2.23.21 POWER FACTOR METER (DIGITAL)

Type	:	Electronic digital 7- segment with fluorescent display
Input	:	4 - 20 mA DC
Mounting	:	Flush Panel, compatible for mounting on mosaic grid panel
Number of digits	:	41/2 digit
Face Dimension	:	192X192 mm
Digit size	:	Approximately 40 mm
Range	:	- 1 - 0 - + 1
Accuracy	:	± 0.25 %
Display	:	Red LED display
Connection	:	Plug in type
Magnetic Shield	:	Shielded Case

2.23.22 SYNCHROSCOPE

Synchroscope shall be designed to provide an illuminate and indication of phase and frequency difference between bus voltages and generator voltage. It shall denote the actual frequency difference corresponding to the inverse of time taken for one rotation of the illuminated vector spot. Synchroscope shall be designed as per IEC/DIN/BS standard.

Input	:	Differential frequency & Differential Voltage
Mounting	:	Flush Panel, compatible for mounting on mosaic grid panel
Face Dimension	:	96 x 96 mm
Accuracy	:	± 0.5%
Magnetic Shield	:	Shielded Case

2.24.00 CONTROL DESK/PANEL PUSH BUTTONS

2.24.01 PB/ ILPBs FOR ON/OFF, OPEN/CLOSE

Type	:	Momentary/Miniaturized Suitable for mosaic grid 24x48 Mm with 2 PB and 3 coloured LED.
Contact Configuration	:	2 NO + 2 NC
Contact Material	:	Hard Silver Alloy
Contact Rating	:	500V / 10 A
Insulation Voltage	:	2 KV for 1 minute between terminals and earth
Lamp Rating :-		
a) Voltage	:	240 V AC

b)	Watt	:	2 Watt (approx.)
Colour			
Red		:	ON/Start/Open ILPB
Green		:	OFF/Stop/Close ILPB
Red		:	energized, running, Start, valve open LED/Lamp
Green		:	de-energized, stopped, valve closed LED/Lamp
Light yellow		:	abnormal, discrepancy LED/Lamp
Red		:	OFF/Stop/Close PB
Green		:	ON/Start/Open PB
Red		:	Emergency trip push buttons with red flap / Hinged Transparent acrylic cover.

2.24.02 PUSH BUTTON FOR Control DESK

Type	:	Momentary mosaic grid mounted 24x48 mm size, single PB 18x40 mm
Colours		
DESK RELEASE PB		- Yellow
Desk Lamp test PB		- Blue
Desk Acknowledge PB		- Green

2.24.03 PUSH BUTTON FOR SEQUENCE START/RELEASE

Momentary (Miniaturised) suitable for mosaic grid 24x48 mm, 3 PB + 5 LED.

2.24.04 PUSH BUTTON FOR ANNUNCIATION

Contacts		
- Number & Type	:	As per requirement
- Breaking capacity	:	1 Amp, 220V DC 10 Amp, 600V AC Different colours for Accept/Acknowledge - Green, reset Grey, test – Yellow & Audio Acknowledge – Black.

2.25.00 Digital Indicators for Control Desk Draw out section.

Type	:	Electronic digital 7- segment with fluorescent display
Input	:	4 - 20 mA DC
Mounting	:	Flush Panel
Number of digits	:	31/2 digit, Float decimal.
Size	:	48 mm (W) x 24 mm (h)/50 mm x 25 mm
Accuracy	:	2.5% of final value
Display	:	Red LED display
Temp. coefficient	:	0.15%/deg C of measured value

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DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)

GENERAL*	* PROJECT	1 x 6600 MW PANKI Thermal Power Project	
	OFFER REFERENCE		
	* TAG NO. SERVICE		
	* DUTY	☐ ON / OFF ☐ INCHING	
	* LINE SIZE (inlet/outlet): MATERIAL		
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY	
	* OPENING / CLOSING TIME		
	* WORKING PRESSURE		
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF -20 to70 DEG C AND RELATIVE HUMIDITY OF 0-95%	
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY	
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY	
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY	
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF,DUST TIGHT SUITABLE FOR OUTDOOR USE WITHOUT CANOPY, NEMA6/IP:68	
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL	
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.	
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.	
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 90% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. **FOR REGULATING SERVICE - 150 STARTS/HR MINIMUM OR REQUIRED CYCLES WHICHEVER IS HIGHER..**	
HANDWHEEL	* REQUIRED	■ YES ☐ NO	
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED	
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.		
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY	
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY	
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF **I.S.** TOLERANCE	
	ACTUATOR APPLICABLE WIRING DIAGRAM	■ ENCLOSED (BIDDER TO CONFIRM) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐DRG. NO. 3-V-MISC-24550 R00 C: ■ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram	
	COLOUR SHADE	■ RAL 7032	
	PAINT TYPE **(## Refer Notes)**	☐ ENAMEL ■ EPOXY ☐	
	SHAFT RPM	BIDDER TO SPECIFY	
	OLR SET VALUE	BIDDER TO SPECIFY	
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY	
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY	
	@ PWR SUPP TO MTR / STARTER	415V +/- 10%, 3 Phase, 3 Wire 50HZ +/-5%	
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ■ 110 V	

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	DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
	@ ENCLOSURE CLASS OF MOTOR	☐ IP 67 ☐ FLAME PROOF	
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B	
	@ WINDING TEMP PROTECTION	■ THERMOSTAT (3 Nos.,1 IN EACH PHASE) ☐ ----------	
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED	
INTEGRAL STARTER	INTEGRAL STARTER	■ REQUIRED ☐ NOT REQUIRED	
	TYPE OF SWITCHING DEVICE	■ CONTACTORS(Reversing type) ☐ THYRISTORS	
	TYPE	■ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)	
	IF SMART		
	a) SERIAL LINK INTERFACE	☐ INTEGRAL ☐ FIELD MOUNTED	
	b) SERIAL LINK PROTOCOL	☐ FOUNDATION FIELD-BUS ☐ PROFI-BUS ☐ DEVICE NET ☐.....	
	c) SERIAL LINK MEDIA	☐ TWISTED PAIR Cu-CBL ☐ CO-AXIAL Cu-CBL ☐ OFC	
	d) HAND HELD PROGRAMMER	☐ REQUIRED ☐ NOT REQUIRED	
	e) TYPE OF HAND HELD PROGRAMMER	☐ BLUETOOTH ☐ INFRARED ☐.....	
	f) MASTER STATION	☐ REQUIRED ☐ NOT REQUIRED	
	g) MASTER STN INTRFACE WITH DCS	☐ MODBUS ☐ TCP/IP	
	h) DETAILS OF SPECIAL CABLE	☐ ENCLOSED ☐ NOT REQUIRED	
	STEP DOWN CONT. TRANSFORMER	■ REQUIRED	
	OPEN-STOP-CLOSE PB(running open/close LED) THREE POSITION SELECTOR SWITCH	■ REQUIRED ☐ NOT REQUIRED	
	INDICATING LAMPS	■REQUIRED ☐ NOT REQUIRED	
	LOCAL-OFF- REMOTE S/S(THREE POSITION SELECTOR SWITCH)	■REQUIRED ☐ NOT REQUIRED	
	STATUS CONTACTS FOR MONITORING	■ REQUIRED ☐ NOT REQUIRED	
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (MOTOR THERMOSTAT TRIPO/L RELAY OPERATED, CONT. /POWER SUPPLY FAILED, S/S IN LOCAL/OFF MODE, TORQUE SWITCH OPEN/CLOSE CUT OFF/STOP PB OPTD.)	
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	☐INTERPOSING RELAY ■OPTO COUPLER ☐ EITHER	
	QUANTITY	■ 2 NOs. ☐ 3 NOs.	
	DRIVING VOLTAGE	■ 20.5 – 24V DC ☐ _____V DC	
	DRIVING CURRENT	■ 125mA MAX ☐ _____mA MAX	
	LOAD RESISTANCE	■ > 192 ohms - <25 k ohms ☐ > _____ohms - < _____ohms	
TORQUE SWITCH (Not Applicable for Smart Actuator) **($$ Refer Notes)**	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN / CLOSE	☐1 No. ■ 2Nos. / ☐1 No. ■2Nos	
	CONTACT TYPE	2 NO + 2 NC	
	RATING	5A 250V AC AND 0.5A 220V DC	
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE	
	ACCURACY	+3% OF SET VALUE	
LIMIT SWITCH (Not Applicable for Smart Actuator) **($$ Refer Notes)**	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN : INT : CLOSE	■2 Nos. / 2 nos(adj) / 1 No. ■2Nos.	
	CONTACT TYPE	2 NO + 2 NC	
	RATING (AC / DC)	5A 250V AC AND 0.5A 220V DC	

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POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	REQUIRED for regulating/inching duty only.	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ■ ELECTRONIC (2 WIRE) contactless inductive type	
	SUPPLY	■ 24V DC ☐	
	OUTPUT	■ 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	230V AC,1 PH.,50 Hz	
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY	
	@ RATING		
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED	
	ENCL CLASS ACTUATOR/MOTOR T.B.	@■ IP 68 @☐ NEMA6	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET(9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	■ REQUIRED ☐ NOT REQUIRED☐ ■ 2 NOS. ☐ ----------	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:----------	
	@ SPACE HEATER CABLE GLAND	SIZE:----------	
	OTHER CONTROL CABLE GLANDS-1	☐ 1No. for BFV of CW PUMP(Cable size 2Px1.5mm2)	
	OTHER CONTROL CABLE GLANDS-2	1 no suitable for 8P X 0.5 sq mm Additional 1 no suitable for 2P X 0.5 sq mm(inching duty only)	

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WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.

NOTES:

1. **SCOPE**: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.

2. **CODES & STANDARDS**: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATION STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
   IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722

3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.

4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.

5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION.THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.

6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.

7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.

$$ **TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.**

**EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.**

8. IT SHOULD BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR.

9. POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL

10. WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE 1.5 SQ. MM.

11. THE MOTOR SHALL BE CAPABLE OF STARTING AT 85 PERCENT OF RATED VOLTAGE AND RUNNING AT 80 PERCENT OF RATED VOLTAGE AT RATED TORQUE AND 85 PERCENT RATED VOLTAGE AT 33 PERCENT EXCESS RATED TORQUE FOR A PERIOD OF 5 MINUTES EACH.

12. THE ACTUATORS SHALL BE DESIGNED TO BE SELF-LOCKING UPON LOSS OF POWER. MOTOR SHALL BE DESIGNED TO CLOSE IN 30 SECS. FROM FULL OPEN POSITION AND SHALL HAVE ADEQUATE CAPACITY TO OPEN AND CLOSE UNDER FULL UNBALANCED DESIGN PRESSURE.

13. ALL SIX (6) LIMIT SWITCHES SHALL BE CHANGEOVER TYPE AND ADJUSTABLE BESIDES HAVING THE SNAP FACILITY.

14. THE INTEGRAL STARTER WHICH SHALL HAVE SOPHISTICATED ELECTRONIC CONTROLS WITH FIELD PROGRAMMING FEATURE. IT SHALL BE DESIGNED FOR REMOTE CONTROL FROM DCS/RESPECTIVE CONTROL SYSTEM. REQUIRED INTERPOSING RELAYS FOR RECEIVING OPEN/CLOSE/STOP COMMAND FROM DCS/RESPECTIVE CONTROL SYSTEM SHALL BE PROVIDED. POTENTIAL FREE CONTACTS AND TRANSDUCERS SHALL BE PROVIDED TO PROVIDE STATUS INDICATION AT REMOTE DCS/RESPECTIVE CONTROL SYSTEM.

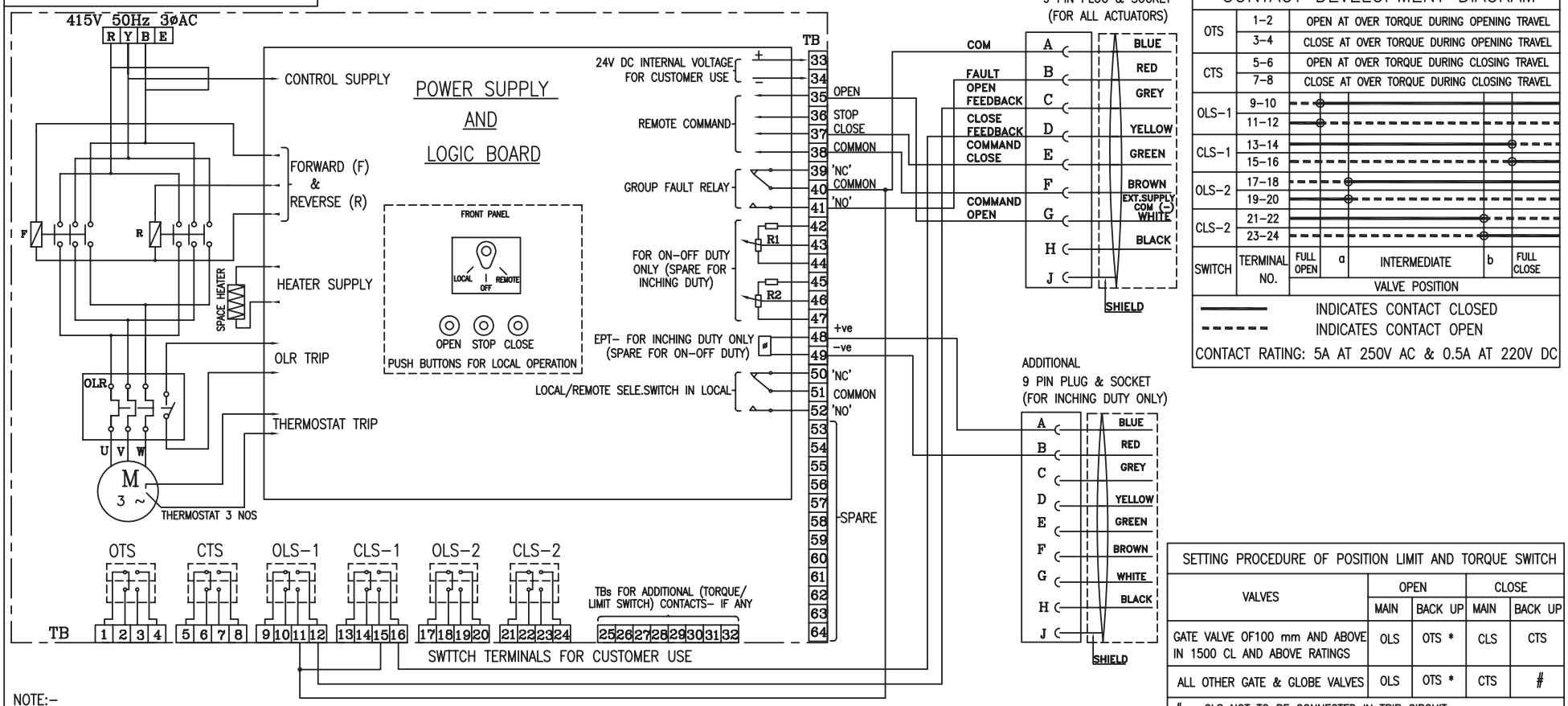
15. THE REMOTE COMMAND SIGNAL (OPEN-STOP-CLOSE) FROM DCS/RESPECTIVE CONTROL SYSTEM/CONTROL PANEL SHALL BE ISOLATED FROM CONTROL ELECTRONICS THROUGH OPTO-ISOLATOR.

16. THE FOLLOWING INDIVIDUAL STATUS ANNUNCIATION LED'S (COLOUR-GREEN) SHALL BE PROVIDED LOCALLY (INTEGRAL TO ACTUATOR) TO ANNUNCIATE THE FOLLOWING FOR EASY LOCAL MONITORING.
    ACTUATOR IN LOCAL MODE
    ACTUATOR IN REMOTE MODE
    ACTUATOR RUNNING IN OPEN DIRECTION
    ACTUATOR RUNNING IN CLOSE DIRECTION
    ACTUATOR IN INCHING MODE.
    ACTUATOR IN SELF-RETAINING MODE
    LIMIT SWITCH OPEN TRIP
    LIMIT SWITCH CLOSE TRIP
    CONTROL VOLTAGE AVAILABILITY

NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @= TO BE FILLED BY ELECTRICAL

ALL DIMENSIONS ARE IN MILLIMETRES. FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP.

DRAWING NO. 3-V-MISC-24283



CONTACT DEVELOPMENT DIAGRAM

OTS	1–2	OPEN AT OVER TORQUE DURING OPENING TRAVEL
	3–4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL
CTS	5–6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL
	7–8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL
OLS–1	9–10	
	11–12	
CLS–1	13–14	
	15–16	
OLS–2	17–18	
	19–20	
CLS–2	21–22	
	23–24	

SWITCH / TERMINAL NO. — FULL OPEN | a | INTERMEDIATE | b | FULL CLOSE — VALVE POSITION

INDICATES CONTACT CLOSED

INDICATES CONTACT OPEN

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS	#

\# – CLS NOT TO BE CONNECTED IN TRIP CIRCUIT

* – BYPASS OTS FOR INITIAL 5% OF TRAVEL(FOR GATE VALVES ONLY)

NOTE:–

1. ALL TORQUE AND LIMIT SWITCHES (OTS,CTS,OLS1&2, CLS1&2) ARE WITH 2NO+2NC CONTACTS '1NO+1NC' IS TERMINATED IN TBS 1–24, REMAINING CONTACTS ARE FOR INTERNAL USE. ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25–32
2. CTS – TORQUE SWITCHES FOR CW ROTATION (CLOSE)
3. OTS – TORQUE SWITCHES FOR CCW ROTATION (OPEN)
4. OLS–1, OLS–2 – LIMITSWITCHES FOR POSITION OPEN
5. CLS–1, CLS–2 – LIMITSWITCHES FOR POSITION CLOSE
6. EPT – ELECTRONIC POSITION TRAMSMITTER (CONTACTLESS TYPE, FOR INCHING DUTY)
7. R1–R2–POTENTIOMETER 2 x 100 OHMS (FOR ON–OFF DUTY)
8. FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
9. M – MOTOR 3ø 415V 50 Hz AC SUPPLY
10. TORQUE SWITCH BYPASS WITH LIMITSWITCH BOTH ON OPEN & CLOSE DIRECTION TO BE DONE INTERNALLY.

REV	DATE	ALTERED
		CHD & APPD

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS FOR NTPC PROJECTS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: HIGH PRESSURE BOILER PLANT.
TIRUCHIRAPALLI–620014.
365–121

	NAME	SIGN	DATE	NO.OF VAR.
DRN	N.P.ESWAR	N.P	17.03.05	–
CHD	D.DINAKARAN	D.D	17.03.05	
APPD	K.ARUNACHALAM	K.A	17.03.05	

DEPT	SCALE	WEIGHT (KG).	REFERENCE INFORMATIONS	NO. OF ITEMS
VL	NTS	–		–
CODE –				

TITLE: WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET FOR NTPC PROJECTS

CARD CODE: U 01

DRAWING NO.: 3–V–MISC–24283

REV: 0

Size A3

CHAPTER –11: CONTROL VALVES WITH ACTUATORS

11.01.00 CONTROL VALVES, ACTUATORS & ACCESSORIES

11.01.00 **General Requirements**

11.01.01 The control valves and accessories equipment furnished by the Bidder shall be designed, constructed and tested in accordance with the latest applicable requirements of code for pressure piping ANSI B 31.1, the ASME Boiler & pressure vessel code, Indian Boiler Regulation (IBR), ISA, and other standards specified elsewhere as well as in accordance with all applicable requirements of the "Federal Occupational Safety and Health Standards, USA" or acceptable equal standards. All the Control Valves, their actuators and accessories to be furnished under this Sub-section will be fully suitable and compatible with the modulating loops covered under the Specification.

11.01.02 All the control valves and accessories offered by the Bidder shall be from reputed, experienced manufacturers of specified type and range of valves.

11.01.03 For special type of control valves such as combined pressure and temperature control valves for Aux PRDS application, separator drain control valves, also refer to the corresponding mechanical sections.

Control valve station shall be provided at the interconnection line between service air header and instrument air header before air dryer unit. When instrument air header pressure falls below set value, the control valve will start opening and maintain the instrument header pressure at specified level in line with plant requirement. Again when instrument air header pressure goes above specified level in line with plant requirement the control valve will fully close automatically. Complete system shall be in bidder scope.

11.02.00 **CONTROL VALVE SIZING & CONSTRUCTION**

11.02.01 The design of all valve bodies shall meet the specification requirements and shall conform to the requirements of ANSI (USA) for dimensions, material thickness and material specification for their respective pressure classes.

11.02.02 The valve sizing shall be suitable for obtaining maximum flow conditions with valve opening at approximately 80% of total valve stem travel and minimum flow conditions with valve stem travel not less than 10% of total valve stem travel. All the valves shall be capable of handling at least 120% of the required maximum flow. Further, the valve stem travel range from minimum flow condition to maximum flow condition shall not be less than 50% of the total valve stem travel. The sizing shall be in accordance with the latest edition of ISA handbook on control valves. While deciding the size of valves, Bidder shall ensure that valves trim exit outlet velocity as defined in ISA handbook does not exceed 8 m/sec for liquid services, 150 m/sec. for steam services and 50% of sonic velocity for flashing services. Bidder shall furnish the sizing calculations clearly indicating the outlet velocity achieved with the valve size selected by him as well as noise calculations, which will be subject to Owner's approval during detailed engineering.

11.02.03 Control valves for steam and water applications shall be designed to prevent cavitation, wire drawing, flashing on the downstream side of valve and downstream piping. Thus for cavitation/flashing service, only valve with anti cavitations trim shall be provided. Detailed calculations to establish whether cavitation will occur or not for any given application shall be furnished.

11.02.04 Control valves for application such as Feed water control valve, HP & LP by pass spray control valves, APRDS control valves, Soot blower control valve, separator drain control valve, SH Spray Control, RH spray Control, Heavy Oil Heating, pressurizing and Control system, HP/LP heater Emergency level control, Emergency Make-up to condenser hotwell, GSC minimum flow, Deaerator Drain to Condenser Hotwell, Condensate spill to condensate reserve tank, condenser normal make- up and valve gland sealing supplying pressure control, CEPs minimum flow control, BFP minimum circulation control valve shall have permissible leakage rate as per leakage Class V. All other control valves shall have leakage rate as per leakage Class-IV.

11.02.05 The control valve induced noise shall be limited to 85 dba at 1 meter from the valve surface under actual operating conditions. The noise abatement shall be achieved by valve body and trim design and not by use of silencers.

11.02.06 The Liquid pressure recovery factor (FL) shall be 0.995 or better for severe flashing/cavitation services.

11.02.07 The Liquid pressure recovery factor (FL) shall be 0.985 or better for low flashing/cavitation services.

11.02.08 The valve travel time shall be less than 10 second for non critical services valves.

11.02.09 Rangeability should be 50 to 1 (min.) for non critical services valves.

11.02.10 Modulating Type Control Valve's Linearity, Hysteresis, Accuracy shall be < +1% and Sensitivity shall be < + 0.5%.

11.03.00 VALVE CONSTRUCTION

11.03.01 All valves shall be of globe body design & straightaway pattern with single or double port, unless other wise specified or recommended by the manufacturer to be of angle body type. Rotary valve may alternatively be offered when pressure and pressure drops permit.

11.03.02 Valves with high lift cage guided plugs & quick-change trims shall be supplied.

11.03.03 Cast Iron valves are not acceptable.

11.03.04 Bonnet joints for all control valves shall be of the flanged and bolted type or other construction acceptable to the Owner. Bonnet joints of the internal threaded or union type will not be acceptable.

11.03.05 Plug shall be of one-piece construction cast, forged or machined from solid bar stock. Plug shall be screwed and pinned to valve stems or shall be integral with the valve stems.

11.03.06 All valves connected to vacuum on down stream side shall be provided with packing suitable for vacuum applications (e.g. double vee type chevron packing)

11.03.07 Valve characteristic shall match with the process characteristics.

11.03.08 Extension bonnets shall be provided when the maximum temperature of flowing fluid is greater than 280 deg. C.

11.03.09 Flanged valves shall be rated at no less then ANSI press class of 300 lbs.

11.04.00 VALVE MATERIALS

Sr.No.	Service	Body material	Trim Material
1	Non-corrosive, non-flashing, and non- cavitation service except DM water	Carbon steel ASTM-A216 Gr WCB for fluid temperature below 275 Deg. C Alloy steel ASTM-A217Gr. WC9 for fluid temperature above 275 Deg. C	316SS stellited with stellited faced guide posts and bushings.
2	Severe flashing/cavitation services	Alloy steel ASTM-A217 Gr. WC9	440 C
3	Low flashing/cavitation services	Alloy steel ASTM-A217 Gr. WC6	17-4 PH SS
4	DM water services	SS 316	316 SS

NOTE Valve body rating shall meet the process pressure and temperature requirement as per ANSI B16.34.

However, Bidder may offer valves with body and trim materials better than specified materials and in such cases Bidder shall furnish the comparison of properties including cavitation resistance, hardness, tensile strength, strain energy, corrosion resistance and erosion resistance etc. of the offered material vis-a-vis the specified material for Owner's consideration and approval.

11.05.00 END PREPARATION

Valve body ends shall be either butt welded/socket welded, flanged (Rubber lined for condensate service) or screwed as finalized during detailed engineering and as per Owner's approval. The welded ends wherever required shall be butt welded type as per ANSI B 16.25 for control valves of sizes 65 mm and above. For valves size 50 mm and below welded ends shall be socket welded as per ANSI B 16.11. Flanged ends wherever required shall be of ANSI pressure-temperature class equal to or greater than that of the control valve body.

11.06.00 VALVE ACTUATORS

All control valves shall be furnished with pneumatic actuators except for pressure and temperature control valve for auxiliary PRDS application (Electro-hydraulic / pneumatically operated) and HP & LP bypass valves, separator drain control valve (Electro-hydraulic type).The Bidder shall be responsible for proper selection and sizing of valve actuators in accordance with the pressure drop and maximum shut off pressure and leakage class requirements. The valve actuators shall be capable of operating at 60 deg.C continuously.

Valve actuators and stems shall be adequate to handle the unbalanced forces occurring under the specified flow conditions or the maximum differential pressure specified. An adequate allowance for stem force, at least 0.15 Kg/sq.cm. per linear millimeter of seating surface, shall be provided in the

selection of the actuator to ensure tight seating unless otherwise specified.

The travel time of the pneumatic actuators shall not exceed 10 seconds.

11.07.00 CONTROL VALVE ACCESSORY DEVICES

11.07.01 All pneumatic actuated control valve accessories such as air locks, hand wheels/hand-jacks, limit switches, microprocessor based electronic Positioner, diffusers, external volume chambers, position transmitters (capacitance or resistance type only), reversible pilot for Positioner, tubing and air sets, solenoid valves and junction boxes etc. shall be provided as per the requirements.

11.08.00 SPECIFICATIONS FOR MICROPROCESSOR BASED ELECTRONIC POSITIONER

1	Electrical	a) Input Demand Signal	4-20 mA
		b) Power Supply	Loop Powered from the output card of Control System.
		c) HART Protocol	Compatibility for Remote Calibration & Diagnostics (Super-imposed HART signal on input Signal (4-20 mA)
		d. Valve position sensing	Position sensing, 4-20 mA output signal to be provided for control system.
2	Environment	a) Operating temp.	(-)30 To 80 Deg. C
		b) Humidity	0-95 %
		c) Protection class	IP-65 Minimum with Die cast Aluminum/SS316 enclosure.
3	Software for Configuration and Diagnostics	Software	Windows based software. Software shall meet the requirements for Configuration, Diagnostics, Calibration and Testing of the actuator.
		Diagnostic/Test features	Advanced diagnostic features like Stroke counter or Travel counter, Leakage in actuators, Valve Signature analysis, Step Response test, Valve friction /Jamming detection etc. to be provided.

4	Test reports/ Certificates	Factory Valve Signature Tests Reports (Pressure versus Valve travel and Travel versus I/P signal) are to be provided.	
		Test certificates as per Manufacture Standard/Relevant Standard are to be submitted.	
5	Configuration/ Calibration	Remote & Local Calibration, Auto & Manual Calibration shall be possible.	
6	Operating Range	Full range/ Split range.	
7	Modes	Valve Action	Direct / Reverse Valve Action
		Flow Characterization	Possible to fit Valve Characteristic Curves- Linear , Equal percentage etc.
8	Fail Safe/Fail Freeze	Fail Safe/Fail Freeze feature is to be provided. (In case the fail freeze feature is not intrinsic to the positioner, Bidder shall achieve the same externally through solenoid valve connected in the pneumatic circuit).	
9	Pneumatic	Air capacity	Sufficient to handle the valves & actuators selected/ Boosters to be supplied, if required.
		Air pressure	To suit the air supply pressure/quality available.
		Process connection	¼" NPT
10	Performance	Characteristic deviation	<=0.5 % of span.
		Ambient temp effect	<=0.01 %/ deg C or better.
11	EMC & CE compliance	Required to International Standard like EN/IEC.	EN50081-2 & EN50082 or equivalent.

12	Accessories	In-built Operator Panel	Display with push buttons for configuration and display on the positioner itself (Password protected/Hardware lock).
		Hand Held Hart Calibrator	Universal Hart Calibrator to be provided (for quantity, refer Part-A Vol-V C&I :).
		Pressure Gauge Block & Position Indicators.	For supply & output pressures, Air Filter Regulator, integral type position transmitter, in built mechanical position indicator and other accessories shall be provided on as required basis for making system complete.
		Electrical Cable Entry	1/2" NPT, side or bottom entry to avoid water ingress.
		Valves Mounting Assembly	For Sliding Stem/Rotary/Single acting/Double acting actuators on as required basis.

*** Note**:

The HART signals shall be picked up from marshalling terminals of DDCMIS (SG/TG DDCMIS as well as BOP DDCMIS), as applicable. The details of the above mentioned HART management system specification are mentioned in HART system Vol-V, Part B, Chapter 3, DDCMIS, cl. no. 3.45.00

The positioners shall be monitored from this HART management system .To achieve this, Bidder shall provide the necessary software to achieve the functionalities described above under "Remote Configuration and Diagnostics", and this software shall be loaded in the HART management system.

11.09.00 **FOR FOLLOWING CRITICAL APPLICATION SPECIAL CONTROL VALVES ARE REQUIRED:**

1. HP & LP Bypass Valves and Control System
2. BFP – Minimum Re-circulation Valve
3. Feed Water Control Valve
4. SH & RH spray Control Valves
5. APRDS System
6. Soot Blower control valve
7. Separator Drain Control Valve.
8. Fuel oil heating and pressurizing
9. Minimum economizer flow control
10. DM make up (emergency / normal)

11. Control valves whose down stream are connected to vacuum such as HP/LP heater emergency level control.

12. CEP minimum flow control

11.09.01 <u>General Requirements for Critical Application Control Valves</u> -.

i) The valve accessories shall include hand wheels, limit switches, smart valve positioner (4-20mA DC type), electro pneumatic converter, Air lock relay, Solenoid valve and all other items required for the completeness and the accessories shall be explosion proof type as per hazardous area classification wherever applicable.

ii) Control valves shall be furnished with IBR certification wherever required.

1. **Noise:** The maximum allowable noise level shall be 85 dba or less at 1 m. distance from the downstream bare pipe surface. The specified noise level shall be attained without the use of orifices, mufflers, diffusers. No credit for thermal or acoustical insulations shall be taken.

2. **Valve Trim:** Valve shall have quick change type trim utilizing top entry. No components shall be screwed or welded into the body. The valve shall have equal pressure distribution around the plug to avoid chattering / vibration.

   Trim of severe/critical service valve shall be of multi stage & multi path design with sufficient no. of discrete pressure drop stage to eliminate the chance of erosion, cavitations, noise, vibration through out the control range of valve.

3. **Leakage Class:** The valve shall have minimum class-V leakage for all steam applications including RH/SH, APRDS, Soot Blower control valve, HP/LP Bypass spray control valves, BFP minimum recirculation valve & Low Load feed water control valve.

   In case of HP/LP Bypass control valve application, the leakage class should be MSS-SP 61 (block valve leakage).

4. **Actuator:** Actuator type should be pneumatic double acting piston/electro-Hydraulic.

11.10.00 TEST AND EXAMINATION

All valves shall be tested in accordance with the quality assurance program agreed between the Owner and Contractor, which shall meet the requirements of IBR and other applicable codes mentioned elsewhere in the specifications. The tests shall include but not be limited to the following:

11.10.01 Non Destructive Test as per ANSI B-16.34.

11.10.02 Hydrostatic shell test in accordance with ANSI B 16.34 prior to seat leakage test.

11.10.03 Valve closure test and seat leakage test in accordance with ANSI-B 16.34 and as per the leakage class indicated above.

11.10.04 Functional Test: The fully assembled valves including actuators control devices

and accessories shall be functionally tested to demonstrate times from open to close position.

11.10.05 CV Test: Please refer Cl No. 13.00.00, Vol. V Part-B, Chapter : 13 (Type test requirements), Control Valves.

Bidder shall furnish all the control valves under this main plant package as finalized during detailed engineering stage without any price repercussions whatsoever depending on the process requirements. All the control valves provided by the Bidder for this project shall meet the specifications requirements specified herein. Specification for control valves in this chapter has to be read in conjunction with other relevant chapter of this specification.

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PROCESS CONNECTION & PIPING

Chapter 8 PROCESS CONNECTION AND PIPING

8.00.00 PROCESS CONNECTION PIPING

8.01.00 The Bidder shall provide, install and test all required material for completeness of Impulse Piping System and Air Piping System as per the requirements of this chapter, enclosed installation drawings and source connection drawings on as required basis for the connection of instruments and control equipments (provided by the bidder) to the process on as required basis for the connection of all instruments and control equipments of entire plant.

The installation and source connection of various items shall generally as per NIT installation drawings (Drawing No. 14A14-DWG-I-0010), however, the bidder shall furnish during detailed Engineering. Installation drawings, GA and fabrication drawings of LIES/LIRs, other relevant drawings, material and tech data sheets of various items service wise for owner's approval/information.

8.01.01 All material, furnished under this chapter and the installation there of shall conform to the latest editions of American National standard Code for pressure piping, power piping ANSI B 31.1, ANSI B16.11, ASME Boiler and pressure Vessel codes, IBR and other applicable ASME, ANSI and state standards.

8.01.02 All material supplied under this chapter shall be suitable for intended service, process, operating conditions and type of instructions used and shall fully conform to the requirements of this specification. The bidder is responsible for the performance of equipments furnished under this specification on system basis. The bidder may offer suggestions for improvement based on his experience, during detailed engineering, which shall be subjected to the Owner's approval.

8.01.01 IMPULSE PIPING, TUBING, FITTINGS, VALVES AND VALVE MANIFOLDS

8.01.02 All impulse pipes shall be of seamless type conforming to ANSI B36.10 for schedule numbers, sizes and dimensions etc. The size of impulse pipe shall be ½" for steam and water applications and ¾" for air and flue gas applications. The material of impulse pipe shall be same as that of main process pipe. For various applications specification of impulse pipe matrials and associated fittings and valves shall be as given in table PCP..

8.01.03 SS tube shall be provided inside enclosures& racks from tee connection to valve manifold and then to instrument. For high pressure/temperature applications (piping class A, B, C & D of the table no PCP) the material shall be ASTM A 213 TP 316H it and for other applications material shall be ASTM A 213 TP 316L. The wall thickness of the tube shall be in accordance with the ANSI B31.1 standard. The bending radius of the tube shall be greater than 6D.

8.01.04 All fittings shall be forged steel and shall conform to ANSI B16.11. The matrial of forged tube fittings for shaped application (e.g. tee, elbow etc) shall be ASTMA 182 Gr 316 H for high pressure/temperature applications (as defined above) and ASTMA 182 Gr 316 L for other applications. The matrial for bar stock tube fitting (for straight application) shall be SS 316.
Metal thickness in the fittings shall be adequate to provide actual bursting strength equal to or greater than those of the impulse pipe or SS tube, with they are to be used.

The source shut off (primary process root valve) and blow down shall be ½ inch size globe valve type for all applications except for air and flue gas service wherein no source shut off valves are to be provided. For various applications the valve body materail, stem material and pressure class shall be as given in table 8.1. The end connections of valves shall be of socket welded type unless otherwise specified in the instrument installation diagrams. The disc and seat ring material of carbon Steel and alloy steel valves be ASTM-A-105 and ASTM-A-182 Gr F22, hard faced with satellite (minimum hardness-350 BHN). The surface finish of 16 RMS or grater is required in the area of stem packing. The valve design shall be such that the seats can be reconditioned and stem and disc may be replaced without removing the valve body from the line.

For Pr/D.P. gauges in fluid application two way globe valve on each impluse line to the instrument and in air/flue gas application two way gate valve on each impulse line to the instrument shall be provided near the instrument. These shall be in addition to the three ways gauge cock provided along with the Pressure/Differential pressure gauges.

The rating of material of impulse pipes, tubes, fittings, valves and their installation thereof shall conform to the latest edition of standards as per following table:

Impulse Pipe, Tube (material & rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70
Valves (Material Pr. Class, size)	ASTM A 182/ ASTM A 105 as per ASME 16.34
Fitting (Size, rating, material)	ANSI B31.1, ANSI B31.1a, ASME B16. 11-2009
Installation Scheme	BS 6739-2009, ANSI/ISA 77.70

Stainless steel tube shall be provided inside enclosures & racks from tee connection to valve manifold and then to instrument. The source shut-off (primary process root valve) and blow down valve shall be of 1/2 inch size globe valve type for all applications except for air and flue gas service wherein no source shut-off valves are to be provided. Two root valves are to be used wherever pressure is more than 40 Kg/cm2 or Temp>280 deg C. The end connections of valves shall be of socket welded type.

8.01.03 The valve manifolds of 316 SS with pressure rating suitable for intended application shall be provided as given below:

Manifold	**Application/Measurement**
2 Valve	Pressure measurements using pressure transmitters/pressure switches.
3 Valve	Pressure measurements using differential pressure transmitter/switches.
5 Valve	Differential Pressure, Flow and Level Measurements

For Pr./D.P gauges, two-way globe/gate valve shall be provided on each impulse line to the instrument in Fluid/Air & Flue Gas applications respectively .

8.01.04 Double ferruled compression type fittings shall be used only, wherever required.

8.02.00 **AIR SUPPLY PIPING**

8.02.01 All pneumatic piping, fittings, valves, air filter cum regulator, purge rotameter and other accessories required for instrument air for the various pneumatic devices/ instruments shall be provided. This will include as a minimum air supply to pneumatically operated control valves, actuators, instruments, continuous and intermittent purging requirements etc.

8.02.02 Instrument air and Service air supply shall be provided for continuous and intermittent purging respectively for all transmitters of mill, dirty air and flue gas applications. Purging scheme shall be as per drawing no. 14A14-DWG-I-0010.

8.02.03 The Bidder shall also provide and connect pneumatic tubing to E/P convertors and then to control valves. For individual supply line and control signal line to control valve, 1/4-inch size light drawn tempered PVC coated copper/SS tubing conforming to ASTM B75 shall be used. It shall be at least 0.065 inch. The fittings to be used with copper/SS tubes shall be of cast brass/SS, screwed type. All other air supply lines shall be of mild steel hot dipped galvanized inside and outside as per IS-1239, heavy duty with threaded ends. Fittings for air supply line shall be of forged carbon steel A234 Gr. WPB galvanized inside and outside, screwed as per ASA B2.1. Dimensions of fittings shall be as per ASA B16.11 of rating 3000 lbs. Air supply piping shall be adequately sloped to prevent accumulation of condensed water within the pipe. The air supply headers, sub-headers and branch pipes shall be supported properly by clamps or supports.

8.02.04 The instrument/service air supply to each equipment/devices requiring air supply shall be provided by a well designed air distribution scheme comprising of 2" GI Pipe Header with isolation valve from the instrument air and service air terminal points. In the boiler/turbine area the 2 inch head shall be provided upto most elevation of boiler/turbine floor and from this 2 inch header, 1 inch sub header shall be branched off at each floor with isolation valve. From this 1 inch sub-header, branch line of ½ inch, with isolation valve shall be provided upto various devices. Similar system is to be followed for service air required for intermittant purging in the local instrument enclosures (LIEs) Instrument air filters cum regulator set with mounting accessories shall be provided for each pneumatic device requiring air supply except for Ash Handling System wherein it shall be provided on instrument air header at each location. The filter regulators shall be suitable for 10 kg/cm2 max. Inlet pressure. The filter size shall be 5 microns and of material sintered bronze. The air set shall have 2 inch size pressure gauge and built in filter housing blow down valve. The end connection shall be ¼ inch/1/2 inch / 3/4 inch NPT as per the requirement to be finalised during detailed engineering.

8.02.05 All the isolation valves in the air supply line shall be gate valves as per ASTM B62 inside screw rising stem, screwed female ends as per ASA B2.1. Valve bonnet shall be union type & trim material shall be stainless steel, body rating 150 pounds ASA. The valve sizes shall be ½ inch to 2 inch.

8.02.06 Purge Air Connection for Air & Flue Gas applications

The continuous purging with instrument air shall be done, for all air and flue gas measurements, at the process source connection end. Necessary arrangements required for continiuous purging shall be provided inside all instruments enclosures and instrument racks for Aot and flue gas applications.

For intermittent purging with service air, necessay arrangements inside al the air and flue gas enclosures shall be provided. The SS316 four ways valve provided in the SS316 tubing shall be used for isolating the transmitter and connecting the srevice air quick disconnect line.

Purging arrangement is not required for instrument air and service air measurement applications. Purge air lines shall be of mild steel hot dipped galvanised inside and outside as per IS1239, heavy duty with threaded ends.

8.03.00 **Process Connections**

The type of instrument source connection shall depend upon the process parameters and the tapping size. The source connection drawings shall be finalised during the engineering stage.

Size of tapping point stub, number and size of root valves for different types of measurements are as follows:

Sl. No.	Quantity of root valves	Size of stub and root valve	Service Condition
Pressure and Differential Pressure Measurement			
(i)	2	25NB	≥ 40 bar(g) OR 425^{0}C
(ii)	1	15NB	< 40 bar (g) AND 425^{0}C.
Level Measurement			
(a)	**Level Gauge & Switch**		
(i)	2	25NB	≥ 40 bar(g) OR 425^{0}C
(ii)	1	25NB	< 40 bar(g) AND 425^{0}C
(b)	**Level transmitter (displacement type)**		
(i)	2	40NB	≥40 bar(g) OR 425^{0}C
(ii)	1	40NB	<40 bar(g) AND 425^{0}C
(c)	**Stand pipe for level measuring instrument**		
(i)	2	80 NB	≥40 bar(g) OR 425^{0}C
(ii)	1	80 NB	< 40 bar(g) AND 425^{0}C
Flow Measurement			
(i)	2	25NB	≥ 40bar(g) OR 425^{0}C
(ii)	1	25NB	< 40 bar(g) AND 425^{0}C
Sampling system measurement (Steam and Water Service)			
(i)	2	25 NB	≥40 bar(g) OR 425^{0}C
(ii)	1	25 NB	< 40 bar(g) AND 425^{0}C

8.04.00 **INSTALLATION AND ROUTING**

8.04.01 All instrument piping, tubing and its accessories shall be supported in a safe

manner to prevent excessive vibrations and anchored sufficiently to prevent undue strain on connected equipment.

Instrument piping & tubing shall not be routed across equipment removal areas, above or below monorails, cranes, removable gratings, cable trays.

For steam and liquid measurements, the impulse pipe should preferably slope downward from source connection to instrument and instrument shall be installed below the source point. If due to any reason instrument is installed above the source point, the impulse pipe should slope upwards continuously and a 'pigtail' should be provided at the instrument to assure water seal for temperature protection. For vacuum measurements instruments shall be installed above source point and impulse pipe should slope upwards.
Impulse piping for air and flue gas shall slope upwards and instrument shall be installed above source point. If this requirement cannot be met special venting or drain provision shall be provided with vent and drain lines along with isolation valves and other accessories including drain pipes this drain is to be connected to plant drain through open funnel also. Horizontal must have a slope of not less than 40 mm per meter and must be adequately supported to maintain a constant slope and to prevent sag in piping.

All impulse piping shall be installed to permit free movement due to thermal expansion, wherein required expansion loops hall be provided.

Special accessories such as condensing pots/reservoirs shall be provided and installed wherever required. In any case condensing pots shall be provided for all level measurements in steam and water services and all flow measurements in steam and water services above 120 Deg. C. For drum level measurement required balancing chamber shall be provided and installed.

Colour coding of all impulse pipes shall be done by the bidder in line with the colour coding being followed for the parent pipes.

Instrument Air & Service Air piping/tubing system

The air supply headers, sub headers and branch pipes shall be supported properly by clamps or supports to be provided and fabricated by the bidder. Air supply piping shall be installed with a slope of over 1/100 to prevent accumulation of condensed water within the pipe. Signal/control air tubing shall run with the minimum number of changes in direction. Suitable identification tags shall be provided for easy link up and checking of proper connections. Single and multi tubes shall run with the minimum number of changes in direction. Suitable identification tags shall be provided for easy checkups and for connections.

PIPING /TUBING SUPPORT

Impulse piping and sample piping shall be supported at an interval not exceeding 1.5 meters. Each pipe shall be supported individually using slotted angle mounted clamps with necessary fixtures. Tubing shall run in proper perforated trays with proper cover. Tubing shall be supported inside the trays by aluminium supports.
Hangers and other fixtures required for support of piping and trays shall be provided, either by welding or by bolting on walls, ceilings and structures. Hanger clamps and other fastening hardware shall be of corrosion resistant

metals and hot-dip galvanised.

8.05.00 **SHOP AND SITE TESTS**

8.05.01 The equipment and work performed as per this chapter shall be subject to shop and site test as per requirements of Vol. II & Vol. V (Quality Assurance & Inspection) other applicable clauses of this chapter and Owner approved quality assurance plan.

8.05.02 Hydrostatic and Pneumatic leakage tests shall be performed on all pipes, tubing and systems and shall conform to ANSI B31.1.

8.05.03 Hydrostatic testing

All instrument piping/tubing shall be hydrostatically tested upon completion of erection. The test pressure shall be 1.5 times the maximum process pressure. The test shall be performed either with the testing of associated process piping or without the associated process piping (by closing the root valve). In both the cases the instrument shall be isolated by closing the shut-off valve.

Air testing

All air headers & branch pipes shall be air tested by pressure decay method as per ANSI B31.1. Flexible hoses ad short signal tubing shall be tested at normal pressure for leakage. Long signal tubing shall be tested by charging each tube with air at 2 Kg/sq.cm through a bubbler sight glass. The boiler draft and vacuum piping shall be air tested by the same method as long signal tubing.

8.06.00 **LOCAL INSTRUMENT ENCLOSURE AND RACKS**

All transmitters, switches etc. in Boiler Turbine Generator measurements (except for all fuel oil applications) shall be suitably grouped together and mounted inside (i) Local instruments enclosures in case of open areas of the plant like boiler area, etc. and (ii) In local instrument racks in case of covered areas like Turbine/Generator area.

These local instrument enclosures and racks shall be furnished as per the actual requirements finalised during detailed engineering stage. The exact grouping of instruments in a particular instrument enclosure/instrument rack shall be as finalised during detailed Engineering stage subject to owner's approval. The GA of LIR should be similar to LIE except for front/rear doors and side panels. Vol. V, Part B, Chapter no. 6 shall also be referred for designing of LIE & LIR.

Sufficient spacing among adjacent transmitters shall be maintained to offer easy accessibility and operational convenience. The enclosure shall be designed with sizes to suit the grouping and to completely include all the hardware for hooking up the transmitters to the process on the basis of approved installation diagrams. A maximum of five (5) transmitters are envisaged to be grouped in one enclosure.

The internal layout shall be such that the impulse piping/ blow down lines are accessible from back side of the enclosure / rack and the transmitters etc. are accessible from front side for easy maintenance. Bulkheads, especially designed

to provide isolation from process line vibration shall be installed on instrument enclosures/racks to meet the process sensing line connection requirement.

Vibration dampeners shall be installed for each enclosure / rack. The Degree of Protection of LIE shall be IP-55.

The enclosure shall be constructed of 1.6 mm sheet plate and shall be of modular construction with one or more modules and two end assemblies bolted together to form an enclosure. Cable glands, Channel and frame shall be 3 mm thick. Double inter locking doors shall be provided. The doors shall be the three point locking type constructed of not less than 1.6 mm thick steel. Doors shall have concealed quick removal type pinned hinges and locking handles. Door locks shall accept the same key.

Neoprene/Polyurethane Gaskets shall be used between all mating sections to achieve protection class of IP-55.

The instrument racks shall be free standing type constructed of suitable 3 mm thick channel frame of steel and shall be provided with a canopy to protect the equipment mounted in racks from falling objects, water etc. The canopy shall not be less than 3 mm thick steel, and extended beyond the ends of the rack.

Bulk heads, especially designed to provide isolation from the process line vibration shall be provided. Exact fabrications details shall be as finalised during detailed Engineering stage. The junction box for LIE/LIR shall conform to IP -65 protection class.

Enclosures/Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein. Centre posts or any member which would reduce access shall not be provided.

Each Transmitter enclosure housing instruments requiring purge air for continuous air purging, shall be provided with common purge air header, redundant air filters regulators of sufficient capacity , required pressure gauge, valves, fittings, SS tubing and individual purge meters for each purge line etc as required and indicated in instrument installation drawings enclosed herewith.

A 15 mm NB service air header shall be furnished in each instrument enclosure housing air and flue gas and coal mill instruments. The header shall be furnished complete with a pressure regulating valve, pressure gauge and quick disconnect connections. A hose for connecting each header to the draft instrument line four way valves shall be furnished. The hose shall be self storing nylon tubing having a burst pressure of 15 Kg/sq Cm the size of the hose shall be ½ " min. The service air header shall originate at a bulkhead penetration or fitting located on one of the bulkhead plates.

The bidder shall prepare the piping drawings and the general arrangement layout drawings for each of the enclosures and racks. The special attention shall be given in the piping layout to avoid air traps liquid filled piping or water pockets in piping intended to be dry. Drawings shall indicate the arrangement of all equipment, piping, valves and fittings within the enclosures/racks and shall be subject to owner's approval.

All liquid Filled Blow down lines, except those measuring vacuum shall be connected to a two inch header which is extended through one end of the enclosure and turned downward for directing the blow down into a drain. The material of the blow down header shall be carbon steel as per ASTM A 106 Gr C or as indicated in NIT's hookup drawings whichever is better.

The bidder shall submit to the owner with his proposal a copy of his welding procedure specification together with proof of his compliance with the latest applicable welding ANSI code. Prior to any welding being performed the bidder shall submit the qualifications of the craftsmen who will perform the work.

Bidder shall provide not more than three variants for LIE/LIR with respect to max. no. transmitters mounted in each LIE/LIR.

Each enclosure shall be provided with universal type 6/16 Amp. power receptacle, light fixture & LED lamps with wire guard and lighting switch etc. Lighting switches shall be door actuated & mounted inside the panel. Outlet box, switch box and device covers shall be of galvanized stamped steel. Light switches and power receptacles shall be installed inside the enclosure on the wall near the latch side of the enclosure door. Light fixtures shall be installed on the ceilings of the enclosures.

Power Supplies for miscellaneous devices shall be provided with 2P MCB located within the enclosures. MCB shall be mounted in Fuse blocks. Nameplates shall be furnished above the MCB blocks, identifying the devices being served.

Technical Specifications for C&I Systems-Table-No. 8.1

S. No.	System/Line Description	Piping Class	Impulse Pipe material	Schedule (Size)	Materials for fitting/ valve body	Valve stem material	Rating of Piping Fitting	Pressure Class of valve
1	Main steam, Up steam & down stream of HP bypass and up stream of auxiliary steam pressure reducing valve, separator level.	A	ASTM-A335 Gr.P-91/22 (Note-2)	XXS (½ Inch)	Note-3	Note-3	9000lb	3000 SPL
2	BFP discharge/ superheater attemperator/spray to PRDS, Phosphate dosing, P/P discharge, BCW pumps.	B	ASTM-A106 Gr. C	160 (½ Inch)	Note-3	ASTM-A-182 Gr.F6a	6000lb	2500 SPL
3	Reheater attemperator	C	ASTM-A106 Gr. C	160 (½ Inch)	ASTM-A-105	ASTM-A-182 Gr.F6a	6000lb	1500 SPL
4	Hot. Reheat/Down stream of Aux.Steam pressure reducing valve upto desuperheater/flash tank drain manifold, HRH upstream & down stream of LP Bypass valve, HP heater level.	D	ASTM-A335 Gr.P-91/22 (Note-2)	160 (½ Inch)	ASTM-A182 Gr.F-22	Note-3	3000lb	2500 SPL
5	Cold reheat upto Tee-off for HP bypass.	E	ASTM-A335 Gr.P-22	80 (½ Inch)	ASTM-A182 Gr.F-22	ASTM-A-182 Gr.F6a	3000lb	800
6	Cold reheat down steam of Tee-off (HP Bypass)	F	ASTM-A106 Gr. C	80 (½ Inch)	ASTM-A105	ASTM-A-182 Gr.F6a	3000lb	800
7	BFP suction/condensate	G	ASTM-A106 Gr. C,	80 (½ Inch)	ASTM-A105	ASTM-A-182	3000lb	800

	system/Extraction to LPH/HPH and Extractions to BFPT, Deaerator, auxiliary steam, service air, instrument air, DMCW/ECW pumps, and other low pressure water services.		ASTM-A335 Gr.P-11/22			Gr.F6a		
8	Air/Flue gas outside furnace, coal-air mixture.	M	ASTM-A106 Gr.C	80 (3/4 Inch)	ASTM-A105	ASTM-A-182 Gr.F6a	3000lb	800
9	Air flue gas inside furnace	N	ASTM-A335 Gr.P-22	80 (3/4 Inch)	ASTM-A182 Gr.F-22	ASTM-A-182 Gr.F6a	3000lb	800
10.	Purge Air	O	ASTM-A106 Gr.C	80 (3/4 Inch)	ASTM-A105	SS316	3000lb	800
11.	DM Cooling water	P	ASTM-A312 TP 316	80/40 (1/2 Inch)	ASTM – A 182 F 316	SS316	3000lb	800
12.	CW & ACW	Q	ASTM-A106 Gr.C	80 (1/2 Inch)	ASTM-A105	SS316	3000lb	800

Note:-

1). Above requirements are minimum to be complied by bidder. Rating of piping / fittings / valves etc. is subjected to be approved by owner as per the final design pressure & temperature finalized during the detailed engineering, as per ANSI B 31.1.
2). In case temperature is more than 540 deg C, the material shall be P-91 only.
3). Material shall be compatible with that of the impulse pipe material and design parameter.
4). For DM Plant or DM water services, complete erection Hardware material shall be SS316 only.
5). Separator related impulse piping material shall be as per main process pipe/tank material.

e) Turbine lube oil pumps

f) Jacking oil pumps

g) Emergency turbine trip push buttons in control room.

h) Boiler turbine: Generator inter-trip which includes the inter connecting cables between:-

- Boiler master fuel trip and turbine trip relays
- Generator trip relays and turbine trip relays
- Generator trip relays and 400 kV circuit breaker
- Generator trip relays and generator field breaker
- Generator trip relays and UAT breakers

i) Fire alarm, annunciation and protection system.

j) Any other system like safety critical circuit, trip protection circuit and for drives required for safe shut down operations of the plant.

9.03.00 INSTRUMENTATION CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY

The cable interconnection philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field mounted group Junction Baxes (JBs) at strategic locations is done and consequently cable with higher numbers of pairs are extensively used between field & Marshalling panels. The details of termination to be followed are mentioned in the given table below:-

Application		**Type of Termination**	
FROM (A)	TO (B)	END A	END B
Valves/Dampers Drives (Integral Junction Box)	Marshalling/ Marshalling- cum Termination Cubicle/ Local group JB	Plug in connector	Post mount cage clamp type
Transmitters, Process Actuated switches mounted in LIE/LIR	Integral Junction Box of LIE/LIR	Plug in connector	Cage clamp (Rail mount type)
RTD heads	Local Junction Box	Plug in Connector	Cage clamp (Rail mount type)
Thermocouple	Local Junction	Plug in Connector	Cage clamp (Rail

	Box		mount type)
Other Field mounted Instruments	Local JB/ Group JB	Plug in Connector	Cage clamp (Rail mount type)
RTD heads	Temperature transmitter	Plug in Connector	Screwed Cage Clamp Type
Thermocouple	Temperature Transmitter	Plug in Connector	Screwed Cage Clamp Type
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/LIR/Group JBs.	Group JB	Cage clamp (Rail mount type)	Cage clamp (Rail mount type)
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/LIR/Group JB/ MCC/SWGR	Marshalling/ Marshalling – cum Termination Cubicles.	Cage clamp (Rail mount type)	Cage clamp (Post mounted type)
Marshalling cubicle/Termination Cabinets	Electronic system Cabinet	Cage clamp (Post mounted type)	Plug-in connector/other system as per Mfr's standard
Marshalling/ Termination System Cabinets	UCD mounted equipments	Cage clamp (Post mounted type)	Plug in Connector/ Cage clamp Type (rail mounted)
DDCMIS/PLC cabinets	OWS, Printer etc.	Plug in connector	Plug in Connector

Notes

1. For Analog signals, individual pair shieldiing & overall shielding & for Binary signals, only overall shielding of iinstrumentation cables shall be provided.

2. Signal and Electrical connection shall be screwed connection with double compression type Nickel-plated brass/SS316 cable glands for Explosion proof area, Flame proof area and high vibration prone area.

3. All screwed connections shall be provided with double compression type Nickel-plated brass/SS316 cable glands.

9.04.00 TERMINAL BLOCKS

For all inputs to the system emanating from the field or other systems, the bidder shall furnish terminals suitable for correct size of field cables.

9.04.01 All outputs going to MCC/SWGR terminal blocks, shall be rated 600 volts minimum and shall have strap screw less terminals suitable for connection of wires with ring tongue type lugs. Standard terminal blocks shall be rail mounted screw less spring loaded cage clamps type.

The terminal blocks for DDCMIS/DCS/PLC input/output connections from/to SWGR/MCC, Actuators with Integral Starter (for Coupling relays and check back signals of 11 kV and 3.3 kV auxiliaries, LT drives/valves & dampers/solenoids, CT&VT, etc.) shall be provided with built in test and disconnect facilities complete with plug, slide clamp, test socket etc. The exact type of terminal blocks to be provided by the bidder and the technical details of the same including width etc. shall be subject to owner's approval.

Terminal blocks shall be approximately sized for larger wire size of higher voltage insulated incoming conductors as necessary. All the TBs used shall be high quality non-flammable insulating material of melamine suitable for working temperature of 105 deg C and 6.6 polymide to withstand corrosion and the metallic portion shall be coated against rust /corrosion. All metal parts should be non –ferrous in nature.

9.04.02 All the Terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, partions, small partions, test plug bolts and test plug (as specified above for SWGR connections) transparent covers, support brackets, distance sleeves, warning label, marking etc.
The marking on terminal strips shall correspond to the terminal numbering on wiring diagrams.

9.04.03 Fuses shall not be mounted on terminal blocks. Neither step type terminal blocks nor angle mounting of terminal blocks will be acceptable.The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and between terminal blocks and junction box walls.

9.04.04 At least 20 per cent spare unused wired terminals shall be provided on each terminal block for circuit modifications and for termination of all conductors in a multi-conductor control cable with each panel, enclosure, cubicle, Junction Boxes, SOV Boxes, instrument racks/enclosures, termination/marshalling cabinets, etc.

All terminal blocks shall be numbered for identification and grouped according to the function. Engraved labels shall be provided on the terminal blocks.

For terminating each process actuated switches, drive actuators, control valves, thermocouples, RTD, etc. in local junction boxes etc. refer NIT’s interfacing & wiring drawings.

9.04.05 For ensuring proper connections, Bidder shall provide suitable accessories, along with insulation sleeves. The exact connecting accessory shall be finalised as per application during detail engineering stage subject to owner's approval without any cost repurcussions.

9.05.00 INTERNAL PANELS/ SYSTEM CABINETS WIRING

9.05.01 Internal panel/cabinet wiring shall be of multi-stranded copper conductor with FRLS PVC insulation without shield and outer sheath meeting the requirements of VDE 0815.

9.05.02 All internal wires shall be provided with tag and identification nos. etched on tightly fitted ferules at both ends. All wires directly connected to trip devices shall be distinguished by one additional red colour ferrule.

9.05.03 All external connection shall be made with one wire per termination point. Wires shall not be tapped or spliced between terminal points.

9.05.04 All floor slots of desk/panels/cabinets used for cable entrance shall be provided with removable gasketed gland plates and sealing material. Split type grommets shall be used for prefabricated cables.

9.05.05 All the special tools as may be required for solder less connections shall be provided by Bidder.

9.05.06 Wiring to door mounted devices shall be provided with (49 strand minimum) adequate loop lengths of hinge wire so that multiple door openings will not cause fatigue braking of the conductor.

9.05.07 Power supply wiring, and interconnecting cables between devices shall pass the following tests.

a) Flammability test IEEE 383/1974
b) When tested under UITPP test method or ASTM 2893/77 light transmittance of 80%
c) When tested under IEC 754-1 maximum acid gas generation shall be 2% by weight
d) Oxygen index not less than 30 as per ASTM D 2863.

9.05.08 Following wire size shall be utilized for internal wiring:

a.	Current (4-20 mA) Low voltage signals (AI/AO & DI signals)	:	0.5 sq.mm
b.	DO signals, Ammeter/ voltmeter circuit,control switches, indicator,recorder	:	0.5 sq.mm
c.	Internal Illumination	:	2.5 sq.mm

d. Size of Power supply cables shall be as below:-

	Load	**Size**
i.	1 to 16 Amp.	- 2.5 sq. mm
ii.	17 to 20 Amp.	– 4 sq. mm
iii.	21 to 32 Amp.	- 6 sq. mm

iv. 33 to 40 Amp. - 10 sq. mm.
v. 41 to 60 Amp. - 16 sq. mm

9.06.00 **INSTRUMENTATION CABLE INSTALLATION & ROUTING**

9.06.01 Immediately prior to the installation of each cable or cable group, the raceway route to be followed shall be inspected and ascertained to be complete in installation and free of all materials detrimental to the cable or its placement. All cables assigned to a particular duct/conduit shall be grouped and pulled in simultaneously using cable grips and suitable lubricants. Cables removed from one duct/conduit shall not be reused without approval of Owner.

9.06.02 Cables shall be segregated as per IEEE Std.-422. In vertically stacked trays, the higher voltage cable shall be in higher position and instrumentation cable shall be in bottom tier of the tray stack. The distance between instrumentation cables and those of other system shall be as follows:

From 11 kV/6.6 kV/3.3 kV tray system	-	914 mm
From 415V tray system	-	610 mm
From control cable tray system	-	305 mm

9.06.03 Cables shall terminate in the enclosure through cable glands. All cable glands shall be properly gasketed. Sealing (to prevent ingress of dust entry and propagation of fire) shall be provided for all floor slots used for cable entrance. Double compression cable glands shall be provided.

9.06.04 The cables emanating from redundant equipment/devices shall be routed through different paths. The above segregation of cables & wiring for redundant equipments/devices shall be in accordance with IEEE-Std-422.

9.07.00 **CABLE LAYING AND ACCESSORIES**

1 Cables shall be laid strictly in line with cable schedule.

2 Identification tags for cables.

Indelible tags to be provided at all terminations, on both sides of wall or floor crossing, on each conduit/duct/pipe entry/exit, and at every 20 m in cable trench/tray.

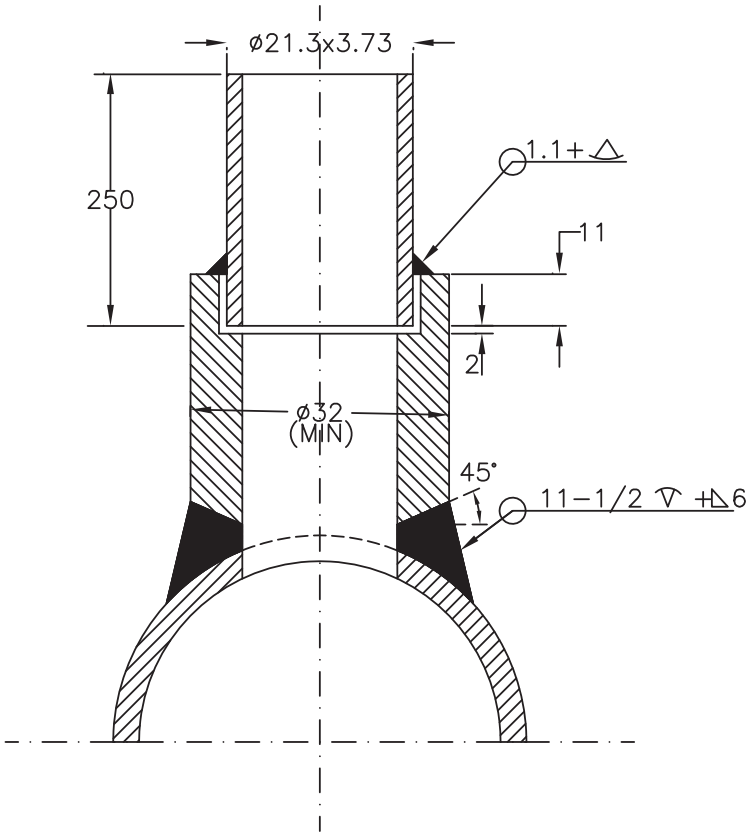
3 Cable tray numbering and marking.

To be provided at every 10m and at each end of cable way & branch connection.

4 Joints for less than 250 Meters run of cable shall not be permitted.

5 Buried cable protection

INSTRUMENT STUB DETAILS



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1/2" GLOBE VALVE OF MATERIAL AS PER ANSI B 31.1.
4. TWO ISOLATION VALVES ARE TO BE USED FOR PRESSURE EXCEEDING 40 Kg/Cm2.
5. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
6. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY(1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.
7. FOR PU COATED PIPE REFER SHT NO.7

TITLE :

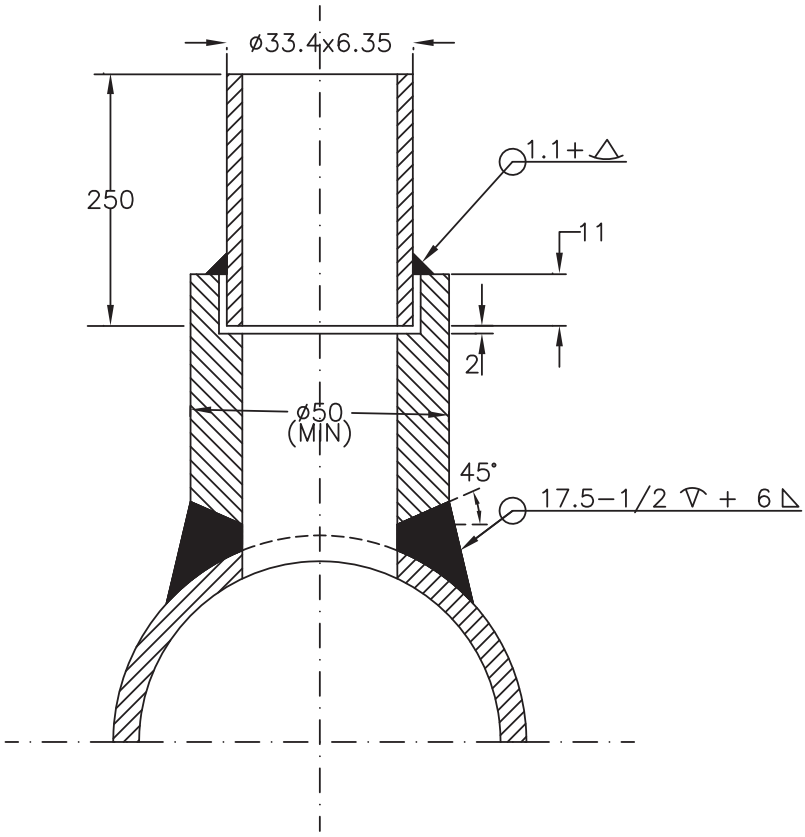
भेल BHEL

STD INSTRUMENT STUB DETAILS

PRESSURE STUB

SYSTEM PRESS < 60Kg/Cm2 & SYSTEM TEMP<425 Deg C, Nb15 , CL3000

DRG. NO. PE-DG-426-145-I101
REV. 00
SH. 02 OF 08



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 31.1.
4. TWO ISOLATED VALVES ARE TO BE USED.
5. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
6. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY(1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.

TITLE :

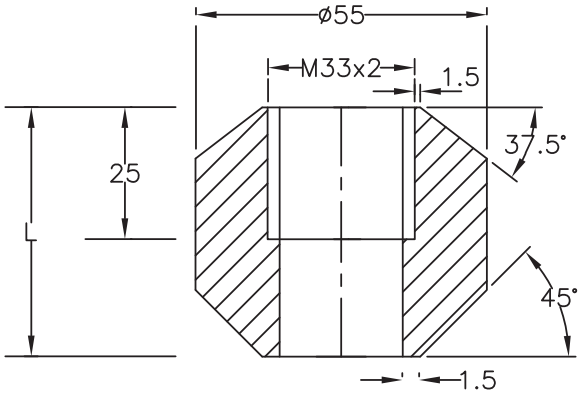
भेल BHEL

STD INSTRUMENT STUB DETAILS

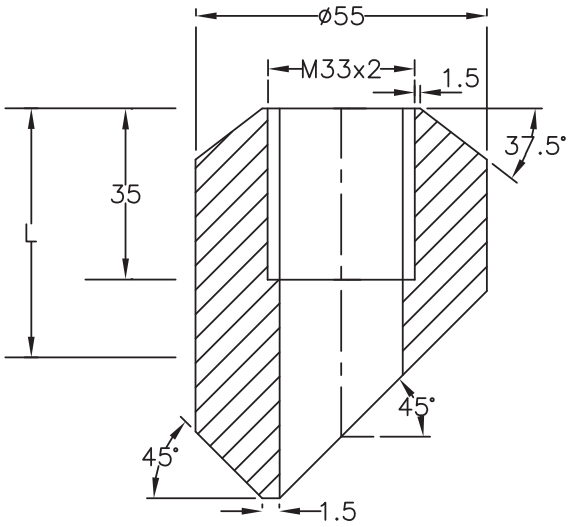
PRESSURE STUB

DRG. NO.
PE-DG-426-145-I101
REV. 00
SH. 03 OF 08

SYSTEM PRESS > 60Kg/Cm2 & 425 Deg C < SYSTEM TEMP <= 500 Deg C , Nb25 , CL3000/6000



TEMPERATURE STUB FOR STRAIGHT IMMERSION



TEMPERATURE STUB FOR SLANT IMMERSION

NOTE :

1. MATERIAL OF THE BOSS SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED.
2. LENGTH OF THE STUB (L) SHALL BE 64/45 mm DEPENDING UPON PIPE SIZE, AS PER CORPORATE STD. AA 7326102.(FOR PIPE OD 88.9 mm TO 159 mm STUB HEIGHT SHALL BE=64mm & FOR PIPE OD ⩾219.1mm STUB HEIGHT SHALL BE=45mm)
3. STRAIGHT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 168.3 mm & ABOVE. THE STUB HEIGHT FOR PIPE OD 168.3 mm TO <219.1 mm SHALL BE 64 mm.
4. SLANT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 88.9 mm TO 159 mm.
5. FOR MAIN PIPE OD'S 88.9 mm & BELOW SUITABLE EXPANDER SHALL BE USED.
6. PLEASE REFER SHEET–6 FOR THERMOWELL INSTALLATION.
7. FOR PU COATED PIPE REFER SHT NO.8

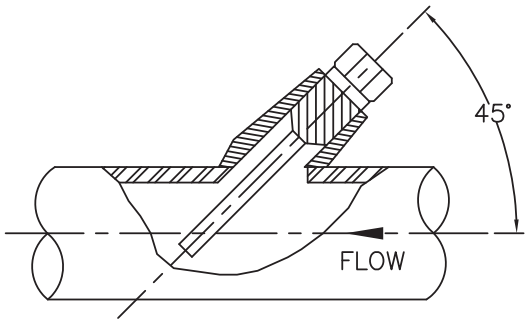
TITLE :

भेल BHEL

STD INSTRUMENT STUB DETAILS

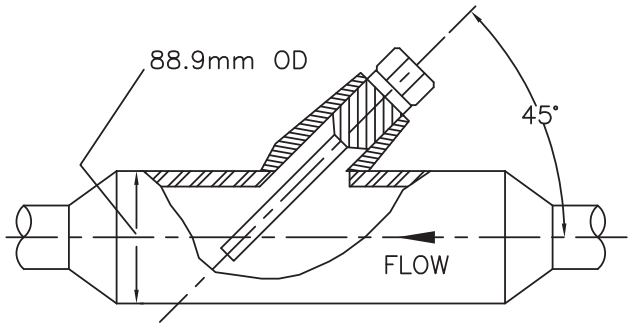
TEMPERATURE STUB

DRG. NO.
PE-DG-426-145-I101
REV. 00
SH. 05 OF 08



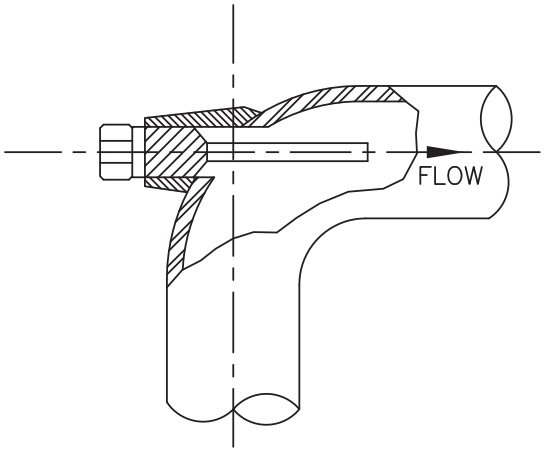
INSTALLATION TYPE–1

FOR MAIN PIPE OD 88.9mm to 159mm



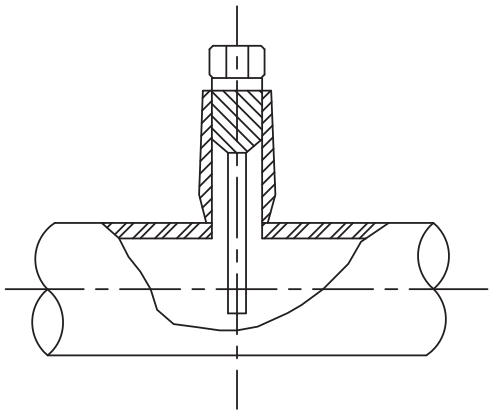
INSTALLATION TYPE–2

FOR MAIN PIPE OD BELOW 88.9mm



INSTALLATION TYPE–3

FOR MAIN PIPE OD 88.9mm & BELOW



INSTALLATION TYPE–4

FOR MAIN PIPE OD 168.3mm & ABOVE

TITLE :

STD INSTRUMENT STUB DETAILS

THERMOWELL INSTALLATION

DRG. NO.
PE-DG-426-145-I101
REV 00
SH. 06 OF 08

	Technical specification for **CONTROL & INSTRUMENTATION** **1X660MW PANKI TPS EXTN.**	SECTION D REV. NO. 00 DATE : 13.07.2018

LOCAL CONTROL PANEL SPECIFICATION & QUALITY PLAN

6.10.00 CONSTRUCTIONAL FEATURES OF LOCAL CONTROL PANELS, CONSOLES, CONTROL Desk, CUBICLES & ENCLOSURES

i. All control panels, cubicles, consoles, SOV panels and enclosures provided anywhere for subject plant per this specification shall be of free standing type and shall be constructed of specified gauge of steel plates (CRCA). The minimum sheet thickness of panels shall be as follows unless otherwise specified herein.

Side and top – not less than 1.6 mm
Door – not less than 2.0 mm
Mounting plate – 2.5 mm
Base metal plate - 2.5 mm
Gland plate – 3 mm

ii. The panels, consoles/desks shall be reinforced as required to ensure true surfaces and adequate support for instruments mounted thereon. All instrument cutouts, mounting studs, and support brackets shall be accurately located. All welds on the exposed panel surfaces shall be ground smooth. Finished panel surfaces shall be free from waves, bellies, or other imperfections. Unless specified, otherwise, panel doors shall be 4 points hinged and shall have turned back edges and additional bracing where required to ensure rigidity. Door hinges shall be of the concealed type. Door latches shall be of the three/four -point type to ensure tight closing. Door locks shall be furnished which will allow actuation of all locks by a single master key. All panels shall have removable lifting eyebolts for safe lifting from top during storage and installation handling.

Cabinet doors shall be hinged and shall have turned back edges and additional braking where required ensuring rigidity. Hinges shall be of concealed type. Door latches shall be of three/four -point type to assure tight closing. Detachable lifting eyes or angles shall be furnished at the top of each separately shipped section and all necessary provisions shall be made to facilitate handling without damage. Front and rear doors shall be provided with locking arrangements with a master key for all cabinets. If width of a cabinet is equal or more than 800 mm, double doors shall be provided.

iii. All panels shall be mounted on vibration dampers, which are secured to C-channels mounted on the floor. The channels shall be field welded to steel plates set into the concrete flooring. The steel plates shall be located such as to approximate the outline of panel bases. The exact mounting details shall be as approved by the owner during detailed engineering stage. All panels shall be provided with adequate ventilation and packaging density of components shall be restricted so as to limit the temperature rise above ambient to 10°C under the worst conditions. All panels shall have auto on/off switch for internal lighting. All the power supply circuit for control panels shall be provided with auto changeover circuitry.

iv. In each panel /cabinet, a 24 VDC Voltmeter digital type shall be provided to check the Field Interrogation voltage.

v. Exhaust Fans with louvers & filters shall be provided on upper side to remove hot air in all consoles and panels.

vi. Fire & Smoke detectors shall be provided inside the Control room mounted system/control cabinets.

vii. Feeder failure/ healthy indication shall be provided in each cabinet & remote indication shall be hooked up to DDCMIS/ PLC/annunciation & suitably grouped.

viii. All the panels shall be equipped with Anti vibration pad of min. 15 mm size thickness. Cable gland plate thickness shall be 3 mm. C Channel height shall be min. 100 mm.

ix. Doors shall be provided with neoprene/polyurethane gasket only. The front and rear doors shall be of full height .

x. Protection class shall be as specified at Vol. V, Part B, chapter 1.

xi. All the cable entries shall be at the bottom of electronic cubicles/control panels.

xii. Control panels shall be provided with proper arrangement and hardware to terminate the inert gas required for fire protection.

xiii. 25x6 mm copper ground bus to be provided for each panel/control desk.

xiv. Terminal blocks shall be Rail mounted 650 V AC grade Terminal blocks (Screw less cage clamp type) with markers and 20% spare wired terminals of each type.

xv. For Panels/cubicles internal wiring details, Bidder to refer Vol. V, Part B, Chapter 9.

6.11.00 TERMINATION/Marshalling CABINETS & Interposing Relay Panel

Marshalling/Termination cabinets for the control system shall be supplied for terminating all cables originating from the field, MCC/SWGR or any other source

of signal and for distributing the signals to different functional panels, MCC/SWGR and control cubicles.

Incoming cables from the field, MCC/SWGR or any other source of signal shall be terminated in suitable terminal blocks in logical sequence.

Prefabricated cables with plug in connectors at both ends shall be used for extending the signals to the functional panels. Matching plug sockets shall be provided in the termination cabinets for terminating the plugs.

Interposing relay panels for the system shall be supplied for mounting interposing relays & terminating all cables originating from the DO cards in case of solenoid valves, HW Annunciation windows and other required services etc. IPR panels shall be placed in CER and LCR.

Interposing relay shall be mounted in respective SWGR/MCC/integral starter required for commands signals of HT/LT unidirectional drives and bidirectional drives, breakers, isolators, bus couplers etc from DDCMIS/DCS/PLC or any control system.

Terminal blocks shall be located inside the cabinets on support wings fabricated of metal plates.

The plug socket shall be mounted on hinged plates to provide an access to the rear pins of the plugs.

General features of termination cabinets and accessories shall conform to the general design and construction specification of panels. Terminal blocks shall be Rail mounted 650 V AC grade Terminal blocks (Screw less cage clamp type) with markers and 20% spare wired terminals.

Wiring shall be 650V grade. PVC insulated FRLS stranded copper wire.

6.12.00 SURFACE PREPARATION AND PAINTING

All panel exterior steel surfaces shall be ground smooth, and painted as specified below:

Suitable filler shall be applied to all pits, blemishes and voids in the surfaces. The filler shall be sand blasted so that surfaces are level and flat, corners are smooth and even. Exposed raw metal edges shall be ground burr free. The entire panel surface shall be sand blasted to remove rust and scale and all other residue due to the fabrication operation. Oil grease and salts etc. shall be removed from the panels by one or more solvent cleaning methods. Alternatively 7 tank process shall be followed.

Two spray coats of inhibitive epoxy primer – surface shall be applied to all exterior and interior surfaces, each coat of primer surface shall be of dry film thickness of 1.5 mil. A minimum of two spray coats of final finish colour (Catalysed epoxy finish) shall be applied to all surfaces of dry film thickness 2.0 mil. The final finished thickness of paint film on steel shall not be less than 65-75 micron for sheet thickness of 2 mm and 50 microns for sheet thickness of 1.6

mm. As an alternative, single coat of anodic dip coat primer along with single textured powder coating with epoxy polyester meeting the thickness requirement is also acceptable.
The Bidder shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory applied painted surface of each item of equipment.

The finish colours for exterior and interior surfaces shall conform to the following shades:

a) Exterior - RAL 7032/RAL 7035.

b) Interior - Glossy white two coats/RAL 7035 with fire resistant paint

One uniform colour shade as finalized by owner during detailed engineering shall be applicable for complete plant.

Paint films, which show sags, checks, blisters teardrops, fat edges or other painting imperfections, shall not be acceptable and if any such defects appear, they shall be repaired by and at the expenses of the Bidder.

6.13.00 PANEL ILLUMINATION

Panels shall be provided with LED based illuminating lamps with door switch and six (6) point 5/15A, 240V AC universal type power sockets with switch for maintenance purposes. These switches shall be with quick make and break mechanism. 100 % spare LED lamps shall be provided with each panel, these are in additional to mandatory spares.

6.14.00 Panel Cooling Fans (for ventilation of the DDCMIS/ PLC / DCS & other cabinets)

Filter Fan for electrical cabinets and enclosures to be used with 120 V or 230 V AC versions having very low acoustic noise and lower power consumption. The fans must have UL approval and should have air flow volume as per the cabinet requirement. Wherever required, the EMC filter fans may be used. Fans should have a life of 50,000 Hours at 40 Deg C. Fan Housing, cover should be of V0 material as per UL94. Filter mat should be compliant to EU3 according to DIN 24185 standard and have a filtering degree of 80 to 90 %. The Ambient temperature range °C should be -10 to +70 Deg C and Protection class should be IP 54. Filter Material shall be Synthetic fibre with progressive construction, temperature resistant to +100°C, self extinguishing, Class F1 as per DIN 53438 standard.

6.15.00 Panel Thermostat (for temperature control of the DDCMIS/PLC/DCS panel – to be connected to switch On/Off Fan/Heater)

The panel thermostat shall be DIN Rail Mounted with an inbuilt snap action thermostatic bimetal sensor and shall be connected in series with the load without any additional supply voltage. The panel thermostat shall be available in setting temperature range of -20 deg C to 40 deg C or 0 to 60 deg C with separate modules for NO or NC contact. The electrical life at rated load AC1 shall be 1 Lakh switching cycles and shall work at an ambient temperature of -45 to +80 deg C. With AgNi contact material for switching, the contact current carrying

capacity shall be 10 Amp at a rated voltage of 250 V AC with a dielectric strength between open contacts of 500 V AC and shall have UL approval.

6.16.00 FUSES & MCB

All fuses shall be fast acting semiconductor types for AC supply and compatible to the UPS fuses. For all DC Powered devices, similarly the fuses shall be fast acting compatible to DCDB fuse provisions. All the AC power supplies shall be provided with the protection of Fast acting semi conductor fuses & 2 P thermo magnetic type MCB. For all the DC power supply circuits, electronic type DC MCB shall be used only. Make of DC MCB shall be Siemens, Phoenix contacts, Murr, Weidmuller, or Lutze.

50 % spare fuses shall be provided with each panel, these are in additional to mandatory spares.

6.17.00 NAME PLATES AND LABELS

Name plates of adequate size shall be provided for each panel on front and rear of the panel. Instruments/other accessories mounted inside the panels shall have identification marking clearly visible from inside.

Devices to be mounted on the panels shall also be labeled on the panels shall also be labeled on the outside of the panel. Name plates shall be of polyamide sheets with black letters on white background. Name plates shall be attached to the boards by means of stainless steel panhead screws. Fuses provided for protection of various boxes shall be accessible for replacement. Fuse boxes shall be provided with circuit label and fuse rated current and voltage.

Markings/Labels

All markers/labels shall be made of halogen & silicon free polyamide material with inflammability class V2 as per UL 94, ensuring scratch proof printing with the use of environment friendly solvent free ink & latest BLUEMARK UV technology so as to comply the WIPE RESISITANCE according to DIN EN 61010-1/VDE 0411-1.

6.18.00 QUANTITIES

Refer Appendix-I to Part-A, Vol.-V of Technical Specifications. Quantities indicated are the minimum requirements, however each & every item shall be provided as per system requirements.

6.19.00 Design Criteria for Control Rooms:

The interiors of the each control Room shall be aesthetically designed with modern designs and technologies. The bidder shall have 2-D and 3-D software for designing the control room layouts. The bidder shall have thorough knowledge on Indian power plant control room requirements. Control rooms shall also be designed as per standard "ISO 11064 (1-7) - Ergonomic design of control centres".

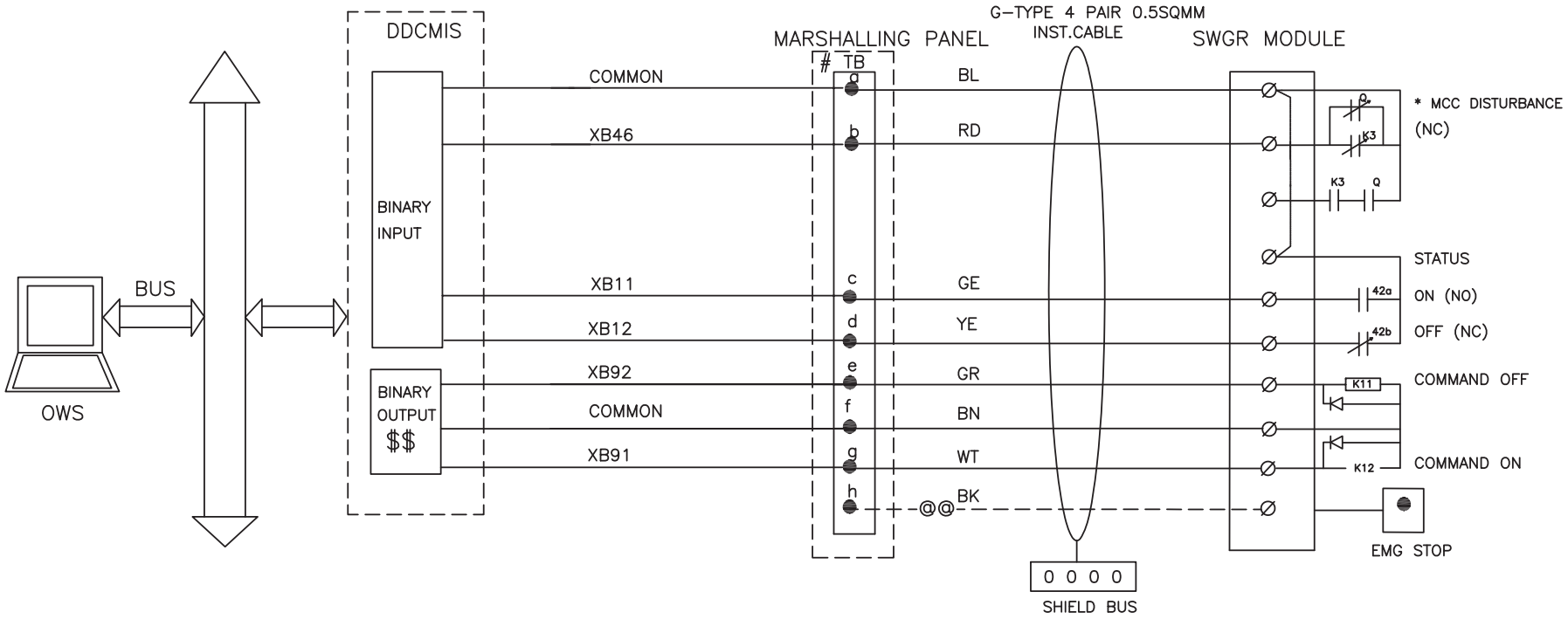
APPLICABLE CABLE TYPES

Cable Sizes for 1X660MW TPS PANKI EXTN.	
SI no.	Cable Type
G-TYPE	
1	2P X 0.5 sqmm
2	4P X 0.5 sq mm
3	8P X 0.5 sqmm
4	12P X 0.5 sqmm
F-TYPE	
1	4P X 0.5 sqmm
2	8P X 0.5 sqmm
3	12P X 0.5 sqmm
4	20P X 0.5 sqmm
CONTROL CABLE	
1	3C X 2.5 sqmm

	Technical specification for **1X660 MW TPS PANKI EXTN.**	REV. NO. 00 | DATE : 04.04.2019

DRIVE CONTROL PHILOSOPHY

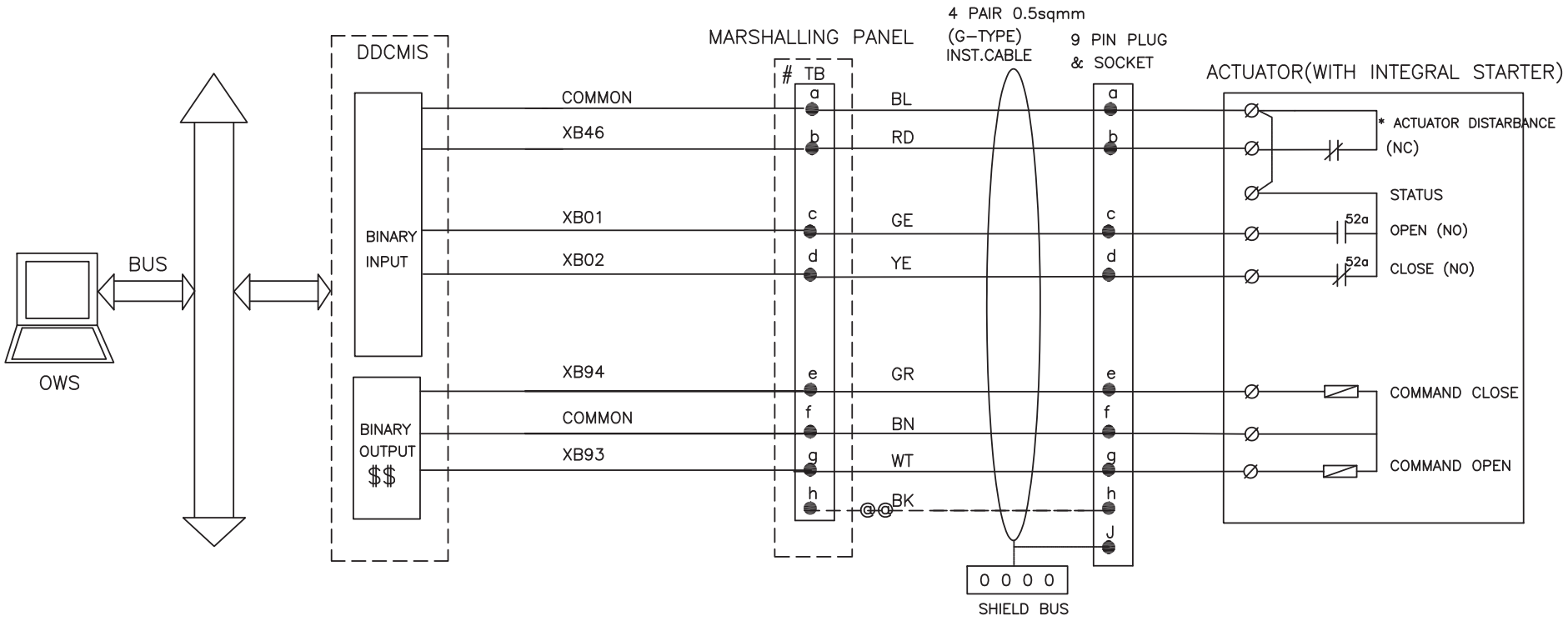
DDCMIS INTERFACE WITH LT MCC (LT)



NOTE:–1 $$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
NOTE:–2 # 8 LEVEL TERMINAL BLOCK
NOTE:–3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION SEQUENTIALLY.
NOTE:–4 * MCC DISTURBED= THERMAL O/L OPT/CONT SUPP FAIL/EPB OPTD /DRIVE POWER SUPPLY OFF

BHEL	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962-001-PE-405-PVI-B-152
	DDCMIS INTERFACE WITH LT MCC (LT)	SHT	05 OF 34

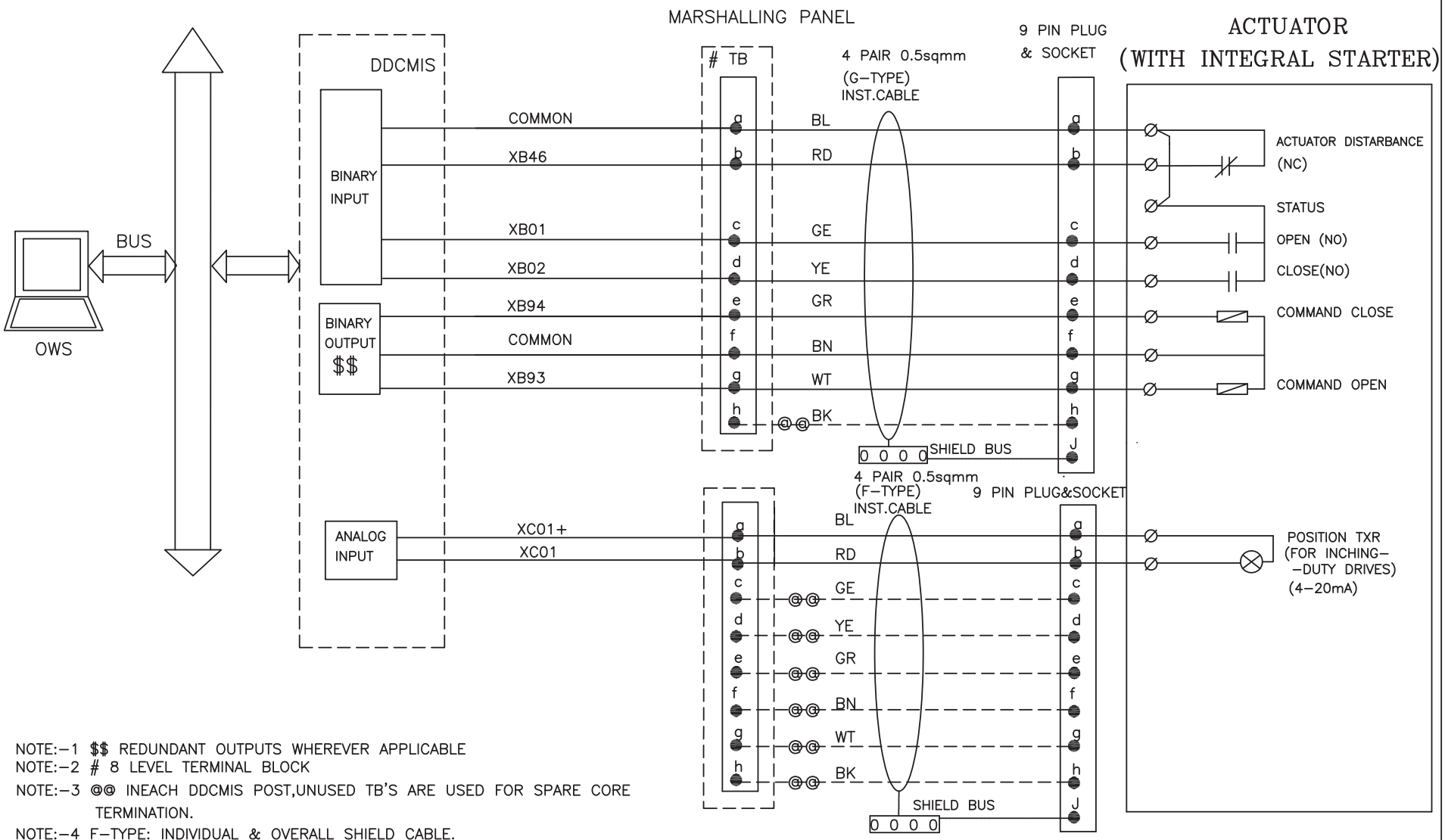
DDCMIS INTERFACE WITH BID/MOV/MOD



NOTE:-1 $$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
NOTE:-2 # 8 LEVEL TERMINAL BLOCK
NOTE:-3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.
NOTE:-4 * DISTURBANCE=LOSS OF POWER SUPPLY(1PHASE/3PHASE)/LOSS OF CONTROL SUPPLY/MOTOR THERMOSTAT TRIP/THERMAL OVER LOAD/ TORQUE SWITCH OPERATED, LOCAL/OFF/REMOTE SWITCH IN LOCAL/OFF POSITION

BHEL	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962-001-PE-405-PVI-B-152
	DDCMIS INTERFACE WITH BID	SHT	06 OF 26

DDCMIS INTERFACE WITH BIDI/MODI/MOVI

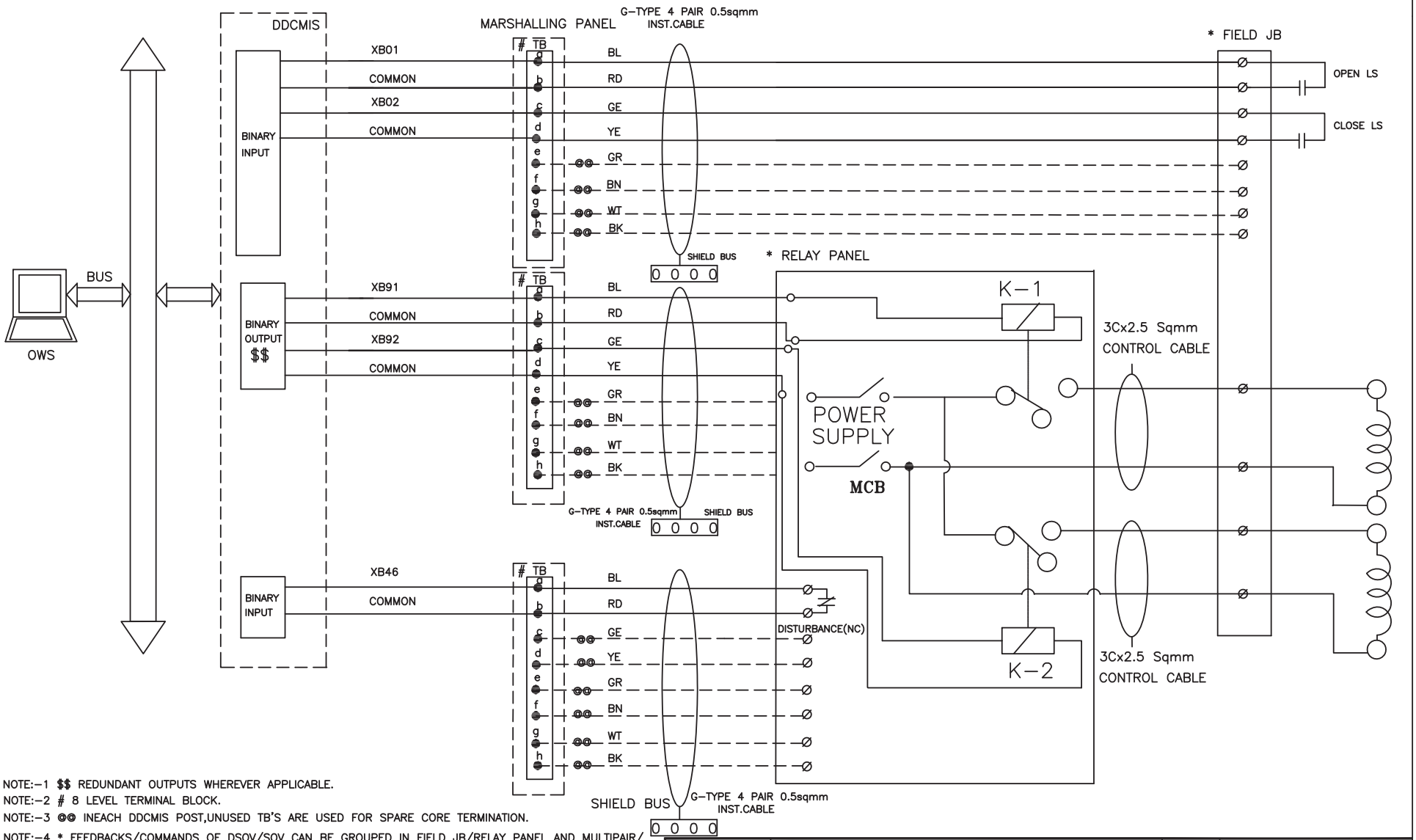


NOTE:–1 $$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
NOTE:–2 # 8 LEVEL TERMINAL BLOCK
NOTE:–3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.
NOTE:–4 F–TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.
NOTE:–5 *DISTURBANCE=LOSS OF POWER SUPPLY/LOSS OF CONTROL SUPPLY/ MOTOR THERMOSTAT TRIP/THERMAL OVERLOAD/TORQUE SWITCH OPTD/ LOCAL/OFF/REMOTE SWITCH IN LOCAL/OFF POSITION

BHEL	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962–001–PE–405–PVI–B–152
	DDCMIS INTERFACE WITH BIDI	SHT	07 OF 34

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-426-163-A001

DDCMIS INTERFACE WITH DUAL COIL SOLENOID (DSOV/L)

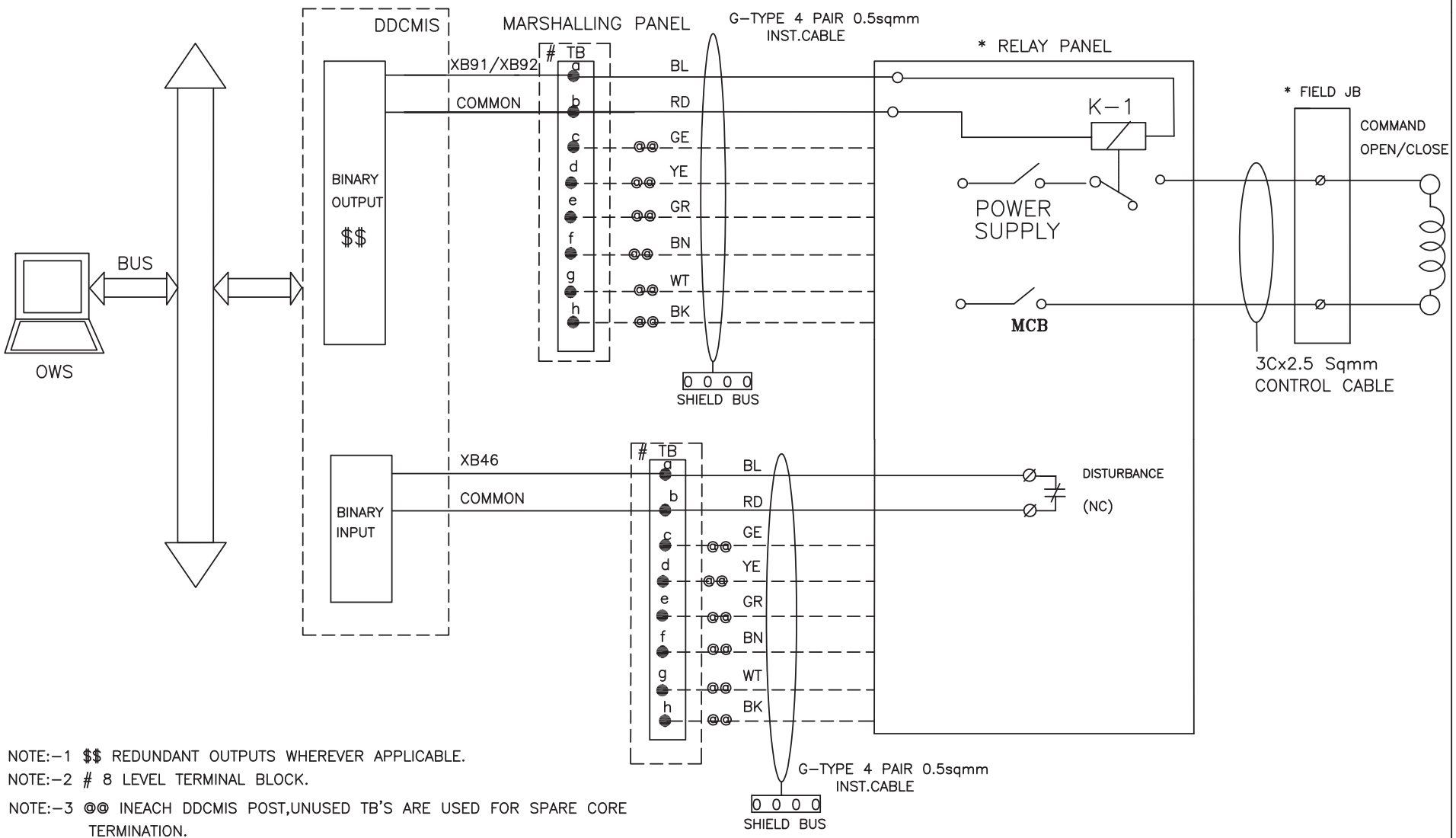


NOTE:-1 $$ REDUNDANT OUTPUTS WHEREVER APPLICABLE.
NOTE:-2 # 8 LEVEL TERMINAL BLOCK.
NOTE:-3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.
NOTE:-4 * FEEDBACKS/COMMANDS OF DSOV/SOV CAN BE GROUPED IN FIELD JB/RELAY PANEL AND MULTIPAIR/ MULTICORE CABLE IS TO BE USED FOR GROUPED SIGNALS FROM FIELD JB/RELAYPANEL TO MARSHALING PANEL.
NOTE:-5 FOR ON/OFF TYPE,SOLENOID ACTUATED CONTROL VALVE.
NOTE:-6 TWO INDEPENDENT OUTPUT FROM CONTROL SYSTEM SHALL BE PROVIDED TO PUSH-PULL TYPE VALVES,WITH DUAL COIL SOLENOIDS.

BHEL	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962-001-PE-405-PVI-B-152
	DDCMIS INTERFACE WITH DUAL COIL SOLENOID (DSOV/L)	SHT	10 OF 34

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-426-163-A001

DDCMIS INTERFACE WITH SOV/O/SOV/C(WITH OUT FEEDBACKS)



NOTE:-1 $$ REDUNDANT OUTPUTS WHEREVER APPLICABLE.

NOTE:-2 # 8 LEVEL TERMINAL BLOCK.

NOTE:-3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.

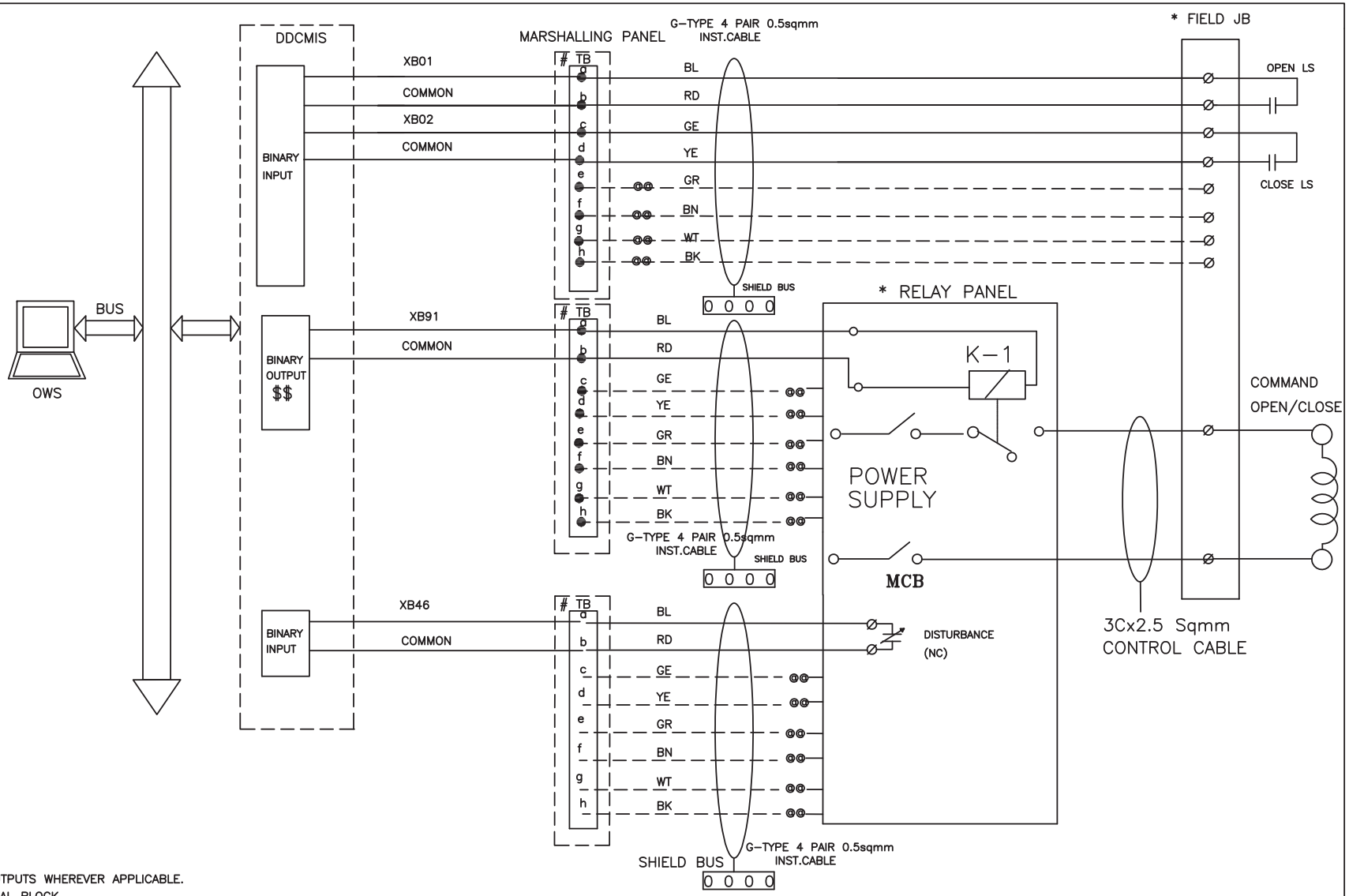
NOTE:-4 * FEEDBACKS/COMMANDS OF DSOV/SOV CAN BE GROUPED IN FIELD JB/RELAY PANEL AND MULTIPAIR/MULTICORE CABLE IS TO BE USED FOR GROUPED SIGNALS FROM FIELD JB/RELAYPANEL TO MARSHELING PANEL.

NOTE:-5 FOR ON/OFF TYPE,SOLENOID ACTUATED CONTROL VALVE.

BHEL	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962-001-PE-405-PVI-B-152
	DDCMIS INTERFACE WITH SOV/O/SOV/C(WITHOUT FEEDBACKS)	SHT	11 OF 34

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-426-163-A001

DDCMIS INTERFACE WITH SOV/O/L(WITH FEED BACKS)

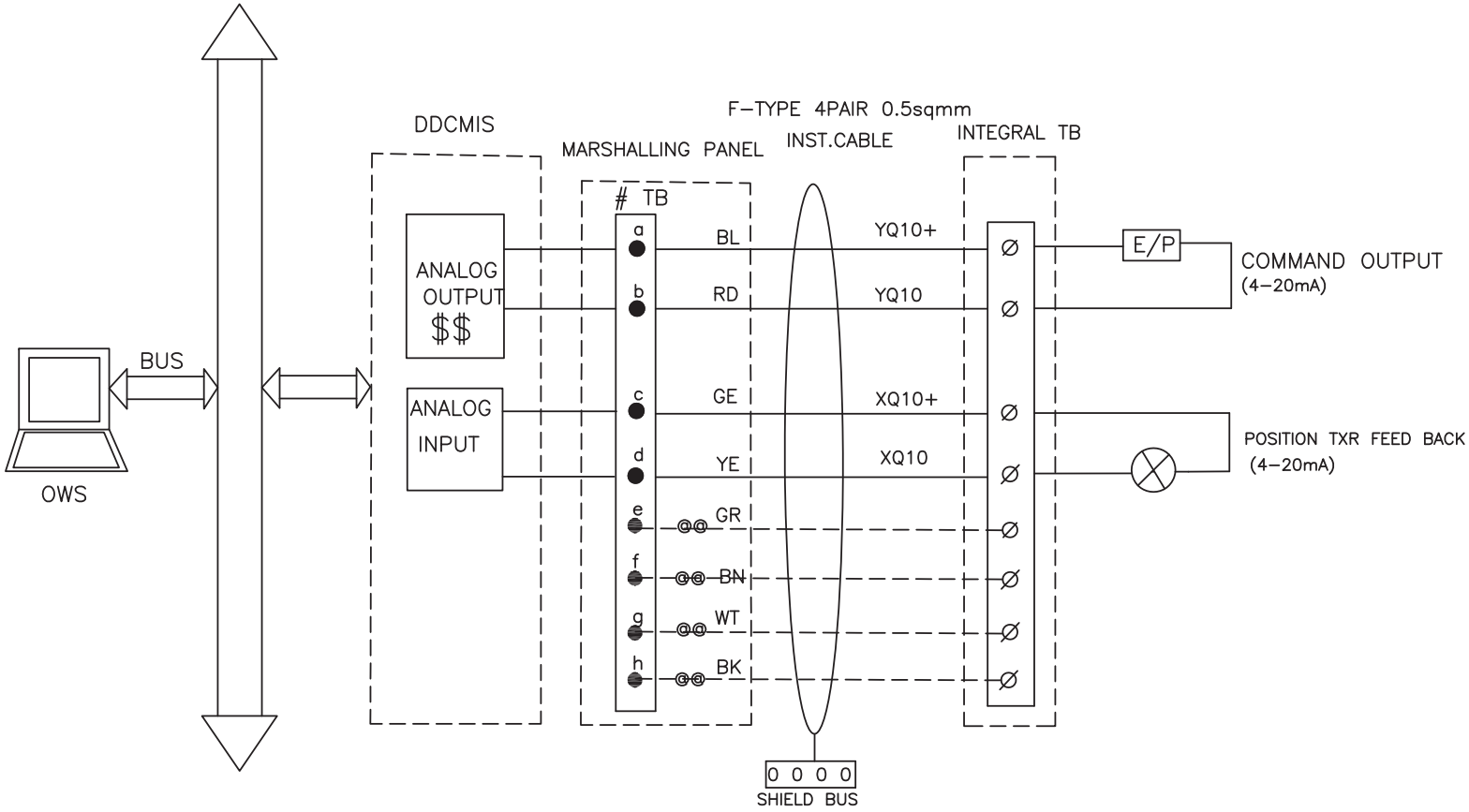


NOTE:-1 $$ REDUNDANT OUTPUTS WHEREVER APPLICABLE.
NOTE:-2 # 8 LEVEL TERMINAL BLOCK.
NOTE:-3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.
NOTE:-4 * FEEDBACKS/COMMANDS OF DSOV/SOV CAN BE GROUPED IN FIELD JB/RELAY PANEL AND MULTIPAIR/ MULTICORE CABLE IS TO BE USED FOR GROUPED SIGNALS FROM FIELD JB/RELAYPANEL TO MARSHALING PANEL.
NOTE:-5 FOR ON/OFF TYPE,SOLENOID ACTUATED CONTROL VALVE.

BHEL	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962-001-PE-405-PVI-B-152
	DDCMIS INTERFACE WITH SOV/O/L(WITH FEEDBACKS)	SHT	12 OF 34

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-426-163-A001

INTERFACE FOR MODULATING DRIVES – CLCS



NOTE:–1 $$ REDUNDANT OUTPUTS WHEREVER APPLICBLE
NOTE:–2 # 8 LEVEL TERMINAL BLOCK

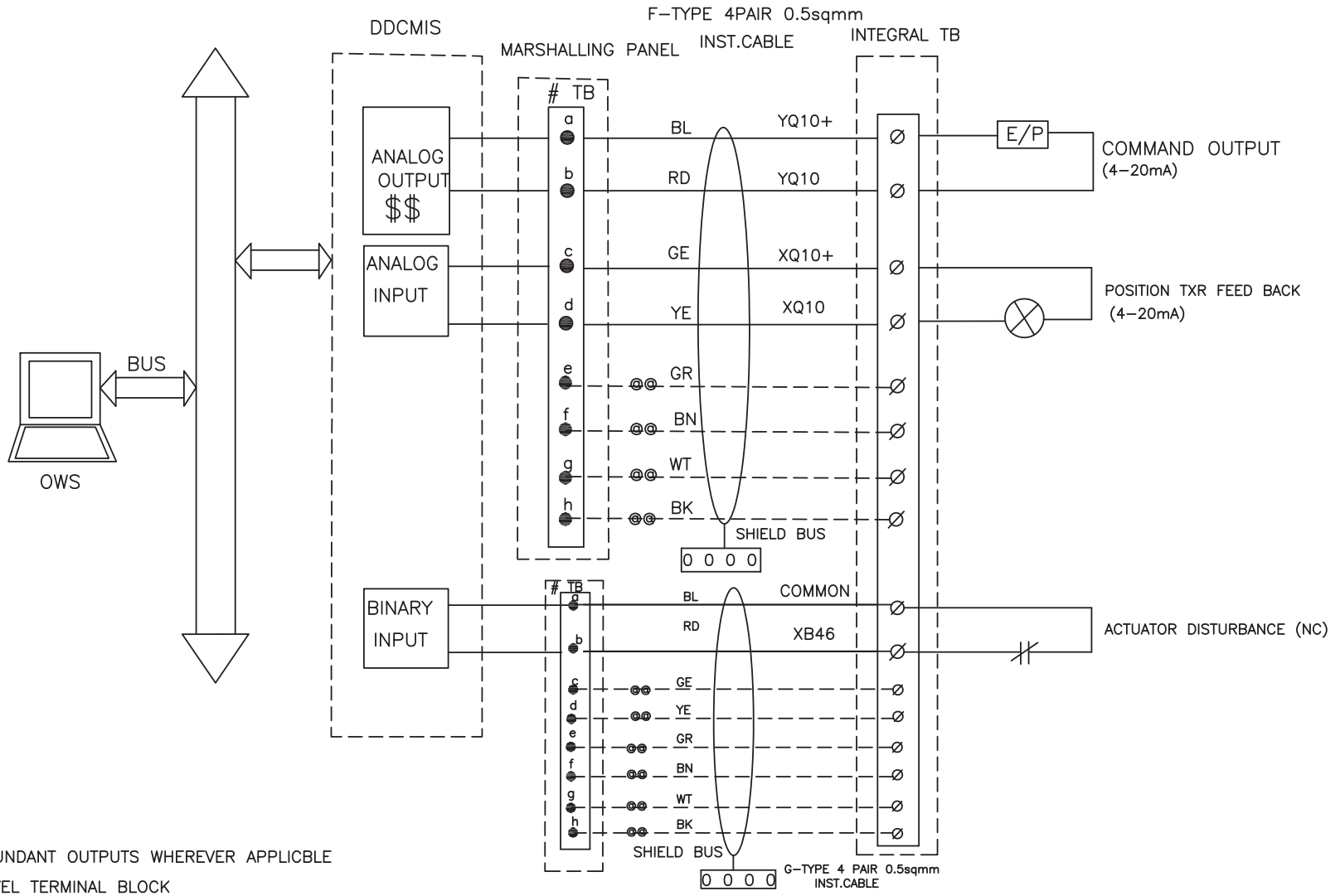
NOTE:–3 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.

NOTE:–4 F–TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.

BHEL	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962–001–PE–405–PVI–B–152
	INTERFACE FOR MODULATING DRIVES – CLCS	SHT	14 OF 34

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-426-163-A001

INTERFACE FOR MODULATING DRIVES – CLCS–M



NOTE:–1 $$ REDUNDANT OUTPUTS WHEREVER APPLICBLE

NOTE:–2 # 8 LEVEL TERMINAL BLOCK

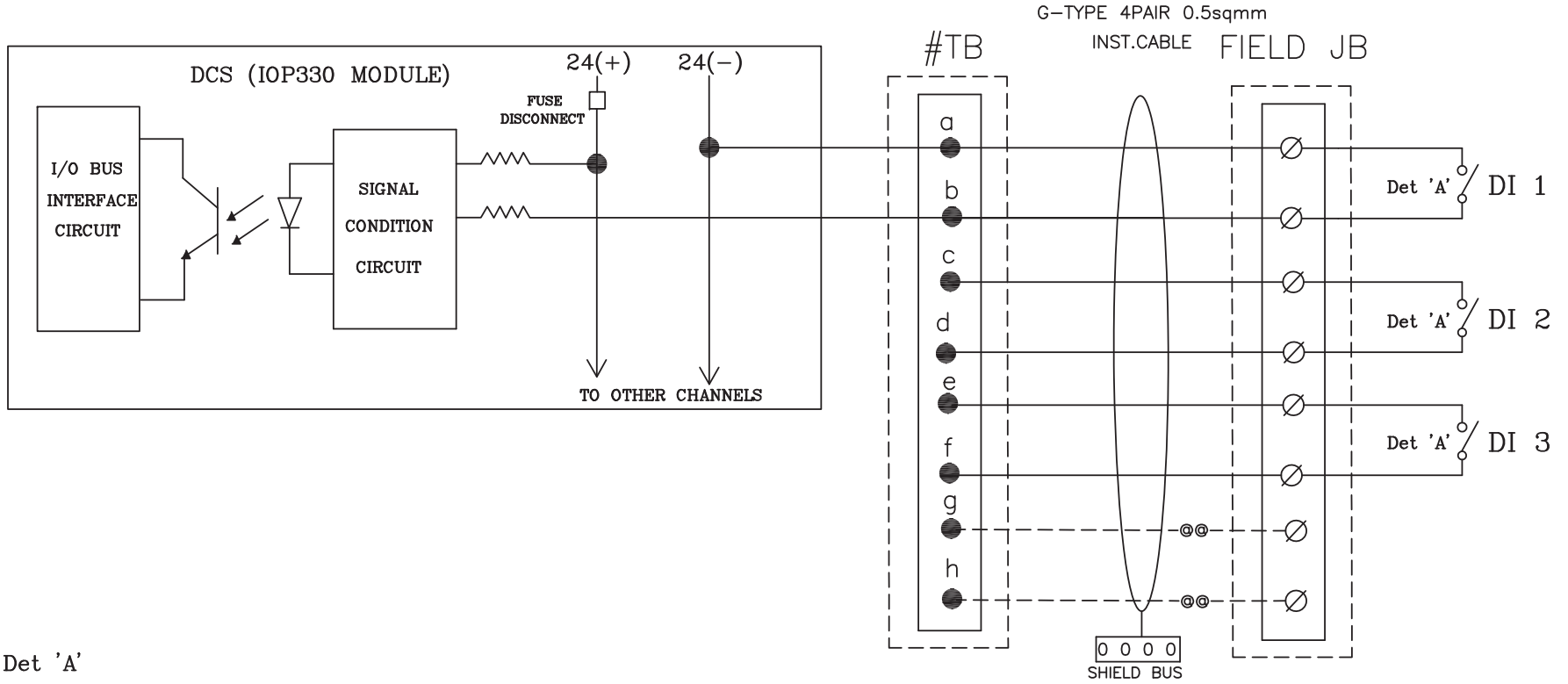
NOTE:–3 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.

NOTE:–4 F–TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.

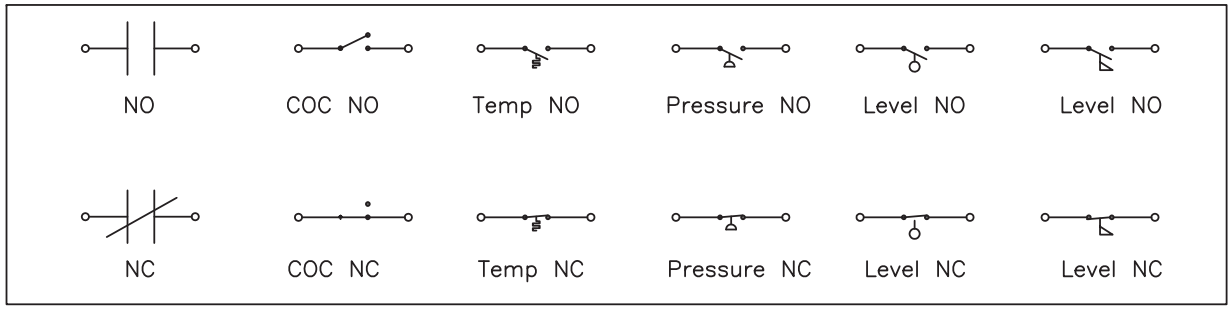
BHEL	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962–001–PE–405–PVI–B–152
	INTERFACE FOR MODULATING DRIVES – CLCS–M	SHT	15 OF 34

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-426-163-A001

DDCMIS INTERFACE WITH DIGITAL INPUT SIGNAL



Det 'A'



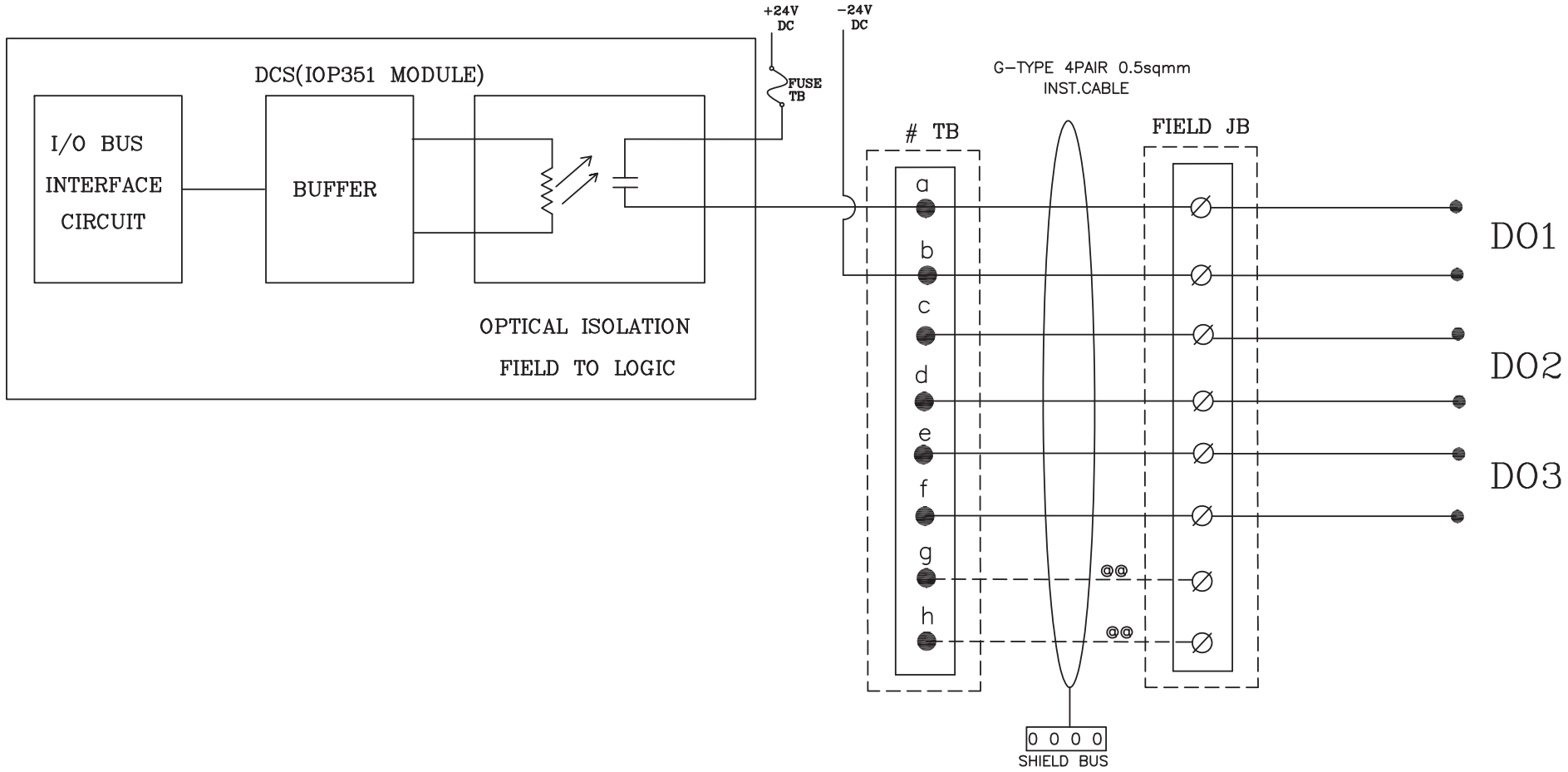
NOTE:–1 #8 LEVEL TERMINAL BLOCK.

NOTE:–2 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.

BHEL	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962–001–PE–405–PVI–B–152
		DATE	11.02.2019
	DDCMIS INTERFACE WITH DIGITAL INPUT SIGNAL	REV.NO.	01
		SHT	23 OF 34

THIS IS A PART OF TECHNICAL SPECIFICATION NO. PE-TS-426-163-A001

DDCMIS INTERFACE WITH DIGITAL OUTPUT SIGNAL

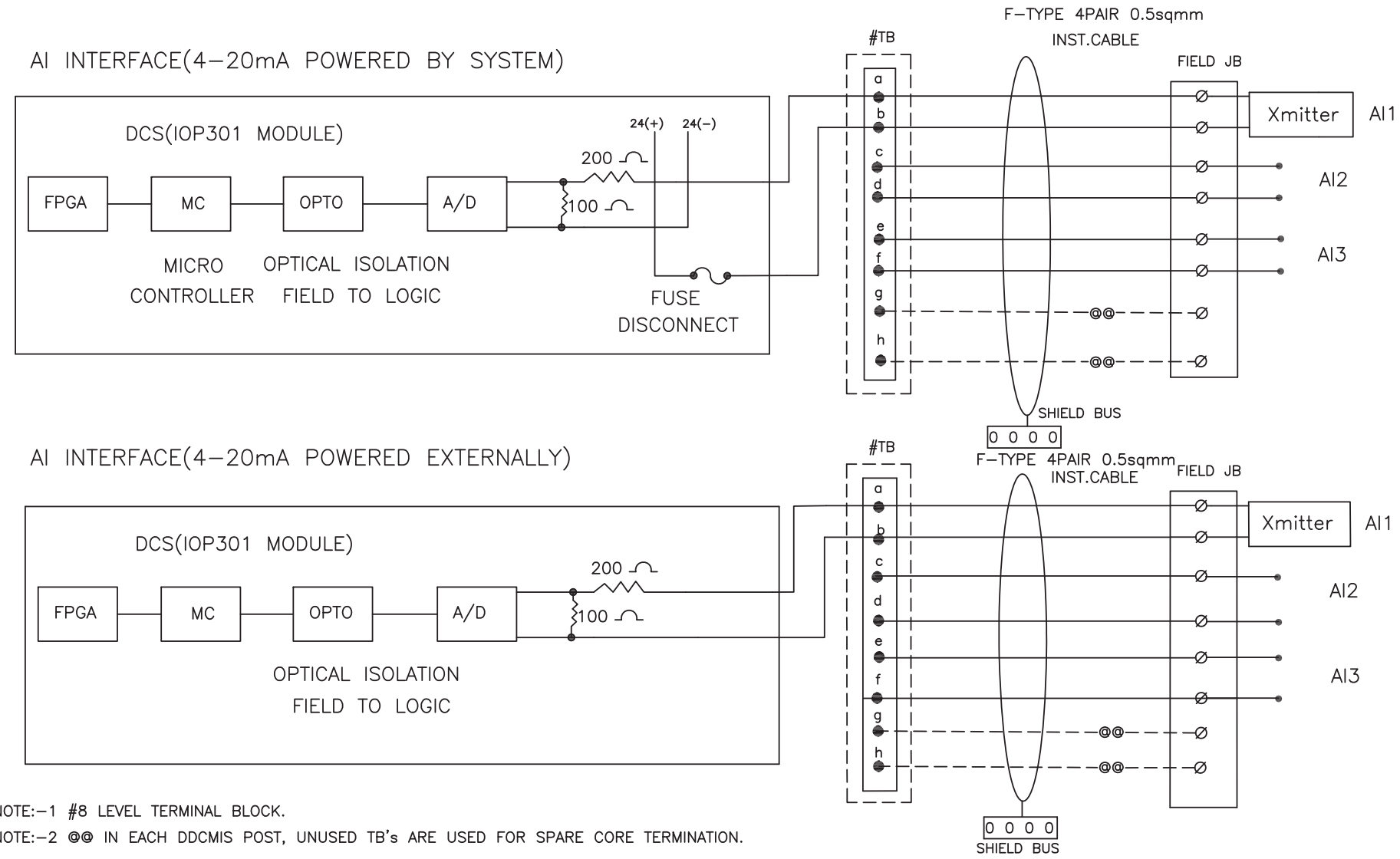


NOTE:-1 #8 LEVEL TERMINAL BLOCK.

NOTE:-2 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.

BHEL	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962-001-PE-405-PVI-B-152
		DATE	11.02.2019
	DDCMIS INTERFACE WITH DIGTAL OUTPUT SIGNAL	REV.NO.	01
		SHT	24 OF 34

DDCMIS INTERFACE WITH ANALOG INPUT SIGNAL



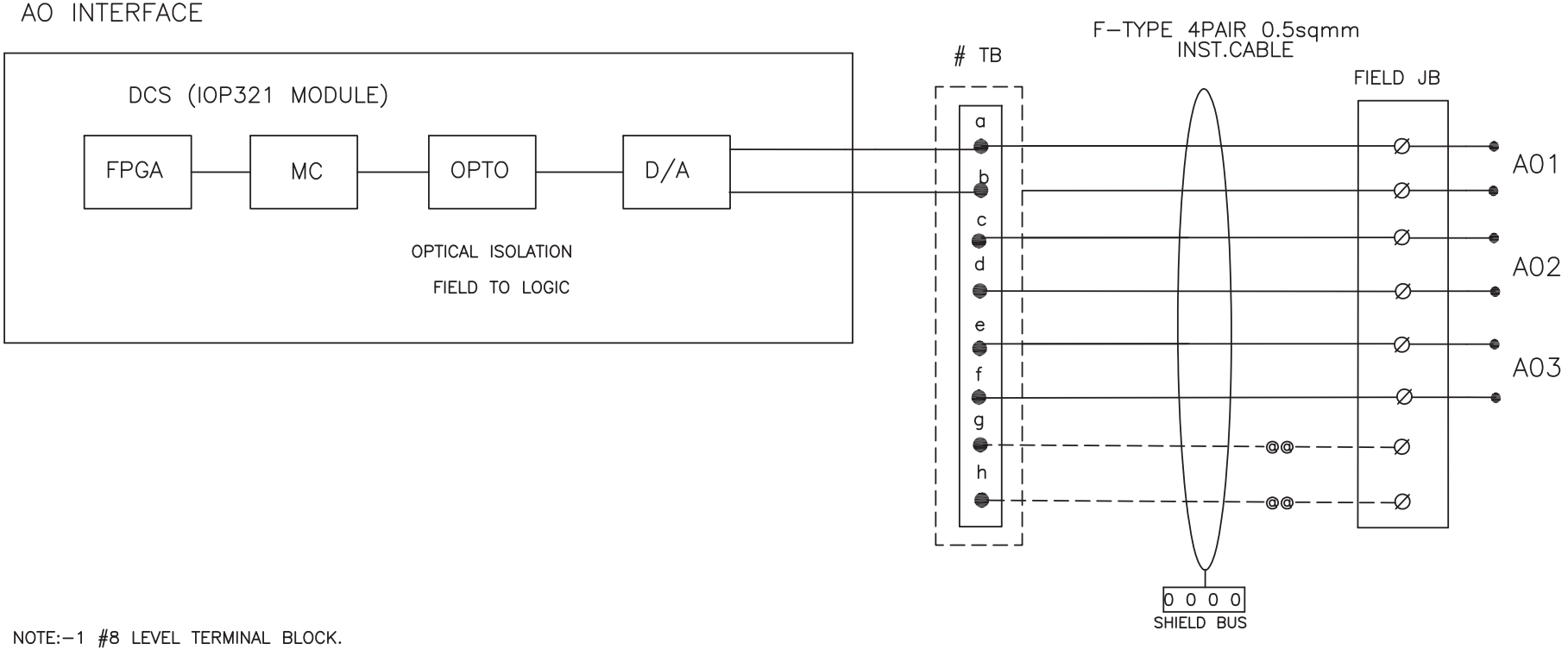
NOTE:–1 #8 LEVEL TERMINAL BLOCK.

NOTE:–2 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.

NOTE:–3 F–TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.

BHEL	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962–001–PE–405–PVI–B–152
		DATE	11.02.2019
	DDCMIS INTERFACE WITH ANALOG INPUT SIGNAL	REV.NO.	01
		SHT	25 OF 34

DDCMIS INTERFACE WITH ANALOG OUTPUT SIGNAL



NOTE:-1 #8 LEVEL TERMINAL BLOCK.

NOTE:-2 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.

NOTE:-3 F-TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.

BHEL	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962-001-PE-405-PVI-B-152
		DATE	11.02.2019
	DDCMIS INTERFACE WITH ANALOG OUTPUT SIGNAL	REV.NO.	01
		SHT	26 OF 34

SECTION III

LIST OF DOCUMENTS TO BE SUBMITTED ALONG WITH BID

1.0 Bidder to furnish following documents/information along with the bid (For electrical and C&I please refer the respective section of the specification).

- Deviation if any strictly in the enclosed Schedule of deviation with cost of withdrawal only with mention of specification clause for which deviation is being asked. (Stamped & Signed). In case of No Technical Deviation, bidder to furnish the same format stating “No Deviation” duly Stamped & Signed.
- Guaranteed Auxiliary Power Consumption Figures. (Duly filled, Stamped & Signed)
- Compliance certificate. (Stamped & Signed)
- Schedule of Declaration. (Stamped & Signed)
- Un Price Schedule duly filled as “Quoted”. (Stamped & Signed)

Any other documents submitted by bidder except as asked in the bid’s specification shall not be evaluated & considered as null & void.

NOTES:

1) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.

2) All drawings/documents shall be approved by BHEL/Customer during detailed engineering stage. Successful Bidder shall comply with the comment of the customer/BHEL without any price & delivery implication.

	TITLE: 1 X 660 MW PANKI TPS EXTENSION PROJECT	SPECIFICATION NO. PE-TS-426-163-A001	
		SECTION : III	
	TECHNICAL SPECIFICATION FOR DM PLANT		
		REV. NO. 00	DATE : 22/05/2017

SCHEDULE OF PRE-BID CLARIFICATION

All clarification from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION

Note: Bidder to furnish all the pre bid in the above indicated pre bid clarification format only. General Pre bid clarification will not be considered.

COMPLIANCE CUM CONFIRMATION SCHEDULE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

a.) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.

b.) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.

c.) All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.

d.) There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.

e.) The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.

f.) The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).

g.) All sub vendors shall be subject to BHEL/CUSTOMER approval.

h.) Any special tools & tackles, if required, shall be in bidder's scope.

i.) Demonstration parameters shall stand valid till the satisfactory completion of demonstration test and its acceptance by BHEL/Customer.

	TITLE: **1 X 660 MW PANKI TPS EXTENSION PROJECT**	SPECIFICATION NO. PE-TS-426-163-A001	
		SECTION : III	
	TECHNICAL SPECIFICATION FOR DM PLANT		
		REV. NO. 00	DATE : 22/05/2017

DECLARATIONS

I ……..……certify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated …….. and there is no deviation to the specification.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Bidders Company Name …….

Authorized representative's Signature ……..

Name …….

Bidder's Name

The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated

THIS IS A PART OF TENDER TECHNICAL SPECIFICATION PE-TS-426-163-A001

SCHEDULE OF DEVIATIONS WITH COST OF WITHDRAWAL

PROJECT:- 1 X 660 MW PANKI TPS EXTENSION PROJECT

DM PLANT

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF withdrawal OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF withdrawal OF DEVIATION IS APPLICABLE	NATURE OF COST OF withdrawal OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	**DESIGNATIONS**	**SIGN & DATE**	

NOTES:

1. For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawal is to be given seperately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
14. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

	TITLE:	BHEL DOCUMENTS NO.: PE-TS-426-163-A001	
	TECHNICAL SPECIFICATION FOR DM PLANT 1 X 660 MW PANKI TPS EXTENSION PROJECT	VOLUME	
		SECTION –III	
		REV. NO. 00	DATE: 22/05/2019

FORMAT FOR GUARANTEED AUXILIARY POWER CONSUMPTION (TO BE FILLED BY THE BIDDER)

S.NO.	DESCRIPTION OF EQUIPMENT	NO OF EQUIPMENT		TOTAL GUARANTEED POWER CONSUMPTION FOR WORKING DRIVES AT MOTOR INPUT TERMINAL (IN KW)
		WORKING	STANDBY	
1	DM Plant Feed Pump	1	1	
2	Degassed Water Pump	1	2	
3	Degassed Air Blower	1	1	
4	UF feed pump	1	2	
5	Neutralized Effluent Disposal pump	1	3	
6	Potable water Pump	1	1	
				Total (Kw)

Note-Base auxiliary power consumption figure for the system (for working drives only) has been considered as **92.7 KW**. As long as bidder's quoted total guaranteed power consumption (GPC) above remains within Base auxiliary power consumption figure, there will be no technical loading of bid on power consumption for evaluation. However, if bidder's quoted GPC exceeds base auxiliary power consumption figure, there shall be technical loading of bid for evaluation @ ₹ 5, 84,000/- (Rupees Five lacs and eighty four thousand) per KW of additional power over Base auxiliary power consumption figure.

Bidder’s guaranteed auxiliary power consumption as furnished above shall be demonstrated by the successful bidder during performance testing at works/ site. In case power consumption is higher than Base auxiliary power consumption figure / bidder's quoted GPC whichever is higher, during inspection/ PG test, penalty @ ₹ 5, 84,000/- (Rupees Five lacs and eighty four thousand) per additional KW shall be levied on vendor. (+) 1.0% of the guaranteed Auxiliary Power Consumption shall be acceptable shortfall with LD.