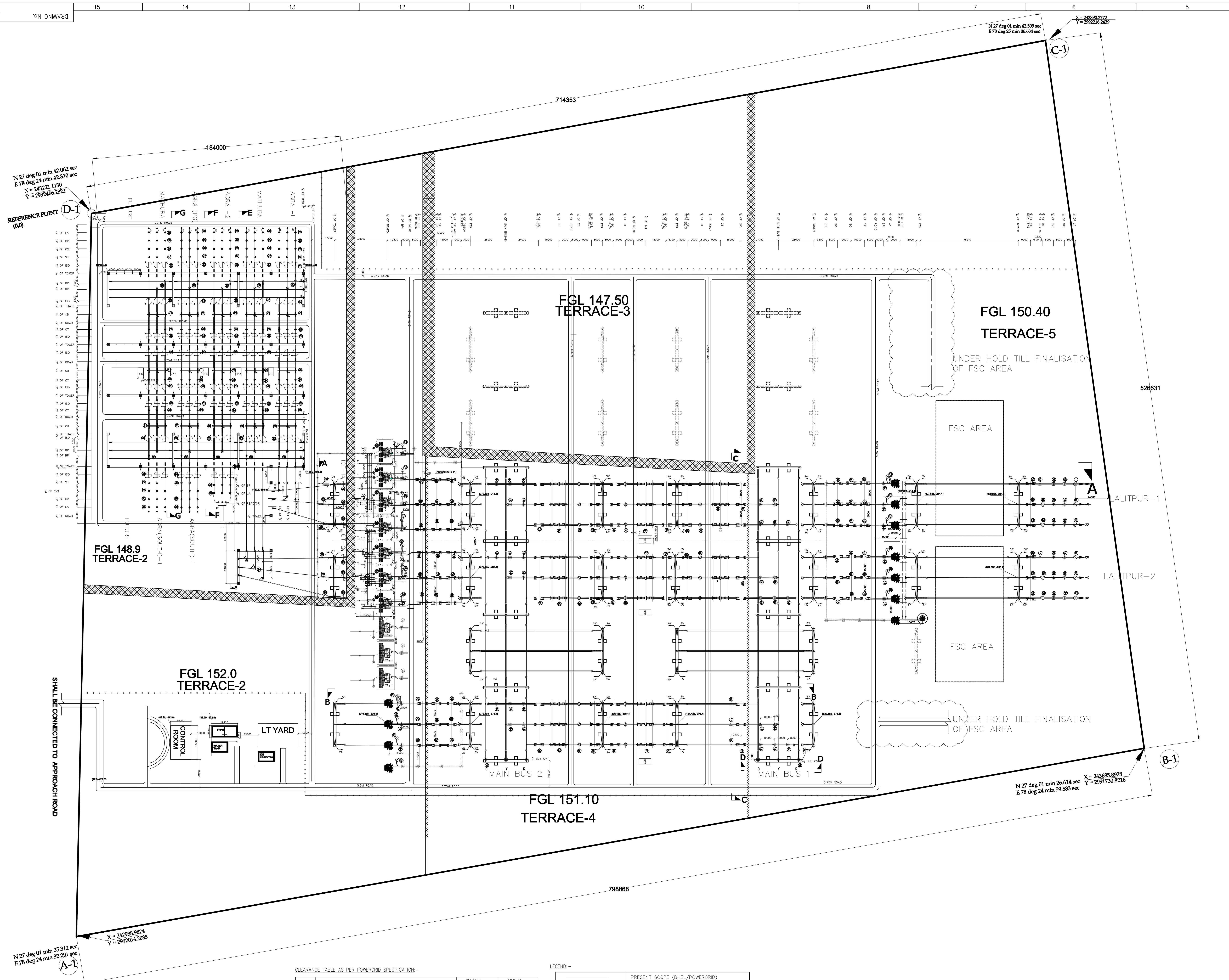

BILL OF QUANTITY – 765kV

ITEM CODE	DESCRIPTION	SYMBOL	QTY.
1	SF6 CIRCUIT BREAKER WITH CLOSING RESISTOR WITH CSD 765kV, 3150A, 40 kA for 1 SEC, (3–PH)		05
2	SF6 CIRCUIT BREAKER WITHOUT CLOSING RESISTOR WITH CSD 765kV, 3150A, 40 kA for 1 SEC, (3–PH)		03
3	ISOLATOR VERTICAL KNEE TYPE WITH ONE EARTH SWITCH 765kV, 3150 A, 40 kA for 1 SEC, (3–PH)		11
4	ISOLATOR WITH TWO EARTH SWITCHES 765kV, 3150 A, 40 kA for 1 SEC, (3–PH)		08
5	765 kV, 3000A, 40 kA for 1 SEC CURRENT TRANSFORMER, 1–PH, 120% Extended Current Rating		24
6	CAPACITOR VOLTAGE TRANSFORMER 765 kV, 1–PH, 8800 pF		12
7	SURGE ARRESTER 624kV, 1–PH, 20KA, 13KJ/KV		24
8	WAVE TRAP, 3150A, 40 kA for 1Sec., 1–PH (PEDESTAL MOUNTED)		04
9	ISOLATOR WITHOUT EARTH SWITCH 765kV, 3150 A, 40 kA for 1 SEC, (1–PH)		27
10	ISOLATOR WITH ONE EARTH SWITCH 765kV, 3150 A, 40 kA for 1 SEC, (1–PH)		16
11	500 MVA, 1–PH, 765/400/33 KV AUTO TRANSFORMER		07
12	765kV, 80 MVAR SHUNT REACTOR, 1–PH WITH NGR & LA		07
13	765kV, 80 MVAR BUS REACTOR, 1–PH (WITHOUT NGR)		04
14	765kV BUS POST INSULATOR (FOR SWITCHYARD)		64
15	765kV GUY WIRE (FOR SWITCHYARD)		05

* EXACT QUANTITY SHALL BE FILLED AFTER FINALIZATION OF LAYOUT.

CLEARANCE TABLE AS PER POWERGRID SPECIFICATION:–

Sl.No.	DESCRIPTION	765kV SYSTEM	400kV SYSTEM
1.	PHASE TO PHASE FOR CONDUCTOR–CONDUCTOR CONFIGURATION FOR ROD–CONDUCTOR CONFIGURATION	7600mm 9400mm	4000mm 4200mm
2.	PHASE TO EARTH FOR CONDUCTOR–CONDUCTOR STRUCTURE FOR ROD–CONDUCTOR CONFIGURATION	4900mm 6400mm	3500mm
3.	SECTIONAL CLEARANCE	10300mm	6500mm
4.	MIN HEIGHT OF EQPMT BUS CENTRE LINE ABOVE PLINTH LEVEL	+14000mm	+8000mm
5.	MIN CLEARANCE IN AIR FOR TRANSFORMER & REACTOR A) PHASE TO PHASE B) PHASE TO EARTH	6700mm (FOR BIL–1950 kVp & SIL–1550kVp 5800mm (FOR BIL–1950 kVp & SIL–1550kVp	3500mm (FOR BIL–1300 kVp & SIL–1050kVp 3100mm (FOR BIL–1300 kVp & SIL–1050kVp

LEGEND:–

	PRESENT SCOPE (BHEL/POWERGRID)
	FUTURE/NOT IN BHEL SCOPE
	FENCE
	765kV TOWER W/O PEAK
	765kV TOWER WITH PEAK
	400 TOWER WITH PEAK
	400 TOWER W/O PEAK
	SHIELD WIRE (765kV)
	SHIELD WIRE (400kV)
	TENSION STRING INSULATOR (765kV)
	TENSION STRING INSULATOR (400kV)

BILL OF QUANTITY – 400kV

ITEM CODE	DESCRIPTION	SYMBOL	QTY.
20	SF6 CIRCUIT BREAKER WITHOUT CLOSING RESISTOR EITH CSD 400kV, 3150 A, 50 kA for 1 SEC (3–PH)		06
21	SF6 CIRCUIT BREAKER WITHOUT CLOSING WITHOUT CSD		09
22	ISOLATOR HDB WITH TWO EARTH SWITCHES 400kV, 3150 A, 50 kA for 1 SEC (3–PH)		02
23	ISOLATOR HDB WITH ONE EARTH SWITCH 400kV, 3150 A, 50 kA for 1 SEC (3–PH)		36
24	CURRENT TRANSFORMER 420kV, 3000A, 50KA for 1 SEC, 1–PH. WITH 120% EXTENDED CURRENT RATING (5 CORE)		45
25	CAPACITOR VOLTAGE TRANSFORMER 420kV, 1–PH, 4400 pF		27
26	SURGE ARRESTER 336 KV, 1–PH, CLASS–4, 12KJ/KV		30+1
27	WAVE TRAP, 3150A, 0.5mH, 50 kA for 1 SEC , 1–PH		14
28	ISOLATOR HDB WITHOUT EARTH SWITCH 400kV, 3150 A, 50 kA for 1 SEC, (1–PH)		05
29	ISOLATOR HDB WITH ONE EARTH SWITCH 400kV, 3150 A, 50 kA for 1 SEC, (1–PH)		07
30	400kV BUS POST INSULATOR (FOR SWITCHYARD)		68
31	400kV,125MVAR 3PH BUS REACTOR.		01

SYSTEM PARAMETERS (765kV):–

Sl.No.	DESCRIPTION OF PARAMETER	765kV SYSTEM	400kV SYSTEM	36kV SYSTEM
1	HIGHEST SYSTEM VOLTAGE	800kV	420kV	36kV
2	NORMAL SYSTEM VOLTAGE	765kV	400kV	36kV
3	RATED FREQUENCY	50Hz	50Hz	50Hz
4	NO. OF PHASES	3	3	3
5	RATED INSULATION LEVELS i) FULL WAVE LIGHTNING IMPULSE WITHSTAND VOLTAGE (1.2/50microsec.) ii) SWITCHING IMPULSE WITHSTAND VOLTAGE (250/2500microsec.) DRY & WET iii) ONE MINUTE POWER FREQUENCY DRY WITHSTAND VOLTAGE (rms)	±2100kV ±1550kV 830kV	±1550kV ±1050kV 630kV	70kV
6	CORONA EXTINCTION VOLTAGE	508kV	320kV	
7	MAX. RADIO INTERFERENCE VOLTAGE LEVEL AT 508kV (rms) FOR 765 kV & AT 320 kV (rms) FOR 400kV.	2500 micro volts	1000 micro volts	
8	RATED SHORT CIRCUIT CURRENT FOR 1 SEC. DURATION	40kA	50kA	25kA (FOR 3S)
9	SYSTEM NEUTRAL EARTHING	EFFECT. EARTHED	EFFECT. EARTHED	EFFECT. EARTHED

CONDUCTOR & STRINGING DETAILS –765kV

SL.NO.	DESCRIPTION	LEVEL FROM PLINTH	SUB–CONDUCTOR	TENSION INSULATOR STRING/PHASE
1.	MAIN BUS–I & II	(AT 27M HEIGHT)	QUAD AAC BULL CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	DOUBLE TENSION 210 kN DISC INSULATOR (2X44 Nos.)
2.	JACKBUS	(AT 39M HEIGHT)	QUAD AAC BULL CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	DOUBLE TENSION 210 kN DISC INSULATOR (2x44 Nos.)
3.	DROPPERS/JUMPERING	–	QUAD AAC BULL CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	SINGLE STRING–210kN DISC INSULATOR (1x44 Nos.)
4.	EQUIPMENT INTERCONNECTION	(AT 14M HEIGHT)	4.5" IPS AL. TUBE (120mm OD)/QUAD AAC BULL CONDUCTOR WITH 450MM SPACING	
5.	EARTHWIRE	(AT 45M HEIGHT)	7/3.66mm GI WIRE (10.98mm DIA)	
6.	INTERCONNECTION BETWEEN 765/400kV TRAFO TO 400kV SUB–STATION	–	QUAD BULL/BERSIMIS ACSR CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING/4.5" IPS AL. TUBE	
7.	EQUIPMENT INTERCONNECTION NEAR 765/400kV ICT AREA FOR HIGH BPI&HIGH LA	(AT 12M HEIGHT)	QUAD BULL/BERSIMIS ACSR CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING/4.5" IPS AL. TUBE	

CONDUCTOR & STRINGING DETAILS –400kV

SL.NO.	DESCRIPTION	LEVEL FROM PLINTH	SUB–CONDUCTOR	TENSION INSULATOR STRING/PHASE
1.	MAIN BUS–I & II	(AT 15M HEIGHT)	QUAD BERSIMIS ACSR CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	DOUBLE TENSION 120 kN DISC INSULATOR (2x25 Nos.)
2.	JACKBUS	(AT 22M HEIGHT)	QUAD BERSIMIS ACSR CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	DOUBLE TENSION 120 kN DISC INSULATOR (2x25 Nos.)
3.	DROPPERS/JUMPERING	–	QUAD BERSIMIS ACSR CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	SINGLE STRING–120kN DISC INSULATOR (1x25 Nos.)
4.	EQUIPMENT INTERCONNECTION	(AT 8M HEIGHT)	4.5" IPS AL. TUBE /QUAD ACSR BERSIMIS CONDUCTOR WITH 450MM SPACING	
5.	EARTHWIRE	(AT 29.5M HEIGHT)	7/3.66mm GI WIRE (10.98mm DIA)	
6.	BUS CVT, CVT & LA IN LINE BAYS AND BUS REACTOR BAY	–	TWIN BERSIMIS ACSR CONDUCTOR WITH 450MM SUB–CONDUCTOR SPACING	

NOTES:–

1. LEVELS FOR SWITCHYARD ARE AS PER POWER GRID DRG–NO C/ENGG/NRI/AGRA/UPPCL/SITELVL/01 REV–01
2. DEAD END TOWER ERECTION AND OUTGOING STRINGING OF LINE CONDUCTOR & SHIELD WIRE ARE NOT IN BHEL SCOPE BUT CONNECTION OF EQUIPMENT TOWARDS LINE SIDE SHALL BE DONE BY BHEL. SUPPLY OF TENSION INSULATOR STRING ON LINE SIDE OF TAKE OFF GANTRY IS IN BHEL SCOPE OF WORK.
3. SUPPLY ERECTION, TESTING & COMMISSIONING OF 765KV TRAFO & REACTOR (INCLUDING TERMINAL CONNECTOR OF TRAFO & REACTOR) & (NGR, 120kV LA, 33kV NCT & TERM. CONNECTOR OF REACTOR), FORMATION OF HV, LV, TERTIARY, NEUTRAL & AUXILIARY BUSES ALONG WITH BPI & ITS STRUCTURE AND ASSOCIATED CIVIL WORKS IS NOT COVERED IN SCOPE OF WORK AS PER TS SECTION PROJECT .
4. INTER EQUIPMENT DIMENSION ARE PLANNED SO AS TO ACHIEVE REQUIRED PHYSICAL AND ELECTRICAL CLEARANCE. HOWEVER IF ELECTRICAL CLEARANCE ARE NOT AVAILABLEAT SITE AND MODIFICATIONS ARE REQUIRED TO ACHIEVE IT, THE REQUIRED MODIFICATION WILL BE DONE BY BHEL WITHOUT ANY EXTRA COST IMPLICATION TO OWNER.
5. FIRE RESISTANT WALL BETWEEN 765kV TRANSFORMER UNITS AND 765kV REACTORS UNITS ARE NOT IN BHEL SCOPE.
6. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED
7. LOCATION OF WT SHOWN ARE INDICATIVE ONLY. EXACT LOCATION SHALL BE FINALIZED DURING COMMISSINING BASED ON PLCC REQUIRMENT HOWEVER FOUNDATION FOR WAVE TRAP SHALL BE CONSTRUCTED FOR ALL THREE PHASES.
8. 765/400 KV ICT AREA SHALL BE FINALIZED AFTER RECEIVING PROJECT SPECIFIC ICT AREA LAYOUT FROM POWERGRID. HENCE THE SAME SHALL BE UPDATED ON SWITCHYARD LAYOUT DRAWING ACCORDINGLY & ICT INTERCONNECTIONS SHOWN ON THIS LAYOUT ARE TENTATIVE.
9. 765KV REACTOR AREA SHALL BE FINALISED AFTER RECEIVING PROJECT SPECIFIC REACTOR AREA LAYOUT FROM POWERGRID. HENCE THE SAME SHALL BE UPDATED ON SWITCHYARD LAYOUT DRAWING ACCORDINGLY & REACTOR INTERCONNECTIONS SHOWN ON THIS LAYOUT ARE TENTATIVE.
10. DETAILS OF BMK, CTJB, CVT JUNCTION BOX & SWITCHYARD PANEL ROOM (SPR) LOCATION SHALL BE SHOWN IN CABLE TRENCH LAYOUT DRAWING.
11. PHASE SEQUENCE IS INDICATIVE & IT SHALL BE VERIFIED AT SITE DURING EXECUTION, ALONG WITH TRANSFORMER LINE.
12. PLINTH HEIGHT OF FOUNDATION WILL BE MIN.300MM FROM FINISHED GROUND LEVEL (F.G.L.). GRAVEL TOP LEVEL WILL BE +175MM FROM
13. FOR SPR REFER CABLE TRENCH DRAWING.
14. * LEVELLING AREA HAS BEEN SHIFTED BY 2MTRS INFRONT OF ICTS.(765kV SIDE).

REV.	DATE	ALTERED	
01	03.04.15	CHECKED	VK
		APPROVED	RS
ZONE	REVISED TO INCORPORATE TRAFO AND REACTOR AREA LAYOUT .		MS/RJ

ADDITIONAL INFORMATION
W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

xzkgd@ifj;kstuk dk uke
NAME OF CUSTOMER: POWER GRID CORPORATION OF INDIA LTD

NAME OF PROJECT: SUBSTATION PACKAGE -SS01 765KV/400KV AGRA (UP) NEW SUBSTATION

NOA NO.– CC–CS/494–NR1/SS–2546/3/G3/NOA–IAII/5163 & 5164

BHARAT HEAVY ELECTRICALS LTD.
TRANSMISSION PROJECTS DIVISION

	NAME	DATE
DRAWN	RJ	22.01.15
CHECKED	VK	
APPROVED	RS	

DEPT. | CODE | SCALE: NTS | CARD CODE

TITLE: LAYOUT PLAN AND SECTIONAL ELEVATION FOR 765/400kV AGRA UPPTCL(NEW) SUBSTATION

DRAWING NO. TB–0–376–316–002 | REV. 01

SHEET No. 01 | NEXT SHEET 02