NOA NO.	CC/TW-AIS/DOM/A10/23/01986/NOA-1/24-102643/01
NAME OF CUSTOMER	BIKANER III NEEMRANA TRANSMISSION LIMITED
NAME OF CONSULTANT	POWERGRID CORPORATION OF INDIA LIMITED
NAME OF PROJECT	EXTENTION OF 400kV BIKANER -II S/S FOR TERMINATION OF 400kV BIKANER -II BIKANER - III T/L

भारत हैवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	नाम / NAME	हस्ता / SGN	दि / DATE
	SY	-SGD-	26.02.25
	SS	-SGD-	26.02.25
	SKS	-SGD-	26.02.25

POWERGRID DRAWING NO. TB202359-1002200-SI3480-EKD-LAYOUT

शीर्षक/TITLE: Bikaner II- ERECTION KEY DIAGRAM LAYOUT PLAN & SECTION

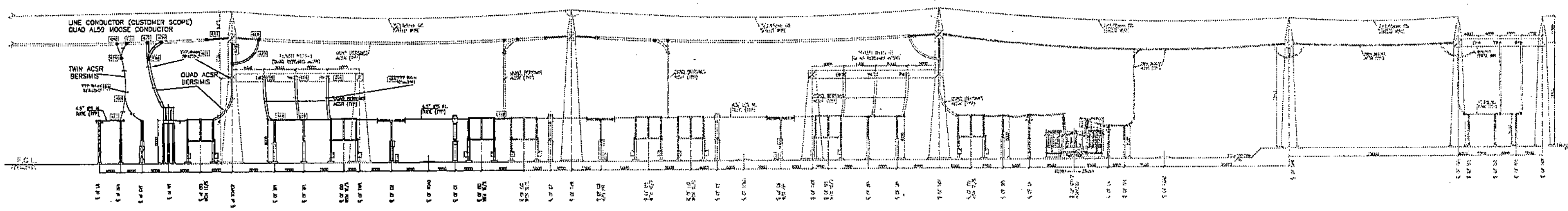
आरेख सं./DRAWING NO. TB-2-424-316-105 — REV. 00

SHEET NO. 01 — NO. OF SHEETS 02

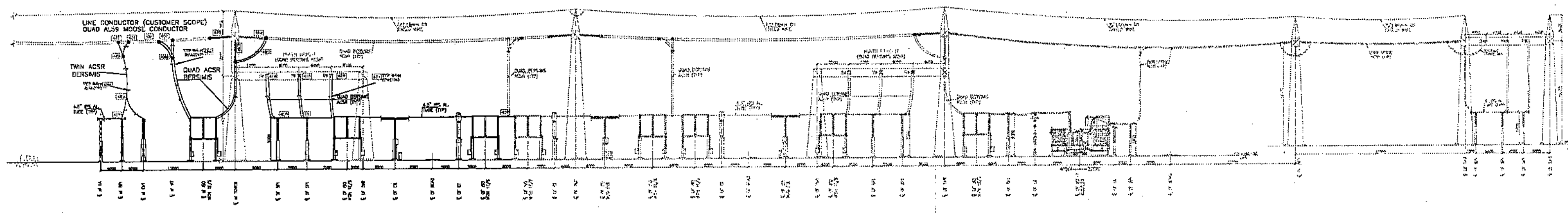
INVENTORY NO | SIGN. AND DATE | REF. DRG. NO. | COMPUTER DRG. PATH NAME :

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRG. NO. TB-2-424-316-105



400kV SECTION A-A (WITH WAVE TRAP)



400kV SECTION A-A (WITHOUT WAVE TRAP)

NOA NO.: CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-10264/01

NAME OF CUSTOMER	BIKANER III NEEMRANA TRANSMISSION LIMITED
NAME OF CONSULTANT	POWERGRID CORPORATION OF INDIA LIMITED
NAME OF PROJECT	EXTENTION OF 400kV BIKANER -II S/S FOR TERMINATION OF 400kV BIKANER -II BIKANER - III T/L

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

भारत हेवी इलेक्ट्रिकल्स लिमिटेड
पारेषण परियोजना विभाग
BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	नाम /NAME	हस्ता./SIGN	दि./DATE
	SY	-SCD-	26.02.25
	SS	-SCD-	26.02.25
	SKS	-SCD-	26.02.25

REV. | DATE | ALTERED / CHECKED / APPROVED
ZONE

अनुपात / SCALE

POWERGRID DRAWING NO. TB202355-1002269-S13460-EKD-LAYOUT

शीर्षक/TITLE
Bikaner II- ERECTION KEY DIAGRAM
LAYOUT PLAN & SECTION

ड्राइंग.सं./DRAWING NO. TB-2-424-316-105 — संशो./REV 00

पृष्ठ सं./SHEET No. 02

COMPUTER DRG. PATH NAME :
REF. DRG. NO.
SIGN. AND DATE
INVENTORY NO

BILL OF QUANTITIES FOR CLAMPS AND CONNECTORS-BIKANER-II-400KV

S.NO.	ITEM DESCRIPTION	CLAMP NO.	UNIT	QUANTITY BPS NO. 9 (2 set)		TOTAL QUANTITY
				BIKANER PG LINE-1	BIKANER PG LINE-2	
1	420KV, 63KA FOR 1S, 3150A, CB CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, EXPANSION TYPE	401	No.	6	6	12
2	420KV, 63KA FOR 1S, 3150A, CT CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, RIGID TYPE	402	No.	6	6	12
3	420KV, 63KA FOR 1S, 3150A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, RIGID TYPE	403	No.	8	8	16
4	420KV, 63KA FOR 1S, 3150A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, EXPANSION TYPE	404	No.	6	6	12
5	400KV, 63KA FOR 1S, 3150A, ISOLATOR (HDB) CONNECTOR SUITABLE FOR QUAD BERSIMIS **(HA)**	405	No.	7	7	14
6	420KV, 63KA FOR 1S, 3150A, WAVE TRAP CONNECTOR SUITABLE FOR QUAD BERSIMIS	406*	No.	4	4	8
7	336KV LIGHTNING ARRESTER, RIGID/SLIDING TYPE CONNECTOR SUITABLE FOR 4.5" IPS AL TUBE	407	No.	3	3	6
8	336KV LIGHTNING ARRESTER, RIGID/SLIDING TYPE CONNECTOR SUITABLE FOR TWIN BERSIMIS	408*	No.	0	0	0
9	400KV, 63KA FOR 1S, 2000A, CVT CONNECTOR SUITABLE FOR TWIN BERSIMIS (UNIVERSAL TAKEOFF)	409	No.	3	3	6
10	420KV, 63KA FOR 1S, 3150A, BPI CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS, SLIDING THROUGH TYPE	410	No.	5	5	10
11	420KV, 63KA FOR 1S, 3150A, BPI RIGID-EXPANSION TYPE CONNECTOR SUITABLE FOR 4.5" IPS AL TUBE, TUBE CUT	411	No.	0	0	0
12	400KV, 63KA FOR 1S, 3150A, BPI CONNECTOR SUITABLE FOR TWIN BERSIMIS THROUGH TYPE	412	No.	0	0	0
13	420KV, 63KA FOR 1S, 2000A, 400KV REACTOR BUSHING CONNECTOR SUITABLE FOR TWIN BERSIMIS	413	No.	0	0	0
14	420KV, 63KA FOR 1S, 3150A, 400KV ICT BUSHING CONNECTOR FOR 400KV ICT SUITABLE FOR QUAD BERSIMIS	414	No.	0	0	0
15	420KV, 63KA FOR 1S, 3150A, 400KV ICT BUSHING CONNECTOR FOR 765KV ICT SUITABLE FOR QUAD BERSIMIS	415	No.	0	0	0
16	CONNECTORS 400KV, 63KA FOR 1S, TEE CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS TO QUAD BERSIMIS CONDUCTOR	416	No.	5	5	10
17	CONNECTORS 400KV, 63KA FOR 1S, TEE CONNECTOR SUITABLE FOR AL TUBE 4.5 INCH IPS TO TWIN BERSIMIS CONDUCTOR	417	No.	3	3	6
18	400KV, 63KA FOR 1S, TEE CONNECTOR SUITABLE FOR QUAD BERSIMIS TO QUAD BERSIMIS	418	No.	6	6	12
19	400KV, 63KA FOR 1S, TEE CONNECTOR SUITABLE FOR QUAD BERSIMIS TO TWIN BERSIMIS	419	No.	0	0	0
20	400KV, 63KA FOR 1S, TEE CONNECTOR SUITABLE FOR QUAD BULL TO QUAD BERSIMIS	420	No.	0	0	0
21	400KV, 63KA FOR 1S, TEE CONNECTOR SUITABLE FOR QUAD AL59 MOOSE CONDUCTOR TO QUAD ACSR BERSIMIS CONDUCTOR	421	No.	3	3	6
22	400KV, 63KA FOR 1S, TEE CONNECTOR SUITABLE FOR QUAD AL59 MOOSE CONDUCTOR TO TWIN ACSR BERSIMIS CONDUCTOR	422	No.	3	3	6

BILL OF QUANTITIES FOR CLAMPS AND CONNECTORS-BIKANER-II-400KV

S.NO.	ITEM DESCRIPTION	CLAMP NO.	UNIT	QUANTITY BPS NO. 9 (2 set)		TOTAL QUANTITY
				BIKANER PG LINE-1	BIKANER PG LINE-2	
23	420KV, 63KA FOR 1S, FLEXIBLE SPACER SUITABLE FOR QUAD BERSIMIS	423	No.	3	3	6
24	420KV, 63KA FOR 1S,RIGID SPACER SUITABLE FOR QUAD BERSIMIS	424	No.	24	24	48
25	420KV, 63KA FOR 1S, FLEXIBLE SPACER SUITABLE FOR TWIN BERSIMIS	425	No.	0	0	0
26	420KV, 63KA FOR 1S, RIGID SPACER SUITABLE FOR TWIN BERSIMIS	426	No.	15	15	30
27	CONNECTORS 420KV, 63KA FOR 1S, FLEXIBLE SPACER SUITABLE FOR QUAD BULL	427	No.	0	0	0
28	PG CLAMP SUITABLE FOR QUAD BERSIMIS ACSR CONDUCTOR (RUN) AND QUAD BERSIMIS ACSR CONDUCTOR (TAP)	428	No.	3	3	6
29	PG CLAMP SUITABLE FOR TWIN BERSIMIS ACSR CONDUCTOR (RUN) AND TWIN BERSIMIS ACSR CONDUCTOR (TAP)	429	No.	3	3	6
30	PG CLAMP SUITABLE FOR QUAD QUAD AL59 MOOSE CONDUCTOR (RUN) AND QUAD BERSIMIS ACSR CONDUCTOR (TAP)	430	No.	3	3	6
31	PG CLAMP SUITABLE FOR QUAD QUAD AL59 MOOSE CONDUCTOR (RUN) AND TWIN BERSIMIS ACSR CONDUCTOR (TAP)	431	No.	3	3	6
32	400KV CORONA END BELL FOR 4.5" IPS AL TUBE	4CB	No.	8	8	16
33	ALUMINIUM WELDING SLEEVES FOR 4.5" IPS AL TUBE	WS1	No.	4	4	8
34	TWO WAY PG CLAMPS FOR 7/9 SWG (10.98MM DIA) GS WIRE	E1	No.	0	0	0
35	TENSION CLAMPS FOR 7/9 SWG(10.98MM DIA) GS WIRE BOLTED TYPE	E2	No.	0	0	0
36	STRUCTURE CLAMPS FOR 7/9 SWG(10.98MM DIA) GS WIRE ON LATTICE TYPE STRUCTURE	E3	No.	0	0	0
37	PAD TYPE CLAMP FOR CONNECTING 7/9 SWG(10.98MM DIA) GS WIRE ON ONE SIDE AND 75X 12 MM GS STRIP ON OTHER SIDE	E4	No.	0	0	0
38	STRUCTURE CLAMPS FOR 75X 12 MM GS STRIPS ON LATTICE TYPE STRUCTURE	E5	No.	280	280	560

* connector being supplied by OEM

Note: To maintain the same clamp no. in all 3 sites of project, we have kept quantity as zero for clamp which is not applicable.

Bill of Quantity - String Insulators Hardware - Bikaner-II Station (400kV)

S.No	Engineering Description	Nomenclature	Sl. No. as per BPS	Description as per BPS	BIKANER-III (CKT-I)	BIKANER-III (CKT-I)	Engineered Quantity Total (Nos)	Quantity as per BPS (Nos)	UNIT	REMARKS
Tension Hardware										
1	400 kV Double Tension Hardware **without** Turnbuckle suitable for Quad AL59 MOOSE Conductor	4H1	9	400KV TENSION INSULATOR STRING AND ASSOCIATED HARDWARE FITTINGS WITHOUT TURN BUCKLE SUITABLE FOR QUAD CONDUCTOR	3	3	6	6	Nos	
Suspension Hardware										
2	400 kV Single Suspension Hardware with **Drop** Clamp suitable for Quad ACSR Bersimis Conductor	4H2	10	400KV SUSPENSION INSULATOR STRING AND ASSOCIATED HARDWARE FITTINGS WITH DROP CLAMP SUITABLE FOR QUAD CONDUCTOR	3	3	6	6	Nos	
COMPOSITE LONG ROD POLYMER INSULATOR-400KV										
1	400KV COMPOSITE LONG ROD POLYMER INSULATOR - 31mm/kV, 120kN - For Tension Insulators		--	--	--	--	12	--	Nos	
2	400KV COMPOSITE LONG ROD POLYMER INSULATOR - 31mm/kV, 120kN - For suspension insulators		--	--	--	--	6	--	Nos	

पावरग्रिड
POWERGRID

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

संदर्भ/Ref : CC-ENGG-TB202359-1002269-SI3480-CABTR-LAYOUT

Date : 27/06/2024

From : Atul Mathur
DGM

To : Bharat Heavy Electricals Limited
Plot No.-7, Sector-142 Noida 201305
201305

Cc :

Subject : Substation Package SS-01 for (i) Establishment of 765/400/220kV Bikaner-III (New) Pooling Station including 400kV class Bus Reactor at Bikaner-III S/s; (ii) Extension of 765kV Neemrana-II S/s for termination of 765 kV D/c line Neemrana-II–Bikaner-III T/L and (iii) Extension of 400kV Bikaner-II S/s for termination of 400kV Bikaner-II Bikaner-III T/L under "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-1) (Bikaner Complex): PART-A"

LOA Ref : CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 Dated 23/02/2024

Please find enclosed following drawings/ documents for necessary action at your end.

Vendor Drg. No.	:	TB-0-424-316-104
Orgn. Drg. No.	:	TB202359-1002269-SI3480-CABTR-LAYOUT
Revision No.	:	00
Drg. Title	:	Bikaner II-CABLE TRENCH LAYOUT
App. Category	:	CAT-I
Release Date	:	27/06/2024

Scan to verify

Comments : Generally in order

अनुमोदित श्रेणी/App. Category:

I. फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु जारी।
Approved/released for fabrication/construction.

II. फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु अनुमोदित/जारी बशर्ते दिए गए टिप्पणियाँ एवं आशोधनों की सम्मिलित किया जाये। कृपया रिवाइजड दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
Approved/released for fabrication/ construction subject to incorporation of comments and modification as noted. Revised drawing required for approval.

III. टिप्पणियाँ सम्मिलित करने के उपरांत दस्तावेज को अनुमोदनार्थ प्रस्तुत करें।
To be resubmitted for approval after incorporating the comments.

IV. सूचनार्थ एवं रिकार्ड हेतु।
For information and record.

CATREL/ REL-CON निर्माण हेतु जारी।
Released for construction.

नोट/Note:

1. Approval/Comments conveyed herein neither relieve the contractor of his contractual obligations and his responsibilities, weights, quantities, design details assemble fits, performance particulars and conformity of the supplies with the Indian Statutory Laws as may be applicable, nor does it limits the purchaser's right under the contract.
2. The approval conveyed vide this letter does not cover the approval of make for sub-vendor items.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRG. NO. TB-0-424-316-104

INVENTORY NO | SIGN. AND DATE | REF. DRG. NO. | COMPUTER DRG. PATH NAME :

E=303944
N=3115426

STORE AREA

BOUNDARY WALL

SCHNEIDER WALL

PRESENT SCOPE

X=0
Y=0
E=304206
N=3115230

E=304717
N=3115544

BOUNDARY WALL

AP-1A AP-1B

SECTION-4-4

NOTES:
1. ALL DIMENSIONS ARE IN mm.
2. THE LOCATION OF CABLE TRENCHES SHOWN IN THIS DWG MAY BE SLIGHTLY ALTERED TO SUIT SITE CONDITIONS.
3. APPROVED PUSH TYPE CABLE GLANDS SHALL BE USED FOR ALL CABLES AT ANY INTERMEDIATE LOCATION IN CABLE TRENCHES
4. ALL CABLES SHALL BE LAID IN TREFOIL FORMATION.
5. CABLES SHALL BE LAID IN MULTI-TIERS ON CABLE SUPPORTS (ANGLES).
6. CABLE SUPPORTS SHALL BE PROVIDED AT EVERY 1.5m. INTERVAL.
7. CROSSING POINT BE ENGINEERED AT EVERY TRENCH. OPTIONAL FOR PIERCE CABLE SUPPORT.
8. ALL CABLES SHALL BE LAID ON THE SIDE OF THE TRENCH AS SHOWN IN SECTION VIEWS. AS PER TECHNICAL SPECIFICATION
9. CABLES SHALL BE LAID ON EXISTING FLOOR AND SHALL BE OF PEB EXISTING LAYOUT.
10. EARTH CONDUCTORS SHALL BE FLAT SHALL BE RUN ALONG THE TOP TIER AND TO BE WELDED ON THE CABLE SUPPORT BEFORE INSTALLATION OF CABLES.
11. ENTRY OF CABLES THROUGH AND ITS SEALING ARRANGEMENT SHALL BE AS PER APPROVED STANDARD SOLUTIONS.
12. ALL OPENINGS IN CABLE TRENCHES AND CABLE TRENCH CROSSINGS SHALL BE SEALED WITH FIRE BARRIER COMPOUND AS PER APPROVED STANDARD SOLUTIONS. ADDITIONAL FIRE PROOFING IF REQUIRED SHALL BE PROVIDED AS PER SITE CONDITION.
13. PIPE SHALL BE SECURELY FIXED AT ENTRY POINT TO PREVENT ANY ENTRY OF RODENTS OR TERMITES.
14. AFTER LAYING THE CABLES THE OPENING OF THE PIPE SHALL BE SEALED WITH SUITABLE SEALING COMPOUND TO PREVENT ENTRY OF RODENTS.
15. CABLE RACK AND SUPPORTS SHALL BE PAINTED AFTER INSTALLATION WITH 2 COATS OF RED OXIDE ZINC CHROMATE OF A SUITABLE VEHICLE FOLLOWED BY THE FINISHING COAT OF ALUMINIUM PAINT.
16. SUITABLE PULL OUT BOX SHALL BE PROVIDED (IF REQUIRED) WHERE CABLE SHALL BE LAID IN PVC PIPE.
17. LONGITUDINAL SLOPE OF CABLE TRENCH SHALL BE AS PER LEVEL.
18. FOR ALL CTFL, TRANS EXCAVATION TRENCHES BETWEEN EXISTING AND NEW SHALL BE FILLING.
19. TOP COVER OF CABLE TRENCH SHALL BE PROVIDED WITH ADEQUATE NUMBER OF GI ANGLES OF 50 NOTED SHALL BE PROVIDED.
20. ALL CABLE TRAYS MAY CABLE TRENCH TO EQUIPMENT AND ALL INTERFACE CABLES (WITH POWER & CONTROL) FOR ALL EQUIPMENT SHALL BE LAID IN PVC PIPE.
21. FIBRE OPTIC CABLES SHALL NOT TRANSVERSE ALL PIPES IN BOTTOM TIER OF TRENCH/CABLE RISE 150mm (AS APPLICABLE).
22. ALL CABLES SHALL BE LAID IN TREFOIL FORMATION. ALL PIPE ON SIDE AS FOLLOWS :- TO BE USED AT STEEL INPUT FOR CABLE TRENCHES. FOR SIDE TOP OF CABLE RACKS AT SITE :- FOR CABLE LAYING AND MOUNTED AT SITE.
23. ALL OTHER DETAILS PERTAINING TO CIVIL WORKS SHALL BE INCORPORATED IN THE RESPECTIVE CIVIL DRAWINGS.
24. LOCATION OF LIVE WIRE EQUIPMENTS VIZ. CVT, SPT & LA ARE INDICATIVE. FINAL LOCATION SHALL BE AFTER DEAD END TOWER LOCATION IS FINALIZED.

LEGEND:
PRESENT SCOPE
EXISTING/ FUTURE

NOA NO.: CC/TW-AIS/CN/AA-122401/05/NOA-I/04-18/2023/01			
ADDITIONAL INFORMATION W.O.No.	NAME OF CUSTOMER: BIKANER III NEEMRANA TRANSMISSION LIMITED NAME OF CONSULTANT: POWERGRID CORPORATION OF INDIA LIMITED NAME OF PROJECT: EXTENTION OF 400kV BIKANER –II S/S FOR TERMINATION OF 400kV BIKANER – III T/L		
STATUS OF DRAWING			
DISTRIBUTION OF PRINTS	भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION		
REV. / DATE / ALTERED / CHECKED / APPROVED	DESIGN / DRN. / CHK. / APP.	3@A0 / SCALE	EDC SYS. / CAD CODE
ZONE	TITLE: Bikaner II-CABLE TRENCH LAYOUT		

	EDC_Proc	EDC_CODE	TO_DATE
PREP.	SY	–SGD–	10.06.24
CHKD.	SKS	–SGD–	10.06.24
APPVD.	SKS	–SGD–	10.06.24

ENGG. DRAWING NO.: TB202359-1802268-S3480-CADTR-LAYOUT

CLIENT DRAWING NO.: TB-0-424-316-104

SHEET NO.: 00

SIZE: A0 | NO. OF SHEET: 1 | DRAWN BY: [illegible]

पावरग्रिड
POWERGRID

पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
POWER GRID CORPORATION OF INDIA LIMITED
(A Government of India Enterprise)

संदर्भ/Ref : CC-ENGG-TB202359-1002269-SI3480-EMAT-LAYOUT

Date : 27/08/2024

From : Somiran Das
Senior GM

To : Bharat Heavy Electricals Limited
Plot No.-7, Sector-142 Noida 201305
201305

Cc :

Subject : Substation Package SS-01 for (i) Establishment of 765/400/220kV Bikaner-III (New) Pooling Station including 400kV class Bus Reactor at Bikaner-III S/s; (ii) Extension of 765kV Neemrana-II S/s for termination of 765 kV D/c line Neemrana-II–Bikaner-III T/L and (iii) Extension of 400kV Bikaner-II S/s for termination of 400kV Bikaner-II Bikaner-III T/L under "Transmission system for evacuation of power from Rajasthan REZ Ph-IV (Part-1) (Bikaner Complex): PART-A"

LOA Ref : CC/T/W-AIS/DOM/A10/23/01956/NOA-1/24-102643/01 & 02 Dated 23/02/2024

Please find enclosed following drawings/ documents for necessary action at your end.

Vendor Drg. No.	:	TB-0-424-316-103
Orgn. Drg. No.	:	TB202359-1002269-SI3480-EMAT-LAYOUT
Revision No.	:	01
Drg. Title	:	Bikaner II- EARTHMAT LAYOUT DRGS
App. Category	:	CAT-IV
Release Date	:	27/08/2024

Scan to verify

Comments : Generally in order, however, in case of any discrepancy between STANDARD Earthing Drawings & earthing layout, Standard Earthing shall be followed for earthing of individual equipment.

अनुमोदित श्रेणी/App. Category:

I. फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु जारी।
Approved/released for fabrication/construction.

II. फेब्रिकेशन/निर्माण/टाइप टेस्टिंग हेतु अनुमोदित/जारी बशर्ते दिए गए टिप्पणियाँ एवं आशोधनों की सम्मिलित किया जाये। कृपया रिवाइजड दस्तावेज अनुमोदनार्थ प्रस्तुत करें।
Approved/released for fabrication/ construction subject to incorporation of comments and modification as noted. Revised drawing required for approval.

III. टिप्पणियाँ सम्मिलित करने के उपरांत दस्तावेज को अनुमोदनार्थ प्रस्तुत करें।
To be resubmitted for approval after incorporating the comments.

IV. सूचनार्थ एवं रिकार्ड हेतु।
For information and record.

CATREL/ REL-CON निर्माण हेतु जारी।
Released for construction.

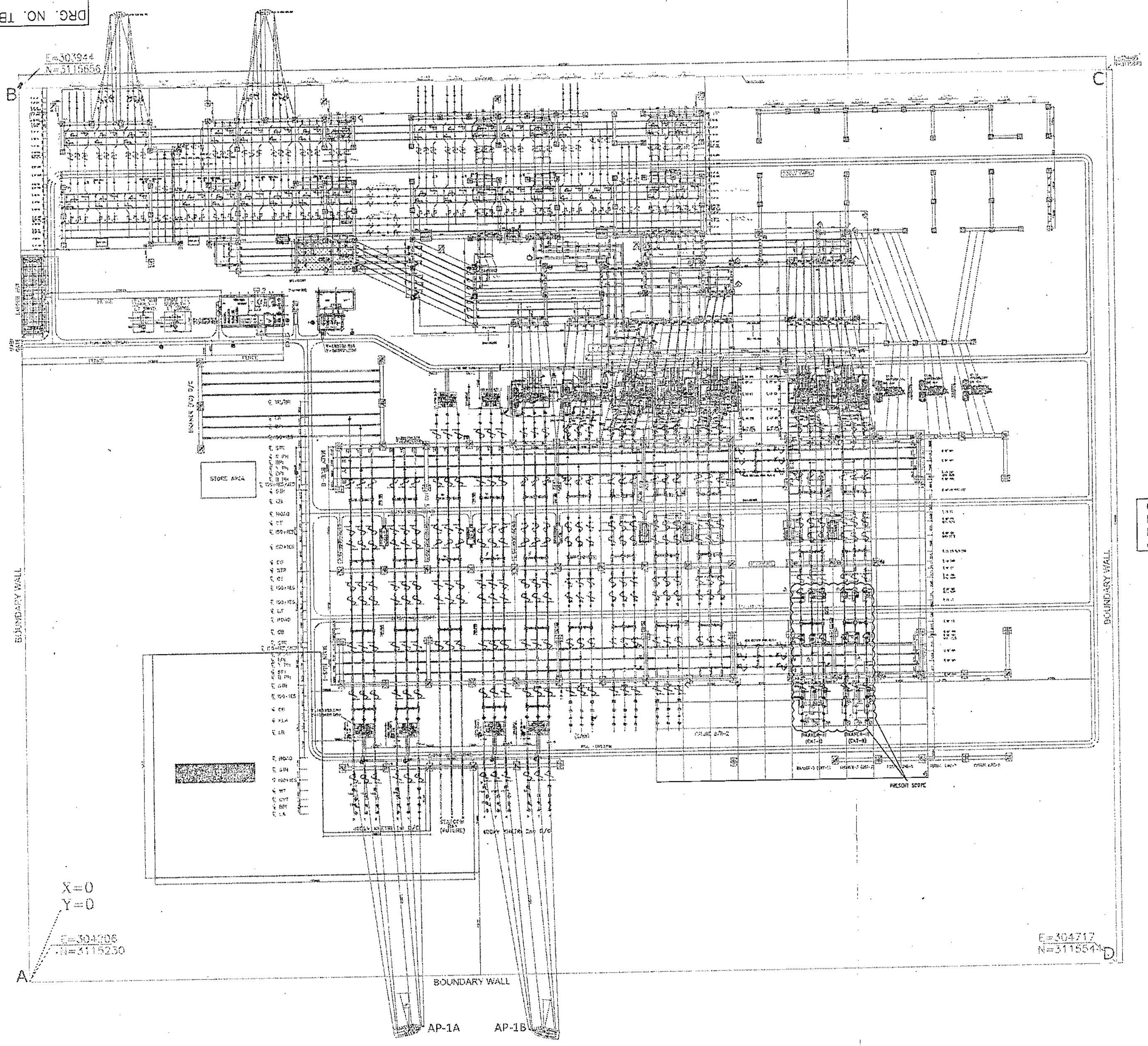
नोट/Note:

1. Approval/Comments conveyed herein neither relieve the contractor of his contractual obligations and his responsibilities, weights, quantities, design details assemble fits, performance particulars and conformity of the supplies with the Indian Statutory Laws as may be applicable, nor does it limits the purchaser's right under the contract.
2. The approval conveyed vide this letter does not cover the approval of make for sub-vendor items.

PROJECT TITLE	Establishment of 6X1500 MVA, 765/400 kV & 5X500 MVA 400/220 kV Bikaner-III Pooling Station (including 400kV, 2x125MVAR, reactor at Bikaner-III)	
CUSTOMER	BIKANER III NEEMRANA TRANSMISSION LIMITED	
CONSULTANT	POWERGRID CORPORATION OF INDIA LIMITED	
EPC CONTRACTOR	Bharat Heavy Electricals Ltd (BHEL)	
REVIEW OF	Bikaner II- EARTHMAT LAYOUT DRGS	
Sl. NO.	POWERGRID Comments dated 20.06.2024	BHEL reply dated 21.08.2024
1	Earthmats enclosed in blue colour not connected to main earthmats, to be connected	Incorporated
2	STANDARD Equipment earthing drawing attached with the Section - Switchyard Erection rev10 to be followed.	Refer Note no. 3
3	Risers for auxiliary Earthmat to be shown	Incorporated
4	Earthing of BPI to consider	Incorporated

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)

DRG. NO. TB-0-424-316-103



Generally in order, however, In case of any discrepancy between STANDARD Earthing Drawings & earthing layout, Standard Earthing shall be followed for earthing of individual equipment.

NOA NO.: CC/T/AAIB/DOM/A10/23/01956/NOA-1/24-10204301			
ADDITIONAL INFORMATION W.O.No.	NAME OF CUSTOMER	BIKANER III NEEMRANA TRANSMISSION LIMITED	
	NAME OF CONSULTANT	POWERGRID CORPORATION OF INDIA LIMITED	
	NAME OF PROJECT	EXTENTION OF 400kV BIKANER -II S/S FOR TERMINATION OF 400kV BIKANER -II BIKANER - III T/L	
STATUS OF DRAWING			
DISTRIBUTION OF PRINTS	भारत हैवी इलेक्ट्रिकल्स लिमिटेड पारेषण परियोजना विभाग BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION	DRAWN: SY -SGD- 05.08.24; CHECKED: SKS -SGD- 05.08.24; APPROVED: SKS -SGD- 05.08.24	
REV. 01, DATE 21.08.24, ALTERED SY, CHECKED SD, APPROVED SKD	अनुपात / SCALE	कार्ड कोड CARD CODE	POWERGRID DRAWING NO. TB202359-1002269-SI3480-EMAT-LAYOUT
ZONE: REVISED AS PER POWERGRID COMMENTS	शीर्षक/TITLE: BIKANER II - EARTHMAT LAYOUT DRGS	ड्राइंग सं./DRAWING NO. TB-0-424-316-103	संशो./REV. 01
		पृष्ठ सं./SHEET No. 01	अगला पृष्ठ/NEXT SHEET --

COMPUTER DRG. PATH NAME :
REF. DRG. NO.
SIGN. AND DATE
INVENTORY NO