BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

NEW DELHI

					Prepared	Checked	Approved
DOCUMENT No.	TB-349-316-120	Rev	00				
CUSTOMER Doc. No.				NAME	RJ	RJ	MK
TYPE OF DOC.	TECHNICAL SPECIFICATION			SIGN			
TITLE	Visual Monitoring system for Watch and Ward of Substation Premises			DATE	18/02/13	18/02/13	18/2
				GROUP	TBEM		
				W.O. No	81005		

CUSTOMER	POWER GRID CORPORATION OF INDIA LIMITED
PROJECT	765kV/400kV S/S AT RAICHUR
NOA Ref:	CC-CS/147-SR1/SS-1217/1/G4/NOA/4181 & 4182 dated 12.03.12

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Drawings:

Control Room building drawing

Layout Plan for 765kV/400kV S/S Raichur

Sectional Elevation 765kV/400kV S/S Raichur

Rev.	Date	Altered	Checked	Approved	REVISION DETAILS
00					First Issue

Distribution	CUSTOMER	TBMM	O/C	
	-	4	1	

SECTION - 1

1.1 SCOPE

This technical specification covers the requirements of design, supply, erection/installation, testing and commissioning the complete visual monitoring system including cameras, digital video recorder system, mounting arrangement for cameras, cables, LAN switches, UPS and any other items/accessories for the 765kV/400kV Raichur S/S.. It shall also be bidder's responsibility to provide all necessary licenses to customer i.e. POWERGRID to run the system successfully.

The VMS system is required for the following Project

Name of the Customer : **POWER GRID CORPORATION OF INDIA LIMITED (PGCIL)**
Name of the Project : **765kV/400kV S/S RAICHUR**

Bidder shall submit the detailed BOQ and drawings indicating qty. of each items required for Visual monitoring system in the tender stage, the drawings and BOQ shall be submitted to BHEL/Powergrid for approval. It shall be bidder's responsibility to get the approval in the drawing/BOQ from POWERGRID.. Bidder shall also be required to visit BHEL/POWERGRID office for technical discussion.

Visual monitoring system (VMS) is required for effective watch and ward of Raichur Substation premises covering the areas of complete switchyard, control room cum administrative building, fire fighting pump house, stores and main gate .

System with colour IP cameras for VMS surveillance would be located at various locations including indoor areas and outdoor switchyard and as per the direction of engineer in charge. The VMS data partly/completely shall be recorded (Minimum for 15 days) and stored on network video recorder.

It will be bidder's responsibility to assess number of cameras and their locations shall be decided in such a way that any location covered in the area can be scanned. The cameras shall be located in such a way to monitor at least

1. The operation of each and every isolator pole of the complete yard (including future scope)
2. All the transformer and reactors (including future scope)
3. All the entrance doors of control room building and fire fighting pump house and switchyard panel room
4. All the gates of switchyard
5. Main entrance gate
6. All other Major equipments (such as CB, CT,CVT,SA etc. For present and future)

The cameras shall be mounted on structures, buildings. Bidder is advised to refer Layout and sectional elevation drawing enclosed with this specification, and if bidder feels that at any one or more locations it is not possible to cover the requisite area by placing cameras on existing structure or building , in that case bidder can suggest alternative mounting

arrangement and such alternative arrangement should be supplied by bidder without any extra cost implication to BHEL. Further alternative mounting arrangement should be proposed to BHEL/POWERGRID for acceptance..

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the enquiry.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

The video monitoring system shall be an integral system with IP network centric functional and management architecture aimed at providing high speed manual/automatic operation for best performance.
The system should facilitate viewing of live and recorded images and controlling of all cameras by the authorized users.
The system shall use video signals from various types of indoor/outdoor CCD color cameras installed at different locations, process them for viewing on workstations/monitors in the control room and simultaneously record all the cameras after compression using H 264/MPEG 4 or better standard. Mouse/Joystic-keyboard controllers shall be used for pan, tilt, zoom and other functions of desired cameras.
The system shall provide sufficient storage of all the cameras recordings for a period of 15 days or more @ 25FPS, at 4 CIF or better quality using necessary compression techniques for all cameras. It shall be ensured that data once recorded shall not be altered by any means.The reading resolution and frame rate for each camera shall be user programmable.
The surveillance VMS system shall operate on 230V, 50Hz single phase Power supply. System shall have back up UPS Power supply meeting the power supply need of all the cameras in the stations including those which are installed at gate for a period of 2 hrs. The bidder shall submit the sizing calculation for the UPS considering the total load requirement of video monitoring system.

System Requirements:

1. System must provide built in facility of watermarking or digital certificate to ensure tamperproof recording.
2. All cameras may be connected through a suitable LAN which shall be able to perform In 765kV class substation environment without fail.
3. All cameras recording shall have camera ID, location/area of recording & data /time shall be programmable by the system administrator with user ID & Password.
4. Facility of camera recording in real time mode (25 FPS)/15/12.5/10 or lower FPS as well as in any desired combination must be available in the system.
5. Facility of camera recording in HD (1280X720P), D1, 4CIF, CIF, VGA as well as in any combination i.e. any camera can be recorded in any quality.
6. System to have facility of 100% additional camera installation beyond the originally planned capacity.
7. In order to optimize the memory , while recording, video shall be compressed using H 264/MPEG-4 or better standard and streamed over the IP network.
8. System shall have triplex i.e. it should provide facility of viewing, recording & reply simultaneously.

9. The offered system shall have facility to export the desired portion of clipping (from a specific date/time to another specific date/time) on CD or DVD. Viewing of this recording shall be possible on standard PC using standard software like windows media player etc.
10. System shall have provision of WAN connectivity for remote monitoring.
11. The equipment should generally conform to electro magnetic compatibility requirements for outdoor equipment in EHV switchyards. The major EMC required for cameras and other equipment shall be as under:

    1. Electrical Fast transient (Level 4) ---As per IEC 61000-4-4
    2. Damped Oscillatory (1MHz and 100kHz) (Level3)-- As per IEC 61000-4-12
    3. AC Voltage dips & Interruption/Vibration (Level 4)—As per IEC 61000-4-12
    4. Electrostatic discharge (Level 4) ---As per IEC 61000-4-2
    5. Power frequency Magnetic field (Level 4) –As per IEC 61000-4-8
    6. Ripple on DC Power supply (Level 4) ---As per IEC 61000-4-17

    Type test reports to establish compliance with the above requirement shall be submitted during detailed engineering.

1.3 Video Surveillance Application software

a) Digital video surveillance control software should be capable to display and manage the entire surveillance system. It should be capable of supporting variety of devices such as cameras, video encoder, servers, NAS boxes/Raid backup devices etc.
b) The software should have inbuilt facility to store configuration of encoders and cameras.
c) The software should support flexible 1/2/4/8/16/32 windows split screen display mode and scroll mode on the PC monitor.
d) The software should be able to control all cameras i.e. PTZ control, Iris control, auto/manual focus, and color balance of cameras, selection of presets, Video tour selection etc.
e) The software should have user access authority configurable on per device or per device group basis. The system shall provide user activity log with user ID, time stamp, action performed etc.
f) The user should be on a hierarchical basis as assigned by the administrator. The higher priority person can take control of cameras, which are already being controlled by a lower priority user.
g) It should have recording modes viz. continuous , manual or programmed modes on date , time and camera-wise . All modes should be disabled and enabled using scheduled configuration. It should also be possible to search and replay the recorded images on date, time and camera wise. It should provide onscreen controls for remote operation of PTZ cameras. It should have the facility for scheduled recording. Different recording speeds (fps) and resolution for each recording mode for each camera should be possible.
h) The software for clients should also be working on a browser based system for remote users. This will allow any authorized user to display the video of any desired camera on the monitor with full PTZ and associated controls.
i) Retrieval: The VMS application should allow retrieval of data instantaneously or

any date/time interval chosen through search functionality of the application software. In case data is older than 15 days and available , the retrieval should be possible. The system should also allow for backup of specific data on any drives like DVD's or any other device in a format which can be replayed through a standard PC based software. Log of any such activity should be maintained by the system.

j) VMS shall provide the full functionality reporting tool which can provide reports for user login/logoff, camera accessibility report, server health check reports etc.

1.4 Netowrk Video Recorder

The Network video recorder shall also include at least server (Min 3GHz, 4 GB RAM, 3000GB HDD(min) , RAID 5, with suitable configuration along with colored TFT 22" High resolution monitor, and Internal DVD writer, Windows XP/Vista/7 Prof. or VMS compatible operating system latest version with hardware like graphic cards, licensed Anti virus etc.

Further the digital video recorder shall conform to the following requirements:

1	Server specification	Intel Quad core (or better) 3 Ghz (min), 8MB cache, 4 GB memory with suitable NVIDIA graphics card, 3TB HDD , Raid 5
2	Recording and Display Frame Rate	Real time 25 frames per second per channel, manual select
3	Recording Resolution	(PAL) 1280x720, 407(H)x586(V)
4	Compression Method	H.264/MPEG-4 or better and latest
5	Video Motion detection capable	Standard and built in (selectable in menu)
6	Monitoring Options	Split screen 1,2,4,8,16,32 or more cameras
7	Playback options	Search, still image capture
8	Alarm/Event recording Capable	To be provided with built in external alarm input/output ports minimum (8 in , 2 Out)
9	Network Operation Capable	To be provided by using WAN or LAN router
10	Remote internal viewing capable	Using WAN or LAN router
11	HDD storage consumption	1GB per hour/channel variable based on frame speed and resolution settings, as well as compression
12	Operation	Triplex operation(simultaneous recording, playback, network operation)
13	Number of video channel	32
14	Audio Recording capable	32
15	Input storage	230V AC or equivalent with UPS as a backup for 30 minutes

1.5 VMS Cameras:

1. The color IP camera for substation shall have PAN, TILT and ZOOM facilities so that it can be focused to the required location from the remote station through a controller. Whereas wireless IP cameras with PTZ controls are required for installation at gates of the Substation premises as per the direction of Engineer-In – Charge.
2. The IP camera at the main gate can be fixed or PTZ based and shall be used for monitoring entry and exit.
3. It should have sufficient range for viewing all the poles of isolators and other equipments with high degree of clarity.
4. The VMS cameras shall be suitable for wall mounting, ceiling mounting and switchyard structure mounting.
5. It shall be possible to define at 128 selectable preset locations so that the camera gets automatically focussed on selection of the location for viewing a predefined location.
6. The cameras should be able to detect motion in day & night environment having light intensity of Color: 0.5 Lux, B & W : .05lux
7. Housing of cameras meant for indoor use shall be of IP 42 or better rating whereas outdoor camera housing shall be of IP 66 or better rating. Housing shall be robust and not have the effect of electromagnetic induction in 765kV/400kV switchyard.
8. All camera recordings shall have camera ID & location/area of recording & date/time shall be programmable by the system administrator with user ID & Password.
9. Facility of camera, recording in real time mode (25FPS)/15/12.5/10 or lower FPS as well as in any desired combination must be available in the system.

1.6 Outdoor IP Fixed Megapixel Camera Specifications (For Main Gate)

1.	Image sensor	2Megapixel Progresive 1/3" CMOS/CCD sensor, Minimum Illumination 0.1 Lux
2.	Min Luminous ring)	0.5Lux (Color) 0.05 Lux (Back)l
3.	Camera Enclosure type	IP 66 Grade
4.	Iris/Focus	Auto/Manual
5.	Video Compression	Dual stream H,264 and MPEG 4 user selectable
6.	Support dual-stream	Primary/secondary stream, H 264/MPEG 4Optional
7.	Video definition	Primary stream: 1600x1200,1200x960,1280x720
8.	Video parameters	Brightness, hue, ,saturation and image quality
9.	Video frame rate	PAL: 1-25 frames/second NTSC: 1-30 frames/second
10.	Video compression BR	32Kbit/S-6Mbit/S
11.	Video Output	One channel composite Streaming
12.	Supported Protocols	TCP,UDP,IP,HTTP,FTP,SMTP,DHCP ,DNS,ARP,ICMP,POP3,NTP,IPsec,UpnP, RTP,RTCP
13.	Operating Temperature	-5~+50^{0}C
14.	Operating humidity	10~90%

1.7 Outdoor IP66 PTZ HD Camera specifications (For Switchyards)

1.	Image Sensor	1/3 type solid state progressive scan CCD,WDR (high definition)
2.	Security	Multiple user access with password protection
3.	Effective Pixels	(PAL): Main stream: 1280x720 Sub stream: 640x360, 320x280 selectable
4.	Compression	Dual Stream H.264 and MPEG 4 user selectable
5.	Signal system	50Hz
6.	S/N (Signal to Noise)	Better than 50 dB
7.	Electronic Shutter	1/60~1/10,000 sec. automatic or better
8.	Scanning system	Progressive/Interface
9.	Low Light Sensitivity (Lux)	Color: 0.5 Lux, B & W :0.02 Lux
10.	Lens	Minimum 10X (Min.)optical in high

		definition (The system shall be able to zoom the images on the monitor without any distortion to the maximum level of optical zoom)
11.	Lens size	Minimum 4.1~73.8mm
12.	Lens Aperture	F1.6(wide)~F2.8(tele), f=4.1~41.0mm,10X zoom Video Auto Focus Angle of view Horizontal: 52^0 (wide) 2.8^0(tele)
13.	PTZ data Transfer Baud/Bit Rates supported	Selectable 2400bps/4800bps/9600 bps
14.	Panning Range	Complete 360degrees (horizontal)
15.	Pan Speed	Adjustable, 0.1 degrees/Second ~250 degrees/second
16.	Tilting Range	Minimum 180^0 Tilt rotation
17.	Tilt speed	Adjustable, 0.1 degrees/sec~150degrees/sec
18.	In built storage	Camera should have inbuilt storage TF or SD format for recording and storing pictures
19.	IP class	IP 66 Standard
20.	Working temperature	-0^0C~+50^0C
21.	Working Humidity	10~90%

1.8 PTZ- Keyboards

The features of PTZ shall include:

- Fully functional dynamic keyboard/joystick controllers
- Controls all pen, tilt, zoom, Iris, preset functions
- Control up to 255 units from a single keyboard
- Many preset options and advanced tour programming
- Compatible with all connected cameras

1.	Key Application	Wired keyboard control operation of PTZ functions for weatherproof dome cameras
2.	Pan/Tilt/Zoom Protocol Languages supported	Selectable
3.	PTZ data transfer Baud Rates supported	Selectable 1200bps/2400bps/4800bps/9600bps
4.	Additional Features	Dynamic joystic for smooth camera movements, preset location option for quick access to frequently monitored areas.

1.9Test Requirement

The vendor shall submit a FAT (factory acceptance test) & SAT (site acceptance test) plan complying the specification for POWERGRID / BHEL approval that will be used during inspection at works & and site respectively.

i) Complete operating and maintenance manuals and training of O&M personnel.
ii) System commissioning and acceptance tests as specified in site acceptance test (SAT) plan.

1.10 Documents to be provided by bidder

- Detailed BOQ to meet the requirement of specification with make, model & quantity of each item
- Technical datasheet/Catalogues/brochures of the item
- Test certificates as per relevant standards
- Reference list of the Projects where similar equipment for similar application is being used for at least 2 years.

1.11 BILL OF QUANTITY:

VMS system with all accessories ---- 1 Lot

(Item/Quantity detail are required, all items to be given by bidder)

- - X X - -

SECTION-2

PROJECT DETAILS

SITE INFORMATION

	Particular	Details
a)	Customer	Power Grid Corporation of India Limited
b)	Project Title	765kV/400kV Substation at Raichur
c)	Location	RAICHUR(KARNATAKA)
d)	Transport Facilities	ROAD/TRAIN Nearest Airport Hyderabad
	SITE CONDITIONS	
a)	Max. ambient air temp.	50°C
b)	Min. ambient air temp.	0°C
c)	Max. design ambient temp.	50°C
d)	Design reference temp.	50°C
e)	Average Humidity	Max. 100%
f)	Special corrosion conditions	No
g)	Solar Radiation	1.2kW/sqmtr
h)	Atmospheric UV radiation	High
i)	Altitude above sea level	Less than 1000meter
j)	Pollution Severity	High Pollution level (25mm/kV)
k)	Seismic Zone	As per the seismic zone defined in the relevant BIS but not less than 0.3g horrizontal
	WIND DATA	
	Wind velocity	As per IS
	Average No. of thunderstorm days per annum	As per IS

ANNEXURE - A
SCHEDULE OF TECHNICAL DEVIATIONS

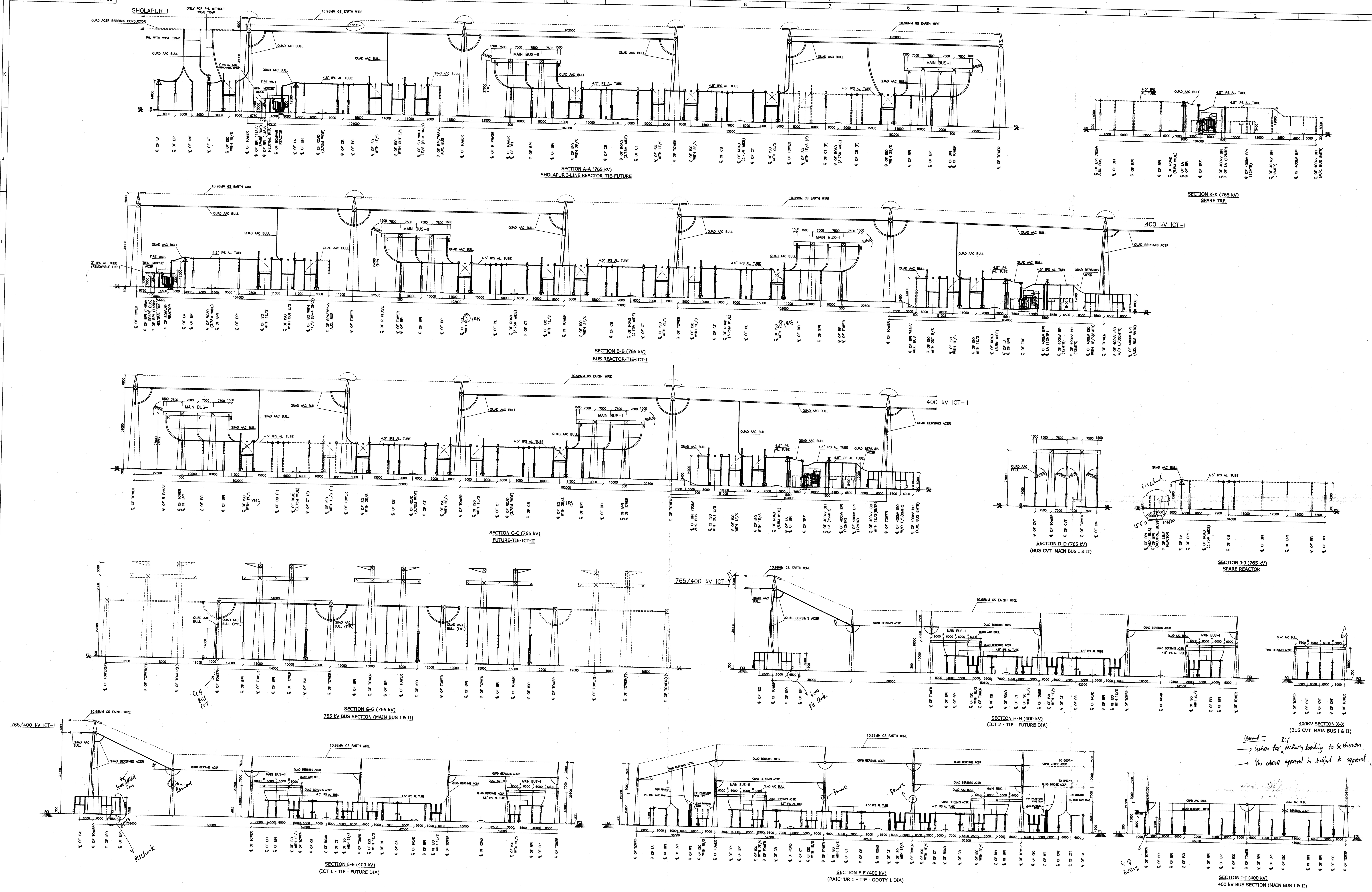
Bidder shall list below all technical deviation clause wise w.r.t. tender specifications:

S.No.	Page No.	Clause No.	Deviation	Reason / Justification

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

Date: Tenderer's Stamp & Signature

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM.)



REV.	DATE	ALTERED / CHECKED / APPROVED	ZONE	REMARKS
04	02.02.13	ALTERED MANOJ; CHECKED MVK/RJ; APPROVED MK		REVISED AS PER CUSTOMER COMMENTS DATED 23.01.13
03	21.05.12	ALTERED MANOJ -SD-; CHECKED MVK/RJ -SD-; APPROVED MK -SD-		REVISED AS PER CUSTOMER COMMENTS DATED : 18.05.12
02	15.05.12	ALTERED MANOJ -SD-; CHECKED MVK/RJ -SD-; APPROVED MK -SD-		REVISED AS PER CUSTOMER COMMENTS DATED : 11.05.12
01	01.05.12	ALTERED MANOJ -SD-; CHECKED MVK/RJ -SD-; APPROVED MK -SD-		REVISED AS PER CUSTOMER COMMENTS DATED : 16.04.12

ADDITIONAL INFORMATION
W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम
NAME OF CUSTOMER: POWER GRID CORPORATION OF INDIA LTD

NAME OF PROJECT : SUBSTATION PACKAGE P260 SS01 FOR 765/400kV RAICHUR S/S (NOS.) UNDER SYSTEM STRENGTHENING IN SR & WR KRISHNAPATNAM FOR UMPP PART-B

NOA NO.– CC-CS/147-SR1/SS-1217/1/G4/NOA I&II /4181&4182 DATED: 12.03.12

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

	नाम /NAME	हस्ता /SIGN.	दि /DATE
बनाया DRAWN	MANOJ	-SD-	13.03.12
जाँचा CHECKED	MVK/RJ	-SD-	13.03.12
स्वीकृत APPROVED	MK	-SD-	13.03.12

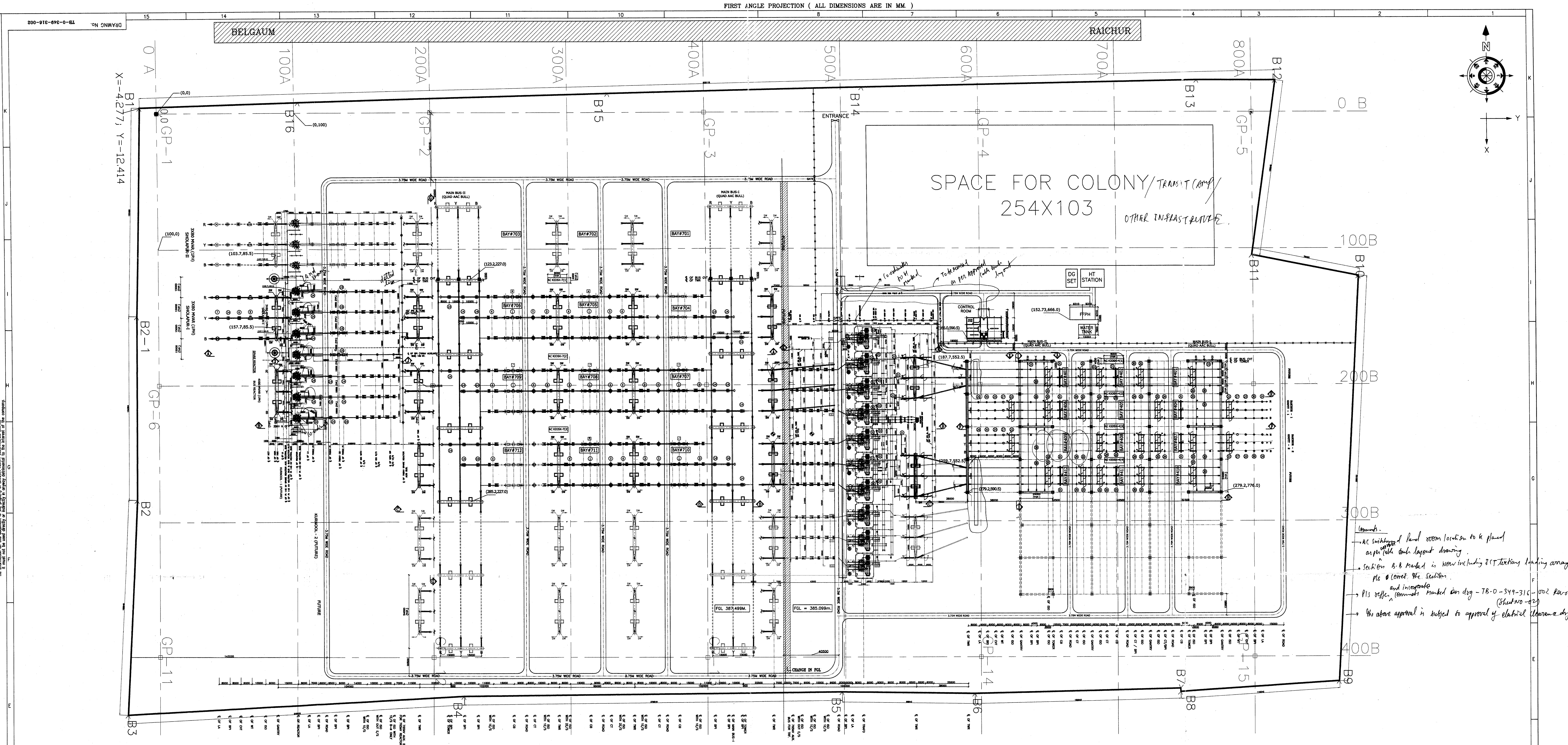
विभाग DEPT.
कोड CODE
अनुपात / SCALE 1:600
कार्ड कोड CARD CODE

शीर्षक/TITLE
ELECTRICAL SECTION ELEVATION
765/400kV RAICHUR SUBSTATION (NEW)

ड्राइंग.क्र./DRAWING NO. TB-0-349-316-002
पुनः/REV. 04
पृष्ठ क्र./SHEET No. 02 | अगला पृष्ठ /NEXT SHEET --

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

Comment:- → Section for stationary loading to be shown.
→ The above approval is subject to approval of electrical clearance dwg.



BILL OF QUANTITY - 765kV

ITEM CODE	DESCRIPTION	SYMBOL	QTY.	SCOPE
1	SF6 CIRCUIT BREAKER WITH CLOSING RESISTOR 765kV, 3150A, 40 kA for 1 SEC, (3-PH)		02	POWERGRID
2	SF6 CIRCUIT BREAKER WITHOUT CLOSING RESISTOR 765kV, 3150A, 40 kA for 1 SEC, (3-PH)		05	POWERGRID
3	ISOLATOR VERTICAL KNEE TYPE WITH ONE EARTH SWITCH 765kV, 3150 A, 40 kA for 1 SEC, (3-PH)		09	BHEL
4	ISOLATOR VERTICAL KNEE TYPE WITH TWO EARTH SWITCHES 765kV, 3150 A, 40 kA for 1 SEC, (3-PH)		08	BHEL
5	765 kV, 3000A, 40 kA for 1 SEC CURRENT TRANSFORMER, 1-PH, 120% Extended Current Rating		21	BHEL
6	CAPACITOR VOLTAGE TRANSFORMER 765 kV, 1-PH, 8800 pF		09	BHEL
7	SURGE ARRESTER 624kV, 1-PH, 20KA, 13KJ/KV		17	BHEL
8	WAVE TRAP, 3150A, 1 mH, 40 kA for 1Sec., 1-PH (PEDESTAL MOUNTED)		02	BHEL
9	ISOLATOR VERTICAL KNEE TYPE WITHOUT EARTH SWITCH 765kV, 3150 A, 40 kA for 1 SEC, (1-PH)		22	BHEL
10	ISOLATOR VERTICAL KNEE TYPE WITH ONE EARTH SWITCH 765kV, 3150 A, 40 kA for 1 SEC, (1-PH)		14	BHEL
11	500 MVA, 1-PH, 765/400/33 KV AUTO TRANSFORMER		07	POWERGRID
12	A) 765kV, 80 MVAR SHUNT REACTOR, 1-PH B) NGR & LA FOR 2 BANKS OF 3 1-PH REACTORS AT S.NO.12(A)		03	POWERGRID
13	765kV, 80 MVAR BUS REACTOR, 1-PH (WITHOUT NGR)		04	POWERGRID
14	765kV BUS POST INSULATOR (FOR SWITCHYARD)		51	BHEL
15	SF6 CIRCUIT BREAKER WITHOUT CLOSE RESISTOR 765kV, 40kA FOR 1S , (1-PH)		04	POWERGRID

BILL OF QUANTITY - 400kV

ITEM CODE	DESCRIPTION	SYMBOL	QTY.	SCOPE
21	SF6 CIRCUIT BREAKER WITHOUT CLOSING RESISTOR 400kV, 3150 A, 50 kA for 1 SEC (3-PH)		10	BHEL
22	ISOLATOR HDB WITH ONE EARTH SWITCH 400kV, 3150 A, 50 kA for 1 SEC (3-PH)		24	BHEL
23	ISOLATOR HDB WITH TWO EARTH SWITCHES 400kV, 3150 A, 50 kA for 1 SEC (3-PH)		02	BHEL
24	CURRENT TRANSFORMER 420kV, 3000A, 50KA for 1 SEC, 1-PH. WITH 120% EXTENDED CURRENT RATING (5 CORE)		36	BHEL
25	CAPACITOR VOLTAGE TRANSFORMER 420kV, 1-PH, 4400 pF		18	BHEL
26	SURGE ARRESTER 336 KV, 1-PH, CLASS-4, 12KJ/KV		12	BHEL
27	WAVE TRAP, 3150A, 0.5mH, 50 kA for 1 SEC , 1-PH		08	BHEL
28	ISOLATOR HDB WITHOUT EARTH SWITCH 400kV, 3150 A, 50 kA for 1 SEC, (1-PH)		05	BHEL
29	ISOLATOR HDB WITH ONE EARTH SWITCH 400kV, 3150 A, 50 kA for 1 SEC, (1-PH)		07	BHEL
30	400kV BUS POST INSULATOR (FOR SWITCHYARD)		34	BHEL
31	400kV BUS POST INSULATOR 12Mtr. HIGHT (H/L)		25	BHEL
32	SURGE ARRESTER HIGH LEVEL		07	BHEL

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 (±1425kV) ±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

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:-

(solid line)	PRESENT SCOPE (BHEL/POWERGRID)
(dashed line)	FUTURE/NOT IN BHEL SCOPE
—x—x—x—	FENCE
15000 15000 / 7500 15000 7500	765kV TOWER W/O PEAK
15000 15000 / 7500 15000 7500	765kV TOWER WITH PEAK
6000 6000 6000 6000	400 TOWER WITH PEAK
6000 6000 6000 6000	400 TOWER W/O PEAK
SW SW	SHIELD WIRE (765kV)
	SHIELD WIRE (400kV)
	TENSION STRING INSULATOR (765kV)
	TENSION STRING INSULATOR (400kV)
Ø	SUSPENSION STRING INSULATOR (765kV)
O	SUSPENSION STRING INSULATOR (400kV)
	CB WITH CONTROLLED SWITCHING DEVICE
	CB WITH PIR
	CB WITH CONTROLLED SWITCHING DEVICE & PIR
	CB WITHOUT PIR

NOTES:-

1. LEVELS (RL) FOR SWITCHYARD ARE AS PER PGCIL E-MAIL DTD. 12.04.12
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 TRAFO & REACTOR INCLUDING (OLTC & TERMINAL CONNECTOR OF TRAFO) & (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 REV.01 CL.3.0(F)
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. LOCATION OF EQUIPMENTS TOWARDS LINE SIDE ARE TENTATIVE WHICH SHALL BE FINALISED ONCE THE DEAD END TOWER LOCATION IS FINALISED in consultation with PGCIL site incharge.
6. BOUNDARY WALL ALONG WITH SUBSTATION PROPERTY LINE, OWNER SITE OFFICE, STORES, CONTOURING AND SUBSTATION LEVELLING ARE NOT IN BHEL SCOPE.
7. FIRE RESISTANT WALL BETWEEN 765kV TRANSFORMER UNITS AND 765kV REACTORS UNITS ARE NOT IN BHEL SCOPE.
8. SOIL INVESTIGATION & SOIL RESISTIVITY MEASUREMENT OF SUBSTATION ARE NOT IN BHEL SCOPE.
9. ALL CORDINATES MARKED IN DRAWING ARE AS PER CONTOUR LAYOUT
10. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED
11. RADIUS BEND OF ROAD SHALL BE SHOWN IN ROAD LAYOUT.
12. CO-ORDINATE FOR 765kV LA & BPI AT INCOMING DIRECTION OF TRAFO./REACTOR AND 400kV LA AT O/G DIRECTION OF TRAFO. SHALL BE GIVEN AFTER RECEIVING TRAFO./REACTOR FDN. DRAWINGS FROM PGCIL.
13. LOCATION OF WT SHOWN IS 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.
14. 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.
15. 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.
16. DETAILS OF BMK, CTJB, CVT JUNCTION BOX & SWITCHYARD PANEL ROOM (SPR) LOCATION SHALL BE SHOWN IN CABLE TRENCH LAYOUT DRAWING.
17. FOR STRUCTURES REFER STRUCTURAL LAYOUT DRAWING.
18. PHASE SEQUENCE IS INDICATIVE & IT SHALL BE VERIFIED AT SITE DURING EXECUTION, ALONG WITH TRANSFORMER LINE.
19. SUPPLY OF 765KV CB IS NOT IN SCOPE OF BHEL AS PER TS SECTION PROJECT.
20. DETAILING OF AUXILIARY TRANSFORMER ARRANGEMENT SHALL BE SHOWN IN SEPARATE DRAWING. LOCATION OF LT STATION IS INDICATIVE. THE SAME SHALL BE FINALIZED IN CONSULTION WITH SITE-IN-CHARGE.
21. PLINTH HEIGHT OF FOUNDATION WILL BE MIN.300MM FROM FINISHED GROUND LEVEL (F.G.L.). GRAVEL TOP LEVEL WILL BE +175MM FROM F.G.L. (GRAVEL THICKNESS 100MM)
22. SWITCHYARD PANEL ROOM LOCATION IS INDICATIVE ONLY. FOR ACTUAL LOCATION CABLE TRENCH LAYOUT SHALL BE REFERRED.

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 120 kN DISC INSULATOR (2x47 Nos.)
2.	JACKBUS	(AT 39M HEIGHT)	QUAD AAC BULL CONDUCTOR WITH 450MM SUB-CONDUCTOR SPACING	DOUBLE TENSION 120 kN DISC INSULATOR (2x47 Nos.)
3.	DROPPERS/JUMPERING	-	QUAD AAC BULL CONDUCTOR WITH 450MM SUB-CONDUCTOR SPACING	SINGLE STRING-120kN DISC INSULATOR (1x47 Nos.)
4.	EQUIPMENT INTERCONNECTION	(AT 14M HEIGHT)	4.5" IPS AL. TUBE /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 AAC BULL CONDUCTOR WITH 450MM SUB-CONDUCTOR SPACING	DOUBLE TENSION 120 kN DISC INSULATOR (2x25 Nos.)
2.	JACKBUS	(AT 22M HEIGHT)	QUAD BERSIMIS ACSR CONDUCTOR WITH [illegible]	DOUBLE TENSION 120 kN [illegible]
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	-	TWIN BERSIMIS ACSR CONDUCTOR WITH 450MM SUB-CONDUCTOR SPACING	

REFERENCE DWG :-

DWG. NO.	TITLE
C:ENGG:SR-KPTM-B:RHR:SLD:1	SINGLE LINE DIAGRAM 765/400kV RAICHUR S/S
TB-1-349-316-001	SINGLE LINE DIAGRAM (765/400kV RAICHUR SUBSTATION)
C/ENGG/SR-II/K'PATNAM/RAICHUR/GA	SWITCHYARD GENERAL ARRANGEMENT

REV.	DATE	ALTERED / CHECKED / APPROVED	DESCRIPTION
04		ALTERED MANOJ; CHECKED MVK/RJ; APPROVED MK	REVISED TO INCORPORATE ICT & REACTOR AREA LAYOUT.
03	23.05.12	ALTERED MANOJ -SD-; CHECKED MVK/RJ -SD-; APPROVED MK -SD-	REVISED AS PER CUSTOMER COMMENTS DATED : 18.05.12
02	17.05.12	ALTERED MANOJ -SD-; CHECKED MVK/RJ -SD-; APPROVED MK -SD-	REVISED AS PER CUSTOMER COMMENTS DATED : 11.05.12
01	01.05.12	ALTERED MANOJ -SD-; CHECKED MVK/RJ -SD-; APPROVED MK -SD-	REVISED AS PER CUSTOMER COMMENTS DATED : 16.04.12

ADDITIONAL INFORMATION W.O.No.

STATUS OF DRAWING

DISTRIBUTION OF PRINTS

ग्राहक/परियोजना का नाम / NAME OF CUSTOMER: POWER GRID CORPORATION OF INDIA LTD

NAME OF PROJECT : SUBSTATION PACKAGE P260 SS01 FOR 765/400kV RAICHUR S/S (NEW) UNDER SYSTEM STRENGTHENING IN SR & WR KRISHNAPATNAM FOR UMPP PART-B

NOA NO.- CC-CS/147-SR1/SS-1217/1/G4/NOA I&II /4181&4182 DATED: 12.03.12

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

	नाम /NAME	हस्ता./SIGN.	दि./DATE
बनाया DRAWN	MANOJ	-SD-	13.03.12
जाँचा CHECKED	MVK/RJ	-SD-	13.03.12
स्वीकृत APPROVED	MK	-SD-	13.03.12

विभाग DEPT. | कोड CODE | अनुपात / SCALE 1:1000 | कार्ड कोड CARD CODE

शीर्षक/TITLE: ELECTRICAL LAYOUT PLAN FOR 765/400kV RAICHUR SUBSTATION (NEW)

ड्राईंग.क./DRAWING NO. TB-0-349-316-002 | पुनः/REV. 04

पृष्ठ क./SHEET No. 01 | अगला पृष्ठ /NEXT SHEET 02

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