

TECHNICAL SPECIFICATION
CONDENSER ON LOAD TUBE CLEANING SYSTEM
(COLTCS)

UPRVUNL
1X660 MW PANKI TPS EXTENSION

Specification No.: PE-TS- 426-165-N002 (REV. 00)



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PPEI BLDG., SEC-16A, PLOT NO. 25
NOIDA – 201301 (UP)



TITLE:
**TECHNICAL SPECIFICATION
COLTCS**
SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-426-165-N002**
SECTION:
SUB-SECTION:
REV. NO. **00** DATE 10.05.2019
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SECTION - I

SPECIFIC TECHNICAL REQUIREMENTS

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SUB-SECTION – IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)



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1.0 GENERAL

- 1.1** This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and / or his sub-contractors works, proper packing for delivery, installation checks, commissioning, Trail run and PG test for Condenser On-line Tube Cleaning System (COLTCS) with mandatory spares complete with all accessories as per the requirements specified in this specification.

The Condenser On Load Tube Cleaning Systems (COLTCS) complete with all accessories shall conform to the standard technical specifications (Section-II) and Data Sheet-A enclosed herewith. In addition, the requirements of this Section-I including customer specification attached (as applicable) shall also be complied with. However, wherever the details given in Section-II and Data Sheet-A are different, the requirements of Data Sheet-A shall prevail. Similarly, in the event of contradictions between Section-I/ customer specification (as applicable) / Section-II/ Data Sheet-A, the same shall prevail in the order as: customer specification (as applicable), Section-I, Datasheet-A, Section-II. The decision of BHEL shall be final in case of any discrepancy.

Section I consists of 4 Sub-Sections Viz. Sub-Sec. IA, IB and IC for Mechanical, Electrical and C&I respectively and Sub-Sec. ID for Datasheet-A, the requirements of all 4 sub-sections shall be complied with.

- 1.2** The omission/ addition of specific reference to any component / accessory necessary for the proper performance of the equipment shall not relieve the supplier of the responsibility of providing such facilities to complete the supply within the quoted prices.

- 1.3** The bids for each project shall be evaluated as per NIT.

- 1.4** Bidder to quote for items as per price schedule attached in NIT.

2.0 DESCRIPTION OF EQUIPMENTS:

3.0 CONDENSER ON LOAD TUBE CLEANING SYSTEMS (COLTCS):

The condenser on load tube cleaning system (COLTCS) is intended to prevent formation of various forms of fouling and scaling in the condenser tubes. The cooling water system is of closed circuit type with cooling towers or open circuit type as specified. The water analysis is indicated with Datasheet-A.

4.0 SCOPE OF SUPPLY UNDER THE SPECIFICATION IN THE BIDDER'S SCOPE FOR COLTCS.

- 4.1** The details of COLTCS with quantities, design parameters, size and MOC's as per Data Sheet-A.

4.2 SCOPE OF SUPPLY IN THE BIDDER'S SCOPE FOR COLTCS:

- 4.2.1** Each set of COLTCS shall comprise following:

- a) One No. Ball Separator at Condenser CW outlet pipe.
- b) One No. Ball recirculation pump with drive motor.
- c) One No. Ball collector.
- d) One No. Manual ball sorter (Bucket type sorter with sieves to manually sort out the undersized balls by shaking the sieved bucket manually) for each set of COLTCS.
- e) Differential pressure measuring system for ball separator.



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DP measuring system shall comprise of 2 nos. DPT and 1 no. DPG for each COLTCS.

Instrument shall be with Remote seal arrangement. Stubs for DPT and DPG shall be independent.

- f) Ball monitoring system comprising an independent balls recirculation monitor and an independent balls oversize monitor. If bidder is not manufacturing Ball over size monitor, then they can offer other alternatives like automatic ball sorter etc.
- g) Length of Ball separator, Scope of Counter Flange, Nuts, bolts and gaskets shall be as per Datasheet-A. Thickness of body flange and counter flange shall be as per Drg no PE-DG-999-141-MO17 enclosed at enclosures at Annexure-II of Datasheet-A.
- h) For Clarified water: - Complete Pipe work, including interconnection piping, flanges/counter flanges for valves & pipes, bends, fittings, distributors, nozzles and support installation materials shall be in Bidder's scope. Bidder shall finalize the pipework to suit the layout at contract stage in such a way that no site welding is required for his pipework otherwise the same shall be carried out by bidder at site.
- i) The Electrical and C&I item / accessory as specified in succeeding clause/ respective sections herein.
- j) Power and Control cables between starter Panel (Switch Gear) and various drives in bidder's scope of supply.
- k) Starter Panel (Switch Gear Panel) shall be as follows:

For each Unit, each side of COLTCS system- Left & Right, shall be supplied with its separate local control cum starter /Switch Gear panel with its MIMIC and annunciator for its operation. Extent of MIMICs and annunciators shall be decided during detailed engg.

Switch Gear Panel should have suitable arrangement like Bus Coupler for providing redundancy to incoming supply feeder (1Working + 1 Standby feeder).

- l) Control cables between field instruments and Switch gear panel.
- m) All the field instruments stipulated in this specification shall be in Bidder's scope.
- n) Commissioning balls and other commissioning spares on "As required basis" and to be supplied at the time of commissioning of COLTCS system.
- o) Balls required for Performance Guarantee test on "As required basis" and to be carried at the time of PG test of COLTCS system.
- p) Set of mandatory spares as indicated in Data Sheet A. Spare balls (if applicable) to be supplied at the time of commissioning of COLTCS system.
- q) Supporting arrangement complete with saddle support, foundation plates, anchor bolts, nuts, sleeves, inserts, all installation materials, fixing bolts, clamps and other accessories etc. for complete equipment supplied under this package.
- r) Finish paints for touch up painting of equipment after erection at site, in sealed containers.



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- s) Set of special tools and tackles if required for maintenance and erection of the equipment supplied.
- t) Various drawings, data test reports/ certificates instruction manuals for erection operation and maintenance etc. as specified in Data Sheet-C. and cables schedule indicating BOQ for power & control cables.
- u) Panels & Instruments: Scope and Type as specified in C&I section wherever required.

Any item not specified but required to make COLTCS a complete package shall also be in bidder's scope.

5.0 SCOPE OF SERVICES INCLUDED IN THE BIDDER'S SCOPE:

The bidder's scope also includes following services at site, for scope under this specification for COLTCS:

- a) Installation checks (Erection in BHEL's scope).
- b) Commissioning of equipment.
- c) Trial run for requisite period
- d) Performance Testing.

The trial run of equipment shall be generally conducted immediately after commissioning while PG testing shall be conducted at a later date. These activities for different units shall be timed separately.

- **For drawings/documents approval**

In the event of order all drawings / documents in soft as well as hard copy shall be submitted as per cl. 10.0 (b) below.

Further on receipt of Customer comments, if required bidder's engineer shall visit BHEL/ Customer along with soft copy to resolve all issues and incorporate comments in the soft copy for across the table finalization and Category-I approval.

- **Site Visits for Installation Check, Commissioning, Trial Run & PG Testing:**

Bidder to consider cost of two site visits for three days each for installation check / commissioning of COLTCS for each unit i.e for 2 nos of COLTCS system.

Bidder to consider cost of two site visits for twenty days each for trial run and PG Testing of COLTCS for each unit i.e for 2 nos of COLTCS system.

In case of non-completion of above activities in site visits stipulated above, for any reasons not attributable to vendor, vendor shall complete above activities in subsequent site visits for which cost shall be borne by BHEL on pro-rata basis on price of site visit quoted by bidder in price schedule. BHEL Site Certification is mandatory for extra stay at site.

6.0 EXCLUSIONS:

The following are excluded from the bidder's scope.

- 6.1 Civil foundation works required for installation
- 6.2 Erection of Equipment at site.



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7.0 DESIGN CONSTRUCTION:

In addition to the requirements of Section-D the following shall also be complied.

- 7.1 Layout Piping Arrangement Drg. is enclosed in the specifications at Annexure-III of Datasheet-A.
- 7.2 Thickness of body flange and counter flange of COLTCS shall be as per Drg no PE-DG-999-141-MO17 enclosed at enclosures at Annexure-II of Datasheet-A.
- 7.3 The materials of construction specified in Data Sheet-A are minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty which shall be subject to purchaser's approval during detailed engineering in the event of order.
- 7.4 Housing/ body of COLTCS shall be designed and manufactured as per the applicable codes for pressure vessels and to take care of force and moments as enclosed in the specification. However, in no case thickness of housing/ body shall be less than connecting pipe thickness as specified in Data Sheet-A of COLTCS.
- 7.5 Adequate provision for future installation of Cathodic Protection for COLTCS (Sacrificial type) shall be kept by the bidder in the equipment.
- 7.6 Flow straightener for streamlining the CW flow in balls collecting strainer if required shall be supplied by the bidder along with mounting arrangement and the fixing details.
- 7.7 Velocity in the pipe work shall be less than 1.5 m/ sec for pump suction and less than 2.0 m/ sec. in other pipe work. All valves upto 150 NB shall be ball valves. For higher sizes, gate/ globe/ B.F. valves shall be provided. All instrument valves shall be needle valves.

8.0 Performance Guarantee and Bid Evaluation criteria for Condenser on Load Tube Cleaning System.

Performance Parameters to be guaranteed by bidders under demonstration category under compulsory corrections shall be as under:

- i) Percentage recovery of balls (min. 90% recovery for 1000 hrs of normal plant operation with 8 hrs Operation of COLTCS per day).
- ii) Life of Sponge Rubber Ball (Min. 3 weeks with 8 hrs operation of COLTCS per day).
- iii) Max. Pressure drop in ball separator in clean condition (Test to be conducted along with commissioning) – not exceeding 0.2 MWC. The Bids shall be technically rejected for pressure drop quoted higher than 0.2 MWC.

Any deviation to above balls life, percentage recovery and pressure drop will not be accepted.

In case the successful bidder fails to demonstrate any of these parameters he shall carry out modifications at his own cost, to purchaser's approval.

In case bidder fails to demonstrate above parameters to purchaser's satisfaction even after modification carried by him at site, the purchaser has the right to reject the equipment out rightly.



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9.0 SPARES:

9.1 Mandatory Spares

Mandatory Spares shall be as per Data Sheet-A or annexure enclosed with data sheet A.

10.0 Quality Plan

Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ Customer approval and 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. Charges for 3rd party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself. If BHEL or BHEL customer decides to witness the tests along with third party, the cost of travel of BHEL or BHEL customer shall be borne by BHEL or BHEL customer themselves.

11.0 DELIVERY & DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE:

- Delivery of Equipment shall be as per NIT.
- The drawings to be submitted by bidder in event of award of contract.

PACKAGE	BHEL DRG NO	DRG TITLE	Drg Sch for vendors
COLTCS	Primary Documents -		
	PE-V2-426-165-N001	P&ID OF COLTCS SYSTEM	R-0 within 20 days (for all except Installation plan, for Installation Plan 30 Days) from LOI/PO & subsequent revisions within 10 days of comments received from BHEL.
	PE-V2-426-165-N002	TECHNICAL DATA SHEET-COLTCS	
	PE-V2-426-165-N003	INSTALLATION PLAN-COLTCS	
	PE-V2-426-165-N004	GENERAL ARRANGEMENT OF BALL SEPERATOR	
	PE-V2-426-165-N005	DETAILS OF BR SKID,BALL INJECTION PIPE & FIXING DETAILS	
	PE-V2-426-165-N006	C&I Part-I,PANEL-TDS, I/O LIST, CABLE SCH AND CONTROL PHILOSPHY FOR COLTCS	
	PE-V2-426-165-N008	QP-COLTCS	
	PE-V2- 26 -165-N007	C&I Part-II, GA & WIRING DIAGRAM OF PANEL-COLTCS	R-0 within 30 days from Cat-I(or)II approval of C&I Part-I document & subsequent revisions within 10 days of comments received from BHEL.
	Secondary Documents -		
	PE-V2- 426 -165-N009	O& M MANUAL -COLTCS	Within 30 days from MDCC



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12.0 The makes of various bought out items shall be subjected to approval of Customer/ BHEL in the event of order.

13.0 It is mandatory for the bidders to submit along with the bid the deviations if any whether major or minor in the schedule of deviations only. ***In the absence of deviations listed in the schedule of deviations the offer shall be deemed to be in full conformity with the specification "non-withstanding" anything else stated elsewhere in bidder's offer, data sheets etc. The implied/ indirect deviations in data sheets etc. Shall not be binding on the purchaser.***

14.0 The following documents shall be furnished by the bidder with his offer:

- Compliance certificate duly signed and stamped (Enclosed at section-III).
- Guarantee schedule duly signed and stamped (Enclosed at section-III).
- GA drawings of following with empty/ filled-ups.
 - Balls Collecting Strainers (as applicable).
 - Balls recirculating Skids.
 - Other equipments considered necessary for Layout/ Civil.
- Electrical Load Data (Enclosed at section-1B of Specification)
- Schedule of Deviation (As per NIT format)

The bidder to note that load requirement furnished and finalized during tender stage shall only be provided by BHEL and any changes or additional requirement of Electrical load by bidder during contract stage shall be provided by BHEL with cost repercussions to the bidder.

NOTE: Apart from above, no other drawing/ document/ data sheet etc. shall be submitted along with the offer. If any drawing/ document etc. is submitted with the offer, same shall be considered as for 'Reference' purpose only and shall not be reviewed/ commented upon and any deviation, exclusion to scope, etc. taken in documents but not highlighted in the deviation schedule shall not be taken cognizance of.

15.0 COLTCS packing procedure before dispatch

The purpose of this procedure is to outline the requirements and procedures for protecting the equipment's during shipment and preserving during the storage.

15.1 Preparation for Packing:

- After hydro testing, operation, all fluids e.g. water etc., shall be completely drained from all COLTCS's parts, and the equipment blown dry.
- All material shall be cleaned internally and externally to remove, scale, rust fillings and any other foreign material.
- The COLTCS shall be placed on a strong wooden base & bolted to the wooden base using the foundation holes for further transportation up to site.

15.2 Protection of parts:

- BALL SEPARATOR) shall be packed in properly in high grad bubble plastic wrap for transportation, and long storage at site.
- Actuators shall be packed in separate wooden box of proper sizes.



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- COLTCS items (EXCEPT BALL SEPARATOR) shall be packed in proper sizes of wooden cases. High grade woods like Rubber woods, jungle wood, hard wood, mango wood, pine wood, etc. is used for packing.
- Loose material, & Electrical & Electronics items shall be packed in corrugated box and plastic bags with proper tagging and marking of handle with care in proper sizes of wooden cases
- All finished (or) machined (External C.S. Surfaces shall be protected against corrosion with corrosion resisting coating, which is easily removable (Compound shall be such that it will remain on the surface at temperature normally encountered during shipping & storage).
- All machined surfaces shall be protected from mechanical damage. All external unfinished carbon steel surfaces shall be sand blasted & shall be coated with rust preventive primer.
- Flanged opening if any shall be covered with blank flanges sealed with blank gasket of natural rubber or equivalent. Butt welded opening shall be closed with temporary closing covers. Internal threads shall be protected with metal plug sealed with Teflon tape (if applicable). External thread shall be protected with PVC sleeve.
- Wooden cases shall be covered with HDPE cloth from inside wooden box and the top. All the opening in COLTCS shall be closed properly by suitably covering to prevent foreign material entering in COLTCS.
- All fabricated wooden cases & crates conform to the requirement as per table given below:

Gross Weight [Kgs.]	Board Thickness	Batton / Rafter Thickness
2000 to 9000	Min. 30 mm	Min. 35 mm
9000 to 18000	Min. 50 mm	Min. 35 mm

- All the equipment shall be protected for entire period of dispatch, storage and erection against corrosion, incidental damage due to vermin, sunlight, rain, high temperature, humid atmosphere, rough handling in transit and storage. All MS parts which are not painted shall be provided with coating of grease.
- Clay Desiccant or such other moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.

15.3 Preservation

The equipment's shall be stored under closed/open space in packed condition until installation. The packages containing loose items are to be protected from extreme climatic conditions.

15.4 Photographs

Bidder to take photographs of all parts like Ball separators, screen, pumps, piping, valves, instruments, actuators, panel (inside & outside) and sent to engineering deptt along with all inspection reports before final dispatch.



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SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
COLTCS**

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION : **C**

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1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for COLTCS.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet the general technical requirements for motor.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

**2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR
ELECTRICAL & TERMINAL POINTS:**

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.



**ELECTRICAL EQUIPMENT SPECIFICATION
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- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) General technical requirements for LV motors.
- c) Datasheet A & C.
- d) Quality plan for motors.
- e) Electrical Load data format (Annexure –II)
- f) BHEL cable listing format (Annexure –III)

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES: COLTCS

SCOPE OF VENDOR: SUPPLY

PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC Starter cum control panel (if applicable)	BHEL Vendor	BHEL BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL Vendor BHEL	BHEL BHEL BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Cabling/ termination by BHEL.
4	Junction box for control & instrumentation cable	Vendor	BHEL	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	BHEL	Refer scope/ C&I portion of specification for scope of fibre Optical cables if used between PLC/ micro processor & DCS.
6	Cable trays, accessories & cable trays supporting system	BHEL	BHEL	
7	Cable glands and lugs for equipment supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty copper lugs for power & control cables.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	BHEL	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding & lightning protection	BHEL	BHEL	

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)**PACKAGES:** COLTCS**SCOPE OF VENDOR: SUPPLY****PROJECT:**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	BHEL	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	BHEL	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Equipment layout drawings	Vendor	-	For preparation of cabling layout drawings by BHEL, vendor shall furnish Electrical equipment layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling,
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.

GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS

SL. NO.	PARAMETERS	PROJECT:- 1X660 MW UPRVUNL PANKI TPS EXT.
1	CODE AND STANDARDS	Motors shall comply with the latest revisions of all relevant standards of BIS (IS-325, IS-900, IS-996, IS-1231, IS-1885, IS-2148, IS-2223, IS-2253, IS-2254, IS-2848, IS-3202, IS-4029, IS-4691, IS-4722, IS-4728, IS-4889, IS-6362, IS-7816, IS-8223, IS-8789, IS: 12615, IS:3177 and IEC : 60034 3Φ Induction motor)
2	SERVICE CONDITIONS	Climate is tropical, conducive to fungus growth, Heavily dusty and highly polluted environment.
3	TYPE AND RATING	Squirrel cage induction motor suitable for direct-on-line starting. Continuous duty LT motors upto 160 KW Output rating (at 50 deg. C ambient temperature), shall be Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.
4	EFFICIENCY CLASS	IE3
5	RUNNING REQUIREMENT	a) Motor shall be capable of running satisfactorily at seventy five (75) percent nominal voltage for five (5) minutes. b) Motor, when running at full load, shall not stall when voltage drops down to seventy (70) percent nominal voltage for one (1) minute. c) The motors shall also be capable of running up again after voltage collapse to about 40% for approximate duration of 0.5 sec. Subsequent rise in voltage to 70% and further to 80% and 100%, the total duration not exceeding 20 sec.
6	STARTING CURRENT	a) Motor shall be capable of starting and accelerating to full speed at full load at eighty (80)percent nominal voltage at motor terminals. b) Cold Start: Under specified voltage variations two (2) starts in quick succession and third start five (5) minutes thereafter, all with full load of driven equipment. No additional start will be made till lapse of further thirty (30) minutes. c) Hot Start: Under specified voltage variations, one (1) immediate and two (2) fifteen (15) minutes interval starts all with full load of driven equipment. No additional start will be made till lapse of further thirty (30) minutes d) Motor shall also be suitable for three (3) equally spread starts per hour when the motor is under normal service condition. e) Motor Starting current shall be as per IS 12615/IEC60034
7	LOCKED ROTOR WITHSTAND TIME	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) (a) Below 110KW : 10.0 (b) From 110 KW & upto 200 KW : 9.0
8	ENCLOSURE	a) Outdoor Motors IP 55 (Additional canopy to be provided) Indoor Motors IP 55. IP-55 degree of protection shall be achieved without application of any compound, putty etc. b) Motor located in hazardous area (if applicable) shall have flameproof enclosure conforming to Group IIC (or Group-I, Div-II as per NEC or Class-1, Gr-B, Div-II as per NEMA/IEC60034) for plant area.

**GENERAL TECHNICAL REQUIREMENTS
FOR LV MOTORS**

SL. NO.	PARAMETERS	PROJECT:- 1X660 MW UPRVUNL PANKI TPS EXT.
9	COOLING	Method of cooling shall be IC 411 (TEFC), IC 511 (TETV) or IC 611 (CACA).
10	WINDING AND INSULATION	a) Winding shall be Non-hygroscopic, oil resistant, flame resistant b) Thermal class 155 (F) insulation, temperature rise limited to class-B c) The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin pour method. d) The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15
11	TROPICAL PROTECTION	a) Motors above 30 KW shall be provided with one (1) or two (2) space heaters suitable for 240V, 50 Hertz single phase AC supply and of adequate capacity to maintain motor internal temperature above dew point to prevent moisture condensation or deterioration of insulation during shut down. Heaters shall be mounted inside the motor in accessible locations so that their removal and replacement is simple. b) Motors upto 30 kW shall have stator windings suitable for connections to 24V, 50 Hz AC supply for space heating. The terminals of space heaters shall be brought out to a separate totally enclosed dust proof and weatherproof terminal box
12	BEARINGS	a) Greased ball, roller and/or sleeve bearing shall be rated for minimum standard life of 20,000 hours taking bearing and driven equipment loads into account. Loss of grease shall be scarce and it shall not creep along shaft into motor housing. Bearing shall be effectively sealed against dust ingress and shall be pressure grease gun lubricated. b) If the bearings are oil lubricated, a drain plug shall be provided for draining residual oil and oil level gauge shall be provided to show precisely oil level required under standstill and running conditions. Bearing lubricating system shall be such that no external forced oil or water is necessary to maintain required oil supply to keep bearing temperature within design limits. c) When pressure oiling is required for horizontal motors, bearings shall be sleeve type arranged for pressure oiling supplied from lubrication system of driven machine, with ring oiling for starting and emergency duty. Ring oiling system shall be adequate for starting and continuous operation of motor for at least half an hour, without pressure oiling system in operation. Oil sight flow gauges shall be provided to indicate oil flow through each bearing. d) Lubricants shall be selected for prolonged storage and normal use of motors in tropical climate and shall contain corrosion and oxidation inhibitors. Greases shall have suitable bleeding characteristics to minimize settling. The selected lubricants shall be indigenously available. e) Sleeve bearings for use with motors having flexible coupling with limited end play, shall have adequate axial end play to prevent transmission of thrust from driven equipment to motor bearings. f) Large motors shall preferably have spherically seated babitted, ring forced, feed lubricated, water-cooled bearings. If anti-friction bearings are provided, these shall be roller bearings rated for a minimum standard life of 30000 hours taking all bearing and driven equipment loads into account.

SL. NO.	PARAMETERS	PROJECT:- 1X660 MW UPRVUNL PANKI TPS EXT.						
13	MOTOR TERMINAL BOX	a) Terminal boxes shall be weatherproof and water-tight confirming to minimum IP-55 degree of protection with removable front cover for making connections. IP-55 degree of protection shall be achieved without application of compound b) Motors shall be provided with separate terminal boxes for main & space heaters. When it is not possible to provide LT motors with separate terminal box for space heater terminals, space heater terminals shall be adequately segregated from the main terminals in the single box. c) Suitable non-magnetic material construction shall be adopted for terminal boxes where single core cables are to be terminated. d) The terminal boxes shall be complete with cable glands and termination accessories as required. e) Main terminal box shall be capable of being turned through 360 degrees in steps of 90 degrees. f) The terminal boxes shall be capable of withstanding Min. fault level of 50 KA for atleast 0.25 seconds at the terminals. Cable for main terminal shall be: 1. Stranded aluminium conductor, XLPE insulated, PVC sheathed, GI wire / strip armoured (for 3 core), FRLS PVC outer sheath, 1100V grade, heavy-duty cables. 2. Stranded aluminium conductor, XLPE insulated, hard drawn aluminium wire/ strip armoured (for single core) FRLS PVC outer sheath, 1100V grade, heavy duty cable. SPACE HEATER cables shall be: Two point five (2.5) mm², two (2) core copper conductor PVC insulated, armoured and FRLS PVC outer sheath heavy duty 1100 V grade cable.						
14	MINIMUM PHASE TO PHASE & PHASE TO EARTH CLEARANCE FOR 415V	a) Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows: <table><tr><td>UP to 110 KW</td><td>10mm</td></tr><tr><td>Above 110 KW and upto 150 KW</td><td>12.5mm</td></tr><tr><td>Above 150 KW</td><td>19mm</td></tr></table> b) Each terminal end shall be furnished with bimetallic washers, spring washers, nuts and crimp type aluminium (preferably tinned) lugs suitable for cables of sizes as specified.	UP to 110 KW	10mm	Above 110 KW and upto 150 KW	12.5mm	Above 150 KW	19mm
UP to 110 KW	10mm							
Above 110 KW and upto 150 KW	12.5mm							
Above 150 KW	19mm							
15	GROUNDING	a) Two (2) grounding terminals one (1) on either side at the bottom suitable for connecting mild steel/GI flat/GI wire grounding conductor. b) At each earthing point, two (2) drilled and tapped holes with hexagonal head bolts, plain washers, spring washers and tinned lugs (for motors upto 5.5 KW) for size of conductor specified shall be provided						
	GROUNDING CONDUCTORS	Shall be finalised during detail engineering						
16	RATING PLATE							

**GENERAL TECHNICAL REQUIREMENTS
FOR LV MOTORS**

SL. NO.	PARAMETERS	PROJECT:- 1X660 MW UPRVUNL PANKI TPS EXT.
17	DRAIN PLUG	
18	LIFTING PROVISIONS	Motors shall be provided with eyebolts, lugs or other means to facilitate safe lifting.
19	PAINTING	a) Motor shall have glossy, light grey finish No. 631 as per IS: 5 b) All sharp edges and scales shall be removed from the surface, which shall then be thoroughly degreased, de-rusted and given two (2) coats of primer and two (2) coats of finish paint. It is preferred that a phosphate coat is given to motor prior to application of primer coat. Motors for water treatment plant shall have Zinc Chromate base with acid resistant Epilex 4 paint.
20	TESTS	LT Motors supplied shall be of type tested design. During detailed engineering vendor to submit, type tests reports for the test conducted (as listed below) on the equipment similar to those proposed to be supplied under this contract carried out at an independent laboratory or should have been witnessed by a client within last five years from the date of bid opening. However if the contractor is not able to submit report as mentioned above, vendor shall conduct all such tests under this contract at no additional cost to BHEL either at third party lab or in presence of customer representative and submit the reports for approval. The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only i) Measurement of resistance of windings of stator and wound rotor. ii) No load test at rated voltage to determine input current power and speed. iii) Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) iv) Full load test to determine efficiency power factor and slip . v) Temperature rise test. vi) Momentary excess torque test. vii) High voltage test. viii) Test for vibration severity of motor. ix) Test for noise levels of motor x) Test for degree of protection and xi) Over speed test. xii) Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

**GENERAL TECHNICAL REQUIREMENTS
FOR LV MOTORS**

SL. NO.	PARAMETERS	PROJECT:- 1X660 MW UPRVUNL PANKI TPS EXT.
21	DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT	a) Motor Data Sheet. b) Certified binding dimension drawing of motor complete with all accessories and fittings specifically showing terminal boxes, terminal spacing and sizes, earthing connections and sizes thereof, mounting details, lifting lugs, final foundation loads and dimensions with tolerances of centering spigot (where needed), shaft extension and key. c) Following characteristics curves: i. Torque-speed curves for motor at eighty (80), hundred (100) and hundred ten (110) percent rated voltage as well as torque-speed curve for driven equipment. ii. Current-speed curves at eight (80), hundred (100) and hundred ten (110) percent rated voltage iii. Current-time curves at eighty (80), hundred (100) and hundred ten (110) percent rated voltage. iv. Thermal withstand curves for hot and cold at eighty (80), hundred (100) and hundred ten (110) percent rated voltage, Efficiency, power factor, current and speed versus power output curves. v. Speed-time curves at eight (80), hundred (100) and hundred ten (110) percent rated voltage. vi. Negative phase sequence current withstand characteristics
22	MINIMUM STARTING VOLTAGE FOR MOTOR	80% of rated voltage
23	SHORT TIME RATING FOR TERMINAL BOXES	The terminal boxes shall be capable of withstanding at the terminals the system fault level of 50 KA without rupture for a duration of atleast 0.25 sec.

DATA SHEET of LV motor		
SL NO.	DESCRIPTION	
		1X660 MW UPRVUNL PANKI TPS EXT.
A	General	
1	Manufacturer & country of origin	DURING DETAILED ENGINEERING
2	Motor type	SQUIREL CAGE INDUCTION MOTOR
3	Efficiency class	IE3
4	Type of starting	DOL
5	Maximum acceptable kW rating of LV motor	200
6	Rating up to which Single phase motors permitted.	
7	Installation (Indoors/ Outdoors)	indoor/outdoor
8	Degree Of Protection	IP55 WITH CANOPY FOR OUTDOOR IP55 FOR INDOOR
9	Name of the equipment driven by motor & Quantity	DURING DETAILED ENGINEERING
10	Maximum Power requirement of driven equipment	DURING DETAILED ENGINEERING
11	Rated speed of Driven Equipment	As per system requirement
12	Design ambient temperature (Degree Celcius)	50 deg C
B	Design and Performance Data	
1	Frame size & type designation	DURING DETAILED ENGINEERING
2	Type of duty	AS PER REQUIREMENT
3	Rated Voltage	240/415 V
4	Rated Frequency	50 Hz
5	System fault level at rated voltage	50kA for 1 sec
6	LV System grounding	solidly grounded
7	Permissible variation for	
a	Voltage	+/-10%
b	Frequency	+/-5%
c	Combined voltage & frequency	10%
8	Rated output at design ambient temp (by resistance method)	as per requirement
9	Synchronous speed & Rated slip	as per requirement
10	Minimum permissible starting voltage	80% of rated voltage
11	TYPE OF STARTER PROVIDED IN MCC	As per system requirement
12	Starting time in sec with mechanism coupled	
a	At rated voltage	As per system requirement
b	At min starting voltage	

13	Locked rotor current as percentage of FLC (including IS tolerance)	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) (a) Below 110KW : 10.0 (b) From 110 KW & upto 200 KW : 9.0
14	Torque	
a	Starting	a) Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. B) Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.
b	Maximum	
15	Permissible temp rise at rated output over ambient temp & method	Thermal class 155 (F) insulation, temperature rise limited to class-B.
16	Noise level in (dB)	85 (dB) at 1 M
17	Amplitude of vibration	As per IS-12075/IEC-60034-14
18	Efficiency & P.F. at rated voltage & frequency	
a	At 100% load	Efficiency as per IS 12615, IEC: 60034-30 (Latest revision), P.F. as per requirement.
b	At 75% load	
c	At starting	Efficiency as per IS 12615, IEC: 60034-30 (Latest revision), P.F. in line with starting requirement as per relevant standard.
C	Constructional Features	
1	Method of connection of motor driven equipment	As per system requirement
2	Applicable Standard	as per relevant standard
3	DOP of Enclosure	IP55 WITH CANOPY FOR OUTDOOR IP55 FOR INDOOR
4	Method of cooling	IC 411 (TEFC), IC 511 (TETV) or IC 611 (CACA).
5	Class of insulation	All motors shall have class F insulation but limited to class B temperature rise
6	Main terminal box	
a	Type	Refer Specific technical requirement for motors
b	Power Cable details (Conductor, size, armour/unarmour)	1.1 kV XLPE armour cable, size shall be provided during detailed engineering
c	Cable Gland & lugs details (Size, type & material)	Refer Specific technical requirement for motors
d	Permissible Fault level (kArms & duration in sec)	
e	Degree of Protection	
7	Earth Conductor Size & Material	Refer Specific technical requirement for motors

8	Space heater details (30KW & ABOVE) (Voltage & watts)	Refer Specific technical requirement for motors
9	Flame proof motor details (if applicable)	During detailed engineering
a	Enclosure	
b	suitability for hazardous area	
i	Zone O / I / II	
ii	Group IIA / IIB / IIC	
c	Degree of Protection	
9	No. of Stator winding	As per system requirement
10	Winding connection	As per system requirement
11	Kind of rotor winding	As per system requirement
12	Kind of bearings	Refer Specific technical requirement for motors
13	Direction of rotation when viewed from NDE	Motor shall be bi-directional
14	Paint Shade & type	Glossy light grey finish no 631 of IS 5, for details refer Specific technical requirement for motors
15	Net weight of motor	DURING DETAILED ENGINEERING
16	Outline mounting drawing No (To be enclosed as annexure)	DURING DETAILED ENGINEERING
D	Characteristic curves/ drawings	
1	(To be enclosed for motors of rating >55KW)	DURING DETAILED ENGINEERING
2	Torque speed characteristic	
3	Thermal withstand characteristic	
4	Current vs time	
5	Speed vs time	
E	Tests on motors	As applicable (As per QAP/For Project specific requirement if any refer Specific technical requirement for motors)



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

SPEC. NO.: **PE-TS-426-165-N002**

SECTION: **I**

SUB-SECTION: **IC**

REV. NO. **00** DATE **10.05.2019**

SPECIFIC TECHNICAL REQUIREMENTS

SHEET **1** OF **1**

SUB-SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS (C &I)

	1X660MW PANKI TPS EXTN.	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSER ON LOAD TUBE CLEANING SYSTEM	
Specific Technical Requirements (C&I): 1.0 The Contractor shall provide Starter cum control panel (Switchgear panel) and complete Instrumentation for control, monitoring and operation of entire package. The requirements given are to be read in conjunction with detailed Technical specification. Further in case of any discrepancy in the requirement within the same section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre bid clarification. In absence of any pre bid clarification, the more stringent requirement as per interpretation of customer shall prevail without any commercial and time implication. 2.0 Bidder shall provide starter panel for local start/ stop monitoring of auxiliaries and equipment along with status indications and alarms as per requirement. The requirement shall be decided during detailed engineering. 3.0 Local push buttons in the field shall be in Vendor's scope. 4.0 The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial/ time implication in this regard shall be acceptable. In case of any conflict or repetition of clauses in the specification, the more stringent requirements among them are to be complied with. 5.0 All KKS tag nos. shall have prefix 10. 6.0 Bidder to supply all the instruments (PT, LT, DPG, LG and DPS etc.) required for the package along with necessary fittings, accessories and valve manifold etc. All instruments shall be provided with durable epoxy coating for housing and all exposed surfaces of the instruments. Instrument Installation along with hardware shall be in bidder scope. Double root valves shall be provided where pressure is above 40 Kg/cm2. 7.0 Bidder shall provide Cable Schedule in BHEL excel format which shall be provided during detailed engineering. Also, Cable Interconnections for Complete System shall be in Bidders' scope. DCS side details for hardwired signals shall be furnished by BHEL during detailed engineering. 8.0 The quantity of instruments for the system shall be as per tender P & ID wherever provided of the respective system as a minimum, for bidding		

	1X660MW PANKI TPS EXTN.	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSER ON LOAD TUBE CLEANING SYSTEM	
	purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments & items are required for safe & reliable operation of plant, bidder shall supply the same without any price implication. Instrument installation and required accessories shall be in bidder's scope.	
9.0	Redundancy of sensors shall be provided, irrespective of instrumentation shown in the PID, by bidder as per sheet attached in the specification. (ANNEXURE 1)	
10.0	All transmitters shall be smart type and shall have 4-20mA DC signal with superimposed digital communication (HART). Each Temperature element shall be complemented with temperature transmitters, compensating cable, JB/rack & other erection hardware. All transmitters shall be fitted with a local analog/digital indicator displaying appropriate physical units which may be read clearly from an easily accessible position.	
11.0	Use of process actuated switches shall be avoided unless Unavoidable.	
12.0	All instruments and control elements shall be terminated on JB/LCP in field and both instrument and JB/LCP are in bidder scope. Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 12-15 mtrs) and trunk cable.	
13.0	For cable scope refer to electrical scope between BHEL and vendor defined in electrical specification.	
14.0	Electrical Actuators with integral starter shall be provided for all on/off and inching type valves along with necessary interface units for linking to corresponding Control System as applicable, typical Hook-up diagram of drives is included for reference.	
15.0	Instrument installation and accessories required for the same shall be in Bidder's scope and shall be submitted after award of contract. However, any instrument/ analyser installation not covered in the same shall be subject to customer and BHEL approval during detailed engineering.	

	1X660MW PANKI TPS EXTN.	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSER ON LOAD TUBE CLEANING SYSTEM	
16.0	All Temperature sensors shall be Duplex type and temperature transmitter shall be provided for all temperature measurement applications.	
17.0	Bidder to provide temperature transmitter, JB/Rack & other erection hardware.	
18.0	Bidder to furnish electrical load/UPS load data during detailed engineering.	
19.0	Local control panel if any required for operation shall be in bidder scope.	
20.0	The solenoid operated valves/Dampers/Gate shall have a limit switch for open/close feedback. Solenoid Valve shall be rated for 24V DC only.	
21.0	All field instruments enclosure shall be IP65 local panel/cabinet enclosure shall be IP 55, unless otherwise specified.	
22.0	All the outdoor field instruments such as analysers/transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipments are protected against rain/ sunlight etc.	
23.0	The junction boxes/LIEs for termination of instruments are in bidder's scope.	
24.0	Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured.	
25.0	All Instruments must have separate tapping lines. Sharing of the same tapping pipe for redundant instruments or various different instruments is not acceptable.	
26.0	As a general rule, measuring points and measuring equipment for critical protection shall be separate from and not combined with measuring equipment for the automatic control equipment.	
27.0	Electronic instruments shall not be located close to hot lines, vessels or other hot equipment. Ambient temperatures exceeding 80 °C shall not result in calibration difficulties or rapid deterioration of electronic components.	
28.0	The junction boxes/LIEs/LIRs for termination of instruments/actuator limit switches etc. are in bidder's scope.	

	1X660MW PANKI TPS EXTN.	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSER ON LOAD TUBE CLEANING SYSTEM	
29.0	All the instruments/equipment/electrical items shall be provided & designed with maximum star rating in line with energy conservation policies as per latest international standards at the time of supply.	
30.0	DP instruments with minimum Capillary length of 15m is to be supplied.	
31.0	Bidder to note that all the transmitters/instruments supplied by Bidder shall be rack mounted. The racks shall be preassembled and provided by Bidder. Also no Instruments/ analysers & JBs/Racks should be protruding on the walkway.	
32.0	All field instruments shall be terminated on Junction box/Local control panel in field. All the instruments along with necessary fittings, accessories and valve manifold etc., erection hardware including racks, junction boxes, canopies, structural steel, LIE, LIR etc.as required shall be in vendor's scope of supply.	
33.0	240 V AC (supply feeder)/415 V, 3 phase, 4 wire AC supply shall be provided by BHEL based on the load data provided by the bidder at contract stage for all equipment supplied by the bidder as part of contract. Any other voltage level (AC/DC) required will be derived by the bidder. Bidder to include necessary power distribution board in his scope and all necessary hardware/software for the same shall be in bidder's scope.	
34.0	Power supply derived for Transmitters, contact interrogation, interposing relay and solenoid shall generally be ungrounded 24V D.C only.	
35.0	MOVs (Motorised Valves) shall be integral type, if applicable.	
36.0	Mandatory spares have to be supplied by bidder as mentioned in the specification.	
37.0	The scope of cable shall be referred in Electrical scope split sheet in Electrical portion of the specification.	
38.0	Interface of control panel, field instruments, actuators etc. with DCS based control system shall be as per Drive Control Philosophy enclosed in Section-D.	

	1X660MW PANKI TPS EXTN.	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSER ON LOAD TUBE CLEANING SYSTEM	
39.0	Bidder to provide erection hardware including junction boxes, canopies, structural steel as required.	
40.0	Bidder to perform tests of C&I items/instruments/systems as per quality plans/type test attached in the specification.	
41.0	Every panel-mounted instrument, requiring power supply, shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.	
42.0	Each valve/instrument shall be fitted with a stainless steel or aluminum nameplate indicating the valve/instrument service and reference number in accordance with the approved equipment coding system.	
43.0	Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured.	
44.0	The make of all the items shall be from approved sub-vendor list.	
45.0	The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards eg. ANSI, ASME, IEEE, ISO, IEC, IGCI, AWS, NFPA, AISC, IGS, SAMA, UBC, UL, NESC, NEMA, ISA, DIN, VDE, IS etc.	
46.0	The specifications for instruments mentioned in the specification are minimum requirements. Datasheets of instrument shall be subject to customer/owner approval.	
47.0	All approval/Inspection are to be carried out by Owner or owner appointed agency only.	
48.0	Drawings/Documents and data to be furnished after award of the contract shall be in line with MDL furnished elsewhere in the specification.	
49.0	Mandatory spare list as per 'List of mandatory spares' attached elsewhere in the specification is in vendor's scope.	
50.0	Editable & pdf copy of Drawings/Documents and data to be furnished after award of the contract: • GA & wiring diagram of local panel. • Local control panel & instruments data sheet.	

	1X660MW PANKI TPS EXTN.	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CONDENSER ON LOAD TUBE CLEANING SYSTEM	
- Any other document decided during detailed engineering. Note:- - All equipment items shall be of latest design with proven on track record from reputed experienced manufacturers of specified type and range of equipment. The make/model of various instruments/items/systems and instrument sub-vendor shall be subject to approval of BHEL/Customer during detailed engineering stage. - The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL. - Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any price/time implication. - Uniformity of make and type of instruments and control components shall be followed throughout for rationalization of spares' inventory, except for certain proprietary items where this requirement cannot be met. - In case of any discrepancy in Section-C and Section-D of the specification, Section-C shall prevail.		

ANNEXURE - 1**(g) Redundancy requirements****i Triple Redundancy**

Triple Sensing device shall be provided for following applications:-

- a. **For** Binary and analog inputs required for protection of boiler, turbine and major auxiliaries of main plant whose non-availability may result in 50% loss of unit availability and loss of generation.
- b. Binary and analog inputs, which are, required for protection of more than one equipment as well as protection signals for important auxiliaries and HT Drives of main plant (fed by a supply feeder of ratings 3.3 kV onwards)/MDBP/TDBFP etc.,
- c. Separate triple sensors for Instruments required for auto starting of HT driven pumps or HT driven pump tripping due to very low level of water & discharge pressure very low.
- d. For binary and analog inputs which are also required for protection in addition to CLCS. The same shall include but not limited to the critical measurement used for following CLCS :-
Furnace draft, main steam and reheat steam temperatures, feed-water flow, throttle pressure, turbine first stage pressure, separator level, LPH and HPH level, deaerator level, hotwell level, CEP minimum recirculation, BFP minimum recirculation etc.
- e. For lube oil protection of all the HT drives, 2 out of 3 logics and necessary pressure transmitters for lube oil pressure shall be provided by bidder accordingly. However for bearing / winding temperature of HT motor, refer Electrical subsections, Vol. IV.
- f. Left and right side shall be treated as individual path / individual parameter, and each side/path shall have own triple redundancy accordingly.

ii Dual Redundancy

Dual Sensing device shall be provided for following applications:

- a. For binary and analog inputs required for all other closed loop control system (CLCS), protection and interlock conditions purpose of other equipments.
- b. For Instruments required for auto starting of LT driven pumps or LT driven pump tripping due to very low level of water/discharge pressure very low.
- c. Dual redundant position transmitters shall be provided for Steam Admission Valves i.e. (Emergency Stop & Control Valves, Reheat Stop Valves & Control valves), Extraction steam QCNRV, CRH NRV.
- d. For instruments required for Heat rate measurements & PADO calculations.

- iii. For binary and analog inputs used for alarm and monitoring only, single sensor criteria shall be applicable.

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.:	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE: 26.02.18
			SHEET 1	OF 4
Data Sheet A & B				
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 to 70 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		



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.:

VOLUME II B

SECTION D

REV. NO. 00

DATE: 26.02.18

SHEET 2

OF 4

Data Sheet A & B

DATA SHEET-A
(TO BE FILLED BY PURCHASER)

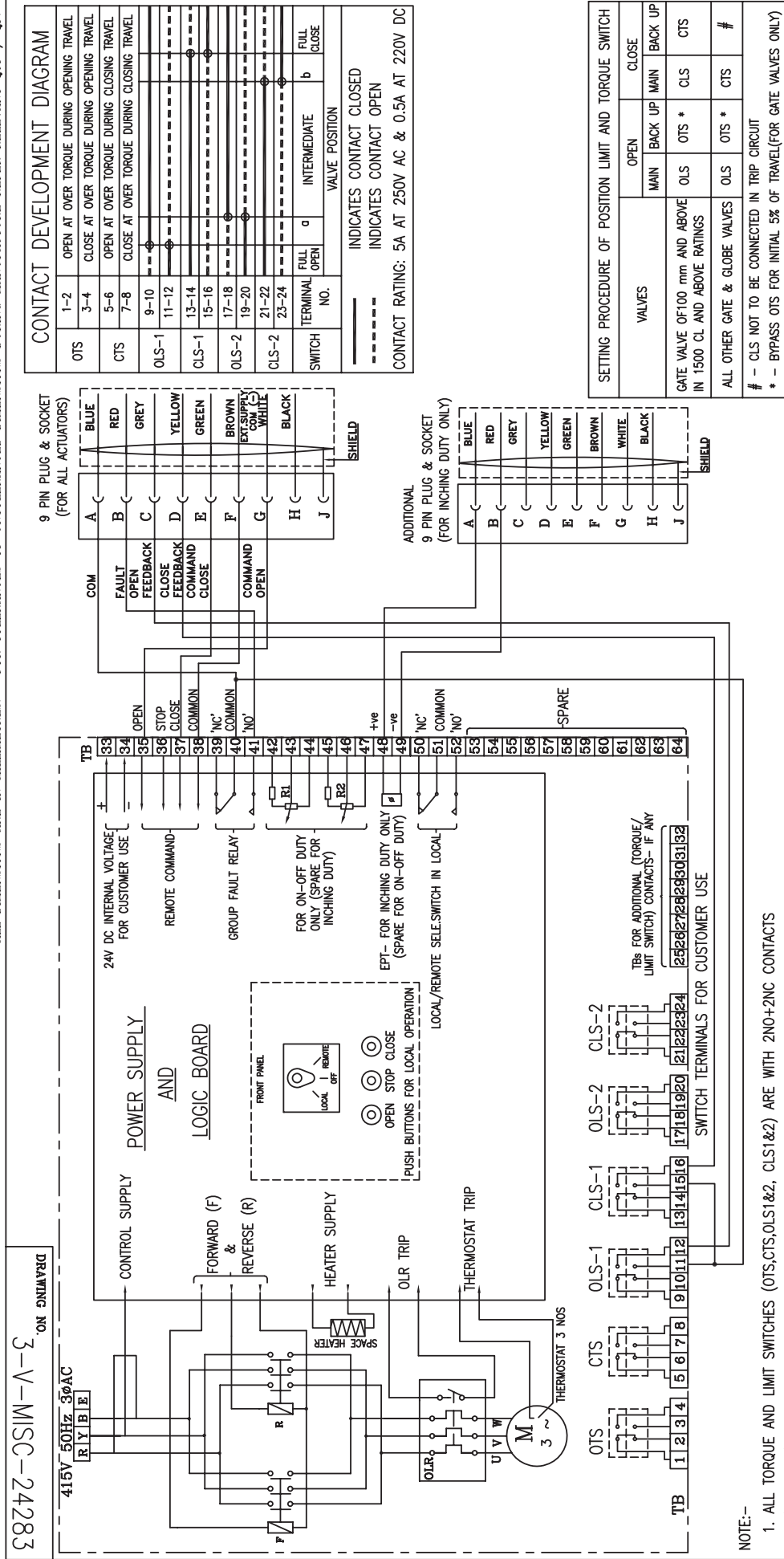
DATA SHEET-B
(TO BE FILLED-UP BY BIDDER)

	@ 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 TRIP/O/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		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.:		
		VOLUME	II B	
		SECTION	D	
		REV. NO.	00	DATE: 26.02.18
		SHEET	3	OF 4
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	

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	$\pm 1\%$ 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 2Px1.5mm ²)	
	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)	

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.:	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE: 26.02.18
			SHEET 4	OF 4
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.	
NOTES: SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY. CODES & STANDARDS: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL 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 - TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C. - CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED. - 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. - 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%. - 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. - IT SHOULD BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR. - POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL - WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE 1.5 SQ. MM. - 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. - 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. - ALL SIX (6) LIMIT SWITCHES SHALL BE CHANGEOVER TYPE AND ADJUSTABLE BESIDES HAVING THE SNAP FACILITY. - 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. - THE REMOTE COMMAND SIGNAL (OPEN-STOP-CLOSE) FROM DCS/RESPECTIVE CONTROL SYSTEM/CONTROL PANEL SHALL BE ISOLATED FROM CONTROL ELECTRONICS THROUGH OPTO-ISOLATOR. - 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				



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 TRANSMITTER
(CONTACTLESS TYPE, FOR INCHING DUTY)
7. RT-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.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT										ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS FOR NIPC PROJECTS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)									
365-121 BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TRUCHIRAPALLI-680014.										DRN CHD		NAME N.P.ESWAR D.DINAKARAN		SIGN N.P. D.D		DATE 17.03.05 17.03.05		NO OF VAR. -	
DEPT VL		SCALE 		WEIGHT (KG). NTS		-		REFERENCE INFORMATIONS				NO. OF THRS -							
CODE		TITLE		WIRING DIAGRAM (TERMINAL PLAN)						DRAWING NO.		REV							
FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET FOR NIPC PROJECTS										CARD CODE U 01		3-V-MISC-24283				0			
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Technical specification for
CONDENSER ON LOAD TUBE CLEANING SYSTEM
1X660MW PANKI TPS EXTN.

SECTION D

REV. NO. 00

DATE : 04.04.2019

SECTION-D

HARDWIRE INTERFACE PHILOSOPHY

INDEX SHEET

SHT.NO.	TITLE	REV.NO. 00	REV.NO. 01	REV.NO. 02	REV.NO. 04	REV.NO. 05
01	TITTLE SHEET	X				
02	INDEX SHEET	X				
03	INDEX SHEET	X				
04	DDCMIS INTERFACE WITH HT SWGR (HT)	X				
05	DDCMIS INTERFACE WITH LT MCC (LT)	X				
06	DDCMIS INTERFACE WITH BID	X				
07	DDCMIS INTERFACE WITH BIDI	X				
08	DDCMIS INTERFACE WITH FIRE DAMPERS OF AC&VENT SYS (BID-FD)	X				
09	DDCMIS INTERFACE WITH MOTORISED OPERATED VALVE OF AC&VENT SYS (AC-MOV2)	X				
09A	DDCMIS INTERFACE FOR SCREW CHILLER AND ACCU OF AC&VENT SYS	X				
10	DDCMIS INTERFACE WITH DUAL COIL SOLENOID (DSOV/L)	X				
11	DDCMIS INTERFACE WITH SOV(WITHOUT FEEDBACKS)	X				
12	DDCMIS INTERFACE WITH SOV(WITH FEEDBACKS)	X				
13	DDCMIS INTERFACE WITH VFD OF AC SYSTEM(VFD-AC)	X				
14	DDCMIS INTERFACE WITH MODULATING DRIVES-CLCS	X				
15	DDCMIS INTERFACE WITH MODULATING DRIVES-CLCS-M	X				
16	DDCMIS INTERFACE WITH ERV CONTROL BOX	X				



UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

DRG.NO. 9962-001-PE-405-PVI-B-152

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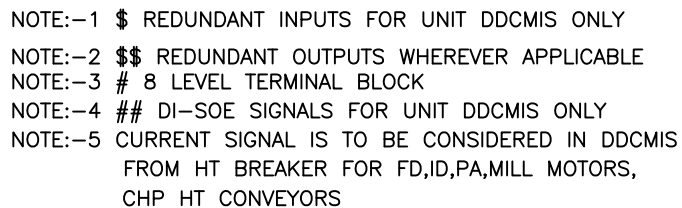
INDEX SHEET

SHT.NO.	TITLE	REV.NO. 00	REV.NO. 01	REV.NO. 02	REV.NO.04
17	DDCMIS INTERFACE WITH EHVCB	X			
18	DDCMIS INTERFACE WITH FIELD BREAKER (FB)	X			
19	DDCMIS INTERFACE WITH ELECTRICAL BREAKER (EB-HT-SYNC)	X			
20	DDCMIS INTERFACE WITH ELECTRICAL BREAKER (EB-HT-NONSYNC)	X			
21	DDCMIS INTERFACE WITH ELECTRICAL BREAKER (EB-LT-SYNC)	X			
22	DDCMIS INTERFACE WITH ELECTRICAL BREAKER (EB-LT-NONSYNC)	X			
23	DDCMIS INTERFACE WITH DIGITAL INPUT SIGNAL	X			
24	DDCMIS INTERFACE WITH DIGITAL OUTPUT SIGNAL	X			
25	DDCMIS INTERFACE WITH ANALOG INPUT SIGNAL	X			
26	DDCMIS INTERFACE WITH ANALOG OUTPUT SIGNAL	X			
27	DDCMIS INTERFACE WITH LTCHP (DOL)	X			
28	DDCMIS INTERFACE WITH BELT WEIGHER (BW)	X			
29	DDCMIS INTERFACE WITH SUSPENDED MAGNET (SM)	X			
30	DDCMIS INTERFACE WITH METAL DETECTOR (MD)	X			
31	DDCMIS INTERFACE WITH INLINE MAGNETIC SEPARATOR (ILMS)	X			
32	DDCMIS INTERFACE WITH REV (DOL)	X			
33	DDCMIS INTERFACE WITH VVVF	X			
34	DDCMIS INTERFACE WITH HTCHP	X			
34a	FDR TYPE: SP FOR DC JOP, EOP & DC SOC MOTOR	X			
34b	DDCMIS INTERFACE WITH CEP VFD	X			

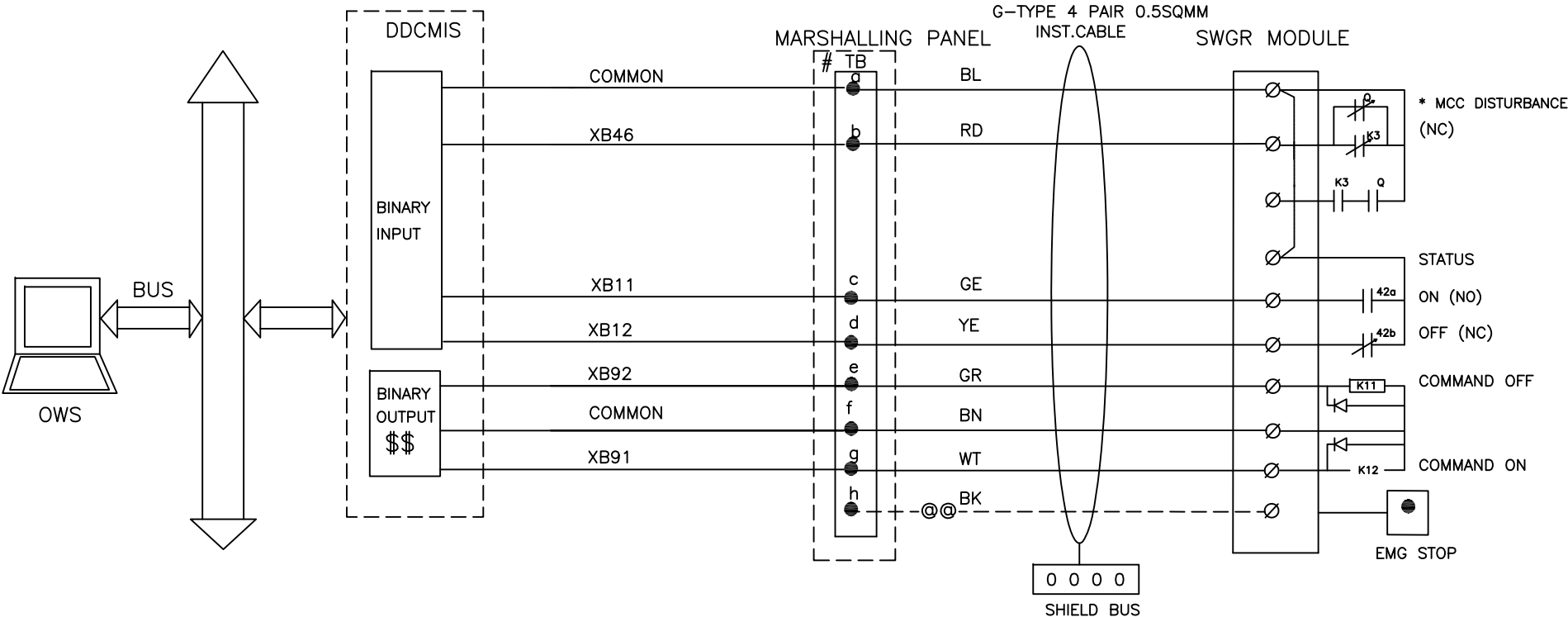
CABLE COLOR CODING PHILOSOPHY:

SL.NO	DCS END TB	CABLE COLOR
1	a	BLUE (BL)
2	b	RED (RD)
3	c	GREY (GE)
4	d	YELLOW (YE)
5	e	GREEN (GR)
6	f	BROWN (BN)
7	g	WHITE (WT)
8	h	BLACK (BK)

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	INDEX SHEET	SHT	03 OF 34



DDCMIS INTERFACE WITH LT MCC (LT)



- NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
NOTE:-2 # 8 LEVEL TERMINAL BLOCK
NOTE:-3 @@ IN EACH 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

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	DDCMIS INTERFACE WITH LT MCC (LT)	SHT	05 OF 34

OWS

BUS

DDCMIS

BINARY INPUT

BINARY OUTPUT

COMMON

XB46

XB01

XB02

XB94

COMMON

XB93

\$\$\$

MARSHALLING PANEL

TB

a

b

c

d

e

f

g

h

BL

RD

GE

YE

GR

BN

WT

BK

4 PAIR 0.5sqmm (G-TYPE) INST.CABLE

9 PIN PLUG & SOCKET

a

b

c

d

e

f

g

h

J

ACTUATOR(WITH INTEGRAL STARTER)

* ACTUATOR DISTARBANCE (NC)

STATUS

52a

OPEN (NO)

52a

CLOSE (NO)

COMMAND CLOSE

COMMAND OPEN

0 0 0 0

SHIELD BUS

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

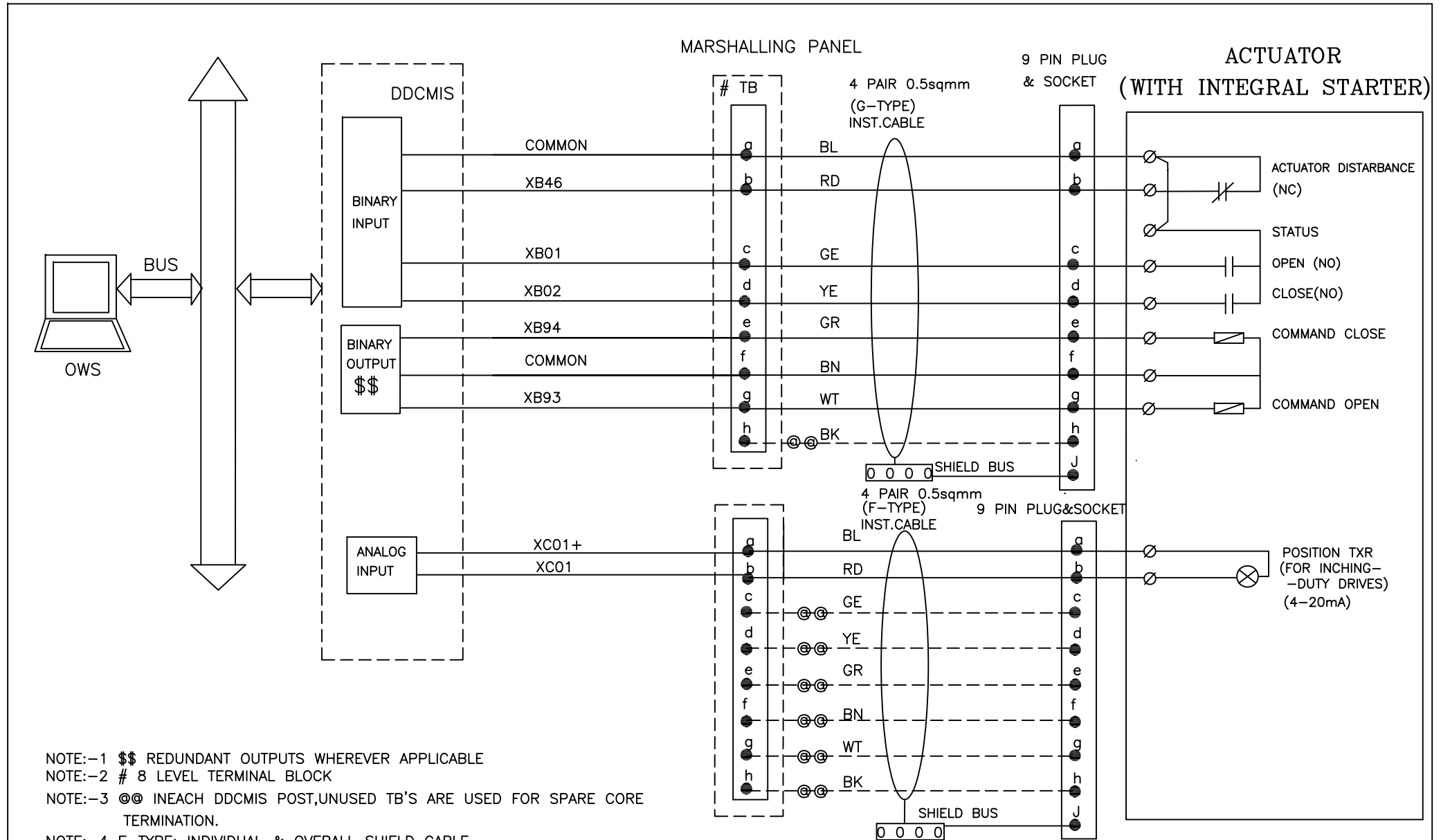
NOTE:-4 * DISTURBANCE=LOSS OF POWER SUPPLY(1PHASE/3PHASE)/LOSS OF
CONTROL SUPPLY/MOTOR THERMOSTAT TRIP/THERMAL OVER LOAD/
TORQUE SWITCH OPERATED, LOCAL/OFF/REMOTE SWITCH IN LOCAL/OFF POSITION



DDCMIS INTERFACE WITH BID

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DDCMIS INTERFACE WITH BIDI/MODI/MOVI



NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

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.

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



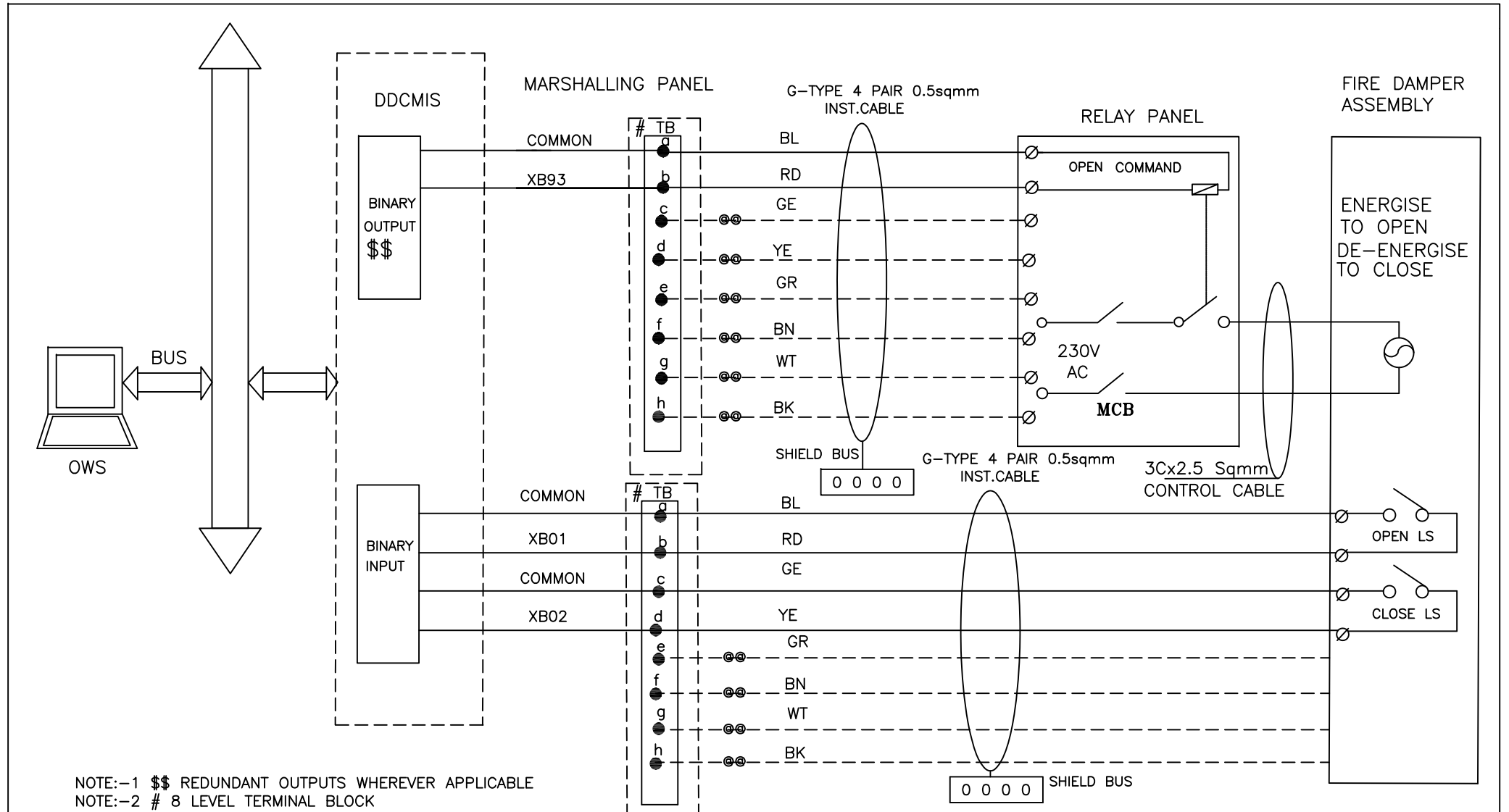
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1 X 660 MW PANKI TPS

DDCMIS INTERFACE WITH BIDI

DRG.NO. 9962-001-PE-405-PVI-B-152

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DDCMIS INTERFACE WITH FIRE DAMPERS OF AC & VENT SYS(BID-FD)



NOTE:-1 \$\$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

NOTE:-2 # 8 LEVEL TERMINAL BLOCK

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



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1 X 660 MW PANKI TPS

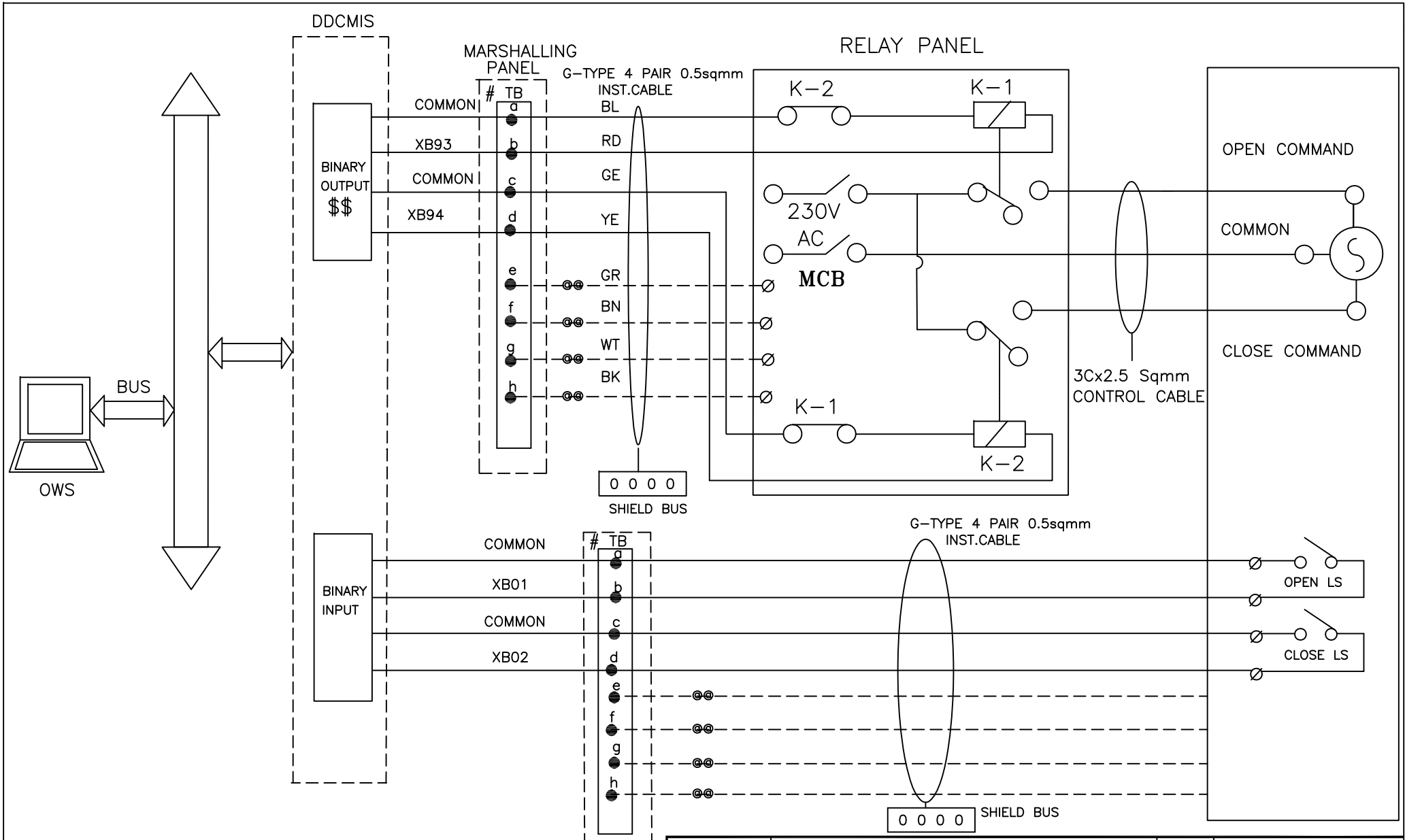
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DDCMIS INTERFACE WITH FIRE DAMPER OF AC&VENT SYS(BID-FD)

SHT

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DDCMIS INTERFACE WITH MOTORISED OPERATED VALVE OF AC & VENT SYS(BID- AC)



NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

NOTE:-2 # 8 LEVEL TERMINAL BLOCK

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



UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

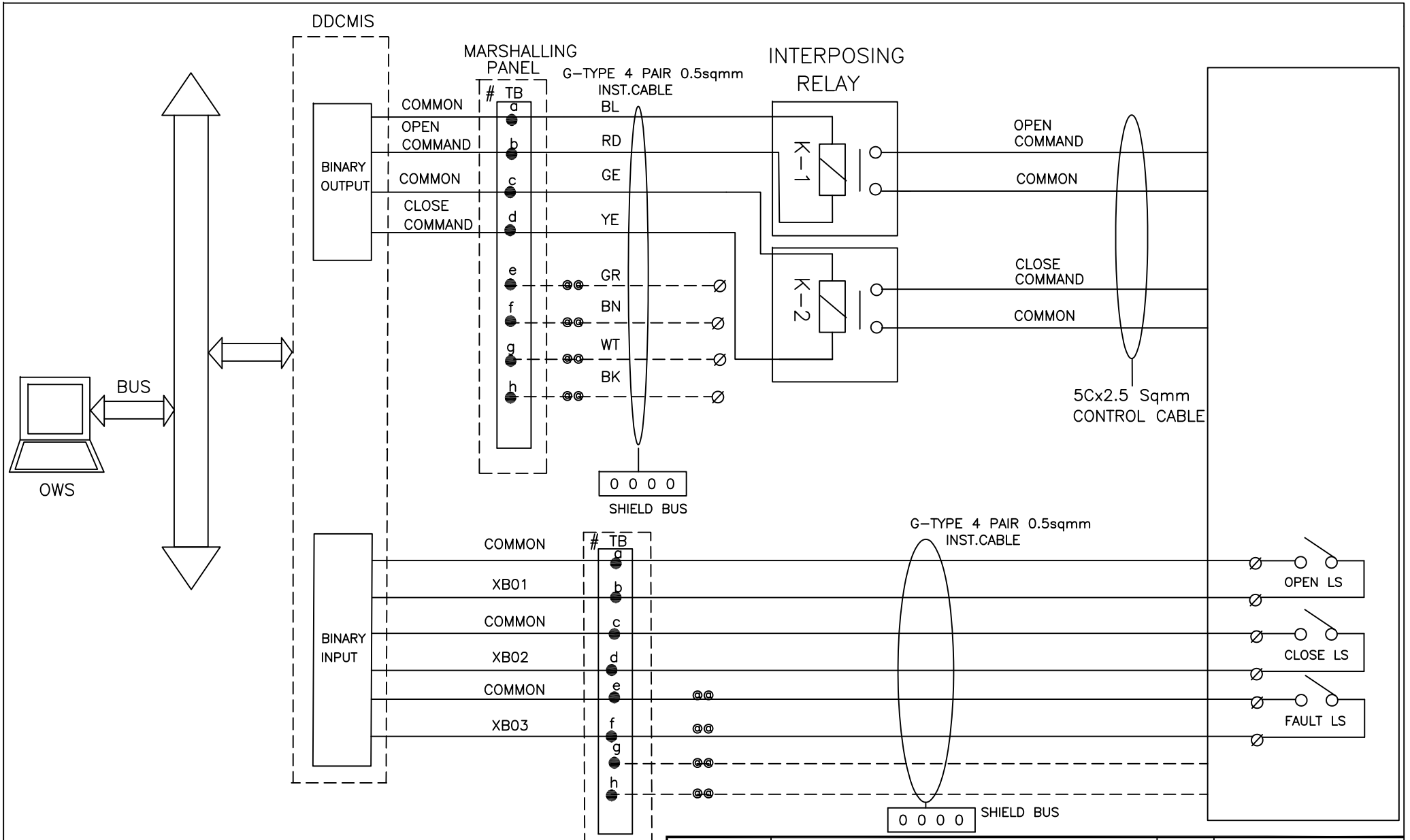
DRG.NO. 9962-001-PE-405-PVI-B-152

DDCMIS INTERFACE WITH FIRE DAMPER OF AC&VENT SYS(BID-AC)

SHT

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DDCMIS INTERFACE OF SCREW CHILLER/ACCU FOR AC AND VENT SYS



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1 X 660 MW PANKI TPS

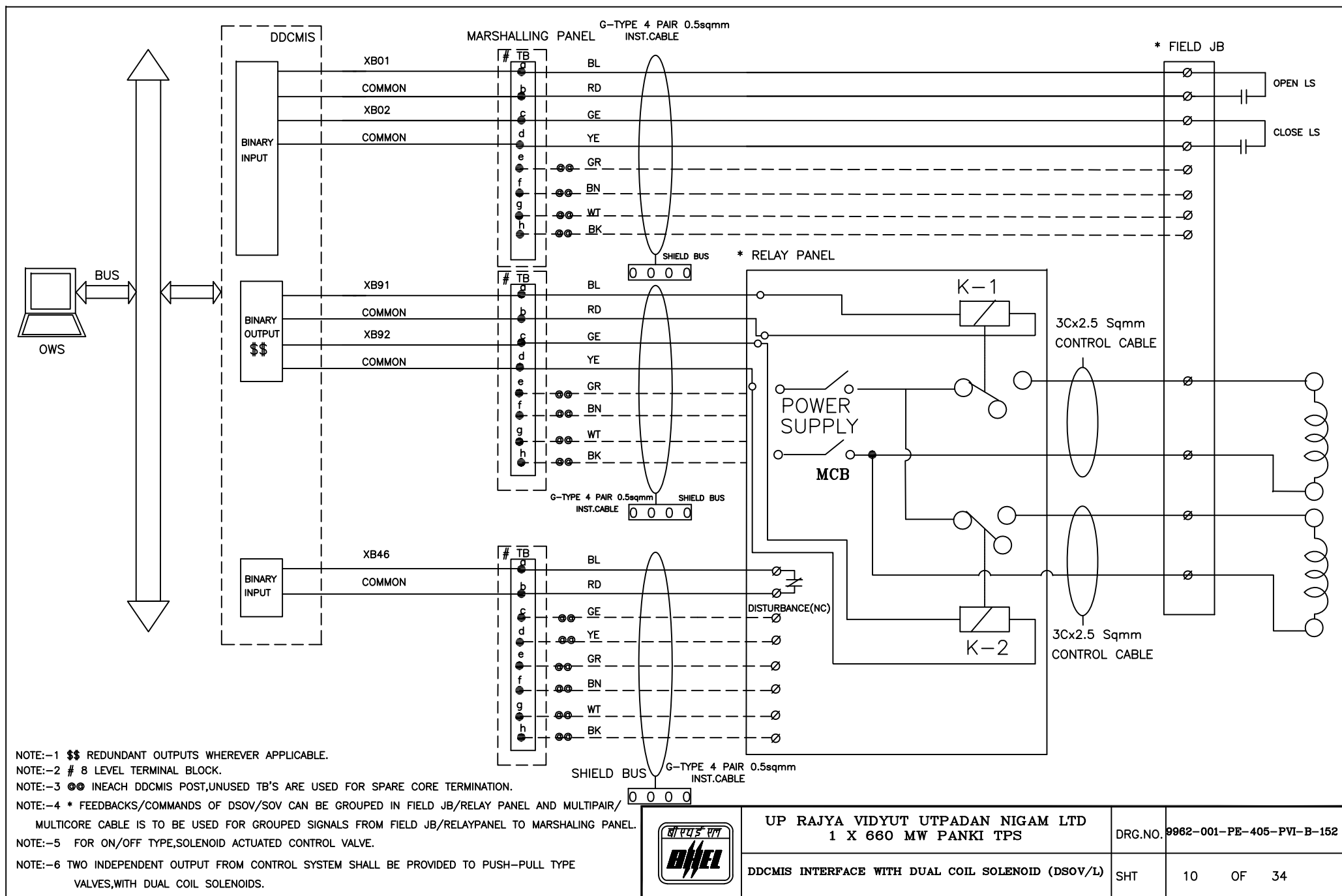
DRG.NO. 9962-001-PE-405-PVI-B-152

DDCMIS INTERFACE OF SCREW CHILLER/ACCU FOR AC & VENT SYS

SHT

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DDCMIS INTERFACE WITH DUAL COIL SOLENOID (DSOV/L)



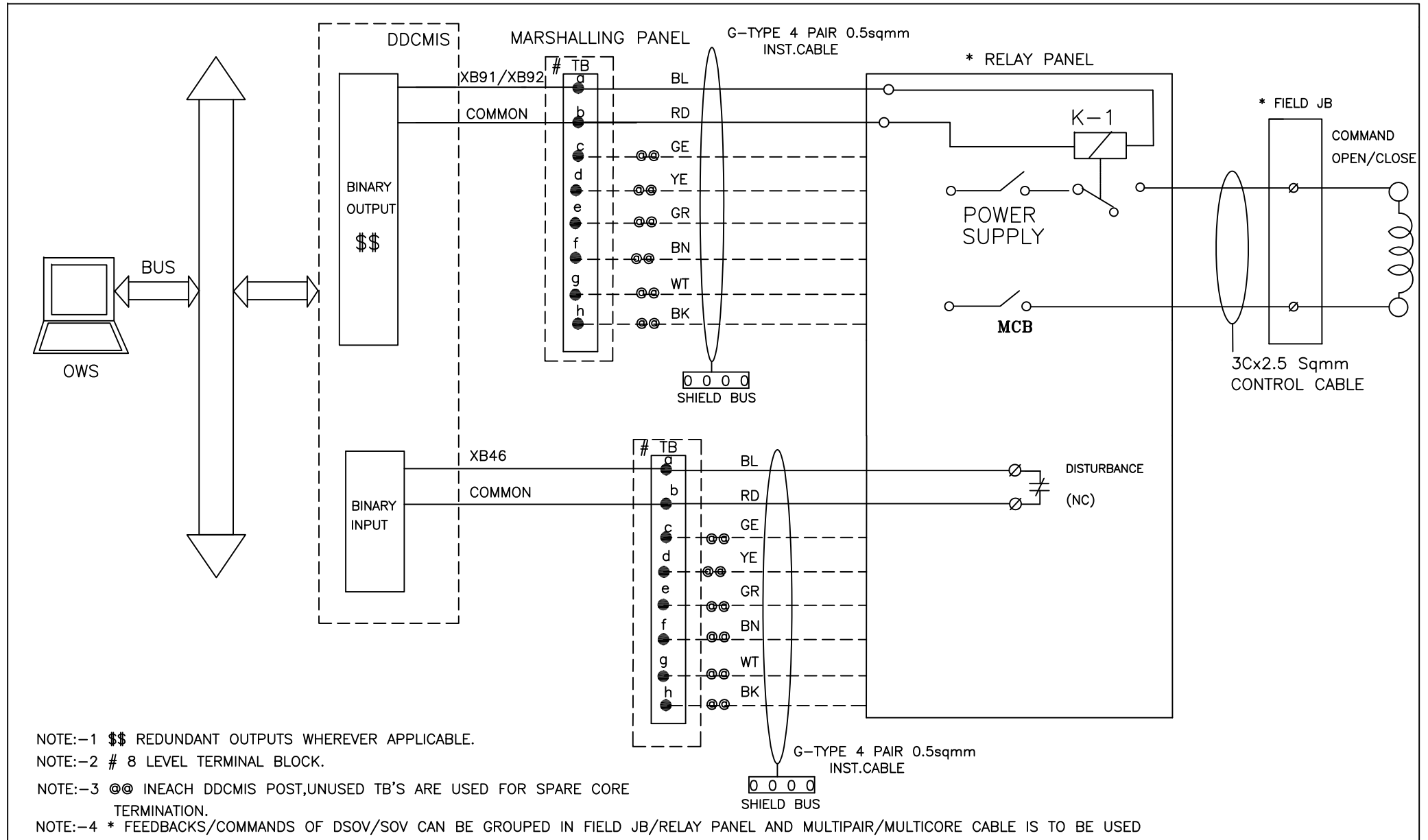
UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

DDCMIS INTERFACE WITH DUAL COIL SOLENOID (DSOV/L)

DRG.NO. 9962-001-PE-405-PVI-B-152

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



NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE.

NOTE:-2 # 8 LEVEL TERMINAL BLOCK.

NOTE:-3 @@ IN EACH 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.



UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

DDCMIS INTERFACE WITH
SOV/O/SOV/C(WITHOUT FEEDBACKS)

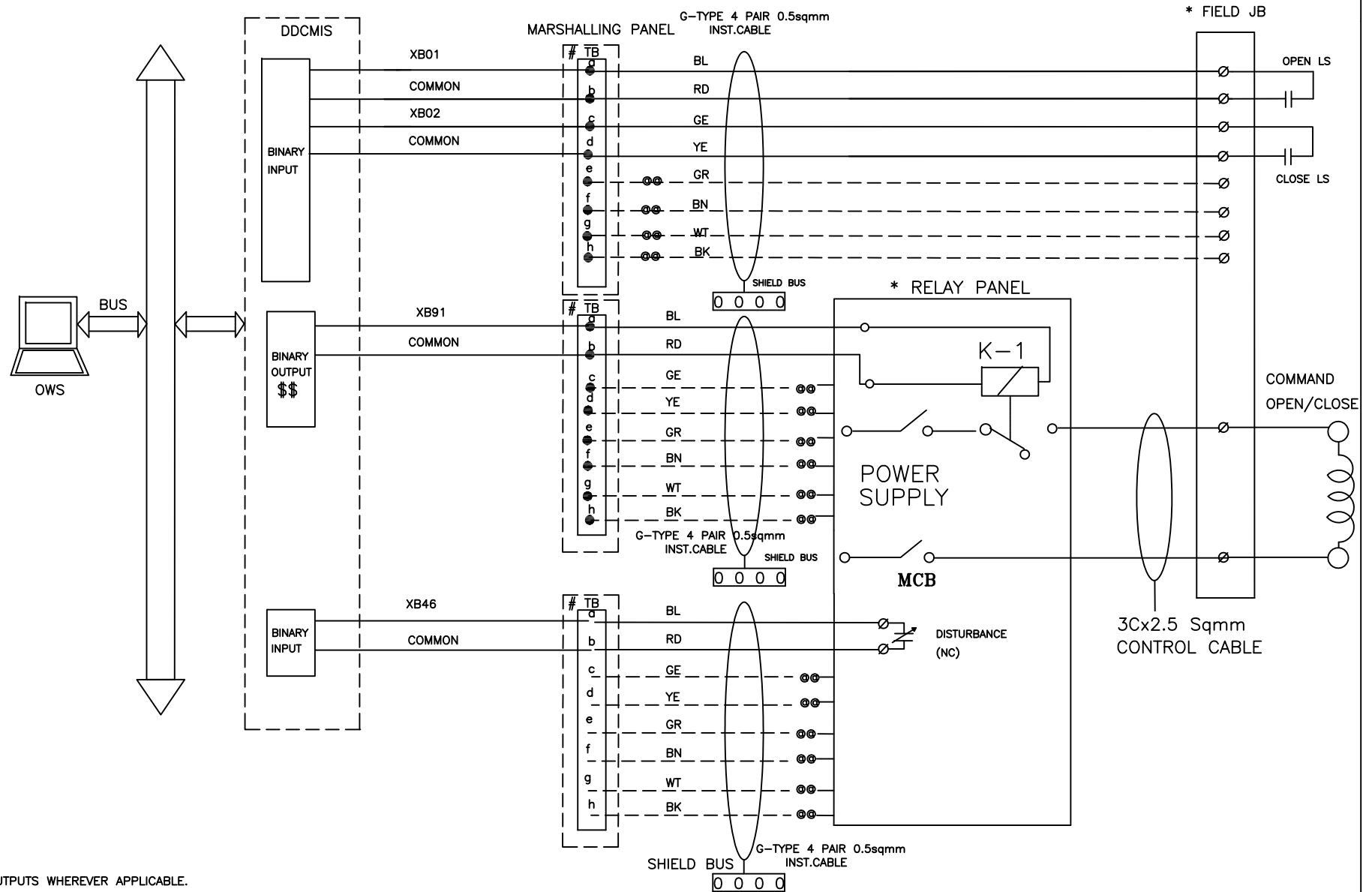
DRG.NO.

9962-001-PE-405-PVI-B-152

SHT

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



NOTE:-1 \$\$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE.

NOTE:-2 # 8 LEVEL TERMINAL BLOCK.

NOTE:-3 @ @ IN EACH 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 MARSHALLING PANEL.

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



UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

DDCMIS INTERFACE WITH SOV/O/L(WITH FEEDBACKS)

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DDCMIS

MARSHALLING PANEL

G-TYPE 4PAIR 0.5sqmm INST.CABLE

VFD-AC PANEL

BINARY OUTPUT

BINARY INPUT

ANALOG OUTPUT

ANALOG INPUT

OWS

BUS

XB91+ START

XB91- COMMAND

XB92+ STOP

XB92- COMMAND

XB93+ BYPASS ON

XB93- COMMAND

XB11+

XB11-

XB12+

XB12-

XB13+

XB13-

SPEED REFERENCE (4-20mA)

SPEED FEED BACK (4-20mA)

ON

FEEDBACK

FAULT

FEEDBACK

BYPASS ON

FEEDBACK

WT

BK

SHIELD BUS

0 0 0 0

0 0 0 0

0 0 0 0

4pX0.5Sqmm 'F-TYPE'

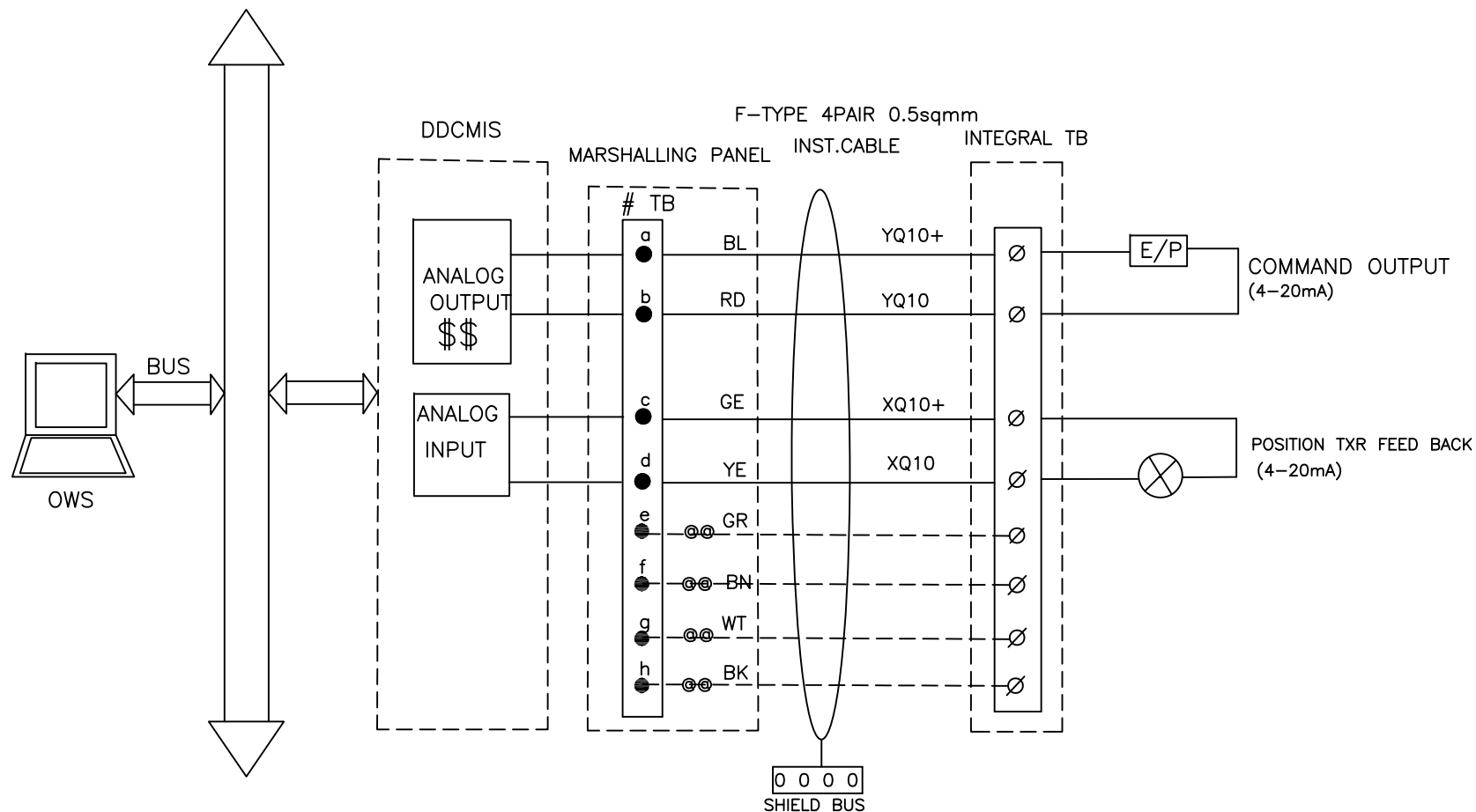
NOTE: 1. ** REDUNDANT OUTPUTS WHERE/EVER APPLICABLE

NOTE:-4 OTHER VFD SIGNALS WILL BE CONSIDERED AS PER IO LIST.



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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.



UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

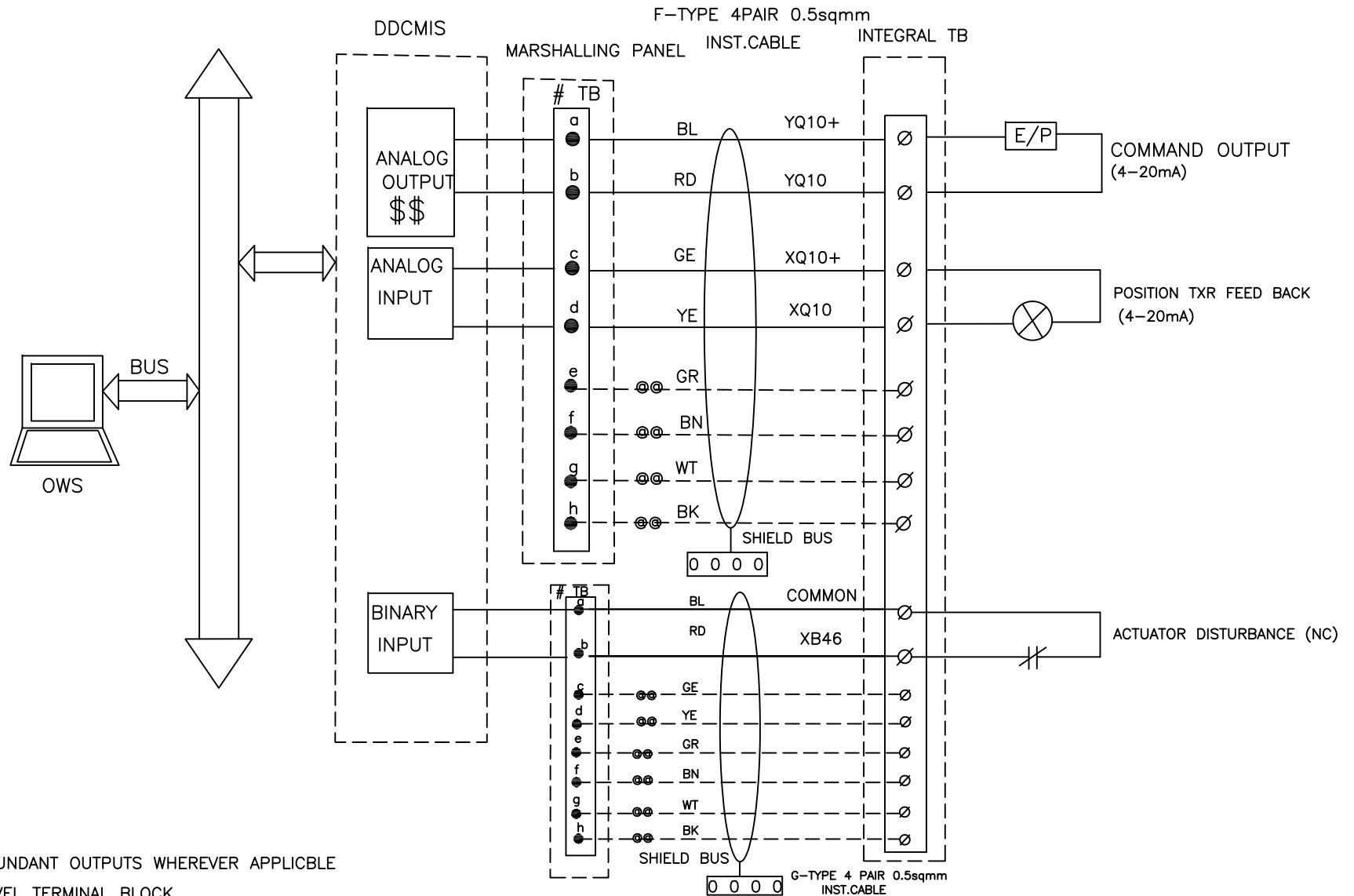
DRG.NO. 9962-001-PE-405-PVI-B-152

INTERFACE FOR MODULATING DRIVES – CLCS

SHT

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INTERFACE FOR MODULATING DRIVES – CLCS–M



NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

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.



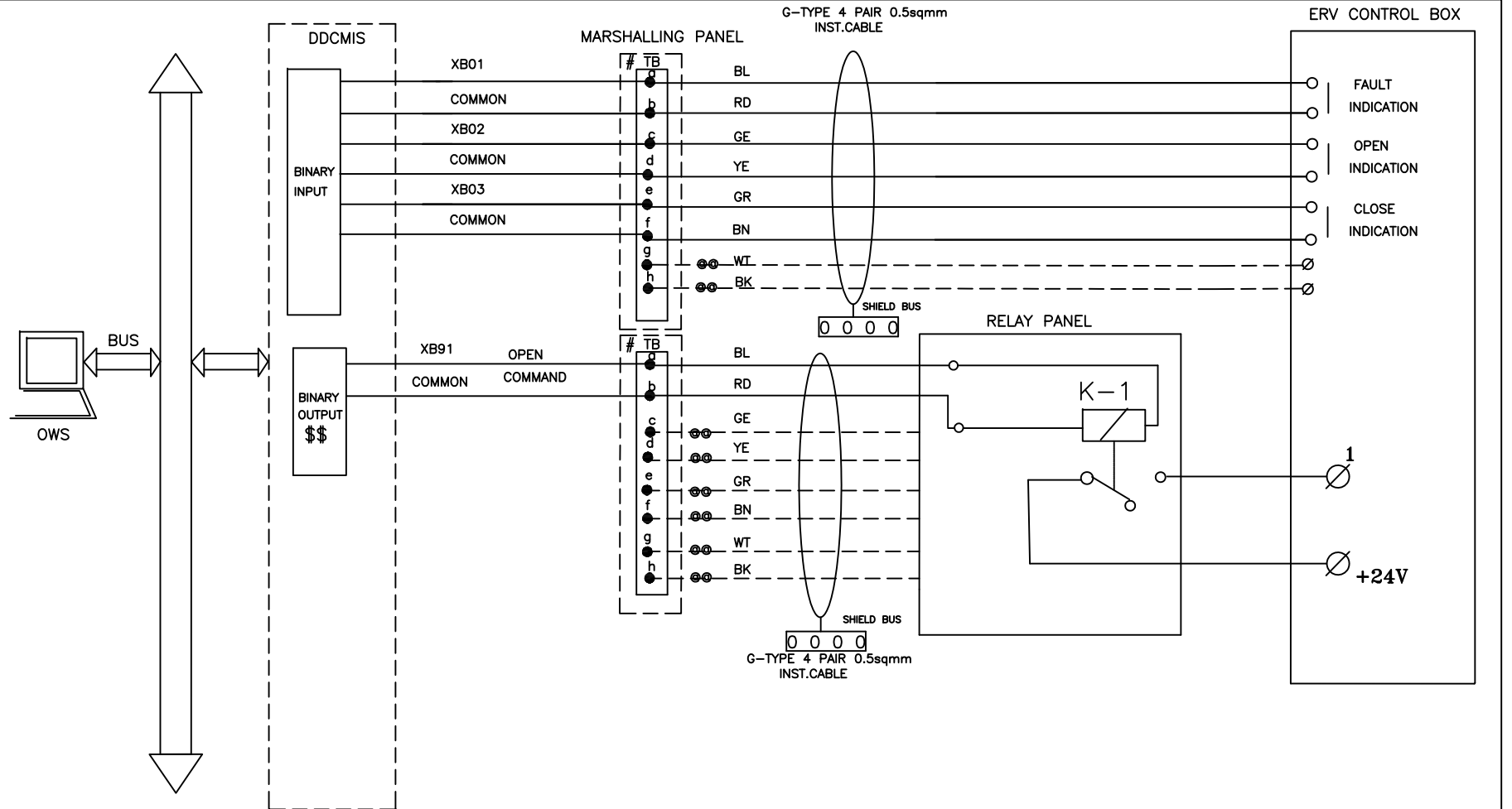
UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

INTERFACE FOR MODULATING DRIVES – CLCS–M

DRG.NO. 9962-001-PE-405-PVI-B-152

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DDCMIS INTERFACE WITH ERV CONTROL BOX (ERV)



NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE.

NOTE:-2 # 8 LEVEL TERMINAL BLOCK.

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



UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

DDCMIS INTERFACE WITH ERV CONTROL BOX

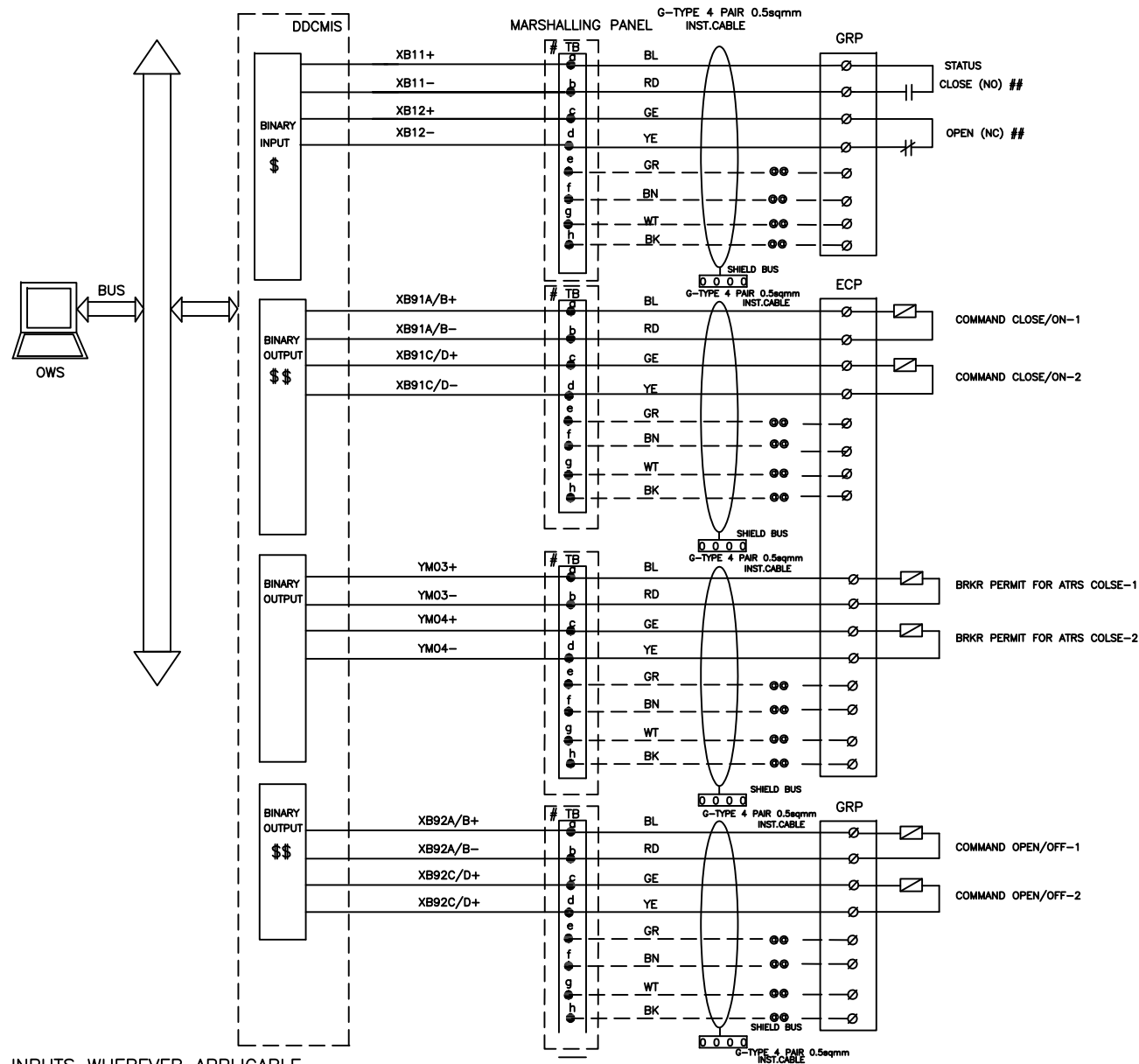
DRG.NO.

9962-001-PE-405-PVI-B-152

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DDCMIS INTERFACE WITH EHVCB



NOTE:-1 \$ REDUNDANT INPUTS WHEREVER APPLICABLE

NOTE:-2 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

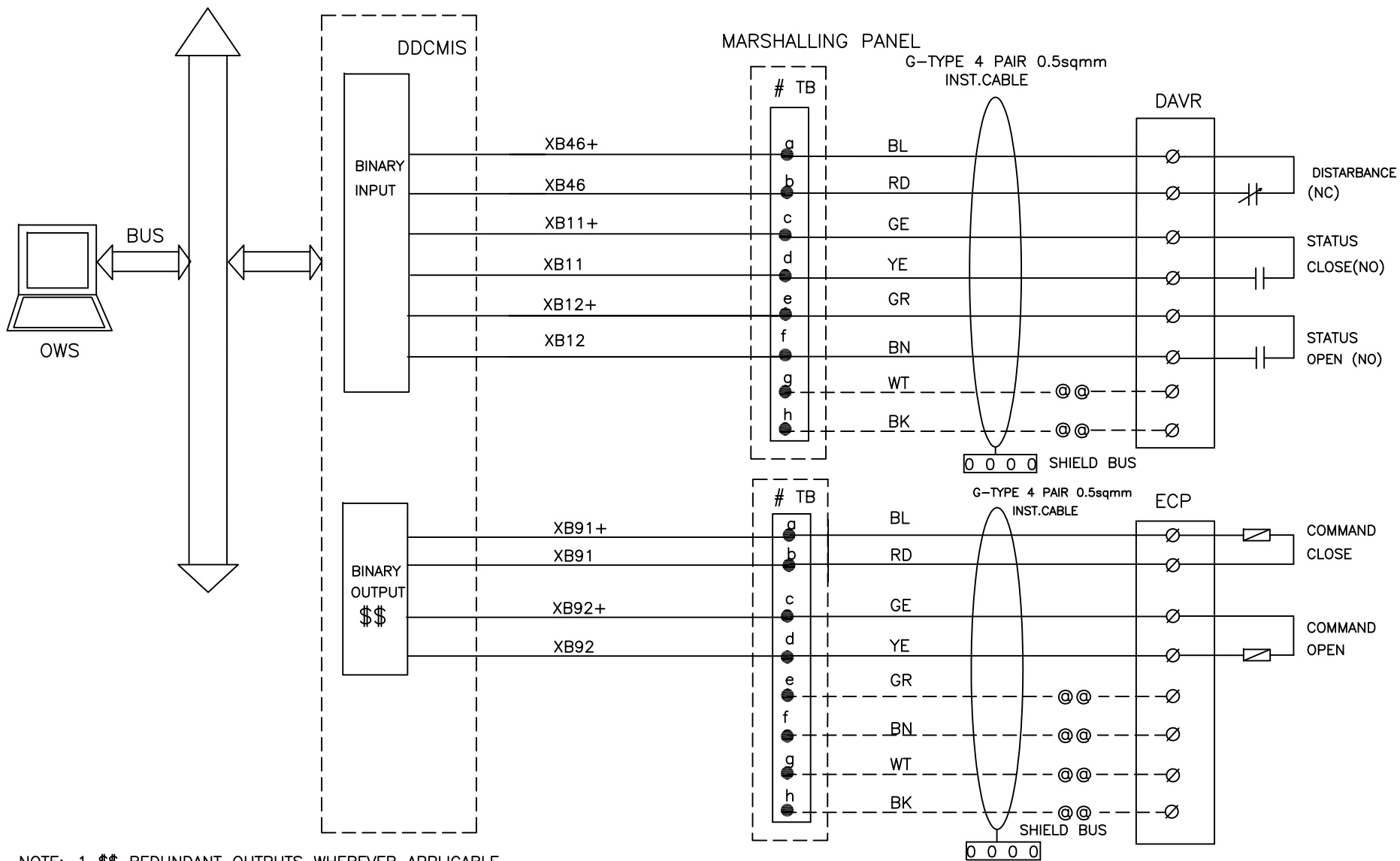
NOTE:-3 # 8 LEVEL TERMINAL BLOCK

NOTE:-4 ## DI-SOE SIGNALS

NOTE:-5 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION

	UP RAJYA VIDYUT UTPADAN NIGAM LTD		DRG.NO.	9962-001-PE-405-PVI-B-152
	1 X 660 MW PANKI TPS		DATE	11.02.2019
	DDCMIS INTERFACE WITH EHVCB		REV.NO.	01
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DDCMIS INTERFACE WITH FIELD BREAKER (FB)



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.



UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

DDCMIS INTERFACE WITH FIELD BREAKER (FB)

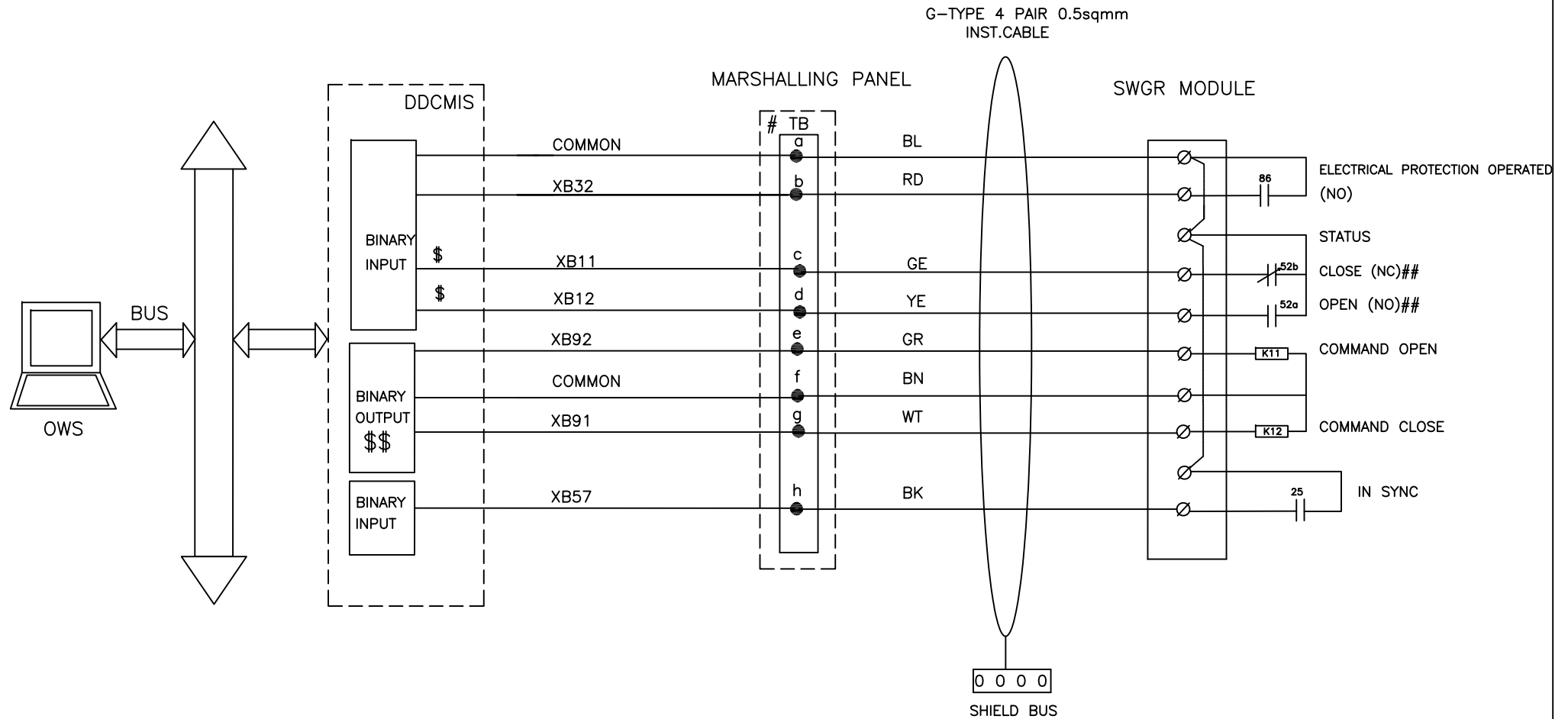
DRG.NO. 9962-001-PE-405-PVI-B-152

DATE	11.02.2019
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REV.NO.	01
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DDCMIS INTERFACE WITH ELECTRICAL BREAKER (EB-HT-SYNC)



NOTE:-1 \$ REDUNDANT INPUTS FOR UNIT DDCMIS ONLY.
 NOTE:-2 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
 NOTE:-3 # 8 LEVEL TERMINAL BLOCK
 NOTE:-4 ## DI-SOE SIGNALS

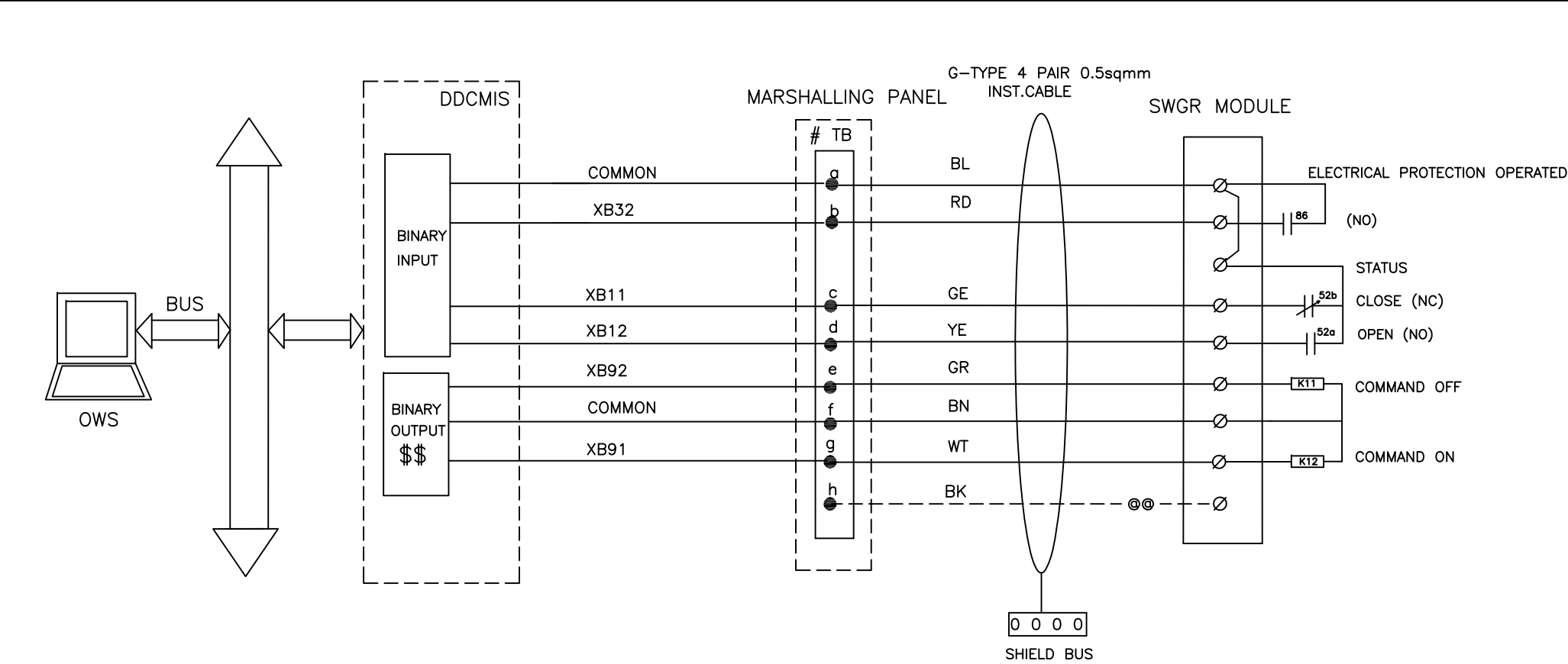


UP RAJYA VIDYUT UTPADAN NIGAM LTD
 1 X 660 MW PANKI TPS

DDCMIS INTERFACE WITH ELECTRICAL BREAKER (EB-HT-SYNC)

DRG.NO.	9962-001-PE-405-PVI-B-152
DATE	11.02.2019
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SHT	19 OF 34

DDCMIS INTERFACE WITH ELECTRICAL BREAKER(EB-HT-NONSYNC)



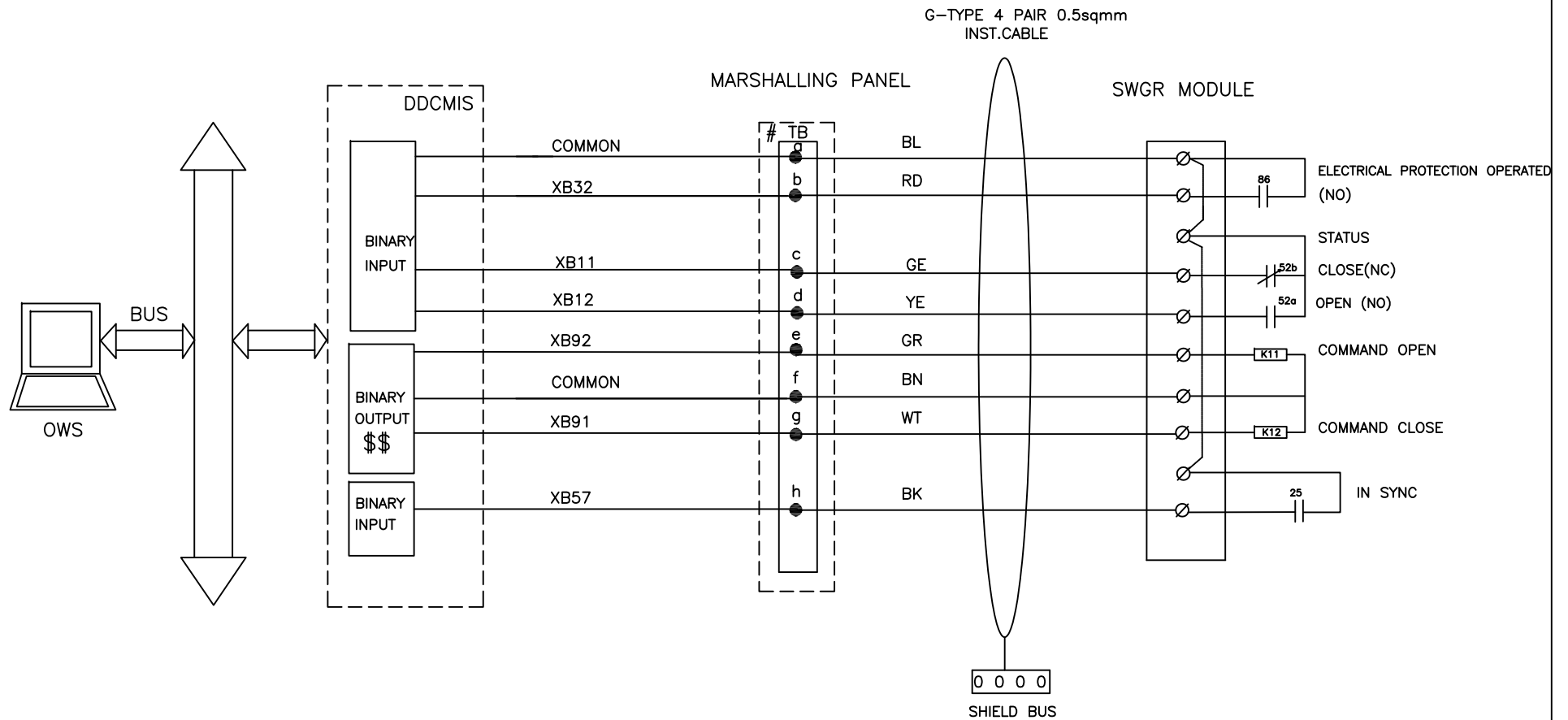
NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

NOTE:-2 # 8 LEVEL TERMINAL BLOCK

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

	UP RAJYA VIDYUT UTPADAN NIGAM LTD		DRG.NO.	9962-001-PE-405-PVI-B-152
	1 X 660 MW PANKI TPS		DATE	11.02.2019
	DDCMIS INTERFACE WITH ELECTRICAL BREAKER(EB-HT-NONSYNC)		REV.NO.	01
			SHT	20 OF 34

DDCMIS INTERFACE WITH ELECTRICAL BREAKER (EB-LT-SYNC)



NOTE:-1 \$\$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
NOTE:-2 # 8 LEVEL TERMINAL BLOCK

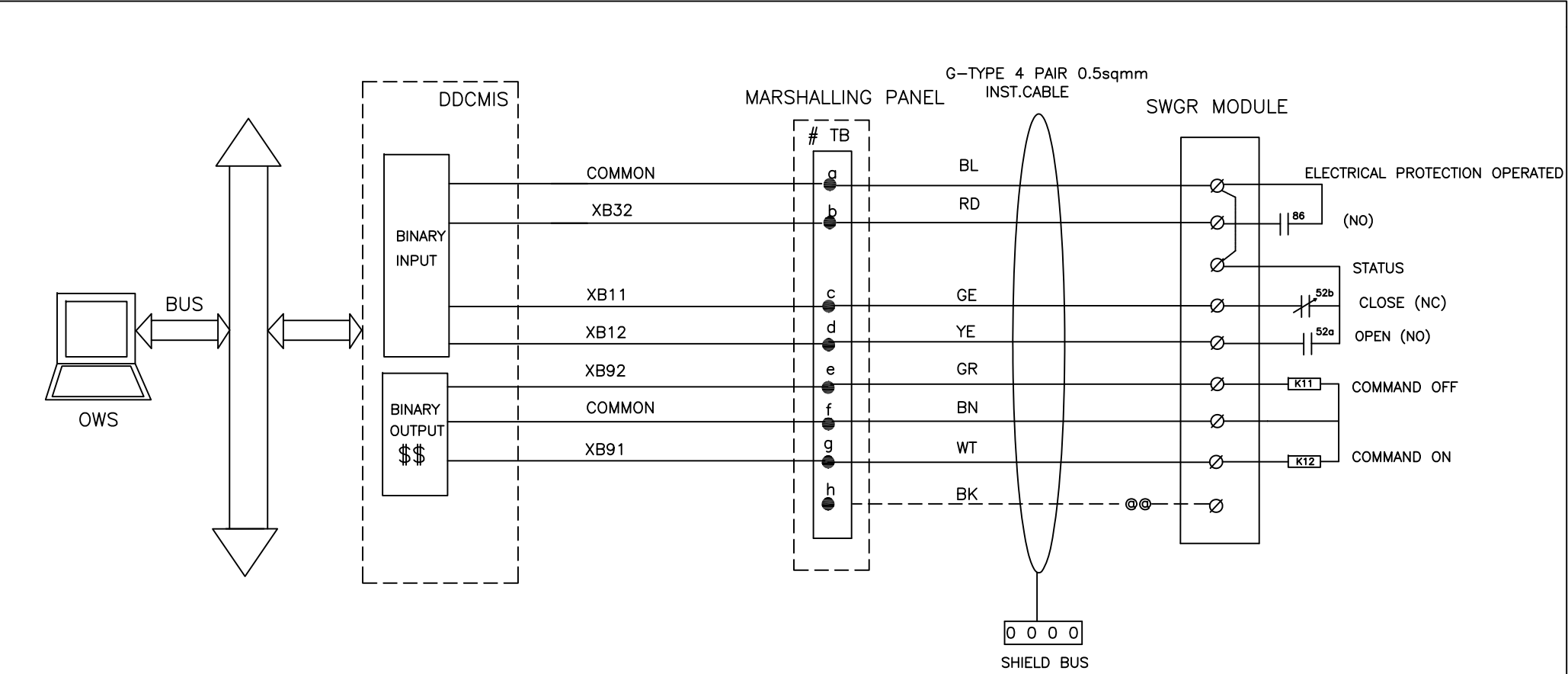


UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

DDCMIS INTERFACE WITH ELECTRICAL BREAKER (EB-LT-SYNC)

DRG.NO.	9962-001-PE-405-PVI-B-152
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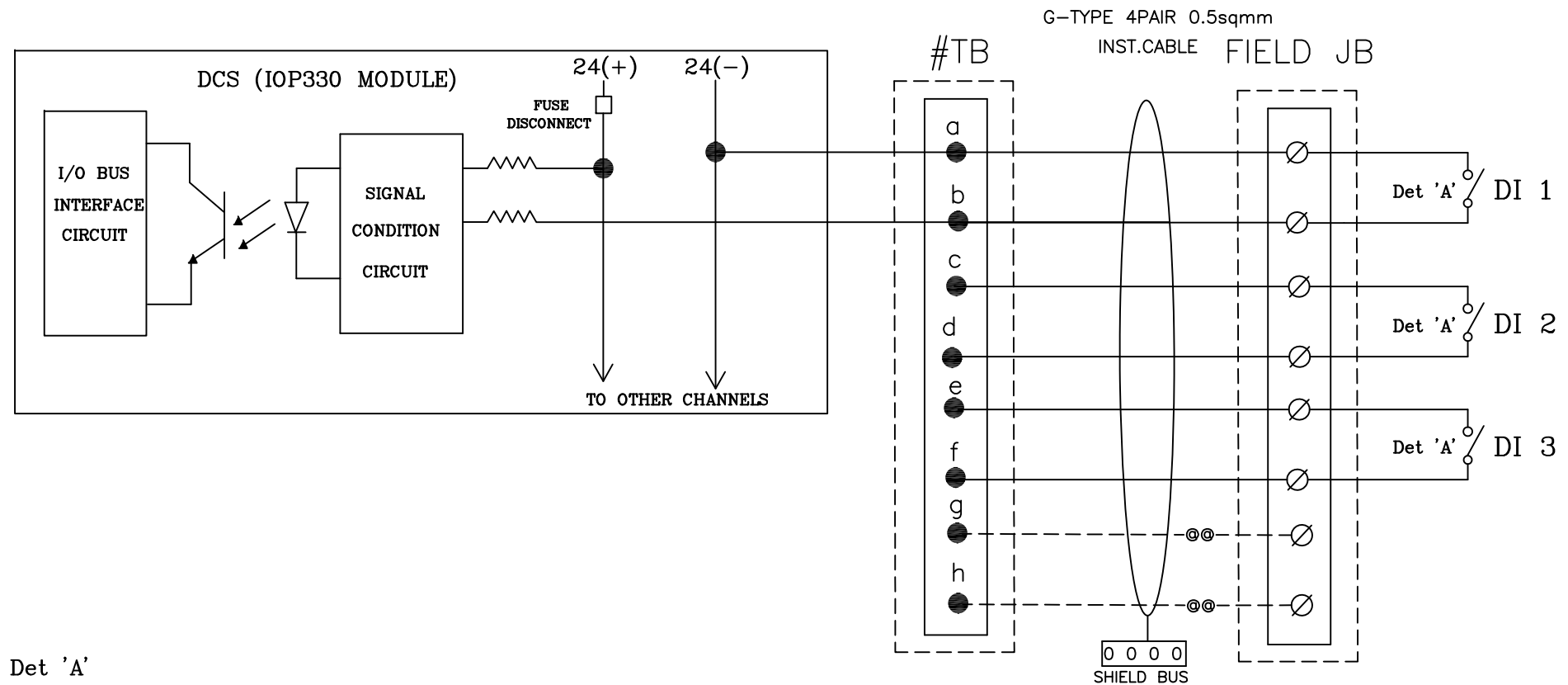
DDCMIS INTERFACE WITH ELECTRICAL BREAKER(EB-LT-NONSYNC)



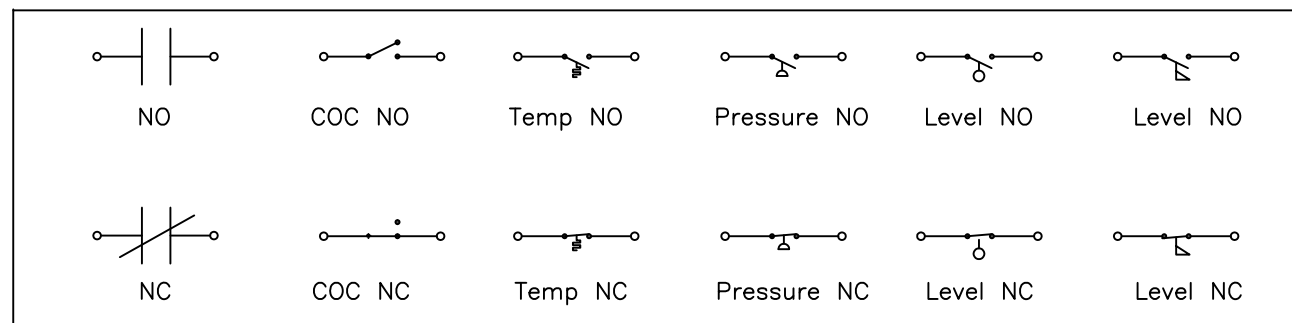
NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
NOTE:-2 # 8 LEVEL TERMINAL BLOCK
NOTE:-3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE
TERMINATION.

	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS DDCMIS INTERFACE WITH ELECTRICAL BREAKER(EB-LT-NONSYNC)	DRG.NO.	9962-001-PE-405-PVI-B-152
		DATE	11.02.2019
		REV.NO.	01
		SHT	22 OF 34

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.

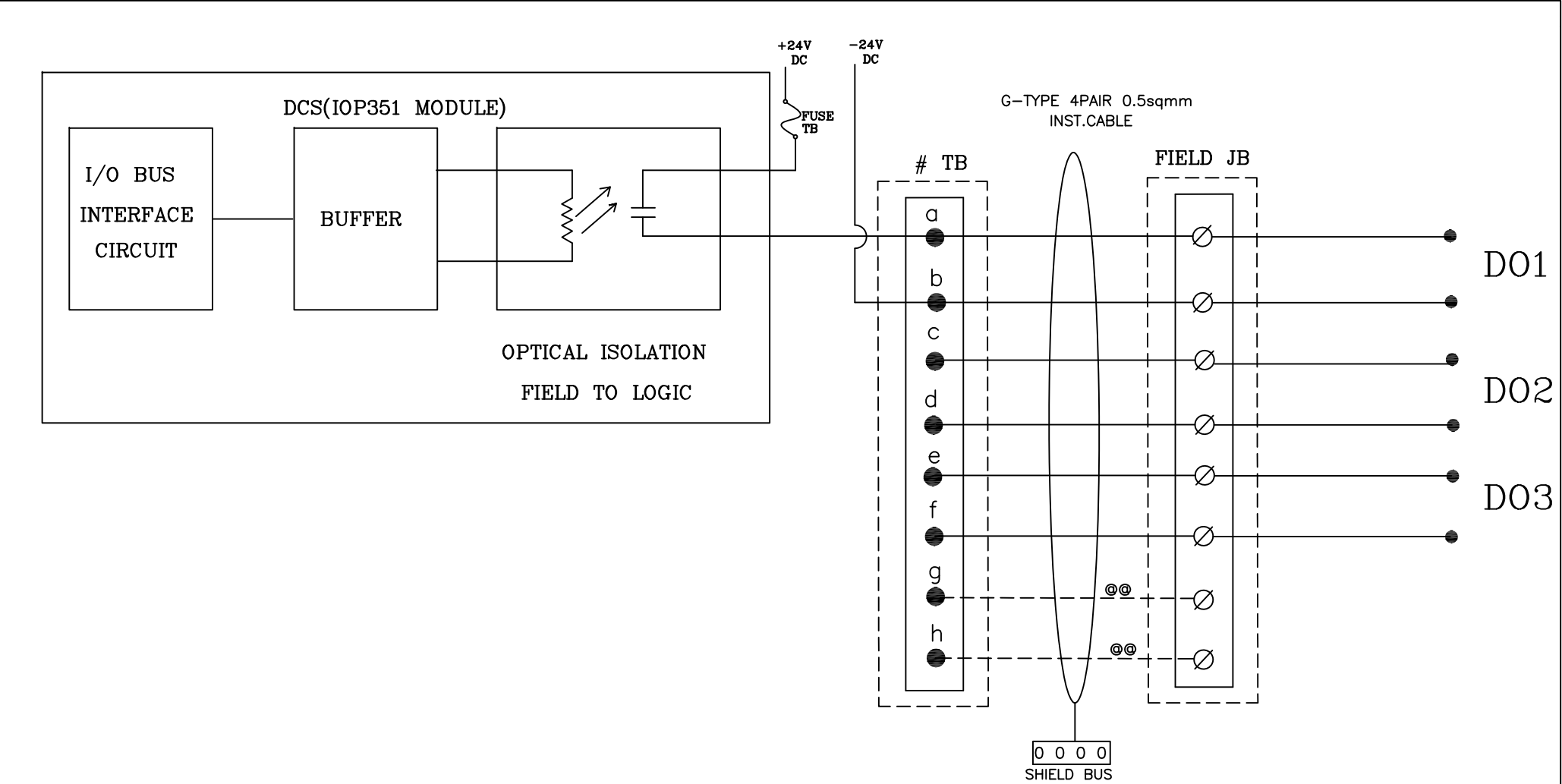


UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

DDCMIS INTERFACE WITH DIGITAL INPUT SIGNAL

DRG.NO.	9962-001-PE-405-PVI-B-152
DATE	11.02.2019
REV.NO.	01
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DDCMIS INTERFACE WITH DIGITAL OUTPUT SIGNAL

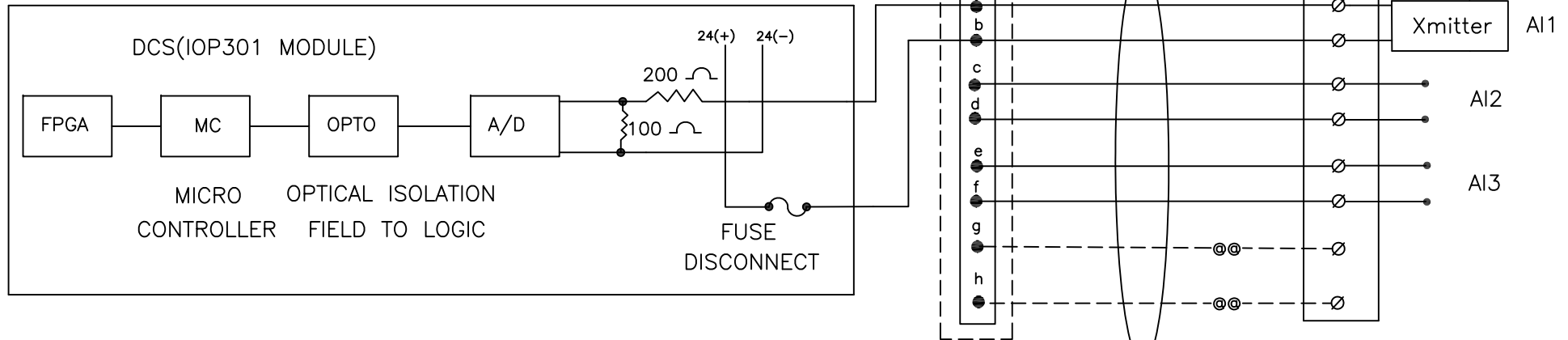


NOTE:-1 #8 LEVEL TERMINAL BLOCK.
NOTE:-2 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.

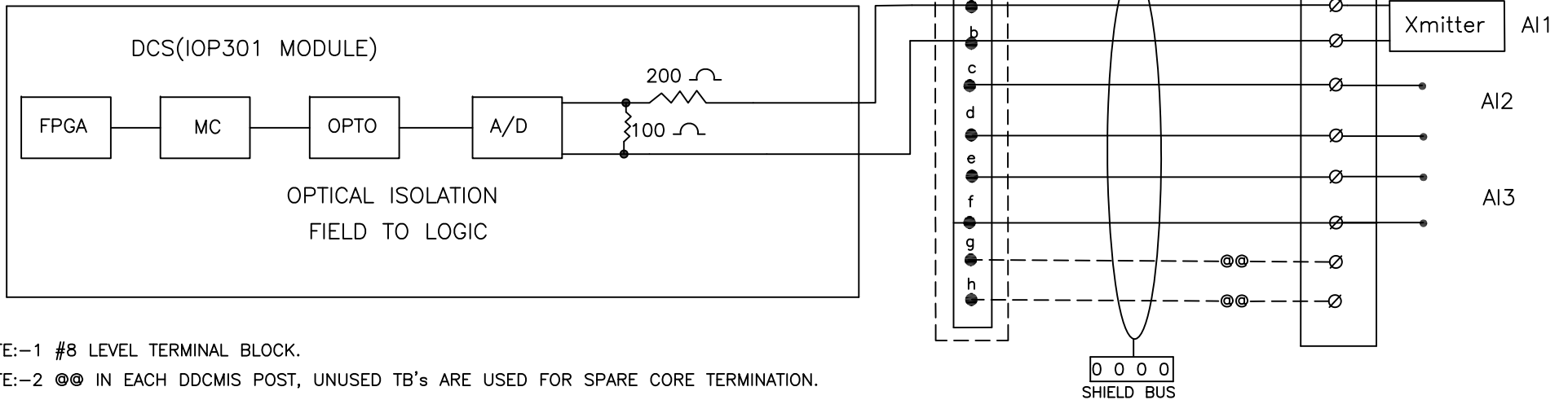
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	DDCMIS INTERFACE WITH DIGITAL OUTPUT SIGNAL		DATE	11.02.2019
			REV.NO.	01
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DDCMIS INTERFACE WITH ANALOG INPUT SIGNAL

AI INTERFACE(4-20mA POWERED BY SYSTEM)



AI INTERFACE(4-20mA POWERED EXTERNALLY)



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.



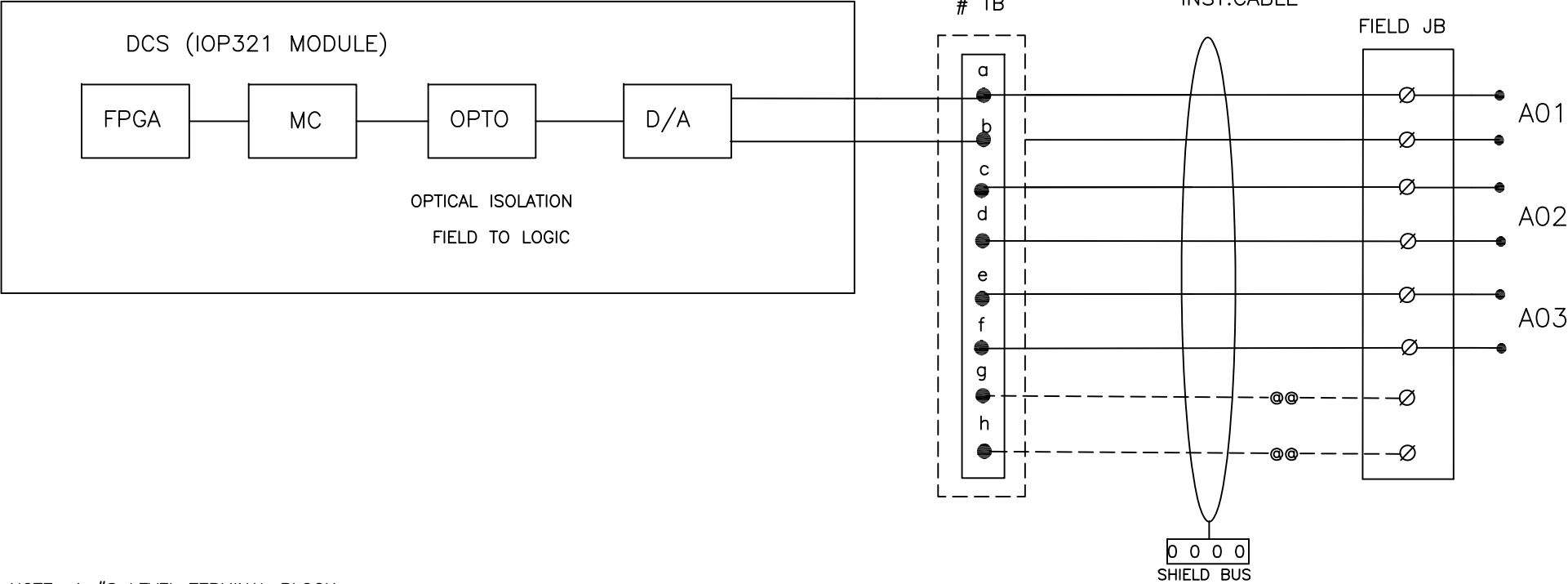
UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

DDCMIS INTERFACE WITH ANALOG INPUT SIGNAL

DRG.NO.	9962-001-PE-405-PVI-B-152
DATE	11.02.2019
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DDCMIS INTERFACE WITH ANALOG OUTPUT SIGNAL

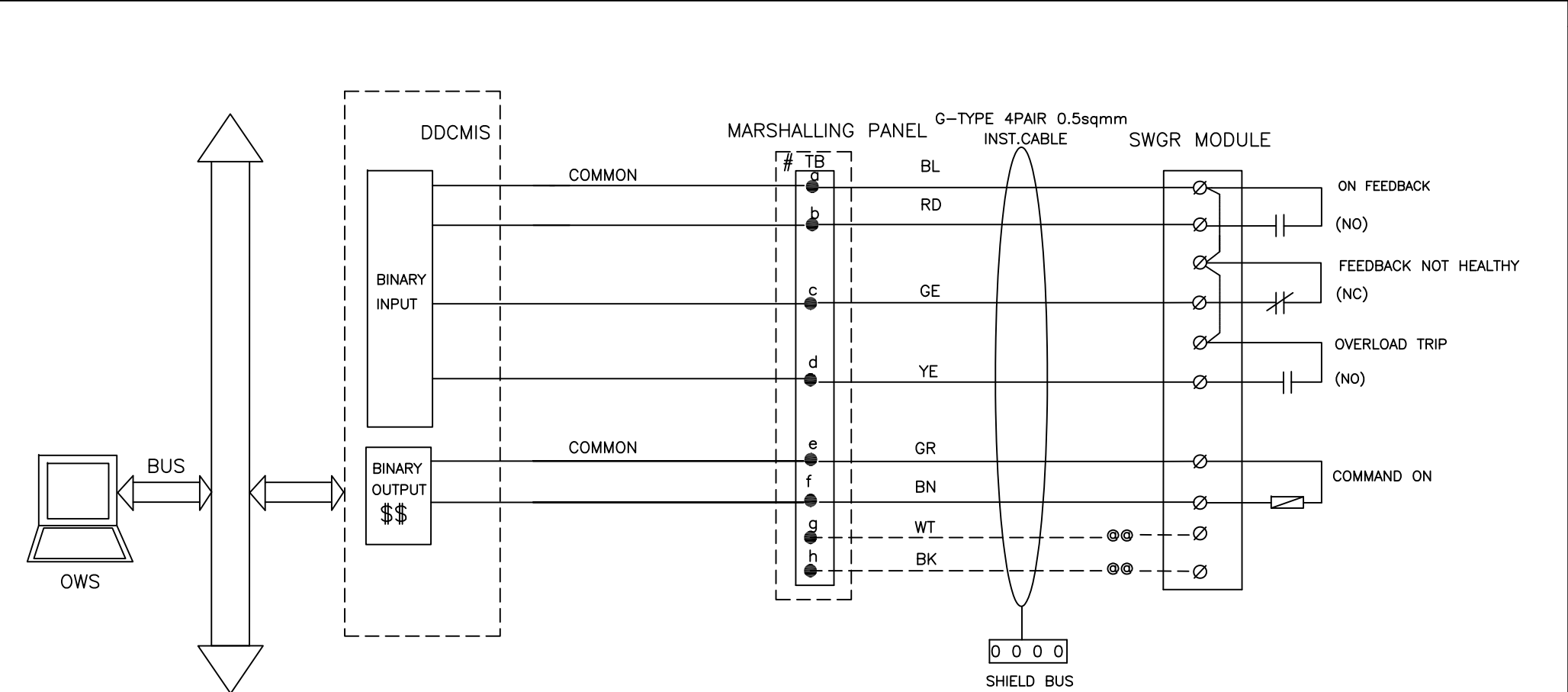
AO INTERFACE



- 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.

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

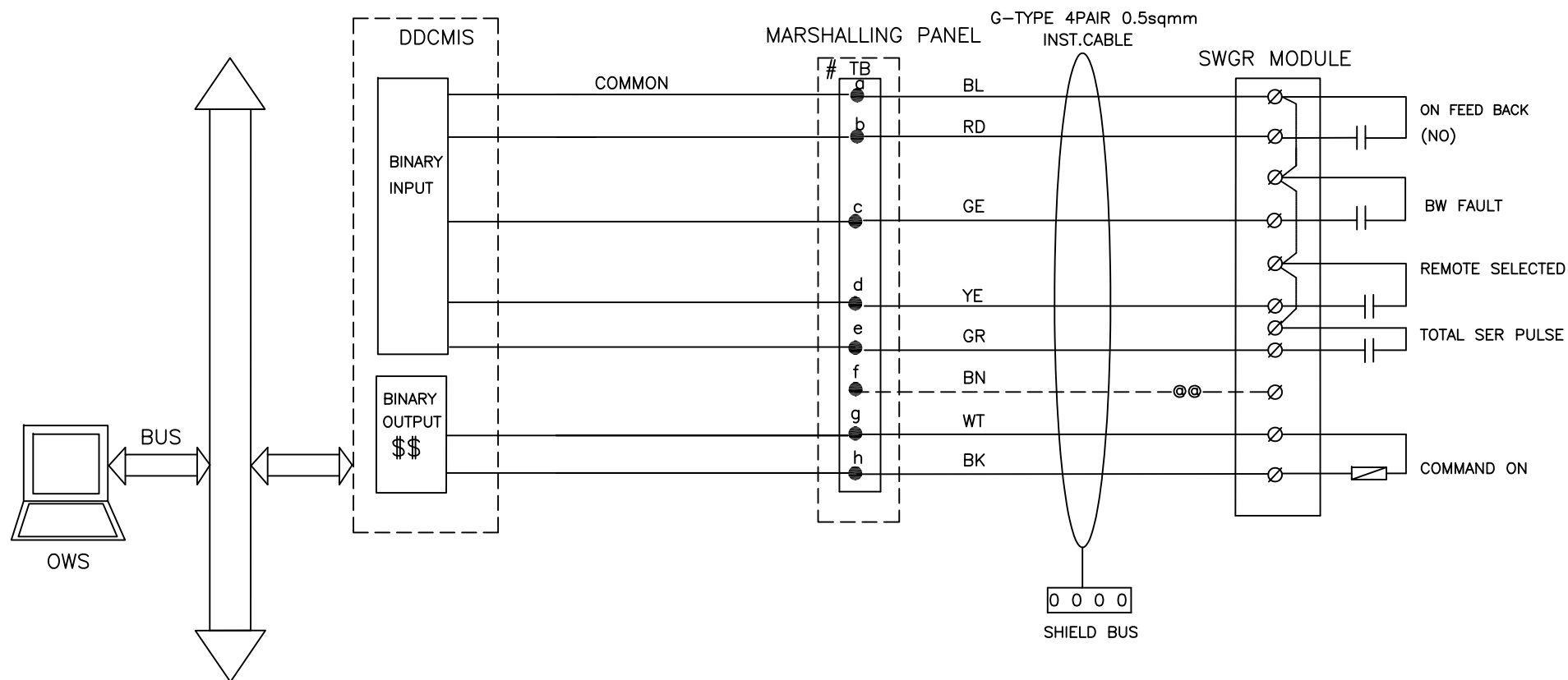
DDCMIS INTERFACE WITH LTCHP (DOL)



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.

	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS		DRG.NO.	9962-001-PE-405-PVI-B-152	
	DDCMIS INTERFACE WITH LTCHP (DOL)		DATE	11.02.2019	
			REV.NO.	01	
			SHT	27	OF 34

DDCMIS INTERFACE WITH BELT WEIGHER (BW)



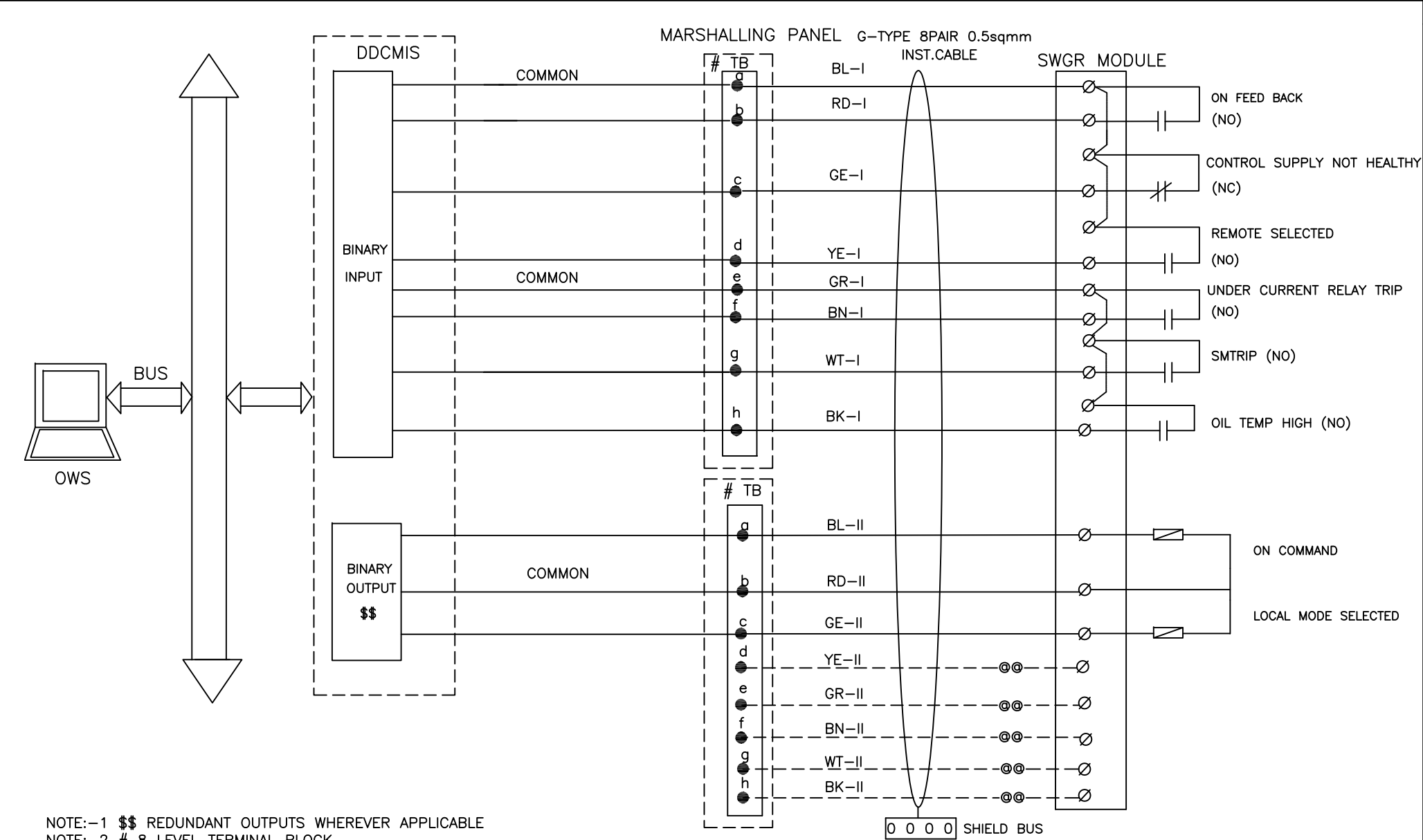
NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE
NOTE:-2 # 8 LEVEL TERMINAL BLOCK
NOTE:-3 @@ INEACH DDCMIS POST,UNUSED TB'S ARE USED FOR SPARE CORE
TERMINATION.



UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS
DDCMIS INTERFACE WITH BELT WEIGHER (BW)

DRG.NO.	9962-001-PE-405-PVI-B-152
DATE	11.02.2019
REV.NO.	01
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DDCMIS INTERFACE WITH SUSPENDED MAGNET (SM)



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.

	UP RAJYA VIDYUT UTPADAN NIGAM LTD		DRG.NO.	9962-001-PE-405-PVI-B-152
	1 X 660 MW PANKI TPS		DATE	11.02.2019
	DDCMIS INTERFACE WITH SUSPENDE MAGNET (SM)		REV.NO.	01
			SHT	29 OF 34

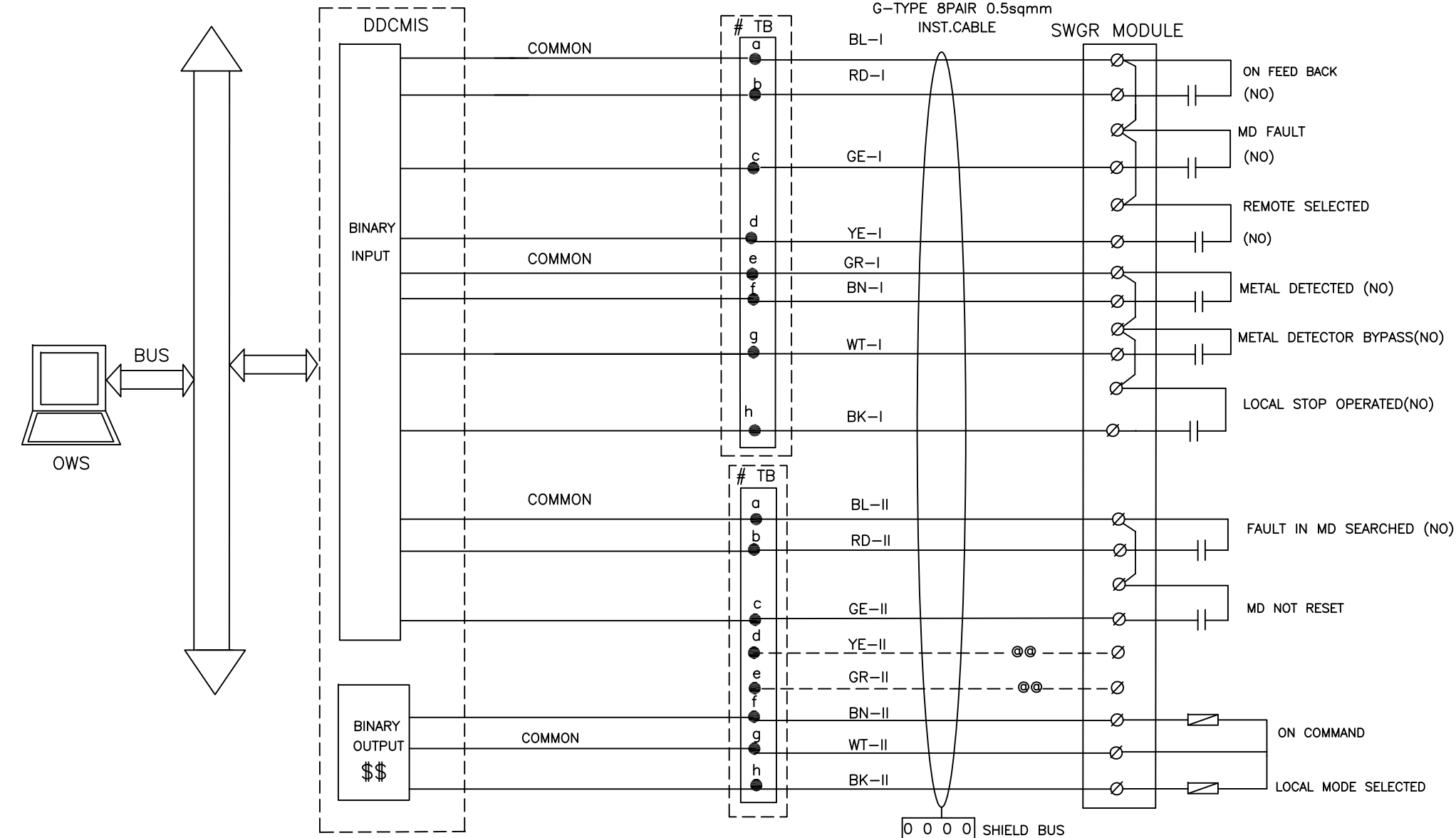
DDCMIS INTERFACE WITH METAL DETECTOR (MD)

MARSHALLING PANEL

G-TYPE 8PAIR 0.5sqmm

INST.CABLE

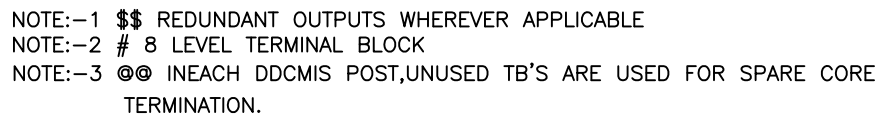
SWGR MODULE



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.

	UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS	DRG.NO.	9962-001-PE-405-PVI-B-152
	DDCMIS INTERFACE WITH METAL DETECTOR (MD)	DATE	11.02.2019
		REV.NO.	01
		SHT	30 OF 34

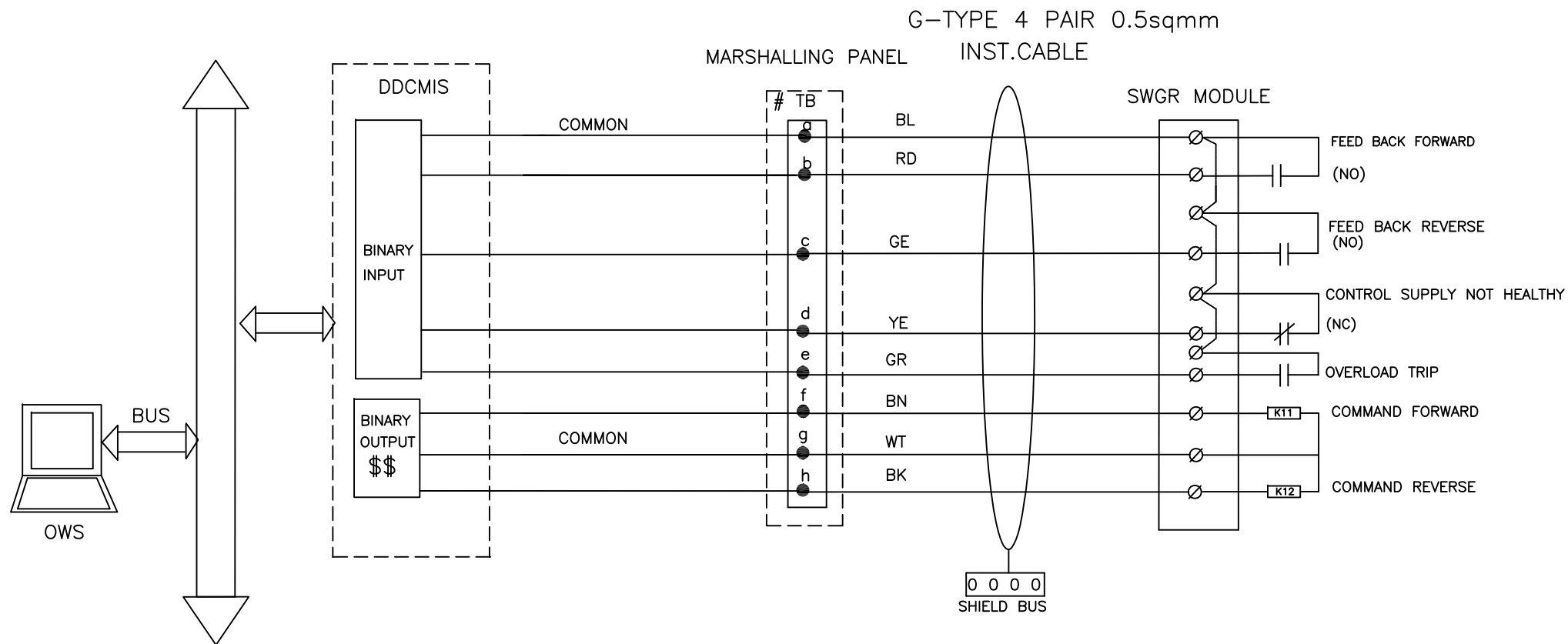
MARSHALLING PANEL G-TYPE 8PAIR 0.5sqmm
INST.CABLE



DDCMIS INTERFACE WITH INLINE MAGNETIC SEPERATOR(ILMS)

DRG.NO.	9962-001-PE-405-PVI-B-152
DATE	11.02.2019
REV.NO.	01
SHT	31 OF 34

DDCMIS INTERFACE WITH REV (DOL)



NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

NOTE:-2 # 8 LEVEL TERMINAL BLOCK



UP RAJYA VIDYUT UTPADAN NIGAM LTD
1 X 660 MW PANKI TPS

DDCMIS INTERFACE WITH REV (DOL)

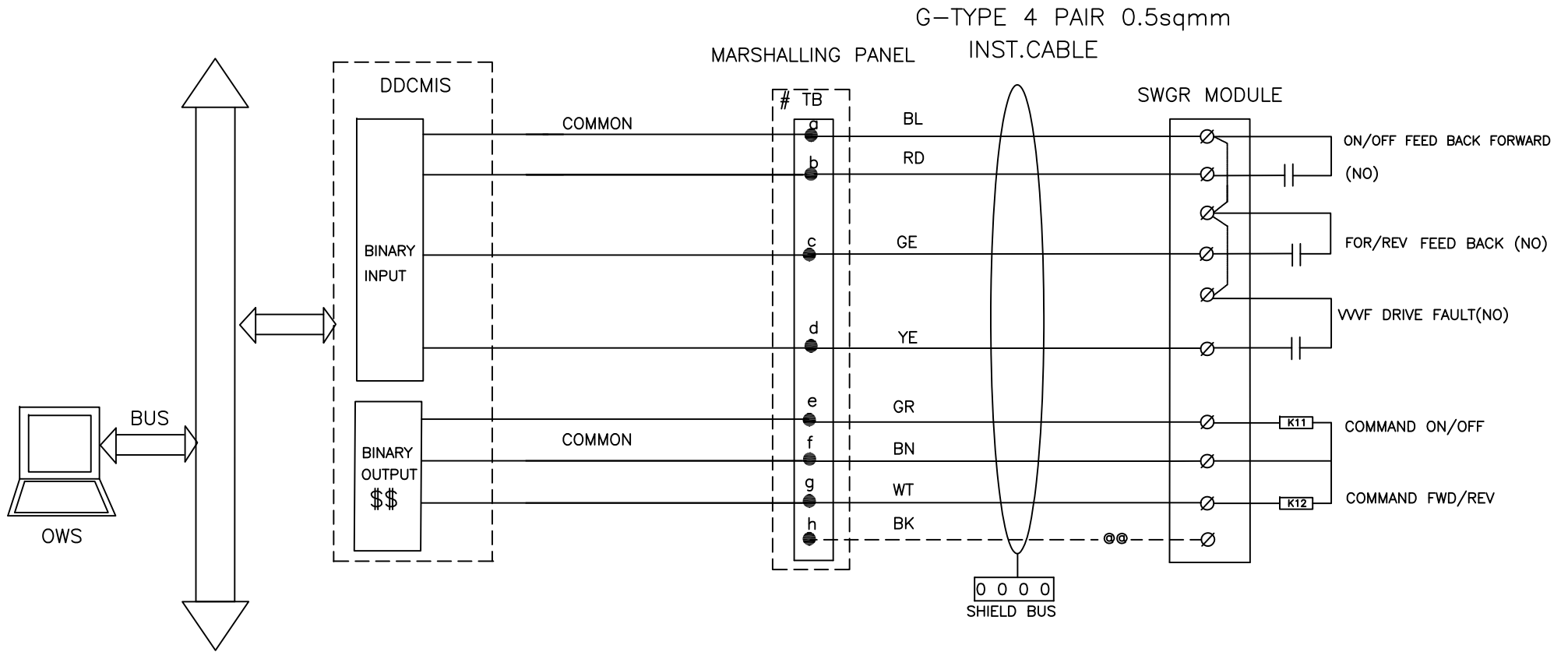
DRG.NO.	9962-001-PE-405-PVI-B-152
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DATE	11.02.2019
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REV.NO.	01
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SHT	32	OF	34
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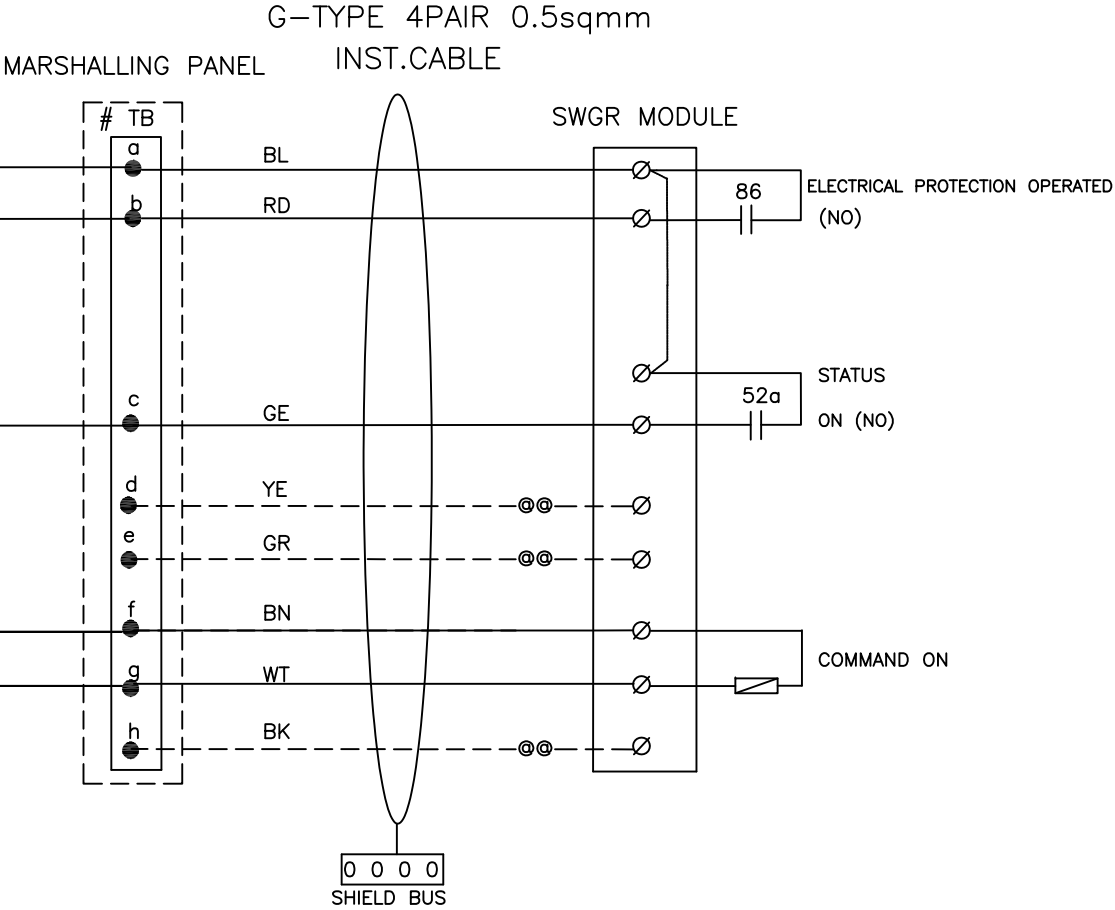
DDCMIS INTERFACE WITH VVVF



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.

	UP RAJYA VIDYUT UTPADAN NIGAM LTD		DRG.NO.	9962-001-PE-405-PVI-B-152
	1 X 660 MW PANKI TPS		DATE	11.02.2019
	DDCMIS INTERFACE WITH VVVF		REV.NO.	01
			SHT	33 OF 34

DDCMIS INTERFACE WITH HTCHP



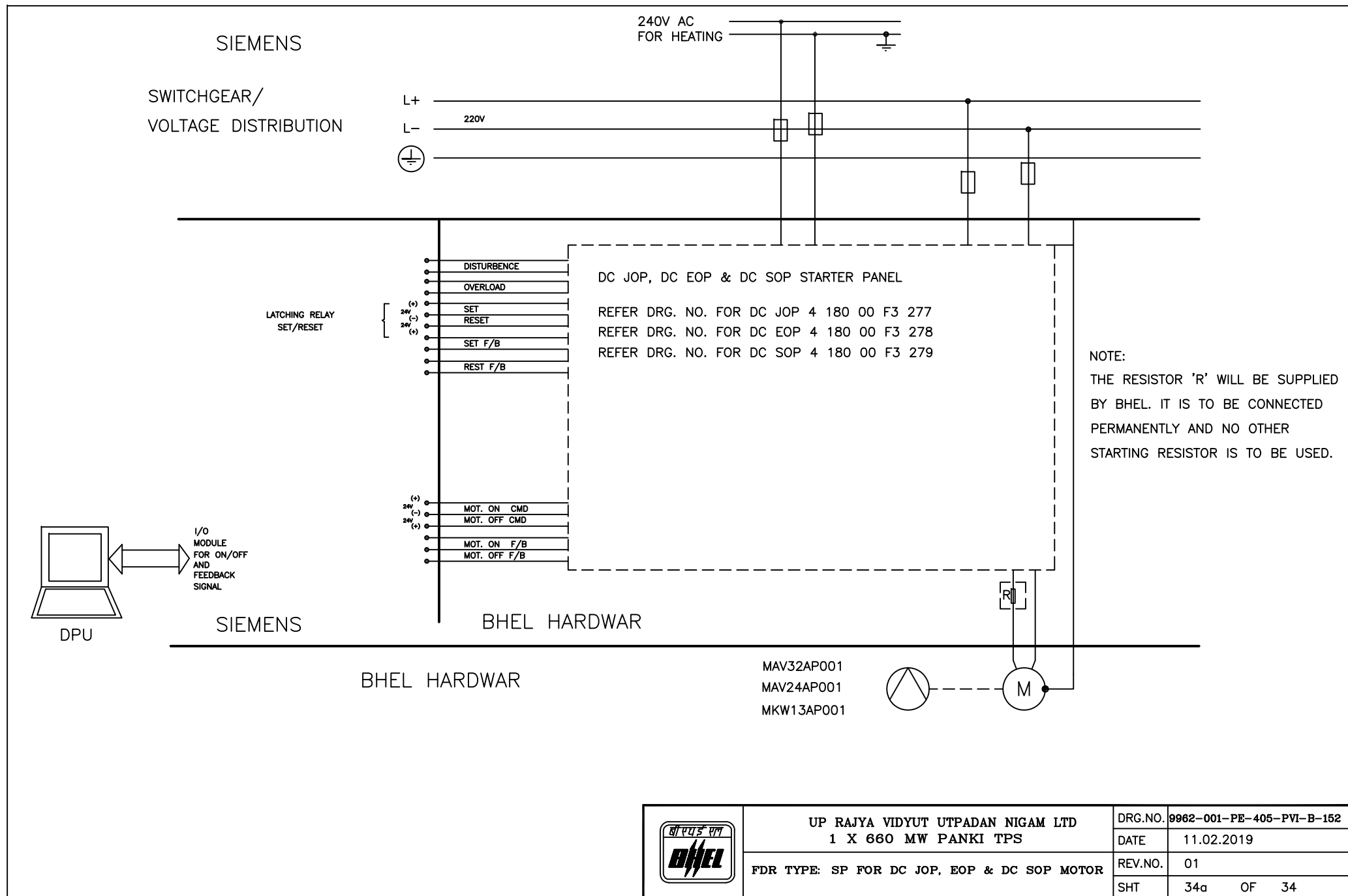
NOTE:-1 \$\$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

NOTE:-2 # 8 LEVEL TERMINAL BLOCK

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

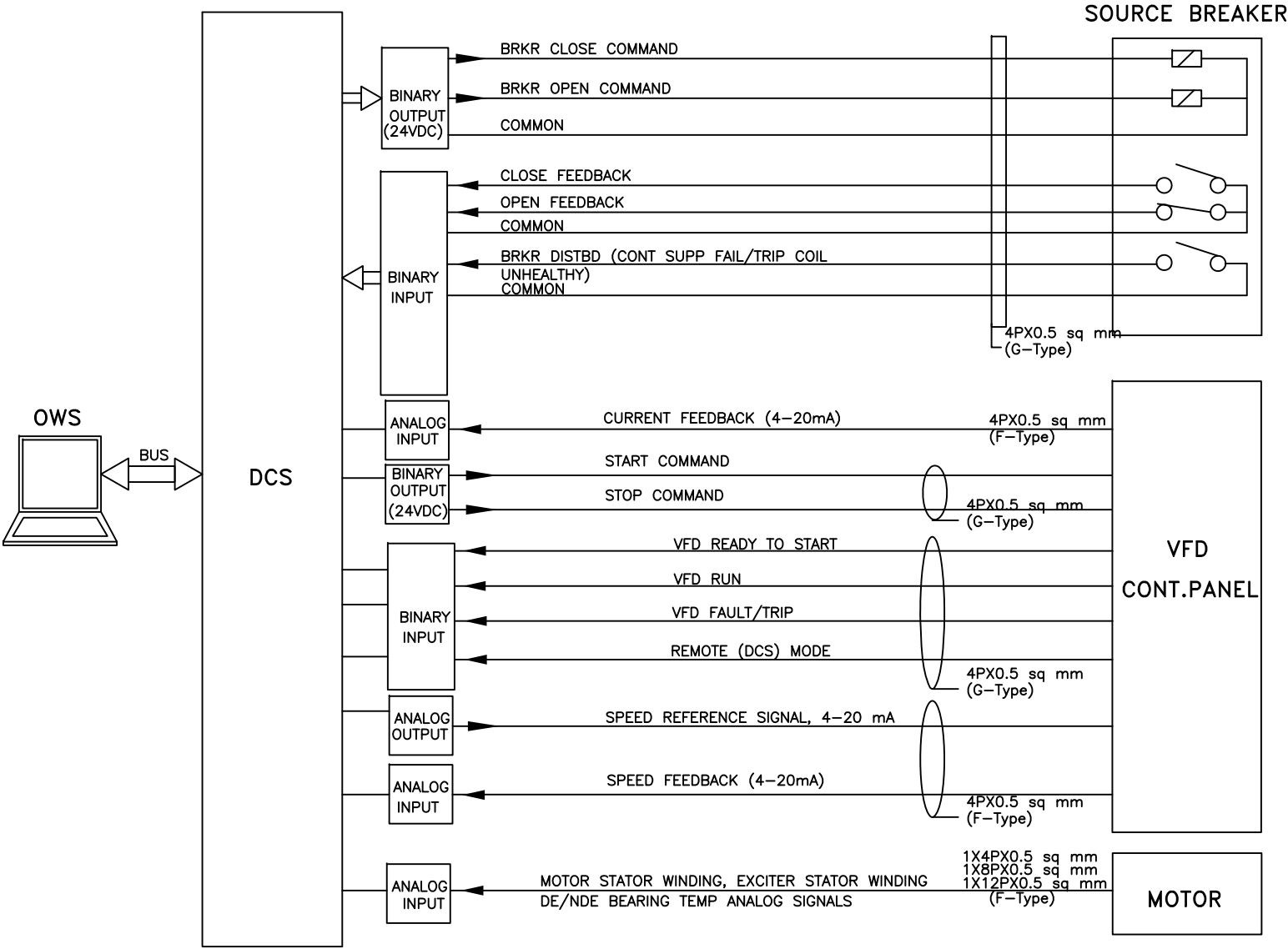
	UP RAJYA VIDYUT UTPADAN NIGAM LTD		DRG.NO.	9962-001-PE-405-PVI-B-152
	1 X 660 MW PANKI TPS		DATE	11.02.2019
	DDCMIS INTERFACE WITH HTCHP		REV.NO.	01
			SHT	34 OF 34

INTERFACE SP FOR DC JOP, EOP & DC SOP MOTOR



UP RAJYA VIDYUT UTPADAN NIGAM LTD 1 X 660 MW PANKI TPS		DRG.NO.	9962-001-PE-405-PVI-B-152
FDR TYPE: SP FOR DC JOP, EOP & DC SOP MOTOR		DATE	11.02.2019
		REV.NO.	01
		SHT	34a OF 34

DCS INTERFACE FOR VFD CONTROL DRIVE



	UP RAJYA VIDYUT UTPADAN NIGAM LTD		DRG.NO.	9962-001-PE-405-PVI-B-152
	1 X 660 MW PANKI TPS		DATE	11.02.2019
	DDCMIS INTERFACE FOR		REV.NO.	01
	CEP VFD		SHT	34b

	ANNEXURE- WRITE UP FOR DRIVE CONTROL PHILOSOPHY (STATION C&I)	DOCUMENT NUMBER	PE-DM-426-145-I002		
		REVISION NUMBER	01	DATE	11.02.19
	PROJECT: 1 X 660 MW PANKI TPS				

A. DRIVE CONTROL PHILOSOPHY

The control philosophy for different type of Drives is detailed below:

1 Bi-directional drives with Integral Starter(Open/Close duty and inching/regulating duty)

- a) All bi-directional drives shall have integral starter. These drives shall be operable from Remote i.e. from Central Control Room (CCR).
- b) Remote manual operation of all drives shall be done from Operator Works Station (OWS).
- c) Remote control commands i.e. open/close generated from DCS shall be issued to Integral Starter through interposing relays, mounted in Integral Starter. For open/close duty bi-directional drives, DCS output command shall be latched in DCS, except for inching duty bi-directional drives where latching is not required.
- d) Necessary electrical protections shall be realized at Integral Starter, whereas process interlocks and protection shall be realized in DCS.
- e) Following signal exchange shall take place between Integral Starter & DCS.
 - open & close command
 - Integral Starter Disturbed (Loss of power supply/Loss of control supply/ Motor thermostat trip/ Thermal O/L / Torque open/close cut off/ Local/off/Remote S/S in Local or Off mode/Stop PB optd).
 - Valve status feedback by means of limit switches (open/close).
 - Valve position feedback (4-20mA) for inching duty drives.

2 Unidirectional LT Drives (Contactor Operated)

- a. Unidirectional LT drives shall be operable from Remote i.e. from Central Control Room (CCR). Drives shall be provided with Local Emergency Stop Push Button (**EPB**).
- b. Remote manual operation of all drives shall be done from OWS.
- c. Remote control commands i.e. start/stop, shall be generated from DCS and shall be issued to MCC through interposing relays located in respective MCC.DCS output command shall be latched in MCC. EPB (stay put type), in MCC supplier's scope, shall be wired directly to MCC. The EPB shall be provided with press to lock and turn to release type, keyless mechanism.

	ANNEXURE- WRITE UP FOR DRIVE CONTROL PHILOSOPHY (STATION C&I)	DOCUMENT NUMBER	PE-DM-426-145-I002		
		REVISION NUMBER	01	DATE	11.02.19
	PROJECT: 1 X 660 MW PANKI TPS				

- d. Necessary electrical protections for the drives shall be realised at MCC, whereas process interlocks and protections shall be realised in DCS.
- e. Following signal exchange shall take place between MCC & DCS
 - i. Drive Start & Stop commands.
 - ii. Drive ON & OFF feedback.
 - iii. MCC disturbed (Thermal O/L /Control supply fail/ EPB operated/ MCC switched off).
- f. Current transducers, 4-20mA types (in MCC suppliers scope), shall be mounted in the MCC for monitoring the current in DCS for all drives $\geq$ 30 KW and for important drives <30 KW. Auxiliary power supply to these transducers shall be provided from the control power supply of the respective MCC.

3 Solenoid Operated Drives

- a. Solenoid operated drives shall be operable from remote i.e. CCR only.
- b. Remote manual operation of all drives shall be done from OWS.
- c. Remote control commands i.e. open/close shall be generated from DCS and shall be issued to the respective solenoid through interposing relays located in Interposing Relay panels.
- d. Necessary process interlocks shall be realized in DCS.
- e. Following signal exchange shall take place between solenoid operated drive & DCS
 - i. Valve open & close command.
 - ii. Valve status feedback by means of limit switches (open/close), wherever available.

	ANNEXURE- WRITE UP FOR DRIVE CONTROL PHILOSOPHY (STATION C&I)	DOCUMENT NUMBER	PE-DM-426-145-I002		
		REVISION NUMBER	01	DATE	11.02.19
	PROJECT: 1 X 660 MW PANKI TPS				

4 **HT/LT Unidirectional Drives (Breaker operated).**

- a. Remote manual operation of Breaker operated drives shall be normally from remote i.e. Station DCS in main Control Room through OWS.
- b. Remote/Switchgear (SWGR) selection shall be realized from SWGR mounted R/S selector switch.
- c. Following are the operational combinations for breaker operated drives:
 - SERVICE POSITION – Drive Operation (Start/Stop) shall be from CCR with R/S (Remote/SWGR) selector switch in Remote position.
 - TEST POSITION – SWGR Testing (Start/Stop) from SWGR/CCR.

Switchgear mounted 'Trip/Neutral/Close' switch shall be provided for testing of switchgear when 'R/S' selector switch is selected as 'SWGR'.
- d. Remote control commands i.e. start/stop, pulse type, shall be generated from DCS and shall be issued to Switchgear through interposing relays located in respective Switchgear.
- e. The EPB shall be wired directly to switchgear. The EPB (stay put type), in SWGR supplier's scope, shall be provided with press to lock and turn to release type, keyless mechanism. Under its locked position, the drive operation shall be inhibited.
- f. Necessary electrical protections for the drive shall be realised at Switchgear, whereas process interlocks and protections are realised in DCS.
- g. Following signal exchange shall take place between SWGR and DCS:
 - i. Drive Start & Stop commands.
 - ii. Drive ON & OFF status feedback.
 - iii. Master Trip Relay (86 Relay) operated.
 - iv. Emergency Stop PB operated.
- h. Current transducers (for FD fan, PA fan, ID fan, Mill Motors, MDBFP, CEP & ECW pumps only), 4-20mA types (in SWGR suppliers scope), shall be mounted in the SWGR for monitoring the current in DCS. Auxiliary power supply to these transducers shall be provided from the control power supply of the respective switchgear.
- i. Multifunction relay shall be provided in SWGR which will be connected to DCS through serial link via Data concentrator for transmission of soft signals to DCS including over load alarm, relay fault, motor current, SWGR disturbed(control supply failed or trip coil unhealthy), SWGR available (Selector switch in remote, Breaker spring charged, SWGR is service position).

B. SEQUENCE CONTROL PHILOSOPHY

	ANNEXURE- WRITE UP FOR DRIVE CONTROL PHILOSOPHY (STATION C&I)	DOCUMENT NUMBER	PE-DM-426-145-I002		
		REVISION NUMBER	01	DATE	11.02.19
	PROJECT: 1 X 660 MW PANKI TPS				

1.0 Sequence control is envisaged for startup and shutdown of main drives and their associated drives from OWS. The drives can be operated manually or automatically through group/sub-group control and through process interlocks.

1.1 Sequence Mode Operation

Sequence controls are organized hierarchically in accordance with the operation concept of the plant process. Accordingly following levels of sequence control exists.

- Functional group control
- Sub group control

Functional Group Control logic co-ordinates between functionally cascaded lower level sequence control logics. It performs following functions

- Mode of operation
- Sequential start/stop of sub group.

Sub Group Control performs sequence control strategies on main drive and related drives as required by the process and taking care of the healthiness of each drive e.g. BFP along with its recirculation valve, discharge valve and AOP in a sequence, will form sequence control logic for BFP.

1.2 Sequence Start Up Mode

- 1) **Automatic mode:** - In this mode of operation, once the sequence is initiated, it shall progress without involvement of the operator.
- 2) **Semi-automatic mode:** - In this mode of operation, once the sequence is initialized, the step progressing shall be displayed on the OWS. But the step execution command shall be interlocked and shall be sent by the operator via keyboard. It shall be possible to bypass and/or simulate one or more criteria to enable the program to proceed. This facility shall allow the program to be executed even if some criteria are not fulfilled. It shall be possible to put the system on the auto mode after operating it on semi-auto mode for some steps or vice-versa, without disturbance to the sequence operation.

	ANNEXURE- WRITE UP FOR DRIVE CONTROL PHILOSOPHY (STATION C&I)	DOCUMENT NUMBER	PE-DM-426-145-I002		
		REVISION NUMBER	01	DATE	11.02.19
	PROJECT: 1 X 660 MW PANKI TPS				

- 3) **Operator test mode:** It shall be possible to use the sequential control in operator guide mode / test mode i.e. the complete system runs and receives input from the plant OWS but its command output is blocked. The whole program, in this case shall run in manual mode. This mode shall allow to practice manual operation using step and criteria indications. The actual protection shall remain valid during this mode of operation also.

C. ANALOG CONTROL & MEASUREMENT PHILOSOPHY

1) Analog Drives Control

- 1.1 A drive control function residing in controller is used to position the pneumatically/electrically operated control valves. Interlock and protection Open/Close Commands, originating from field or generated internally in Control Logics (ACS), are interfaced with the drive control function residing in controller.
- 1.2 Control Valve actuator design shall take care of fail safe condition i.e. bringing valve to full open/full close or stay put mode, on signal (pneumatic/electric) failure.
- 1.3 Auto/Manual operator control and display for various control loops shall be provided through OWS, using Analog Displays.
- 1.4 Analog Displays have following functionality:
 - Auto/Manual selection with control device “Raise/Lower Buttons”
 - Set point indication with “Raise/Lower Buttons”
 - Indication for deviation between set point and measured value
 - Measured value indication
 - Final control element portion indicators



**Technical specification for
CONDENSER ON LOAD TUBE CLEANING SYSTEM
1X660MW PANKI TPS EXTN.**

SECTION D

REV. NO. 00

DATE : 04.04.2018

INSTRUMENTS & VALVES SPECIFICATIONS

CHAPTER-2: FIELD AND MEASURING INSTRUMENTS

2.00.00 MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)

- 2.00.01 Measuring instruments/equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Refer Sub-section/chapter 1, Vol. V, Basic Design Criteria. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance and shall comply with the acceptable international standards and shall be subject to Owner's approval.
- 2.00.02 Every panel-mounted instrument requiring power supply shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.
- 2.00.03 All transmitters, sensors, and switches, Gauges for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment in the system under the scope of specification shall be provided on as required basis with in quoted lump sum price. The Bidder shall furnish all Instrumentation / Control equipment & accessories under this specification as per technical specification, ranges, makes & model as approved by the Owner during detailed engineering.
- 2.00.04 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.
- 2.00.05 For corrosive applications, all instruments applications, they shall be provided with wetted parts made of Monel/ Hastelloy C or any other material (if proven ness experience of the proposed material for such applications is established by bidder).
- All instruments shall be provided with durable epoxy coating for housings and all exposed surfaces of the instruments.
- 2.00.06 All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC article 500, class 1/2, Division 1 area & Flame proof area) and an anti corrosive paint shall be applied to the field mounted enclosures / instruments.



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In general, double cable entry shall be provided, wherever available, unused cable entry shall be provided with blind metal plug. All the field instruments shall also be provided with SS tag nameplate. Counter and mating flange (SS316 material), fastener, gaskets, Nuts, bolts etc. shall also be included wherever required with the field instruments.

- 2.00.07 In general, front draw out type instruments with plug-in facility at the rear for connecting cables for power supply and signal shall be provided unless otherwise specified like for Explosion proof area, Flame proof area and high vibration prone area. Separate plugs & socket connection shall be provided for connecting power supply cables and signal cables.

The plug & sockets shall be polarized to prevent wrong connections and have facility for secure coupling in plug-in position to prevent loose connections.

Signal and Electrical connection shall be screwed connection with double compression type Nickel-plated brass/SS316 cable glands (Material as decided by owner) for Explosion proof area, Flame proof area and high vibration prone area.

- 2.00.08 The quantity of secondary instruments etc. to be provided by Bidder shall be adequate to meet the requirements of Technical Specifications. Any other additional quantity of secondary instruments envisaged by Bidder as per system and process requirements shall also be supplied without any cost implication.

2.01.00 SPECIFICATION FOR ELECTRONIC TRANSMITTERS

2.01.01 SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF. PRESSURE AND DP BASED FLOW, LEVEL MEASUREMENTS

Sl. No.	Features	Essential/Minimum Requirements
1	Type of Transmitter	Microprocessor based 2 wire type, Hart protocol compatible
2	Accuracy	± 0.1% of calibrated span (minimum) (upto turn down ratio of 10:1).
3	Output signal range	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol)
4	Turn down ratio	10:1 for vacuum/very low pressure applications. 5:1 for very high pressure application. 30:1 for other applications.
5	Stability	± 0.1% of calibrated span for six months for Ranges up to and including 70Kg/cm ² . ± 0.25% of calibrated span for six months for Ranges more than 70Kg/cm ² .
6	Zero and span drift	+/- 0.015% per deg.C at max span.



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		+/- 0.011% per deg.C at min. span.
7	Load impedance	500 ohm (min.)
8	Housing	Weather proof as per IP-65 with durable corrosion resistant coating.
9	Over Pressure	150% of max. Operating pressure.
10	Connection (Electrical)	Plug and socket type
11	Process connection	1/2 inch NPT (F)
12	Span and Zero	Continuous, tamper proof, Remote as well as adjustability manual from instrument with zero suppression and elevation facility
13	Material	Die cast Aluminum with epoxy coating/SS316 for body. SS316 for Diaphragm.
14	Accessories	-Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition. - LCD/TFT digital integral Indicators with scale of Engg. Units. -2 valve SS316 manifold for absolute & Gauge pressure transmitters, 3-valve SS316 manifold for vacuum pressure transmitters & where DP transmitters are being used for pressure measurement and 5 valve SS316 manifold for DP/Level/Flow applicable. Transmitters should not be mounted directly on the manifold; Manifold shall be non integral type only. - Snubbers/Pulsation dampners shall be used where the process media is unstable for measurement such as the discharge of a pump. -For hazardous area, explosions proof enclosure as described in NEC article 500.
15	Diagnostics	Self Indicating feature
16	Power supply	24V DC $\pm$ 10%.
17	Adjustment/calibration From hand held calibrator/centralized OWS based system n/maintenance (as applicable).	From hand held calibrator/centralized OWS based system



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Notes

For primary air/ secondary air/flue gas applications, DP type transmitters shall be provided for pressure measurement.

LVDT type is not acceptable.

Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

2.02.00 Specification for Pressure Gauge, D.P Gauge, Temperature Gauge and Level Gauge

s. no.	Features	Essential minimum requirements		
		Pr. Gauge/DP Gauge/Draught gauges	Temperature gauge	Level Gauge
1	Sensing Element and Material	Bourdon for high pressure, Diaphragm/ Bellow for Low pr. Of SS 316	Mercury in Steel/Bimetallic type for below 450°C and inert gas actuated for above 450°C of SS bulb and capillary	Tempered * toughened Borosilicate gauge glass steel armoured reflex or transparent type.
2	Body Material	Die Cast Aluminum with stoved enamel black finish /SS316	Die Cast Aluminum with stoved enamel black finish /SS316	Forged carbon steel/SS 304
3	Dial Size	150 mm with toughened shatter proof glass	150 mm with toughened shatter proof glass	Tubular covering entire range
4	End Connection	½ inch NPT (M)	¾" NPT (M)	Process connection as per ASME PTC and drain/vent 15 NB
5	Accuracy	+/- 1% span	+/- 1% span	+/- 2%
6	Scale	Linear, 270° arc graduated in metric units	Linear, 270° arc graduated in °C	Linear vertical
7	Range Selection	Cover 125% of max. of scale	Cover 125% of max. of scale	Cover 125% of max. of scale



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8	Over range test	Test pr. For the assembly shall be 1.5 to the max. Design pr. At 38°C		
9	Housing	Weather and dust proof as per IP-65	Weather and dust proof as per IP-65	CS/304 SS leak proof.
10	Zero/span Adjustment	Provided	Provided	-
11	Identification	Engraved with service legend or laminated phenolic name plate		
12	Accessories	Blow out Disc, siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	SS316 Thermowell	Gasket for all KEL-F shield for transparent type vent and drain valves of steel/SS as per CS/ alloy process requirement.
13	Material of Bourdon/ movement	SS 316	SS 316	

Notes – *Bicolour type level gauges will be provided for applications involving steam and water except for condensate and feed water services.

Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.

Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with inert liquid suitable for the application.

2.03.00 GUIDED WAVE RADAR TYPE LEVEL TRANSMITTER

Guided wave radar type level transmitters shall be provided for level measurements of the vessel under vacuum or low pressure applications as specified in Part-A.	
Type	Guided wave Radar
Principle	TDR (Time domain reflectometry)
Probe Type & Material	Coaxial, SS316/316L. If required, probe shall be suitable for overfill prevention.
Connection type and material	Flanged and SS316/316L.
Signal o/p	4-20mA with HART signal suitable for overfill prevention.
Display	Integral
Power supply	24 VDC



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Overall Range	:	-60°C to +20°C Dew point
Accuracy	:	± 2°C Dew point
Material	:	SS316 (wetted parts)
Features	:	a) AUTOMATIC CALIBRATION (b) Can be Configured for Linear 4-20mA signal in °C & °F Dewpoint, ppm(v), ppb(v), g/m3 (c) Temperature Compensation (d) Failure Diagnostics (e) Long Term Stability (f) Fast Response (g) IP 66 / NEMA4X Protection (h) Supplied with Calibration Certificate Traceable to National & International Humidity Standards (i) Sensor protection with sintered filter (j) Local LCD Display for Dew Point

2.18.00 Limit switches

For offsite plant application Limit switches shall be gold plated with high conductivity and non corrosive type. Contact rating shall be sufficient to meet the requirement of DDCMIS subject to a minimum of 60 V, 6 VA rating. Protection class shall be IP 65. Contact shall be either 1 no, DPDT or 2 nos. SPDT minimum.

For main plant application, limit switches are to be provided as per bidder standard and proven practice.

All limit switch shall be conform to IEC-60947-5-1.

2.19.00 MATERIAL HANDLING SYSTEM RELATED SPECIAL INSTRUMENTS

2.19.01 PULL CORD SWITCH

Type	:	Addressable Type
Body	:	Cast Iron
Contact rating	:	Continuous 10 Amp, Breaking 2 Amp. (240 V AC)
No. of contact	:	2 NO + 2 NC
Reset facility	:	Manual Reset
Type of enclosure	:	Die Cast Aluminum
Degree of protection	:	Flame proof/Explosion proof for NEC class 2, Division 1 area
Local trip indication	:	Required
Accessories	:	1. Canopy over lever of pull Cord switch. 2. Linking of switches through a single cable for each section.

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	:	4 1/2 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	:	3 1/2 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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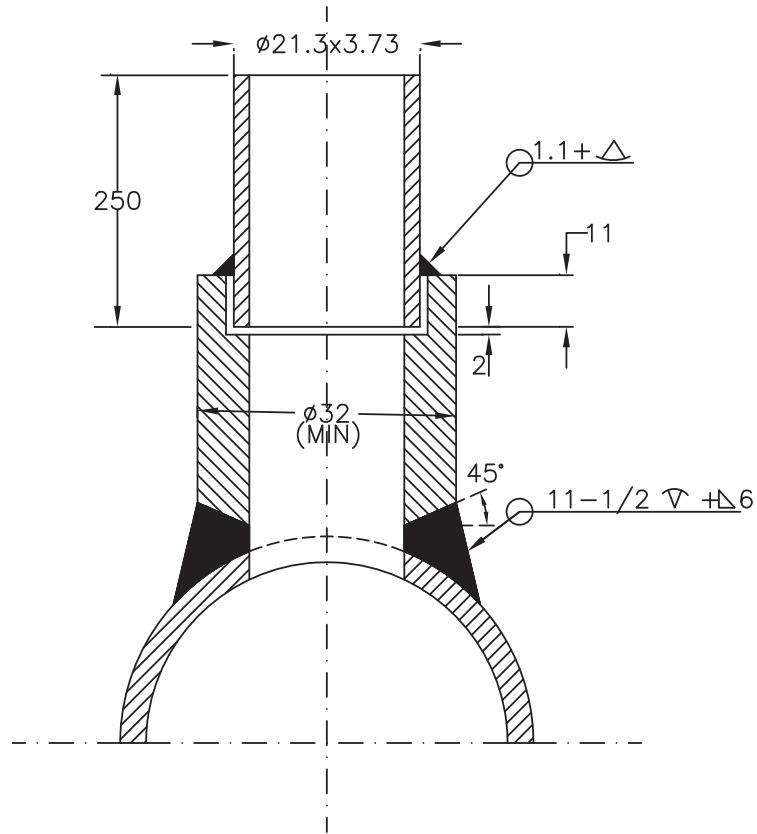
Technical specification for
CONDENSER ON LOAD TUBE CLEANING SYSTEM
1X660MW PANKI TPS EXTN.

SECTION D

REV. NO. 00

DATE : 04.04.2019

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

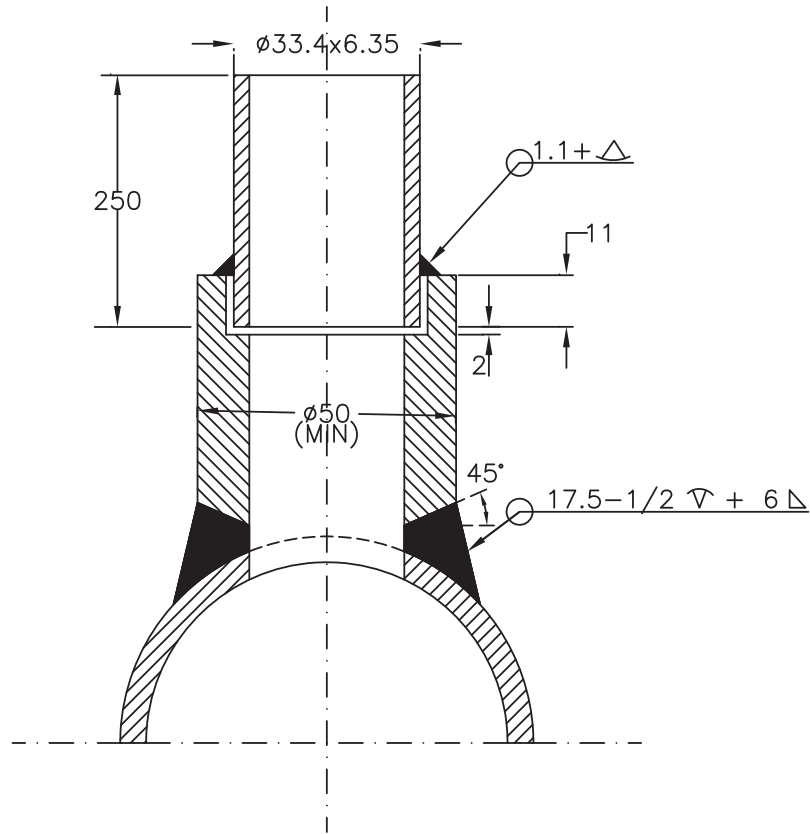


TITLE :

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.

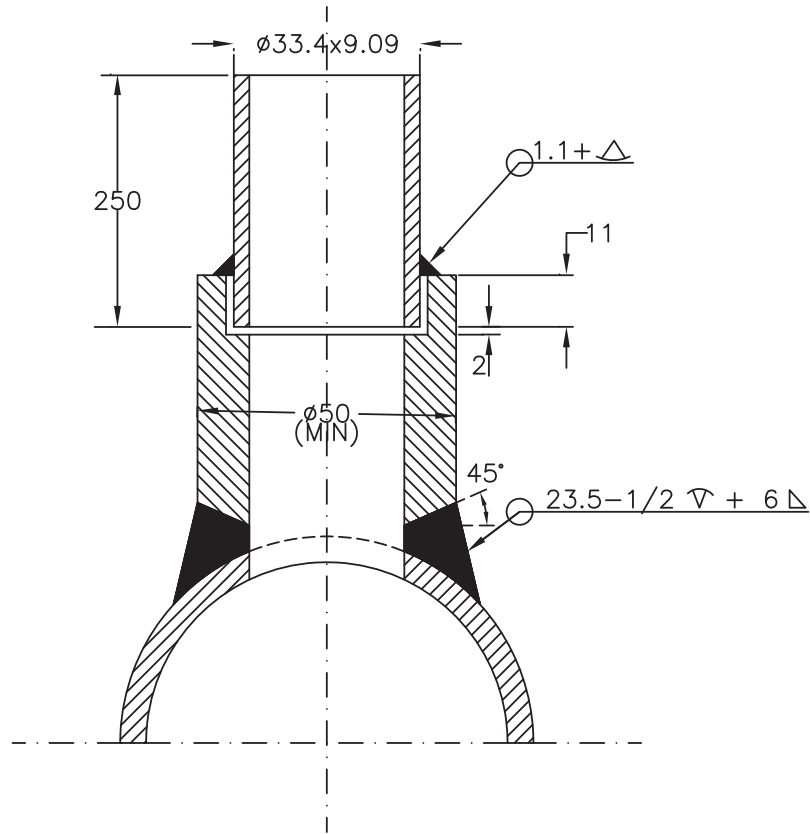


TITLE :

**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



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.

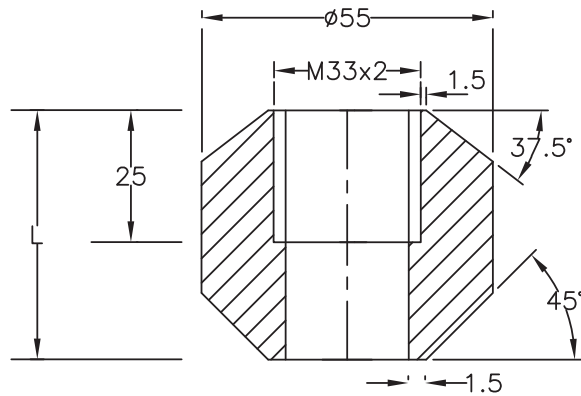


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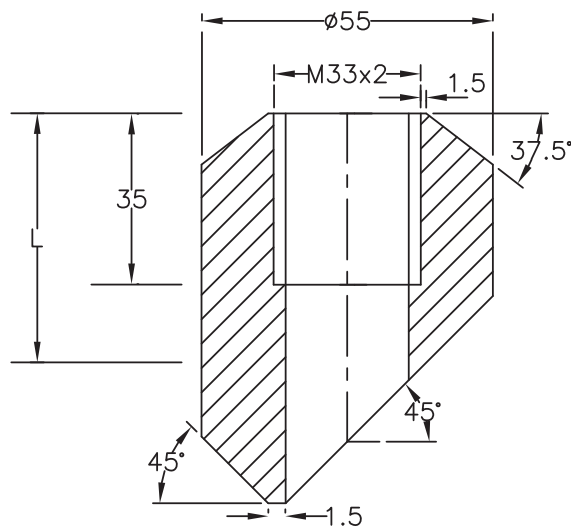
STD INSTRUMENT STUB DETAILS

PRESSURE STUB
SYSTEM TEMP > 500 Deg C , Nb25 , CL9000

DRG. NO.
PE-DG-426-145-1101
REV. 00
SH. 04 OF 08



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 ≥ 219.1 mm 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

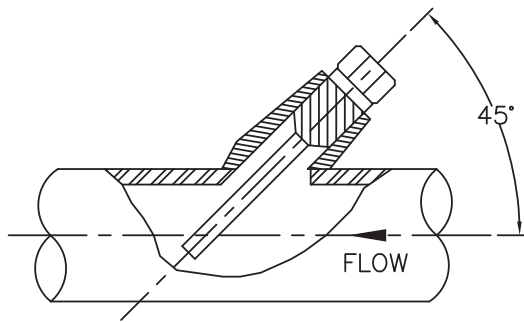
TITLE :



STD INSTRUMENT STUB
DETAILS

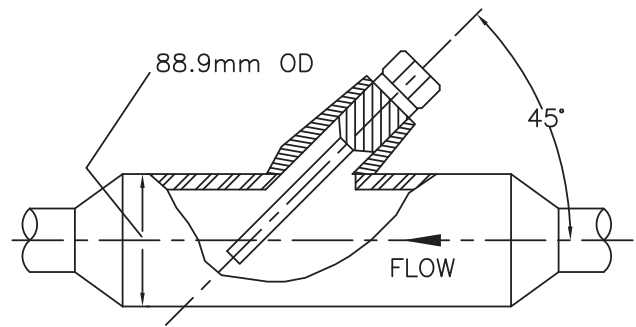
TEMPERATURE STUB

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



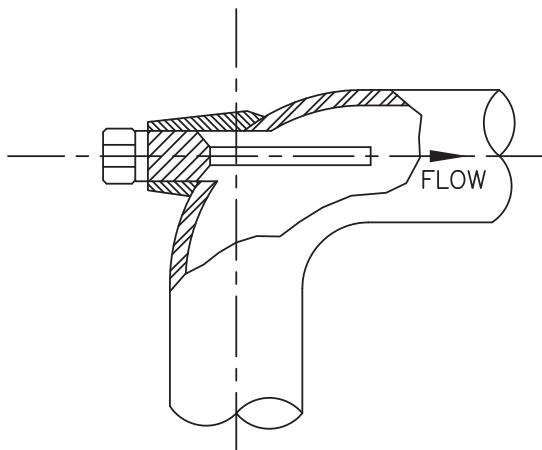
INSTALLATION TYPE-1

FOR MAIN PIPE OD 88.9mm to 159mm



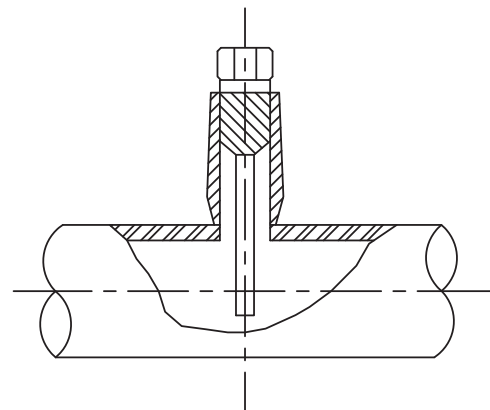
INSTALLATION TYPE-2

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

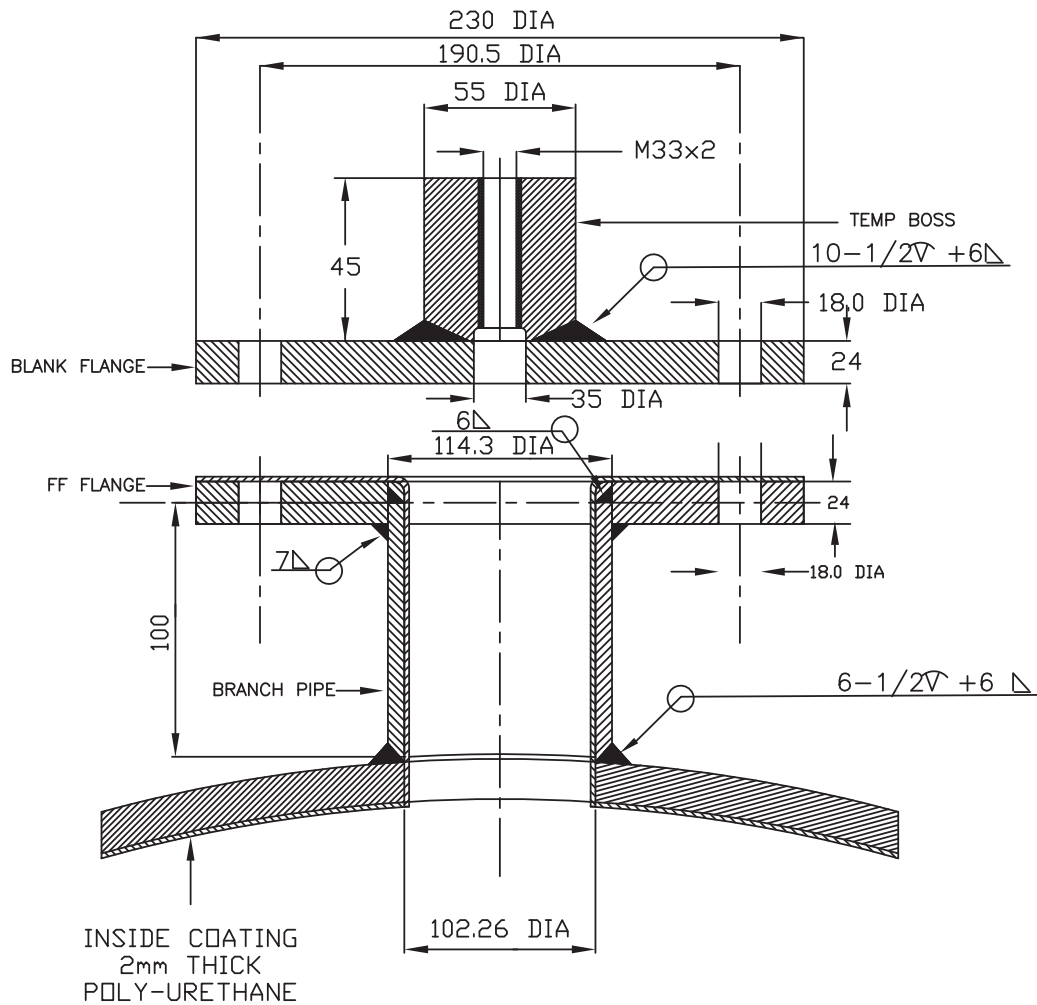


TITLE :

STD INSTRUMENT STUB
DETAILS

THERMOWELL INSTALLATION

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



NOTES :-

1. THIS TYPE OF TEMPERATURE TAPPING IS APPLICABLE FOR PU COATED PIPING.
2. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED.
3. MATERIAL OF THERMOWELL SHALL BE SS316L.
4. MATERIAL OF BLANK FLANGE, TEMP BOSS SHALL BE OF SS304.
5. BRANCH PIPE MATERIAL SHALL BE SAME AS MAIN PIPE MATERIAL.
6. FF FLANGE SHALL BE NB100, CLASS 150 AND OF THE SAME MATERIAL AS THAT OF MAIN PIPE.



TITLE :
INST. STUB DETAILS (TEMP)
APPLICABLE FOR PU COATED PIPES
(CW/ACW SYSTEM)

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



Technical specification for
CONDENSER ON LOAD TUBE CLEANING SYSTEM
1X660MW PANKI TPS EXTN.

SECTION D

REV. NO. 00

DATE : 04.04.2019

LCP & JB/RACKS SPECIFICATION

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 bracing 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.

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 RESISTANCE 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".

- 6.19.01 The TG building operating floor area and other elevations shall be partitioned to different rooms suitably by bidder with approval from owner to house the following equipment/panels/cabinets:
- (a) Unit Control Desk (UCD), Printers, Electrical Control Panel (ECP), LVS, Fire Alarm Panel, Plant CCTV monitoring System, etc. in the main central control room.
 - (b) The system cabinets, marshalling cabinets and electrical auxiliary cabinets, TSI & VMS panels, Electrical panels, DAVR panels, GCP, DDCMIS/DCS Network panels, & other aux. system cabinets etc. in the electronic cubicle room.
 - (c) Maintenance Engineer & Shift Incharge's OPERATING STATIONS with keyboards, printers and other peripherals in Maintenance Engineer room (Computer Room) and Shift Incharge's Room respectively. A separate air conditioned room shall also be provided for PADO.
 - (d) Uninterrupted Power Supply (i.e., inverters and distribution boards) (UPS) in UPS room and 24 V DC charger with DCDB in 24 V DC charger room. A separate room shall also be provided for Batteries.
 - (e) Similarly OPC servers, MIS server & station LAN Network panel shall be located in separate Air conditioned room.
 - (f) SWAS Room.
- 6.19.02 Every control room layout shall be designed in line with guidelines given below.
- (a) Lighting shall be designed for maximum comfort and minimisation of OPERATING STATION/LVS glare and shall be adjustable.
 - (b) Co-ordinated colours and material for floors, walls and ceiling shall be provided.
 - (c) Room designs shall absorb noise in the control room and engineers/shift supervisor room.
 - (d) Positively pressurised and filtered air conditioning shall be provided for all control rooms.
 - (e) Designs and material will be in accordance with NFPA Fire protection for Power/Electric Generating plant.
 - (f) All control Rooms shall be designed to minimise dust ingress. Air locks shall be provided at main entry.
 - (g) Double Doors and the corridors shall be of sufficient size and layout to allow access of 2750 mm height for equipment.
 - (h) Fire and Smoke detection equipment shall be located in all ceilings.
 - (i) Temp. & humidity monitoring system in each control room, cubicle room, meeting room, training room, & conference room etc.

(j) Air Curtains at each entrance to Main Control room & BOP control room.

6.19.03 Item (a) to (e) referred above at cl. No. 6.19.01 shall be mounted in an air-conditioned control room having false roof and false flooring. In addition SWAS dry room shall also be air conditioned only. The control room will be partitioned with toughened glass/insulated glass between the following rooms:

- (a) Main Control Room and Maintenance Engineer's Room/Computer Room.
- (b) Maintenance Engineer/Computer's Room and Electronic Cubicle Room
- (c) Main control room and Shift Incharge room.
- (d) Main control room and Electronic cubicle room.
- (e) Main control room and Operating Floor.

6.19.04 In additions to above following rooms shall be provided at operating floor-

- 1) C&I Staff air-conditioned room.
- 2) Shift Supervisor air-conditioned room.
- 3) Documentation air-conditioned Centre for storage for all Plant O & M manuals, control system software backup, & all others operating / maintenance files, logs, records etc.
- 4) Conference air-conditioned sound proof Room.
- 5) Pantry room.
- 6) Toilets/refreshing room.

6.19.05 Following C&I rooms shall be provided in service building -

- 1) Meeting Room/ Conference air-conditioned sound proof Room.
- 2) DMS air-conditioned Room.
- 3) C & I Maintenance/laboratory air-conditioned Room.
- 4) DDCMIS/DCS Simulator air-conditioned sound proof room.
- 5) CAAQMS air – conditioned room.
- 6) Training air-conditioned sound proof Room.

6.19.06 Following rooms shall be provided at Local control room building for respective BOP/offsite packages-

- 1) Control room and Electronic cubicle room (air-conditioned).
- 2) UPS room (air-conditioned).
- 3) UPS Battery room.



- 4) Toilets/refreshing room.
- 5) Locker & staff air-conditioned room.
- 6) Pantry Room.
- 7) Office Rooms.

6.19.07 Quantities of above mentioned rooms are minimum to be met by bidder, however actual quantities & size of rooms shall be finalised by owner during detailed engineering.



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1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site, **supervision, erection, and commissioning at site** of Local Panels required for control and monitoring of the Auxiliary Plant & Equipment.

2.0 CODES AND STANDARDS

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant National and International standards.

2.2 As a minimum requirement, the following standards shall be complied with:

- a) IS-6005 : 1998 : Code of practice for phosphating of iron and steel.
- b) IS-5 : 2007 : Colors for ready mixed paints and enamels.
- c) IS-1248:2003 : Direct Acting Indicating Analog Elec Measuring Instruments.
- d) IS/IEC 60947:Part 1:2004 : Low Voltage switchgear & control gear: Part-I (General Rules)
- e) IS-8828:1996 : Circuit breaker for household and similar installations.
- f) IS-13947 (Part-I):1993 : Low Voltage switchgear & control gear : Part-I (General Rules)
- g) ISA-18.1:1979 : Annunciator Sequences and Specification
- h) NFPA-496:2003 : Purged & Pressurised Enclosure for Electrical Equipment in Hazardous Locations.

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

3.1.1 The local panels shall house the secondary instruments, annunciation system, Single loop controller, Control switches / push buttons, indicating lamps/**LED cluster**, relays, timers and other devices required for operation and monitoring of the equipment locally.

3.1.2 The panels shall be of free standing type either welded construction on angle iron (minimum section of 50 x 50 x 4 mm) structure or folded construction by sheet metal formation depending upon the equipments to be mounted on it. The panels shall be robustly built and **stiffeners** as necessary shall be provided.

3.1.3 The panel shall be suitably reinforced to ensure adequate support for all instruments mounted thereon. All welds on exposed panel surfaces shall be ground smooth.

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel

Frame thickness: Not less than 3.0mm

Enclosure thickness: Not less than 2.5 mm for load bearing sections (Mounted with instruments)
1.6 mm for doors and Not less than 2.0 mm for others

Panel Height: Not less than 2365 mm (Refer data sheet-A (No. PES-145A-DS1-0)

Gland plate thickness: 3.0mm

Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

3.1.5 The panel shall be provided with rear doors with integral lockable handle. The door when locked shall be held at minimum three places. The door width shall not be more than 550mm. The doors shall be provided with suitable **stiffeners** to prevent buckling. The handle shall be on the right side of the door. The door shall be removable type with concealed hinges to facilitate maintenance work. Suitable pocket inside the door shall be provided for keeping the drawings / documents. **Double door shall be provided with suitable glass windows, as per the requirement.**

3.1.6 Suitable neoprene gasket shall be provided on all doors and removable covers. Suitable ventilation **system along with louvers** shall be provided at bottom and top of the doors covered with removable wire mesh.



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- 3.1.7 The class of protection shall be in accordance with IP-42 unless otherwise specified in the data sheet – A (No. PES-145-54A-DS1-0).
- 3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in data sheet-A (No. PES-145A-DS1-0). Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.
- 3.1.9 The cable glands of the required size and type as given in data sheet-A (No. PES-145A-DS1-0) shall be supplied alongwith the Panel.
- 3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.
No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.
- 3.1.11 Single / dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.
- 3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm² size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs.
- 3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm² to 2.5mm² external cables. **The TB points in terminal block shall be cage clamp type / screw type.** The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm **height from finished floor. The panel shall have ten (20) percent spare terminal.**
- 3.1.14 The interior of each panel shall be suitably illuminated through fluorescent **lamps / tube lights with shrouded cover of minimum 15W** operable on 240V 50 Hz AC power supply through panel door switch. A 15 Amp. 3-pin Power receptacle shall be provided.
- 3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.
- 3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm² size.
- 3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte



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Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self tapping non-rusting screws.

3.1.18 Vendor shall furnish electric load and heat load list (in case panel is to be placed in ac environment) of each panel.

3.2 Hazardous Area Panel Requirement

3.2.1 The Local Panel located in hazardous area shall be pressurized as per NFPA-496 requirements to render it non-hazardous. Alarms shall be provided for local and remote annunciation when pressurisation falls below 2.5 mm of water column. Protection shall be of type Z of NFPA-496. It shall not be possible to switch ON the power of purged section unless it is purged as per the recommendation of NFPA-496. Vendor must provide a protective device on the panel to protect the panel from over pressurisation.

3.2.2 Vendor shall supply pressurisation kit consisting of valves, restriction orifices, dual filter regulation, pressure gauges, pressure switches, rotameter etc. Pressurisation kit shall be surface mounting on a metal board and located outside the local panel. Pressurisation kit shall further consist of solenoid valve flow switch, timer blow off safety device etc., so as to make purging fully automatic. However final start shall be manual. Panel protection against over pressure to be provided as per NFPA-496.

3.2.3 Pressurised local control panel pressurization kit assembly design shall provide minimum leakage flow through the Local Control Panel. Panel venting shall be as per NFPA-496.

3.2.4 All components in the local panel like indicating instruments, push buttons switches, lamps etc., which are required to be energized without panel pressurization or before completion of purge cycle shall be explosion proof as per NEMA-7 & suitable for area classification.

3.2.5 All push buttons etc. requiring frequent operation during machine running shall have good positive sealing. Weatherproof housing or cover to be provided wherever necessary. Vendor shall provide pressurisation bypass switch outside explosion proof enclosure of pressurized panel with lamp indication. This shall be used only during maintenance. All hinges, screws, other non-painted metallic parts shall be of stainless steel material.

3.2.6 Provision to switch off manually all types of power shall be provided in the panel. In addition, it shall also be possible to switch off power circuits / components which are powered from motor control centre or control room manually in case of pressurization failure. All such cables from MCC and main control room shall be terminated in explosion proof boxes (NEMA-7).

3.3 Control & Monitoring devices

3.3.1 Instruments like Indicators, recorders, single loop controllers etc. as applicable and specified elsewhere for the plant / equipment shall be supplied and mounted on the panel.

3.3.2 Alarm Annunciator System

It shall be solid state discrete facia type having a sequence of ISA-S18.1A or as specified, opaque facia windows of 70 mm x 50 mm size, having two (2) lamps per window, and hooter of 10W, and provision for repeat group alarm at remote. The annunciator shall be provided with ten (10) percent spare windows or minimum two (2) windows along with electronics.

3.3.3 Relays

The relays shall be electromagnetic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable. There shall be ten (10) percent spare contacts.

3.3.4 Timers

The timers shall be electronic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However, minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable.



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3.3.5 Control / Selector Switches

Switches shall be Rotary Cam type with minimum of 5 Amps AC & 2 Amp DC continuous current rating. Selector switches shall be stay put type while control switches shall be spring-return-to-neutral type. Contact configuration and rating shall be as per the control function requirement. The switches shall be lockable type wherever specified. Each switch shall be provided with engraved plates indicating the switch position / functions.

3.3.6 Push Buttons / Indicating Lights

The push buttons shall be momentary action self-resetting type, however stop P.B. for unidirectional drives shall be provided with manual reset facility. Its contact configuration & rating shall be as required for the control function but minimum 2 NO + 2 NC of 5 Amp. AC rating. It shall have round coloured projecting tab and engraved escutcheon plate / inscription plate. Colour coding of push buttons shall be as under:

RED	Motor OFF / Valve CLOSE	YELLOW	Alarm acknowledge	Left Hand Side
GREEN	Motor ON / Valve OPEN	BLACK	Lamp test	Right Hand Side

Indicating lights shall be suitable for direct connections across specified power supplies. It shall be fitted with built in resistance to prevent circuit tripping on shorting of lamp filament. It shall be fitted with LED cluster type lamp replaceable from front.

GREEN	Motor OFF / Valve CLOSED condition	AMBER	Motor tripped	Left Hand Side
RED	Motor ON / Valve OPEN condition	WHITE	Normal / healthy	Right Hand Side

3.3.7 Ammeters

Ammeter shall be 96 x 96 mm size, 90 deg. deflection, 1.5% accuracy, 1 Amp. CT operated or with 4-20mA input and Flush mounting type as called for in the data sheet-A (No. PES-145-54A-DS1-0). Ammeters for motors shall have six (6) times folded scale at upper end to enable motor starting current indication

3.3.8 Miniature Circuit Breaker (MCB)

These shall be instantaneous magnetic trip type for short circuit in addition to current time inverse delayed thermal trip feature for over current protection. The housing of MCB shall be made of non-ignitable, high impact material. It shall have minimum short circuit rating of 9 KA for AC Voltages and 4 KA for DC Voltages.

3.3.9 Makes of various instruments / devices shall be as given below

1.	Alarm Annunciators	:	Procon / IIC
2.	Ammeters	:	AEP / IMP
3.	Control / Selector Switches	:	Alsthom / Kaycee / Siemens / L&T
4.	Push Buttons / Indicating Lamps	:	Siemens / L&T / Teknic / Alsthom
5.	Auxiliary Relays	:	Jyoti / Siemens / L&T / OEN
6.	Timers	:	L&T / Alsthom / Bhartiya Cutler Hammer
7.	MCBs	:	S&S Power Engg. / Indo Asian / MDS
8.	Terminal Blocks	:	Jyoti / Elmex

4.0 TESTING AND INSPECTION

4.1 The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.

4.2 BHEL's standard Quality Plan for LCP is enclosed with the specification. The bidder shall furnish his acceptance to BHEL's QP and submit the signed and stamped copy of QP along with the offer.



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4.3 The vendor shall conduct the following tests as a minimum requirement:

4.3.1 Routine Tests

1. High Voltage (H.V.)
2. Insulation Resistance (I.R.)
3. Functional

4.3.2 Type Tests

1. Enclosure Class Test



DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS-999-145-054A

VOLUME

SECTION

REV. NO. 02

DATE: 10.02.2015

SHEET 1 OF 3

TAG No. Qty.....

Data Sheet No.: PES-145A-DS1-0

Data Sheet A & B

DATA SHEET-A FOR LOCAL PANEL
(TO BE FILLED BY PURCHASER)

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

GENERAL

MANUFACTURER

CONSTRUCTION

☐ FOLDED ☐ WELDED

(As per requirement EDN)

ENCLOSURE SHEET THICKNESS

FRONT ■ 2.0 mm

OTHER ■ 2.0 mm

DOOR ■ 1.6 mm

HEIGHT ■ 2365 mm for stand alone panels. ☐ Other

OTHER ■ Load bearing sheet front shall have 3mm thickness

TECHNICAL

INPUT POWER SUPPLY *

(ANY OTHER POWER REQUIREMENT
TO BE DERIVED FROM THIS SUPPLY ONLY)■ 240V 50 Hz AC ☐ 220V DC☐ 415V 3 PHASE 3W ☐ 415V 3 PHASE 4W

NO. OF FEEDERS

☐ ONE☐ TWO

STARTER WITH MCC

(CHECK WITH MAUX/ELEC)

☐ REQUIRED☐ NOT REQUIRED

IPR POSITION

☐ MCC☐ RELAY PANEL

CONTACT RATING OF RELAY

☐ 5 Amp, 230 V AC☐ 0.25 Amp, 220V DC

CONTROL SUPPLY

☐ 110V AC☐ 220V AC☐ 220V DC☐ Other.

■ (As per requirement)

ALARM ANNUNCIATOR WINDOW
(EXCLUDING SPARES)

__During Detailed Engineering__ NOS. (AS REQUIRED)

TEMP SCANNER

(IF REQUIRED -NO. OF CHANNELS TO BE
SPECIFIED UNDER SEC-C)☐ REQUIRED☐ NOT REQUIRED

PAINT TYPE

☐ EPOXY ENAMEL☐ EPOXY POWDER COATEDMIMIC (TYPE OF MIMIC- MATERAIL, THICKNESS
TO BE SPECIFIED DURING DETAILED ENGG.)☐ REQUIRED☐ NOT REQUIRED

PANEL COLOUR (EXTERNAL)

☐ LIGHT GREY (RAL-7035)☐ OPALINE GREEN (Shade 275) .

FINISH (EXTERNAL)

☐ MATT☐ GLOSSY☐ SEMI GLOSSY

PANEL COLOUR (INTERNAL)

☐ WHITE☐ CREAM☐ OFF WHITE

FINISH (INTERNAL)

☐ MATT☐ GLOSSY☐ SEMI GLOSSY

CLASS OF PROTECTION

☐ IP-42 (FOR INDOOR SERVICE)☐ IP-55 (FOR OUTDOOR SERVICE) ☐ ANY
OTHER

CONTROL HARDWARE

☐ RELAY BASED



DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS-999-145-054A

VOLUME

SECTION

REV. NO. 02

DATE: 10.02.2015

SHEET 2 OF 3

TAG No. Qty.....

Data Sheet No.: PES-145A-DS1-0

Data Sheet A & B

DATA SHEET-A FOR LOCAL PANEL
(TO BE FILLED BY PURCHASER)

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

FOUNDATION ARRANGEMENT

☐ FOUNDATION BOLTS ☐ ANCHOR
FASTENERS ☐ SKID MOUNTED

WEIGHT OF PANEL (Kg.)

.....(Vendor to specify)

PANEL TYPE

☐ PRESSURISED ☐ UNPRESSURISED
As per Requirement

CABLE GLAND

☐ DOUBLE COMPRESSION

AMMETER (TYPE OF INPUT) *

☐ 1 Amp CT ☐ 4-20 mA
SCOPE OF SUPERVISION FOR
ERECTION & COMMISSIONING
☐ APPLICABLE ☐ NA

* TO BE CO-ORDINATED WITH PEM ELECTRICAL

PREPARED BY

CHECKED BY

APPROVED BY

NAME
DESIGNATION

SIGNATURE

DATE

COMPANY SEAL

NAME:

SIGNATURE:

DATE:



DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS-999-145-054A

VOLUME

SECTION

REV. NO. 02

DATE: 16.09.2013

SHEET 3 OF 3

TAG No. Qty.....

Data Sheet No.: **PES-145A-DS1-0**

Data Sheet C

DATA SHEET-C FOR LOCAL PANEL
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

GENERAL	MANUFACTURER				
	ENCLOSURE SHEET THICKNESS		☐ FOLDED ☐ WELDED (As per requirement EDN)		
			FRONT		
			OTHER		
			DOOR		
			HEIGHT		
	OTHER				
TECHNICAL	INPUT POWER SUPPLY				
	NO. OF FEEDERS				
	CONTACT RATING OF RELAY				
	TEMP SCANNER				
	CONTROL SUPPLY				
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)				
	PAINT TYPE				
	PANEL COLOUR (EXTERNAL)				
	FINISH (EXTERNAL)				
	TYPE OF MIMIC MATERIAL OF MIMC THICKNESS OF MIMIC				
	PANEL COLOUR (INTERNAL)				
	FINISH (INTERNAL)				
	CLASS OF PROTECTION				
	CONTROL HARDWARE				
	FOUNDATION ARRANGEMENT				
	WEIGHT OF PANEL (Kg.)				



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A

VOLUME II B

SECTION D

REV. NO. 03

DATE : 16-09-2013

SHEET 6 OF 6

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

The bidder shall supply all commissioning spares and consumables 'as required' during Start-up, as part of the main equipment supply.

5.2. Mandatory Spares

The bidder shall offer alongwith main offer, the Mandatory Spares as specified elsewhere in the specification. The Mandatory Spares offered shall be of the same make and type as the main equipment.

5.3. Recommended Spares

The bidder shall furnish a list of Recommended Spares indicating the normal service expectancy period and frequency of replacement; quantities recommended for 3 years operation alongwith unit rate against each item to enable BHEL/BHEL's Customer to place a separate order later, if required.

6.0 DRAWINGS AND DOCUMENTS

6.1 The bidder shall furnish the following documents in required number of copies along with the bid :

1. Data Sheet no. PES-145A-DS1-0
2. General Arrangement Drawing.
3. Catalogue and technical information for instruments and devices.
4. Quality Plan.

6.2 The vendor shall furnish the following documents in required number as agreed after the award of contract:

1. Data Shee No. PES-145A-DS2-0
2. GA Drawing indicating layout of instruments, construction details, foundation details, cable gland plate alongwith cable glands and all details mentioned in this specification.
3. Control Schematic Diagram along with grouping of different terminals for various functions.
4. Catalogue and technical information for instruments and devices with selected options clearly marked.
5. O&M Manuals.
6. "As Built" Drawing.
7. CDs.

7.0 MARKING AND PACKING

7.1 Panel with all instruments / devices mounted on it shall be suitably packed & protected for the entire period of despatch, storage and erection against impact, abrasion, corrosion, incidental damage due to vermin, sunlight, high temperature, rain moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in Transit and storage in open.

8.0 APPLICABLE DATA SHEET FORMS

This document shall be read with one or more of the following data sheet forms :

- | | | |
|-----------------------------------|---|-------------------------------|
| - Data sheet A&B for Local Panels | : | Data sheet no. PES-145A-DS1-0 |
| - Data sheet C for Local Panels | : | Data sheet no. PES-145A-DS2-0 |

- ~~Interface Units, Surge suppressors, Opto isolators, Interface Converters, Fibre Optic Card Cage, Fibre Optic Line Driver, Repeater / Modem (for Optical Fibre Cables), cable glands, grommets, lugs, termination kits etc. on as required basis.~~
- 9.07.02 Cables, which terminate in cabinets of draw out sections shall have sufficient cable coiled in the bottom of the cabinet to permit full withdrawal of draw out sections without disconnecting the cables. When prefabricated cables with factory connectors on both ends are longer than required, the excess cable shall be coiled in the bottom of one or both termination cabinets.
- 9.07.05 The Bidder shall be responsible for proper grounding of all equipment under this package. Further, proper termination of cable shields shall be verified and the grounding of the same shall be coordinated so as to achieve grounding of all instrumentation cable shields at same potential. This shall be completed prior to system tests.
- 9.07.06 The Bidder shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Bidder.

9.08.00 Field Mounted Local Junction Boxes

Type of Enclosure	:	Flame proof/weather proof IP-65 /Explosion Proof as per area classification. Design as per NEC-370 Article 18, 19 & 20.
No. of Ways	:	12/24/36/48/64/72/96/128 with 20% spares terminals.
Material	:	4 mm min. thick FRP (Fiberglass Reinforced Polyester) with protective Coating
		3 mm min. thickness Die cast aluminum for Flame proof/Explosion proof area.
Cable entry	:	Bottom or Side
Cable glands	:	Double compression type – Nickel plated Brass/SS316 with PVC hoods.
Mounting	:	Indoor/Outdoor
No. of terminals	:	As required with standardization with 20% spare of each size & type.
Terminals	:	Phoenix/Wago (screw less rail mounted cage clamp type spring loaded suitable for conductor size up to 2.5 sq. mm)
Grounding	:	Two terminals for body and shield ground
Door	:	Hinged, lockable type.
Accessories	:	Suitable mounting clamps and other accessories shall be in scope of bidder.
		The brackets, bolts, nuts, screws, glands, lugs required for erection shall be of SS304, included in bidder scope of supply. High voltage & insulation resistance test shall also be conducted.



Technical specification for
CONDENSER ON LOAD TUBE CLEANING SYSTEM
1X660MW PANKI TPS EXTN.

SECTION D

REV. NO. 00

DATE : 04.04.2019

APPLICABLE CABLE TYPE

Cable Sizes for 1X660MW TPS PANKI EXTN.	
Sl 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

SUB VENDOR LIST		
Package Name	Vendor Name	Vendor Address
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	DRESSER INDUSTRIES INC.	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Barksdale GmbH, Germany	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Works-1->C S Shankar 127, Sidco North Phase, Ambattur Estates, -CHENNAI-TAMIL NADU INDIA Phone- 8754491904 FAX : 044-26248849 Pincode : 600050 Email : cservice@switzerinstrument.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	PRECISION MASS PRODUCTS PVT. LTD.	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -KALOL-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS INDUSTRIES LIMITED	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	GENERAL INSTRUMENTS CONSORTIUM	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SOR INC.	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS- USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS (INDIA) LIMITED	
PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Kaustubha Udyog,	
PRESSURE GAUGE/ DIFF. PRESSURE GAUGE	H.GURU INDUSTRIES	Works-1->NA NA -- Phone- FAX : Pincode : Email :
PRESSURE GAUGE/ DIFF. PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Works-1->Mr. Partha Bose 44, Saheed Hemanta Kumar Bose,Sarani, -Kolkata-WEST BENGAL India Phone- +91 33 2548 7220 FAX : +91 33 2548 0429, Pincode : 700074 Email : parthabosebp@gmail.com
PRESSURE GAUGE/ DIFF. PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	bosepanda@vsnl.net Works-1->Mr. Gautam Mukherjee Kusumba,Sonarpur Station Road,P.O. -Narendrapur, -Kolkata-WEST BENGAL INDIA Phone- 9836878855 FAX : 033-24342748 Pincode : 700103 Email : gkm_ani@hotmail.com
PRESSURE GAUGE/ DIFF. PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -KALOL-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
PRESSURE GAUGE/ DIFF. PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 A GIDC A Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
PRESSURE GAUGE/ DIFF. PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	Works-1->Shikha Hazra/ Shiyamal Hazra 32, Industrial Suburb,Yeshwanthpur -BANGALORE-KARNATAKA INDIA Phone- 080-23370300 FAX : 080-23379890 Pincode : 560022 Email : shikhaHazra@hgurusouth.com

PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	Works-1->MR G.SRINIVASAN/MR ANUJ MALPANI PLOT NO:A-19/2 & T-4/2,I.DA. NACHARAM , -HYDERABAD-TELANGANA INDIA Phone- 09866550762 FAX : 040 27152193 Pincode : 560076 Email : gsrinivasan@forbesmarshall.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, -Kalamboli Taluka Panvel-MAHARASHTRA INDIA Phone- 022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com
PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	Works-1-> Others 26/2, G Type, Global Ind. Park Near Nahuli Railway Crossing, -Vapi-GUJARAT INDIA Phone- 9920576002 FAX : Pincode : 396105 Email : sales@nesstech.co.in, bkapadia@nesstech.co.in
TRANSMITTERS	V. AUTOMAT & INSTRUMENTS (P) LTD.	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
TRANSMITTERS	ABB LIMITED	
TRANSMITTERS	Pune Techtrol Pvt. Ltd.	
TRANSMITTERS	Moore Industries International Inc.	Works-1->Matt Moren/Gina Cruz 16650 Schoenborn St., North Hills -CALIFORNIA- USA Phone- +1 818 894 7111, ext FAX : +1 818 830 5588 Pincode : 91343 Email : gcruz@miinet.com
TRANSMITTERS	PANAM ENGINEERS	Works-1->Mr. Santosh Shukla Others R-628, TTC Industrial Area, MIDC Rabale, -Navi Mumbai-MAHARASHTRA INDIA Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com
TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Works-1-> Khasra No.: 218-230& 235, Industrial Estate,Makhupura, -Ajmer-RAJASTHAN INDIA Phone- 9887865856, FAX : 0145-2695174, Pincode : 305002, Email : rajeev.gupta@tipl.com
TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Works-1-> M-171 to 173, MIDC, Waluj, -Aurangabad-MAHARASHTRA INDIA Phone- 9881000474, FAX : 0240-2555179, Pincode : 431136, Email : Narendra.Kulkarni@wetzer.endress.com
TRANSMITTERS	YOKOGAWA INDIA LIMITED,	Works-1-> PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, -BANGALORE-KARNATAKA INDIA Phone- 080-41586000, FAX : 080-28521442, Pincode : Email : uday.shankar@in.yokogawa.com
TRANSMITTERS	SBEM PVT. LTD.	Works-1->MR. MOHAN PADWAL 691/A/2,BIBWEWADI INDL ESTATE -PUNE-MAHARASHTRA INDIA Phone-918600042374 FAX : 912024215670 Pincode : 411037 Email : wmi@sbern.co.in
TRANSMITTERS	SIEMENS LIMITED	Works-1->Ankit Varshney Kalwa Works, Thane-Belapur Road, Thane, -MUMBAI-MAHARASHTRA INDIA Phone- FAX : Pincode : 400708 Email :
TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Works-1->Kalpesh Chandan/Hrishikesh Aghor Plot No. A 145/4 TTC IND AREA,MIDC, PAWANE, -NAVI MUMBAI-MAHARASHTRA INDIA Phone- 9619688001 FAX : 022-66736000 Pincode : 400 705 Email : kalpesh.chandan@emerson.com
TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	
TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Works-1->Mr. Praveen Toshniwal 104-115, Electronic Complex, -Indore-MADHYA PRADESH INDIA Phone-0731-4081305 FAX : 0731-255075 Pincode : 452010 Email : sales@nivocontrols.com

TRANSMITTERS	Honeywell Automation India Limited	Works-1->Mr.Kedar Tiliu 53, 54, 56 & 57,Hadapsar Industrial Estate -PUNE-MAHARASHTRA INDIA Phone- 9665034625 FAX : 020 66039905 Pincode : 411013 Email : kedar.tiliu@honeywell.com
JUNCTION BOX	Shrenik & Company,	Works-1->Mr.Pulin Shah/ Mr. Kaloesh Parmar 39 A/3 ,Panchratna Industrial Est,Sarkhej-Bavla Road, Changodhar -Ahmedabad-GUJARAT INDIA Phone- 98250 80339 1 FAX : 079-26932424 Pincode : 382213 Email : sales@sumip.com
JUNCTION BOX	SUCHITRA INDUSTRIES	Works-1->B. Srinivas Suchitra Industries, Opp No 53, Muneshwara Black Devinagar, Lottagal hal - BANGALORE-KARNATAKA INDIA Phone- 080-23511247 FAX : Pincode : 560094 Email : suchitra_industries@yahoo.com
JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Works-1->Mr. Dineshbhai Zaveri CEO C-1/ 27&37, GIDC, Kabilpore, -Navsari-GUJARAT INDIA Phone- 02637-265140,265003 FAX : 02637-265308 Pincode : 396424 Email : flexpro@flexproltd.com
JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	
JUNCTION BOX	AJMERIA INDUSTRIAL & ENGINEERING WORKS	Works-1->JIGNESH MAHENDRA AJMERA DENA BANK BLDG., SHREE NAGESHINDL. ESTATE,STATION ROAD, -MUMBAI-MAHARASHTRA INDIA Phone- 022 67973578 FAX : Pincode : 400 088 Email : ajmeria@ajmeria.net
INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd.Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	
INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd.Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	
INSTRUMENT FITTINGS	AURA INCORPORATED	
INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Works-1->Miss Sonal Pithadia/Miss Pavan Chavda Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway, Laxmipura -Nandasan-GUJARAT INDIA Phone- 8460848087 FAX : 2764-267036/37 Pincode : 382705 Email : domestic@com-fit.com
INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	Works-1->S. Harichandran/ P.S. Pandi B-11, Mugappair Industrial Estate, -CHENNAI-TAMIL NADU INDIA Phone- 044-26252537 FAX : 044-26252538 Pincode : 600037 Email : sales@hpvalvesindia.com

INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	
INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	Works-1->Shahanawaz Khan Vishweshwar Ind. Premises Co-op Soc. Ltd,F-18/19, Pradhikaran,Bhosadi MIDC -PUNE-MAHARASHTRA INDIA Phone- 020-30694134 FAX : 022-23013010 Pincode : 411026 Email : shahanawaz.khan@perfectinstrumentation.com
INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	Works-1->ALEX BAPTIST/ K. SRINIVAS 7, SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com
INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Works-1->Mr. Abbas Bhola Unit No. 16, Supreme Industrial Estate,Kaman Bhiwandi Road,Devdal, -Vasai East-MAHARASHTRA India Phone- 9920044113 FAX : 07303178243 Pincode : 401208 Email : ab@fluidfitengg.com
INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com
INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indi.Co-op.Estate Ltd,Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com
INSTRUMENT FITTINGS	PANAM ENGINEERS	Works-1->Mr. Santosh Shukla Others R-628,TTC Industrial Area, MIDC Rabale, -Navi Mumbai-MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com

Note:-

- 1.The above Sub-vendor list is tentative & reference only.However Sub-vendor list is subject to BHEL/End user approval without any commercial/delivery implication.
2. New Sub-vendor if proposed by vendor during contract stage shall subject to BHEL/ End user approval without any commercial/delivery implication.

1 X 660 MW PANKI EXTN.					
LIST OF DELIVERABLES (C&I) FOR COLTCS					
S.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CATEGORY	SCH. SUBMISSION WEEK FROM LOI	Resubmission after incorporating comments
1	PE-V0-426-XXX-I901	CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM	A	5	1 week
2	PE-V0-426-XXX-I902	INSTRUMENT & DRIVE LIST WITH SET POINTS	A	8	1 week
3	PE-V0-426-XXX-I903	FIELD JB/LIE/LIR,DRIVES TERMINATION DETAILS	A	9	1 week
4	PE-V0-426-XXX-I904	DATASHEETS FOR INSTRUMENTS, JBs, etc. along with CATALOGUES*	A	8	1 week
5	PE-V0-426-XXX-I905	INPUT / OUTPUT SIGNAL LIST (ANALOG & BINARY)	A	8	1 week
6	PE-V0-426-XXX-I906	ANNUNCIATION & SOE LIST	A	8	1 week
7	PE-V0-426-XXX-I907	QUALITY PLANS (INSTRUMENTS,LCP etc.)	A	6	1 week
8	PE-V0-426-XXX-I908	INSTRUMENT INSTALLATION/ HOOK-UP DRAWING	A	6	1 week
9	PE-V0-426-XXX-I909	& INTERCONNECTION DETAILS	A	8	1 week
10	PE-V0-426-XXX-I910	O & M MANUAL	A	10	1 week
11	PE-V0-426-XXX-I911	GA & Wiring diagram of Local Control Panels	A	8	1 week
	NOTES:				
1	Any other document for the package decided during detailed engineering shall be provided by Bidder without any commercial/ technical implication.				
2	Reusable database format like MS Excel, MS Access etc. of these documents shall also be provided by Contractor in BHEL approved format. Soft copy of the formats as applicable shall be provided to the successful bidder during detailed engineering.				
3	XXX- PACKAGE CODE				



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

SPEC. NO.: **PE-TS-426-165-N002**

SECTION: **I**

SUB-SECTION: **ID**

REV. NO. **00** DATE 10.05.2019

SPECIFIC TECHNICAL REQUIREMENTS

SHEET **1** OF **1**

SUB-SECTION – ID

DATASHEET-A

	DATA SHEET - A		SPECIFICATION NO.: PE-TS- 426-165-N002
	CONDENSER ON LINE TUBE CLEANING SYSTEM(COLTCS)		REV. NO.: 00. DATE : 10/05/2019
			SECTION : I. SUB-SECTION : ID
SL NO	DESCRIPTION	UNITS	PANKI TPS - 1X660 MW
1.00	GENERAL		
1.1	Nos. of tube cleaning systems sets required for station	Nos.	Total Ten (2) nos. for Station. viz. One independent set common for each half of two condensers placed in series There are 2 nos. condenser per Unit in Series,i.e. Balls from one Separator/ Collector has to pass through two nos. Condensers placed in Series.
1.2	Liquid Handled		Clarified water (Refer enclosed water analysis at Annexure I)
1.3	Size of COLTCS	NB	2600
1.4	Length of Ball Separator	mm	4200 Note: 1. Scope of Ball Separator counter flange is in Purchaser's scope. (Associated Gaskets, nuts and bolts are in Bidder's Scope) 2. Ball Separator shall be mounted directly on the existing Butterfly valve - Refer Annexure III. 3. Flap of butterfly valve shall be extended to approx 1300-1400 mm inside the Ball separator.
2	DESIGN DATA		
2.1	Operating pressure at Condenser inlet flange	kg/cm2 (g)	Approx 1.5 to 2.5
2.2	Design Pressure for ball separator	kg/cm2 (g)	5.5 kg/cm ² (g) & 0.1 Kg/cm2 (abs)
2.3	Design Mechanical temperature	Deg. C	60
2.4	Condenser Details		
	a) Type of condenser		Single pass
	b) No. of Condenser sections	Nos.	Two (2)
	c) No. of passes per condenser section (viz. condenser half)	Nos.	One (1)
	d) No. of tubes per condenser	Nos.	2x24156
	• Condensing zone	Nos.	2x23744
	• Air Cooling zone	Nos.	2X412
	e) Tube Dia. OD x Thickness		
	• Top two rows	mm x mm	28.575 x 0.889
	• Remaining	mm x mm	28.575 x 0.7112
	f) Length of tubes between ends.	mm	13600
	g) Tube material		Welded SS 304
	h) Pressure drop across condenser - At Normal flow (between Inlet and Outlet flanges of condenser)	MWC	2X2.2 MWC (excl. interconnection pipes) (However the actual value can vary +/-10% of the design value)
2.5	CW flow rate through each ball separator		
	- Normal	cu.m/hr	43750
	- Maximum	cu.m/hr	52500
2.6	Design differential pressure for ball separator strainer/screen	kg/cm2 (g)	0.3
2.7	Pressure drop across ball separator i.e. between inlet & outlet flanges in clean condition at normal flow.	MWC	0.2
2.8	Pressure drop across ball separator in choked condition when strainer backwashing starts	MWC	Not to exceed 0.30
2.9	No. of balls required for COLTCS per condenser section		Minimum 10% of number of condenser tubes
3	CONNECTING PIPE DETAILS		
3.1	Condenser inlet pipe		
	a) Material		Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589
	b) O.D. X Thickness		2640 X 18
3.2	Condenser outlet pipe		
	a) Material		Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589
	b) O.D. X Thickness		2640 X 18
3.3	Manhole		Yes, 600 NB size
4	MATERIALS OF CONSTRUCTION		
4.1	BALL SEPARATOR		
	a) Body / housing		Carbon Steel to IS -2062 Gr.B. with epoxy painted inside (with minimum housing thickness same as connecting pipe thickness)
	b) Screen / Strainer		SS-316
	c) Strainer shaft		SS-316
	e) Internal Hardware in contact with circulating water including nuts, bolts , etc.		SS-316
	f) Site Glass provision		YES

	DATA SHEET - A		SPECIFICATION NO.: PE-TS- 426-165-N002
	CONDENSER ON LINE TUBE CLEANING SYSTEM(COLTCS)		REV. NO.: 00. DATE : 10/05/2019
			SECTION : I. SUB-SECTION : ID
SL NO	DESCRIPTION	UNITS	PANKI TPS - 1X660 MW
4.2	BALL RECIRCULATING PUMP		Non clog Type
	a) Casing		CI IS-210 FG 260
	b) Impeller		SA 351 or eq
	c) Shaft		SS-304 or eq
4.3	BALL COLLECTOR		
	a) Body / housing		Carbon Steel to IS -2062 Gr.B
	b) Screen / Strainer/other internals		SS-316
	c) Site Glass Provision		YES
4.4	Differential pressure measuring system		SS-316
4.5	Injection nozzle		SS-316
4.6	Valves		
4.6.1	Check Valves (65 NB & Above)		For sizes 65 NB and above:- Swing check or dual plate type.
	a) Body & Bonnet		SS316, Flanged Ends
	b) Disc for Check Valve		SS316
	c) Stem		ASTM A182 Gr F6a
4.6.2	Check Valves (50 NB & Below)		For size 50 NB and below-Piston type
	a) Body & Bonnet		SS-316, Socket welded Ends
	b) Disc for Check Valve		SS316
	c) Stem		ASTM A182 Gr F6a
4.6.3	Gate/ Globe Valves 50 Nb & Below		
	Body & Bonnet		SS-316, Socket welded Ends
4.6.4	Gate/Globe Valves (65NB & above)		
	Ø Body & Bonnet		SA 351 CF8M
	Ø Disc		SA 351 CF8M
	Ø Stem		ASTM A182 Gr F6a
	Ø Companion Flange		SS316
4.6.5	BFV Valves (65NB & above)		BFV (400 Nb & above)
	Ø Body & Disc		SA 351 CF8M
	Ø Sealing, Retaining segment & internals		18 – 8 -SS
	Ø Bearing		Self lubricating type
	Ø Companion Flange		SS316
4.6.6	Ball valves		
	i) Body		SA 351 CF8M
	ii) Ball		SA 351 CF8M
	iii) Stem		SS316
4.7	Interconnecting Piping		By Bidder
	Material		SS-316
5	COUNTER FLANGES FOR BALL SEPARATOR		
5.1	MATERIAL		
	a) Flanges		Carbon Steel to IS 2062 Gr. B or eq for thickness, drilling etc refer Annexure II in section C1(In Bidder's Scope)
	b) Fasteners		A 193 & A 194 (In Bidder's scope).
	c) Gaskets		Min 4 mm thick rubber (In Bidder's scope).
5.2	Drilling Standard		
6	OTHER COUNTER FLANGES		(for interconnecting piping, valves, bends, fittings, distributors, nozzles & support installation materials)
6.1	MATERIAL		
	a) Flanges		Carbon Steel to IS 2062 Gr. B or eq for thickness, drilling etc refer Annexure II in section C1(In Bidder's Scope)
	b) Fasteners		A 193 & A 194 (In Bidder's scope).
	c) Gaskets		Min 4 mm thick rubber (In Bidder's scope).
7	Material of Other components not specified above		1. All Non-wetted Fastners in Bidder's Scope shall be of SS316L material. 2. Suitable for intended duty and shall be subject to Purchasers approval during detailed engg. In the event of order.

		DATA SHEET - A	SPECIFICATION NO.: PE-TS- 426-165-N002
CONDENSER ON LINE TUBE CLEANING SYSTEM(COLTCS)			REV. NO.: 00. DATE : 10/05/2019
			SECTION : I. SUB-SECTION : ID
SL NO	DESCRIPTION	UNITS	PANKI TPS - 1X660 MW
8	PAINTING		
8.1	External Surface		
	a) Surface preparation		SA - 2.5 of Swedish Specn. SIS-05-59-00-1967
	b) Primer		Two coat of Red Lead primer
	c) Intermediate		-
	d) Final paint		Two (2) coats of High build Epoxy paint with minimum thickness of 35 microns dft of each coat.
8.2	Internal Surface		
	a) Surface preparation		SA - 2.5 of Swedish Specn. SIS-05-59-00-1967
	b) Primer		Two coat of Epoxy Resin based Red oxide primer
	c) Final paint		Adequate no. of coats (min. Two) of Synthetic Enamel paint to achieve total DFT of min. 200 microns. Colour-code shall be as per IS 9404
9	Adequate provision for future installation of cathodic protection		YES (Along with Sacrificial type anodic protection by purchaser)
10	Flow straightener for streamlining the CW flow in ball collecting strainer		If required as per bidder's design – the same to be incorporated by bidder in its constructional feature.
11	The tube cleaning system shall be designed for following operation modes		
	a) Automatic start up initiated by push button		YES
	b) Automatic shut down with ball collection effected by : i. Push button ii. Adjustable timer iii. Ball monitoring system		YES
	c) Automatic backwashing of ball separator with ball collection effected by : a. Push button b. Adjustable timer c. Diff. Pressure measuring system		YES
	d) Automatic emergency backwashing of ball separator effected by diff. Pressure measuring system		YES
	e) Automatic ball sorting initiated by push button		YES
	f) Provision for manual operation of complete tube cleaning system in case of control system failure		YES
	g) Whether the contacts for DPG, DPS and DPT are independent		YES
	h) Timer for Backwashing		YES
	i) Whether the ball monitoring system is designed to perform the following functions : i. Continuously counting the balls in circulation and giving an alarm calling for investigation of ball losses when the number of balls falls below a set value ii. Continuously measuring the size of the balls in circulation and initiating the shutdown of the tube cleaning system with alarm calling for replacement of balls when the no. of oversized balls falls below a set value		YES
	j) Whether the electronic processor of the ball monitoring system is provided with the following : i. Indicators for required basic ball charge ii. Indicators for recirculating ball quantity iii. Indicators for oversized ball quantity iv. Time counters for total cleaning system operating hours v. Time counters for cleaning system operating hours with sufficient no. of oversized balls vi. Recorders for ball consumption		YES
	k) Whether provision for self-testing and self-calibration are made		YES
12	MANDATORY SPARES - to be supplied under this specification –		YES (As indicated in ANNEXURE-IV)

ANNEXURE-I: CLARIFIED WATER ANALYSIS

S. No.	Description	Unit	Parameter
1	Physical characteristics		
	pH at 25°C	-	7.59
	Turbidity	NTU	<15
	Conductivity	μs /cm	590
	Total Dissolved solids	ppm	285
	Total Suspended Solids	ppm	<15
2	Cations		
	Calcium Hardness	ppm as CaCO ₃	113.86
	Magnesium Hardness	ppm as CaCO ₃	40
	Sodium + Potassium	ppm as CaCO ₃	37.2
	Iron	ppm as CaCO ₃	0.3
	Total Cations	ppm as CaCO ₃	191.36
3	Anions		
	Bicarbonate	ppm as CaCO ₃	97
	Carbonate	ppm as CaCO ₃	0.34
	Hydroxyl	ppm as CaCO ₃	0.02
	Chlorides	ppm as CaCO ₃	27.1
	Sulphate	ppm as CaCO ₃	66.4
	Nitrate	ppm as CaCO ₃	0.5
	Total Anions	ppm as CaCO ₃	191.36
4	Carbon Di-oxide as CO ₂	ppm	5.54
5	Dissolved Silica	ppm as SiO ₂	10.0
6	Colloidal Silica	ppm as SiO ₂	0.5



1 x 660 MW - Panki Thermal Power Station

Bidding Doc. No. : 14A14-SPC-G-0001

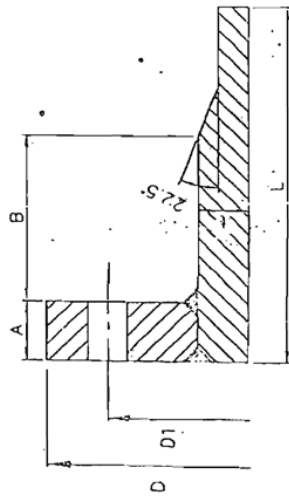


ANNEXURE-II

ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

7101-141-666-DG-3d 3d DWG



NOTES:-

Flange thicknesses listed are for Design pressure=5Kg/cm²(g) and Flange dimensions as given in the table. Final thickness of the flange is to be checked for actual OD/Bolting PCD/Neck dimensions.

PIPE SIZE	PIPE THK.	FLANGE OD 'D'	BOL PCD 'D1'	WELD NECK FLANGE		SLIP-ON FLANGE THICKNESS		
				FLANGE THICK. 'A'	NECK THICK. 'B'			
1200	10-12	1465	1380	40	24	70	200	90
1400	14	1675	1590	50	24	70	200	100
1600	14	1915	1920	60	32	80	220	110
1800	14-16	2115	2020	70	32	90	250	120
2200	18	2550	2420	80	36	100	300	140
2300	20			90	38	110	325	150
2500	20			90	38	110	325	150
2700	20			90	38	110	325	150

— TENTATIVE

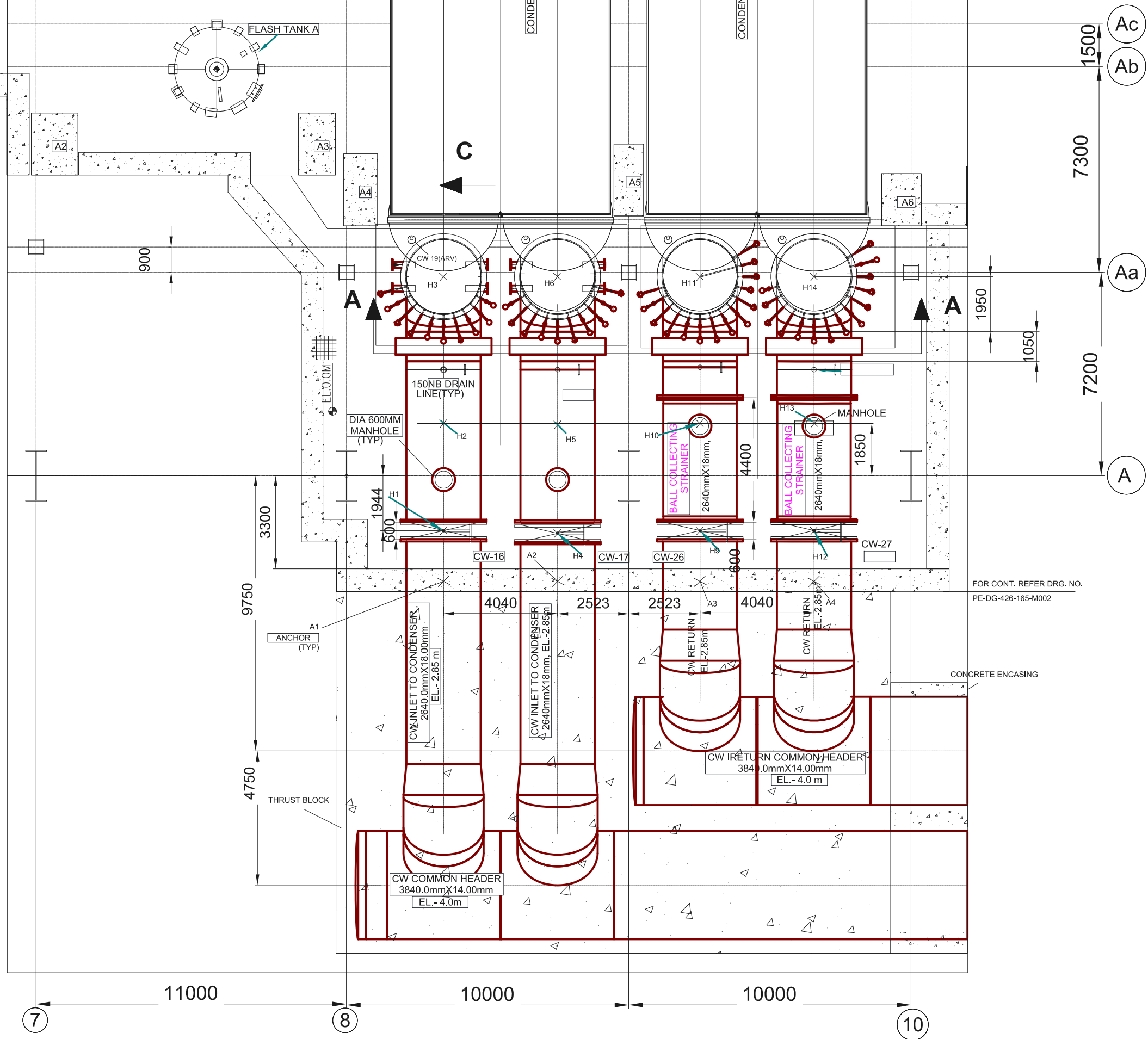
DRAWING FOR BAL' SEPARATOR COUNTER FLANGE

REV.		DATE	ALTU	QUD	APPS	JOB NO.	999
STATUS		DISTRIBUTION					
7101-141-666-DG-3d 3d DWG 7101-141-666-DG-3d 3d DWG 7101-141-666-DG-3d 3d DWG 7101-141-666-DG-3d 3d DWG							

BENT CODE		JUGA	
NEW	OLD	NEW	OLD
23.06.07	23.06.07	23.06.07	23.06.07
DRAWING NO.		SHEET 01 OF 01	
PC-DG-999-141-M017		REV 00	

BENT CODE		JUGA	
NEW	OLD	NEW	OLD
23.06.07	23.06.07	23.06.07	23.06.07
DRAWING NO.		SHEET 01 OF 01	
PC-DG-999-141-M017		REV 00	

BENT CODE		JUGA	
NEW	OLD	NEW	OLD
23.06.07	23.06.07	23.06.07	23.06.07
DRAWING NO.		SHEET 01 OF 01	
PC-DG-999-141-M017		REV 00	



FOR CONT. REFER DRG. NO.
PE-DG-426-165-M002

KEY PLAN FOR COLTCS

	DATA SHEET - A		SPECIFICATION NO.: PE-TS- 426-165-N002
	CONDENSER ON LINE TUBE CLEANING SYSTEM(COLTCS)		REV. NO.: 00. DATE : 10/05/2019
	Mandatory spares list (Annexure-IV)		SECTION : I. SUB-SECTION : ID
SL NO	DESCRIPTION	UNITS	Quantity
1	Sponge rubber balls for condenser on-load tube cleaning system (20% Abrasive remaining normal)	Nos.	25000
2	Ball circulating pumps (set consisting of shaft, rotor, bearings, seals, gland package shafts sleeves for complete replacement in one pump)	set	1
3	Temperature Transmitters and Electronic Transmitters of all type, range and model no. (For Pressure, DP, Temp, Flow, Level), Process Transmitters, Radar type level transmitter, 3D type level Transmitter with local display, Magnetic/Electromagnetic flow meter with local display, mass flow meter with local display., Process meters, Junction Box, Position Transmitter, Transducer or any other instrument etc.	Nos.	10% of total number of instruments/transducers offered for each model and type, rating or a minimum of one number for each model, rating and type , whichever is more.



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-426-165-N002**

SECTION: **II**

SUB-SECTION: **IIA**

REV. NO. **0** DATE 10.05.2019

SHEET **1** OF **1**

SUB-SECTION - IIA

STANDARD TECHNICAL SPECIFICATION (MECHANICAL)

STANDARD TECHNICAL SPECIFICATION FOR COLTCS

STANDARD QUALITY PLANS



TITLE :

SPECIFICATION NO. PE-TS-999-165-N002

STANDARD TECHNICAL SPECIFICATION
CONDENSER ON - LOAD TUBE CLEANING
SYSTEM (Sponge Rubber Ball Type)

SECTION : II

SUB-SECTION : IIA

REV. NO. 01

DATE : 26.05.2016

SHEET 1 OF 11

1.00.00 GENERAL

This specification covers the design, performance and operational requirements, configuration and constructional features, manufacture, assembly, inspection and testing at the manufacturer's and/or his sub-contractor's works and painting for delivery of condenser on-load tube cleaning system (sponge rubber balls type) complete with all accessories as specified hereinafter. Each half of the condenser shall be provided with an independent tube cleaning system.

2.00.00 CODES AND STANDARDS

2.01.00 The design, materials, manufacture, inspection and testing of the condenser on-load tube cleaning system complete with all accessories, shall comply with the requirements of the latest versions of the following appropriate codes and standards.

2.01.01 IS/BS/DIN/US Standards regarding pressure vessels, pumps, piping, flanges and others as necessary.

2.01.02 IS/BS/DIN/ASTM Standards for materials specification and testing procedures.

2.01.03 IS/BS/DIN/AWWA Standards for valves and the testing.

2.02.00 In case of any conflict between the above codes/standards and this specification, the later shall prevail and in case of any further conflict in the matter, the interpretation of the specification by the Engineer shall be final and binding.

3.00.00 DESIGN AND CONSTRUCTION

3.01.00 General Requirements

3.01.01 Unless otherwise necessary, manufacturer's standard and proven models of the tube cleaning system shall be supplied.

3.01.02 The tube cleaning system shall be capable of safe, continuous and trouble-free operation for removal of fouling and scaling materials from condenser tubes. Vibration, noise, mechanical stresses shall be kept within allowable limits specified by relevant codes/standards. In design, due attention shall be given to ease of maintenance, repair and cleaning.

3.01.03 Suitable Corrosion allowance shall be provided whenever necessary. Adequate provision for future installation of cathodic protection shall be provided.

3.01.04 The tube cleaning system shall consist of ball separator at condenser outlet, recirculating pump, ball collector, differential pressure measuring system for ball separator, ball monitoring system, cleaning balls, piping valves, distributors, injection nozzles, instrumentations, control panel, interconnecting cables and others as necessary. The configuration of the tube cleaning system shall be as described in section C and / or as per the scheme enclosed.



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CONDENSER ON - LOAD TUBE CLEANING
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3.02.00 DELETED

3.03.00 **Operational Requirements.**

The tube cleaning system and other accessories shall be designed for the following operation modes :

3.03.01 Complete automatic start-up of tube cleaning system initiated by pressing the push button (manual command).

3.03.02 Complete automatic shut-down of tube cleaning system with ball collection, effected by the following :

- ◆ Push button (manual command).
- ◆ Adjustable timer (after a defined cleaning period).
- ◆ Ball monitoring system (when the number of oversized balls falls below a set value).

3.03.02 Complete automatic backwashing of ball separator with ball collection, effected by the following :

- ◆ Differential pressure measuring system at a pre-determined differential across the ball separating strainer/ screen.
- ◆ Adjustable timer
- ◆ Push button

3.03.04 Complete automatic emergency backwashing of ball separator with alarm, indication, effected by differential pressure measuring system.

3.03.05 Manual operation for start-up, shut-down with ball collection backwashing of ball separator, flushing of differential pressure measuring system etc., in case of failure of control system.

3..04.00 **Ball Separator**

3.04.01 Ball separator body shall be of rigid construction and shall be designed and manufactured as per the applicable codes for pressure vessels. It shall house the ball separating screen / strainer and shall have flanged inlet, outlet, ball extraction opening and pressure measuring tappings etc. Body shall be designed and manufactured as per the applicable codes for pressure vessels and to take care of forces and moments as enclosed in the specification. However in no case thickness of housing/body shall be less than the connecting pipe thickness as specified in data sheet A

3.04.02 The ball separator shall be provided with manhole with bolted cover and sight glass to observe its internals.

3.04.03 If specified in Data Sheet -A, ball separator body shall be Epoxy lined.



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- 3.04.04 The ball separating screen / strainer shall be designed for the maximum differential pressure across the separator and shall be securely mounted in the body. Screen / strainer shaft shall be sized adequately considering the overloading of screens / strainer due to debris accumulation.
- 3.04.05 The ball separating strainers / screens shall have electric actuators for swivelling to allow for their backwashing. Also suitable hand wheels shall be provided to enable manual swivelling of strainers / screens.
- 3.05.00 **Ball Recirculating Pump**
- 3.05.01 The ball recirculating pump shall be horizontal centrifugal type. The casing shall be designed to withstand 1.5 times the shut-off pressure or twice the operating pressure, whichever is higher.
- 3.05.02 The impeller shall be non-clog type and shall be contoured suitably to avoid damage to the cleaning balls. The impeller shall be secured suitably to the shaft and shall be retained against circumferential movement by keys, pins or lock rings. Loctite compound shall be applied after tightening of locknuts to prevent dislocation of impeller.
- 3.05.03 Replaceable type wearing ring shall be provided to prevent damage to the casing and impeller.
- 3.05.04 Pumps shall be provided with mechanical seals to the extent feasible. If Gland packing is provided it should be of good quality to be provided to prevent leakage of water from pump glands.
- 3.05.05 Shaft size selected shall take into Consideration the critical speed which shall be away from the operating speed as recommended in applicable codes / standards. Renewable type fine finished shaft sleeves shall be integral with water thrower plates at the end and the length must extend beyond the outer faces of gland packing so as to distinguish between the leakage between shaft and the shaft sleeve and that past the seals / glands.
- 3.05.06 Bearings of adequate design shall be provided for taking the entire pump load arising from all probable conditions of continuous operation through its range of operation. The bearings shall be designed on the basis of 20,000 working hours minimum for the load corresponding to the duty point. Proper lubricating element does not contaminate the liquid being pumped. Bearings shall be easily accessible without disturbing the pump assembly
- 3.05.07 Stuffing box of suitable design to permit replacement of packing without removing any part other than the gland shall be provided. The stuffing boxes shall be sealed / cooled by the fluid being pumped.
- 3.05.08 Pumps shall be of self-lubricated, self - sealed and self-cooled type. All pipework, fitters etc., for sealing, cooling and lubricating purpose shall be supplied and no external cooling/lubricating/sealing water will be supplied. Pump capacity shall take into account



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the cooling/lubricating/sealing water requirement.

3.05.09 All rotating components shall be statically and dynamically balanced.

3.05.10 The pump shall be designed such that pump impellers and other accessories of the pump, are not damaged due to flow reversal.

3.05.11 The pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the head Vs. flow characteristic curve over a range or 40% of rated flow to 120 -130 % of rated flow.

3.05.12 The pump shall preferably be non-overloading type. The total head Vs. capacity curve shall be continuously rising from the maximum flow point towards shut-off without any zone of instability.

3.05.13 The pump shall run smoothly without undue noise and vibration. Peak to peak vibration limits and noise level shall be within the acceptable values of applicable codes/standards.

3.05.14 The pump and motor shafts shall be connected through a pin and rubber bush flexible type of couplings. Suitable coupling guards shall be provided for the couplings.

3.05.15 The pump shall be capable of being started with discharge valve fully opened. Motor rating shall be adequate for this condition. The output KW rating of the pump drive motor shall not be less than the larger of the following :

- a) Maximum power input to the pump over the entire range for maximum flow to shut-off condition.
- b) 125% of power input to the pump at duty point corresponding to 103% of the rated speed.

3.06.00 **Ball Collector**

3.06.01 The body of the ball collector shall be designed to withstand 2.0 times the operating pressure or 1.5 times the recirculating pump shut-off pressure, whichever is higher. The ball collector shall be designed and manufactured as per the applicable codes for pressure vessels.

3.06.02 Ball collector shall be provided with an inspection window/sight glass for visual inspection of the cleaning balls.

3.06.03 Ball collector shall be provided with suitable ports with covers for ball feeding and removal.

3.06.04 The ball collector shall be provided with vent and drain connections with isolating valves.

3.06.05 Provision shall be made in the ball collector for separating the undersized balls and ball collector shall have a separate chamber for collecting the undersized balls.



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3.06.06 If specified in Data Sheet -A, ball collector body shall be lined with suitable resilient material.

3.06.07 The differential pressure measuring system shall be provided with D.P. transmitter ,DPS & DPGof remote seal arrangement.

3.07.00 **Differential Pressure Measuring System.**

3.07.01 The ball separator shall be provided with a measuring system for differential pressure across the ball separating strainer/screen, to check debris accumulation and to initiate ball catching and backwashing operations. This shall consist of a differential pressure switch/transmitter for automatic backwashing operation, a differential pressure guage for manual observation with adequate number of tappings with isolating valves.

3.07.02 The contacts for differential pressure switch/transmitter and for differential pressure guage shall be independent so that in the event of failure of one, the other is available.

3.07.03 The differential pressure measuring system shall be with remote seal arrangement .

3.08.00 **Ball Monitoring System**

3.08.01 Ball monitoring system shall be provided for continuously monitoring the quantity and size of the cleaning balls in circulation. The monitoring system shall perform the following functions :

- a) Continuously counting the oversize balls in circulation and giving an alarm calling for investigation of ball losses, when the number of oversize circulating balls falls below a set valve.
- b) Continuously measuring the size of the balls in circulation and initiating the shut-down of the tube cleaning system with alarm calling-for replacement of balls when the number of oversized balls falls below a set valve.
- c) Bidder's if not manufacturing ball oversized monitor, can supply automatic ball sorter in lieu of same for automatic sorting of the undersized balls.

3.08.02 The monitoring system shall be of proven and reliable design and shall be complete with necessary transducers, amplifiers, transmission lines, power cables and electronic processor etc.

3.08.03 The electronic processor of the ball monitoring system shall be housed in the control panel and shall consist the following : -

- a) Indicators for
 - ◆ required basic ball charge.
 - ◆ recirculating ball quantity.
 - ◆ oversized ball quantity.



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- b) Time counters for
 - ◆ total cleaning system operating hours.
 - ◆ cleaning system operating hours with sufficient number of oversized balls.
- c) Recorder for ball consumption.

3.08.04 The ball monitoring system shall have provisions for self-testing and self-calibration.

3.09.00 **Cleaning Balls**

3.09.01 The sponge rubber cleaning balls shall be slightly oversized to the internal diameter of condenser tubes and should be able to remove all fouling and scaling deposits in the condenser tubes.

3.09.02 The specific gravity of the cleaning balls shall be such that good distribution of balls across the tube sheet and cleaning of all tubes are ensured.

3.09.03 The composition of the cleaning balls shall be based on natural rubber and shall be suitable for temperature upto 100°C. Hardness of the cleaning balls shall be compatible to tube material and corrosion/fouling behaviour. If cleaning balls consist of abrasive coated balls, the abrasive material shall also be compatible for use with the tube material.

3.09.04 Calculations and basis for selection of cleaning balls circulation quantity, type, size, hardness, cleaning frequency etc., shall be furnished during contract stage.

3.10.00 **Piping, Valves, Distributors and Injection Nozzles.**

3.10.01 Interconnecting piping, valves, injection nozzles and other fittings shall be designed to withstand 2.0 times the operating pressure or 1.5 times the pump shut-off pressure whichever is higher.

3.10.02 Interconnecting piping shall be sized and routed optimally. Velocity in the pipe work shall be less than 1.5 m/s for pump suction and less than 2.2 m/s in other pipe work.

3.10.03 Necessary isolation valves, vent and drain valves for various equipments shall be provided. Valves shall conform to appropriate standards. Valves provided in ball transport piping shall be ball type. Gland packing of all valve shall be of superior quality to avoid leakage. All valves upto 150 Nb shall be ball valves. For higher sizes, gate / globe / B.F. valves shall be provided. All instrument valves shall be needle valves.

3.10.04 Adequate number of ball injection nozzles shall be provided for proper distribution of cleaning balls in condenser inlet. Ball injection nozzles shall be flanged type and shall have two sets of flanges, one for connecting to ball transport pipe and other for connecting to the stub on condenser inlet pipe for ease of removal during repairs or checking.

3.10.05 Distributors (if applicable) with sight glass shall be provided wherever ball transport



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pipings branching out or joining together for proper guidance of cleaning balls.

3.10.6 Type of valves shall be ball valves, no diaphragm type valve shall be used.

3.11.00 **Actuators**

3.11.00 Tube cleaning system shall be provided with actuators wherever necessary for various automatic operations. The actuators shall be electric motor operated and shall meet the requirements of the enclosed specification. The actuator shall be provided with auxiliary handwheel for manual operation in the event of control system failure.

3.12.00 **Electric Motors**

The drive motors for recirculating pump and differential pressure measuring system flushing pump shall conform to the requirements of the enclosed specification.

3.13.00 **Instrumentation and Control System.**

3.13.01 Complete instrumentation and control system for automatic operation of tube cleaning system, protection, interlocking, indication / annunciation of differential pressure and other malfunctions etc., shall be provided. This shall consist of adequate operational hardware, local control panel (As applicable) and interconnecting control and power cabling between the control panel and various equipments in the tube cleaning system.

3.13.02 The control panel shall house all necessary instruments, indicating / annunciation lamps, alarms, differential pressure indicator, timer, function selection switches, ball monitoring system processor, relays, protection and interlocking systems, start / stop push button etc., and shall be complete with internal wiring. The control panel shall meet the requirements of the enclosed specification.

3.13.03 Pressure gauges shall be provided at recirculating pump suction and discharge. All instrumentation shall be of reputed make and shall meet the requirements of the enclosed specifications.

3.14.00 **Other Accessories.**

3.14.01 Counter flanges, complete with gaskets, bolts and nuts etc., shall be supplied for ball separator inlet, outlet connections and all other terminal points. Fabrication, dimensions and drilling of the flanges shall conform to the codes/standards specified in Data Sheet-A / Section -C.

3.14.02 Ball recirculating pump, ball collector with interconnecting piping and valves, shall be mounted on a frame. For fixing the frame, necessary foundation plates, bolts, nuts etc. shall be provided.

3.14.03 Suitable lifting arrangement shall be provided for various equipments of the tube cleaning system, for handling during erection and maintenance.

	TITLE : STANDARD TECHNICAL SPECIFICATION CONDENSER ON - LOAD TUBE CLEANING SYSTEM (Sponge Rubber Ball Type)	SPECIFICATION NO. PE-TS-999-165-N002	
		SECTION : II	
		SUB-SECTION : IIA	
		REV. NO. 01	DATE : 26.05.2016
		SHEET 8 OF 11	
4.00.00	DELETED		
5.00.00	<u>SHOP INSPECTION AND TESTS</u>		
5.01.01	<u>General</u>		
5.01.01	Manufacturer shall conduct all tests and stage inspections as per the approved quality plan to ensure that the various equipments and other accessories of the tube cleaning system shall conform to the requirements of this specification and of the applicable codes / standards.		
5.01.02	All materials used for manufacture /fabrication of the various equipments of the tube cleaning system shall be of tested quality. Relevant test certificates for chemical analysis, mechanical tests and heat treatment shall be made available before the final shop inspection. In case the relevant test certificates are not available, the manufacturer shall arrange to carry out the necessary tests as per the approved quality plan and applicable codes at his cost for which samples shall be identified by BHEL's representative.		
5.01.03	All shop tests shall be conducted as per approved quality plan and test certificates / reports for the same shall be furnished to BHEL for approval.		
5.01.04	Qualification of welding procedures and welders shall be as per ASME B&PV code, Section - IX / applicable codes.		
5.2.00	<u>Ball Separator</u>		
5.02.01	Chemical analysis, mechanical tests shall be carried out on materials used for body, strainer / screen, strainer / screen shaft and other appurtenances as per the applicable material specification standards.		
5.02.02	All butt welded joints shall be subjected to radiographic/ ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.		
5.02.03	Strainer / screen shaft shall be subjected to ultrasonic test as per ASTM-A388 for subsurface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1.		
5.03.00	<u>Ball Recirculating Pump</u>		
5.03.01	Chemical analysis, mechanical tests shall be carried out on materials used for casing, impeller, shaft, sleeves, wear rings etc., as per the applicable material specification standards.		
5.03.02	The casting used for pump casing and impeller shall be sound, clean and free from porosity, blow holes, hard spots, cold shuts, distortion and other harmful defects. All accessible surfaces of the impeller shall be subjected to penetrant test as per ASTM-		



TITLE :

SPECIFICATION NO. PE-TS-999-165-N002

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- 5.03.03 E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1. No welding or repairs shall be carried out without prior permission of BHEL. Pump shaft and sleeves shall be subjected to ultrasonic test as per ASTM - A388 for sub-surface defects and penetrant test after finish machining as per ASTM-E165 for surface defects.
- 5.03.04 Wear rings shall be subjected to penetrant test as per ASTM-E165.
- 5.03.05 Pump impellers and rotor assembly shall be statically and dynamically balanced as per ISO-1940
- 5.04.00 **Ball Collector**
- 5.04.01 Chemical analysis, mechanical tests shall be carried out on materials used for body and other appurtenances / accessories as per the applicable material specification standards.
- 5.04.02 All but welded joints shall be subjected to radiographic / ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.
- 5.05.00 **Piping, Valves, Distributors, and Injection Nozzles.**
- 5.05.01 Chemical analysis, mechanical tests shall be carried out for materials used for piping, fittings, valves, distributors and injection nozzles.
- 5.05.02 All welded joints of distributors & injection nozzles shall be subjected to penetrant test as per ASTM-E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1.
- 5.05.03 Inspection and testing of valves including leakage test shall be carried out as per the requirements of the applicable standards. Valve stem and ball shall be subjected to penetrant test as per ASTM-E165.
- 5.05.04 All materials for various nozzles, stubs, gaskets, nuts, bolts etc. shall be of tested quality and correlating test certificates for chemical and mechanical properties shall be furnished.
- 5.06.00 **Rubber Lining (as applicable)**
- Rubber lining shall be subjected to surface crack test, 100% spark and hardness tests and shall be checked for layer thickness, defects etc.
- 5.07.00 **Flanges**
- 5.07.01 Chemical and mechanical test certificates shall be furnished for flange materials.
- 5.07.02 In case of fabricated flanges, all the welds shall be subjected to 100% radiography as



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per ASME B&PV code, Section VIII, Division 1.

5.07.03 In case of forged flanges, ultrasonic testing shall be carried out as per ASTM-A 388.

5.07.04 If the thickness of the plate used for flanges is 40mm or more, the same shall be checked ultrasonically as per ASTM-A435 to demonstrate the absence of lamination and lack of fusion etc.

5.07.05 Flanges shall be checked for edge preparation, fit up and satisfactory working with matching parts.

5.08.00 **Dimensional Checks.**

Dimensional checks for various equipments/components of the tube cleaning system shall be carried out as per assembly drawing approved by BHEL. Alignment and fit up of movable parts shall be checked.

5.09.00 **Hydrostatic Test**

Hydrostatic test shall be conducted on various assemblies / equipments / components of the tube cleaning system at a pressure of 1.5 times and design pressure. The duration of the test shall be minimum 30 minutes.

5.10.00 **Leakage Test**

Leakage test shall be conducted at the design pressure on all assemblies of the tube cleaning system to demonstrate that the assemblies are leak tight and no water seepage shall take place at various nozzles and valve connections.

5.11.00 **Performance Test on Recirculating Pump**

Performance test on recirculating pump with drive motor shall be conducted as per BS-599 / ASME PTC 8.0. Performance curves i.e., discharge flow Vs head, discharge flow Vs power consumption and discharge flow Vs efficiency shall be plotted and acceptance norms shall be as per BS-599 / ASME PTC 8.0. Vibration and noise shall be measure and acceptance norms shall be as per Hydraulic Institute (USA) standard.

5.12.00 **Functional Tests**

Various assemblies / equipments / components of the tube cleaning system shall be subjected to functional tests and the following shall be checked.

5.12.01 Smooth and free operation of all movable parts.

5.12.02 Interlock and sequential operation.

5.12.03 Satisfactory operations of ball monitoring system.



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5.12.04 Satisfactory operations of actuators torque switches, limit switches etc.

6.00.00 **TESTING AT SITE**

After completion of installation at site, the tube cleaning system will be tested to check that the tube cleaning system performance meets the requirements of this specification. Rectification of all defects shall have to be done by the supplier at no extra cost to the owner / purchaser. However, the owner / purchaser reserves the right to reject the equipments / parts not meeting the requirement if the deficiency still persists.

7.00.00 **QUALITY ASSURANCE & QUALITY PLAN**

7.01.00 The tube cleaning system and other accessories to be supplied, shall have assured quality and workmanship.

7.02.00 Typical quality plans are enclosed herewith this specification for bidder's guidance. The bidder shall furnish his own quality plan based on materials, equipments and components of the tube cleaning system being offered.

8.00.00 **NAME PLATE AND TAG NUMBERS**

8.01.00 Ball separator, recirculating pump, ball collector shall be provided with a permanently attached brass or stainless steel plate indicating the following details :-

- a) Design and maximum flow rates.
- b) Design and test pressures.
- d) Design temperature.
- e) Empty and operating weights.

8.02.00 Each valve in the tube cleaning system shall be provided with a name plate indicating the following :-

- a) Service.
- b) Design and test pressures.
- c) Maximum flow and flow direction.
- d) Size.
- e) Tag Number.

Tag Numbers will be indicated on the drawings submitted for approval during contract stage.

8.03.00 Each motor shall be provided with a name plate indicating the following details:

- a) Supply conditions.
- b) KW Rating.
- c) Make.



	TITLE : DATA SHEET - C CONDENSER ON - LOAD TUBE CLEANING SYSTEM (Sponge Rubber Ball Type)	SPECIFICATION NO. PE-TS-999-165-N001	
		VOLUME : II B	
		SECTION : D	
		REV. NO. 01	DATE : 20.06.16
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1.00.00 **DRAWING, DATA & INFORMATION TO BE SUBMITTED AFTER THE AWARD OF CONTRACT.**

After the award of contract, the following drawings, data and information is to be submitted for review / approval of BHEL.

1.01.00 The drawings to be submitted by bidder in event of award of contract shall be as per cl. 10.0 (b), sub-section-1A.

1.01.01 Data sheet (s) - B.

1.01.02 Final versions of the following drawings to enable BHEL to finalise the layout and to design foundations and structures:-

- General arrangement / installation drawings of ball separator, ball recirculating unit, control panel each complete with all accessories, incorporating the principal dimensions and weights of equipment offered, size and location of various nozzle connection, supporting arrangement (wherever applicable) and scope of supply etc.
- Foundation arrangement drawings (wherever applicable) showing load data on supports, size and location of anchor bolts etc.
- General arrangement drawing indicating the layout of the equipments and interconnecting piping with pipe supports.

1.01.03 Bar chart and inspection schedule.

1.02.00 Within the stipulated time period as per Vendor's drawing /document list, the following shall be submitted.

1.02.01 Cross Sectional/ detailed drawing of ball separator, recirculating pump, ball collector, differential pressure measuring system, ball monitoring system distributors, injection nozzles actuators, motors, control panel etc, indicating bill of quantities and materials of construction.

1.02.02 Final versions of calculations and basis for selection of cleaning balls circulation quantity, type, size, hardness, cleaning frequency etc.

12.2.03 Flow and control logic diagrams for various operations of the tube cleaning system.

1.02.04 Detailed schedule of valves indicating Tag numbers, type, make size, pressure and temperature ratings, materials etc.

1.02.05 Detailed schedule of instruments indicating tag numbers, type, make, materials , of construction, range and accuracy etc.

1.2.6 Detailed schedule of piping and fittings indicating sizes, materials, maximum working pressure and temperatures etc.



	TITLE : DATA SHEET - C CONDENSER ON - LOAD TUBE CLEANING SYSTEM (Sponge Rubber Ball Type)	SPECIFICATION NO. PE-TS-999-165-N001	
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- 1.02.07 Control panel layout and list of instruments provided on control panel.
- 1.02.08 List of annunciations, protections and interlocks provided.
- 1.02.09 Detailed drawings of flanges.
- 1.02.10 Ball recirculating pump performance characteristic curves.
- 1.02.11 Write-up and instruction manuals for erection, operation and maintenance.
- 1.02.12 Storage instructions.
- 1.02.13 Vendor to send 3 sets of final documents (O&M manual, GA drg, P&ID) direct to site under intimation to PEM.

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		Manufacturer's Name & Address		STANDARD QUALITY PLAN					BHEL Doc No.: PE-QP-999-165-N008				
		P.O. No.		Item : Ball Separator		Vendor Q.P. NO:		PROJECT:					
						PACKAGE : COLTCS		CUSTOMER:					
						Date :		PURCHASER:					
				Page 02 of 15		CONSULTANT:							
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency		Remarks		
1	2	3	4	5	6	7	8	9	D*	M	C	O	11
1.0.0	Ball Separator												
1.1.0	Raw Material												
[a]	Housing Shell, Nozzle flanges	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample/cast heat / batch	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Mill Test Certificate / Lab test report/Raw material flow sheet	*	P	V	V	
		Surface defects	Minor	Visual	100%	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Inspection report/ Raw material Flow sheet	-	P	V	V	
		Sub Surface Defects	Major	Ultrasonic test	100%	ASME SA 435	ASME SA 435	Inspection report	*	P	V	V	Plates > 20mm Thk only (UT - Full Volume)
[b]	Nozzle Pipes	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample/heat	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Mill Test Certificate / Lab test report/Raw material flow sheet	*	P	V	V	
		Surface defects	Minor	Visual	100%	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Inspection report/ Raw material Flow sheet	-	P	V	V	
		Leak Tightness	Major	Hydrostatic test	100%	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Mill Test Certificate	*	P	V	V	
[c]	Main Flange	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample/cast heat / batch	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Manufacturer's Test Certificate	*	P	V	V	
		Heat treatment (Normalising)	Major	Verification	HT Chart	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Manufacturer's Certificate	*	P	V	V	If casting
		Surface defects	Critical	Magnetic particle test	100%	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Inspection report	*	P	V	V	If casting
		Sub-surface defects	Critical	Ultrasonic test	100%	ASME SA609 / SA 435	ASME SA609 Level II / SA 435 / SA 388	Inspection report	*	P	V	V	
[d]	Screen Shaft	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample/heat	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Mill Test Certificate / Lab test report/Raw material flow sheet	*	P	V	V	
		LEGEND											
		* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.											
		** M : Manufacturer / Manufacturer's Sub-contractor											
		C : Contractor O : Owner											
Manufacturer / Sub-Contractor Signature		Contractor		Indicate : "P" - Perform, "W" - Witness and "V" - Verification				Reviewed By		Name & Sign. Of approving authority & Seal			

		Manufacturer's Name & Address		STANDARD QUALITY PLAN				BHEL Doc No.: PE-QP-999-165-N008		
P.O. No.		Item : Ball Separator		Vendor Q.P. NO:		PROJECT:				
				PACKAGE : COLTCS		CUSTOMER:				
				Date :		PURCHASER:				
				Page 03 of 15		CONSULTANT:				
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks
1	2	3	4	5	6	7	8	9	D* **	10
		Surface defects on machined area	Critical	Penetrant test	100%	ASME Sec.VIII Div.1 Appendix 8	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P V V
		Sub-surface defects	Critical	Ultrasonic test	100%	ASME SA745	ASME SA745	Inspection report	*	P V V
[e]	Screen ribs	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample / heat	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Lab test report/Raw material flow sheet	*	P V V
		Corrosion Resistance	Major	IGC	One/Heat	ASTM A 923	ASTM A 923	Test Report/Lab test report	*	P V V
		Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report/ Raw material Flow sheet	-	P V V
[f]	Ball Extraction Nozzle Pipe [Duplex Stainless Steel]	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample / cast/heat/ batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Lab test report/Raw material flow sheet	*	P V V
		Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report/ Raw material Flow sheet	-	P V V
		Leak Tightness	Major	Hydrostatic Test	100%	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's Test Certificate	*	P V V
1.2.0	Inprocess Quality Control									
1.2.1	Welding procedure specification	Correctness	Critical	Scrutiny	100%	ASME Sec.IX	ASME Sec.IX	QW 482 of ASME Sec.IX	*	P V V
1.2.2	Welding procedure qualification	Weld soundness	Critical	Physical test	100%	ASME Sec.IX	ASME Sec.IX	QW 483 of ASME Sec.IX	*	P V V
1.2.3	Welder performance qualification	Weld soundness	Critical	Radiography	100%	ASME Sec.IX	ASME Sec.IX	QW 484 of ASME Sec.IX	*	P V V
1.2.4	Fit-up of butt weld	Alignment, and dimensions	Major	Template, visual	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Log book		P W/V -- BHEL to witness > 20mm thick butt joint
1.2.5	Fit-up of shell flange and nozzle assembly to shell	Orientation, alignment and dimensions	Major	Template, visual	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Log book		P -- --
LEGEND										
* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.										
** M : Manufacturer / Manufacturer's Sub-contractor										
C : Contractor O : Owner										
Manufacturer / Sub-Contractor Contractor Indicate : "P" - Perform, "W" - Witness and "V" - Verification										
Signature										
Reviewed By										
Name & Sign. Of approving authority & Seal										

		Manufacturer's Name & Address					STANDARD QUALITY PLAN			BHEL Doc No.: PE-QP-999-165-N008				
		P.O. No.					Vendor Q.P. NO:		PROJECT:					
							Item : Ball Separator		PACKAGE : COLTCS		CUSTOMER:			
							Date :		PURCHASER:		CONSULTANT:			
							Page 04 of 15							
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency				Remarks	
1	2	3	4	5	6	7	8	9	D*	M**	C	O	10	11
1.2.6	Weld quality for Pressure Parts													
	[a] Root run	Surface defects	Major	Penetrant test / Visual	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Operation Process Sheet	-	P	V	V		
1.2.7	[a] Completed butt welds	1.Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V		
		2.Sub-surface defects	Critical	Radiography test	10% of total weld length & 100% T Joints	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 4 / UW 52	Radiographs & inspection report	*	P	V	V		RT films will be reviewed by BHEL
	[b] Completed fillet welds	Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V		
1.2.8	Fabricated Shell (Prior to sand blasting)	1.Dimensions, Orientation	Major	Measurement by visual	100%	Manufacturing Drawing	Manufacturing Drawing	Inspection report	*	P	V	V		
		2. Hydro test	Critical	Hydrostatic Pr. @ 1.5 times design pr. (positive) Duration 30 minutes	100%	ASME Sec.VIII Div.1	No Leakage	Inspection report	*	P	W	V		
1.2.9	Pickling and Passivation	Protection Layer	Major	Visual	100%	IS : 10117	IS : 10117	Log Book	-	P	--	--		
1.2.10	Final tests (completed equipments) - After assembly	1.Dimensions, orientation, workmanship & finish	Major	Measurement by visual	100%	G.A.drawing	G.A.drawing	Inspection report	*	P	W	W		
		2.Leak tightness for assembly	Critical	Leak Tightness @ design pr. (positive) Duration 30 minutes	100%	ASME Sec.VIII Div.1	No Leakage	Inspection report	*	P	W	W		
		3.Dry function test for Ball Separator	Critical	Operational test	100%	Approved procedure	Approved procedure	Inspection report	*	P	W	W		
LEGEND														
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C : Contractor O : Owner														
Indicate : "P" - Perform, "W" - Witness and "V" - Verification														
Manufacturer / Sub-Contractor									Reviewed By		Name & Sign. Of approving authority & Seal			
Signature														

		Manufacturer's Name & Address				STANDARD QUALITY PLAN			BHEL Doc No.: PE-QP-999-165-N008			
		P.O. No.				Item : Ball Separator		Vendor Q.P. NO:		PROJECT:		
						PACKAGE : COLTCS		CUSTOMER:				
						Date :		PURCHASER:				
						Page 05 of 15		CONSULTANT:				
Sl. No.	Component / Operation	Characteristics	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency			Remarks
		Checked							M	C	O	
1	2	3	4	5	6	7	8	9	D*	**	10	11
1.3.0	Rubber Lining for ball Separator Shell, V-Piece & skid IC Pipe.											
1.3.1	Rubber formulation	Tensile elongation and hardness	Major	Physical test	One per lot	Manufacturer's procedure	BS 6374/Equivalent	Manufacturer's test certificate	P	V	V	
		Polymer Identification	Major	Flame test	One per lot	For Semi Ebonite	For Semi Ebonite	Inspection report	*	P	V	V
						Ebonite Polymer catches fire; catches fire and On removal from fire it continues to burn	Ebonite Polymer catches fire; catches fire and On removal from fire it continues to burn					
		% Change in weight after 24 hrs immersion in sea water at 70 degrees	Major	Immersion test (bleeding test)	One per lot	ASTM D 471	+ / - 1 %	Inspection report	*	P	V	V
1.3.2	Surface preparation of items to be lined	Free from rust scale, dust and grease	Major	Visual	100%	SA 2.5	SA 2.5	Manufacturer's Internal inspection	P	-		
1.3.3	Vulcanising	Temperature, Pressure and time	Major	Process monitoring	100%	Manufacturer's procedure	Manufacturer's procedure	Process Procedure	P	-	-	
1.3.4	Vulcanised rubber lined items	a) Chip test	Major	Chip test	One per lot	Approved drawing and BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V
		b) Adhesion, Visual defects, thickness and hardness	Major	Measurement, visual inspection	100% visual, Thickness 0 hardness at random	Approved drawing and BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V
		c) Spark test for Pin holes at 5 kv/mm	Major	Spark test for Pin holes	100%	Approved drawing and BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V
LEGEND * Records identified with "STAR" shall be essentially included by contractor in QA Documentation. ** M : Manufacturer / Manufacturer's Sub-contractor C : Contractor O : Owner												
Manufacturer / Sub-Contractor Signature		Contractor		Indicate : "P" - Perform, "W" - Witness and "V" - Verification				Reviewed By		Name & Sign. Of approving authority & Seal		

		Manufacturer's Name & Address		STANDARD QUALITY PLAN				BHEL Doc No.: PE-QP-999-165-N008		
		P.O. No.		Item : WORM GEAR & ACTUATORS		Vendor Q.P. NO:		PROJECT:		
						PACKAGE : COLTCS		CUSTOMER:		
						Date :		PURCHASER:		
						Page 06 of 15		CONSULTANT:		
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks
1	2	3	4	5	6	7	8	9	D* **	10
1.4.0	Complete Unit of Worm gear	Reduction Ratio	Critical	Functional Test	100%	Approved Sheet	Approved Data Sheet			
		Angle of Rotation						Manufacturer test certificate	*	P V V
		Input Torque								
		Output Torque								
		Degree of protection	Critical	Water & Dust ingress tests	Type test	Approved Data Sheet	Approved Data Sheet	Type test certificate	*	V V V
1.5.0	Actuators	Routine Test	Major	Electrical test	100%	Supplier catalogue	Supplier ADS	Manufacturer TC	*	V V V
		Make, Range, Model	Major	Visual	100%					
		Assembly check alongwith ball valves	Major	Visual	100%	Supplier catalogue	Supplier catalogue / ADS	Inspection Report	-	P -- --
		Functional check alongwith settings/auxiliary contacts	Major	Visual	100%					
Note: ADS - APPROVED DATA SHEET										
LEGEND										
* Records indentified with "STAR" shall be essentially included by contractor in QA Documentation.										
** M : Manufacturer / Manufacturer's Sub-contractor										
C : Contractor O : Owner										
Indicate : "P" - Perform, "W" - Witness and "V" - Verification										
Manufacturer / Sub-Contractor Signature						Reviewed By		Name & Sign. Of approving authority & Seal		

		Manufacturer's Name & Address					STANDARD QUALITY PLAN			BHEL Doc No.:		PE-QP-999-165-N008	
		P.O. No.					Vendor Q.P. NO:			PROJECT:			
							Item : Ball Recirculation Skid & Ball Vessel			PACKAGE : COLTCS		CUSTOMER:	
							Date :			PURCHASER:			
					Page 07 of 15			CONSULTANT:					
Sl. No.	Component / Operation	Characteristics	Class	Type of	Quantum of	Reference	Acceptance	Format of	Agency			Remarks	
		Checked		Check	Check	Documents	Norms	Record	M	C	O		
1	2	3	4	5	6	7	8	9	D*	**	10	11	
2.0.0	Complete Skid												
	Recirculating Skid with ball vessel and ball oversize monitor	Completeness, Correctness, Orientation, Dimensions	Major	Visual & Measurement	100%	Approved Drawing	Approved Drawing	Inspection report	*	P	V	V	
	Ball Vessel												
2.1.0	Raw Material												
[a]	Housing Shell, Nozzle flanges and dished end	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample/heat	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Lab test report / raw material flow sheet	*	P	V	V	
		Surface defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill TC/Inspection report	*	P	V	V	
		Sub-surface defects	Major	Ultrasonic test	100%	ASME SA 435	ASME SA 435	Inspection report	-	P	V	V	
												Plates > 20mm Thk only (UT - Full Volume)	
2.2.0	Inprocess Quality Control												
2.2.1	Welding procedure specification	Correctness	Critical	Scrutiny	100%	ASME Sec.IX	ASME Sec.IX	QW 482 of ASME Sec.IX	*	P	V	V	
2.2.2	Welding procedure qualification	Weld soundness	Critical	Physical test	100%	ASME Sec.IX	ASME Sec.IX	QW 483 of ASME Sec.IX	*	P	V	V	
												Welding procedure already approved by BHEL/LRQA/GL/DNV/TUV shall be employed for this job.	
2.2.3	Welder performance qualification	Weld soundness	Critical	Radiography	100%	ASME Sec.IX	ASME Sec.IX	QW 484 of ASME Sec.IX	*	P	V	V	
												Welders already qualified by BHEL/LRQA/GL/DNV/TUV shall be employed for this job.	
2.2.4	Dished end for ball vessel	Dimensions	Major	Template	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Inspection report	-	P	V	V	
		Surface defects	Critical	Penetrant test	100%	ASME Sec VIII Div.1	ASME Sec VIII Div.1 Appendix 8	Inspection report	-	P	V	V	
			LEGEND										
			* Records indentified with "STAR" shall be essentially included by contractor in QA Documentation.										
			** M : Manufacturer / Manufacturer's Sub-contractor										
			C : Contractor										
			O : Owner										
Manufacturer / Sub-Contractor			Contractor		Indicate : "P" - Perform, "W" - Witness and "V" - Verification								
Signature							Reviewed By				Name & Sign. Of approving authority & Seal		

											Manufacturer's Name & Address				STANDARD QUALITY PLAN				BHEL Doc No.: PE-QP-999-165-N008	
P.O. No.											Item : Ball Vessel & Ball Injection Pipe				Vendor Q.P. NO:		PROJECT:			
Date :											PACKAGE : COLTCS				CUSTOMER:					
Page 08 of 15											PURCHASER:				CONSULTANT:					
Sl. No.	Component / Operation	Characteristics	Class	Type of	Quantum of	Reference	Acceptance	Format of	Agency				Remarks							
		Checked		Check	Check	Documents	Norms	Record	D*	M	C	O								
1	2	3	4	5	6	7	8	9	10	11	12	13	14							
2.2.5	Fit-up of butt weld	Alignment and dimensions	Major	Measurement	100%	Manufacturing Drawing	ASME Sec.VIII Div.1	Log book	-	P	W/V	--	BHEL to witness >20mm thick butt joint.							
2.2.6	Fit-up of shell flange and nozzle assembly to shell	Orientation, alignment and dimensions	Major	Template, visual	100%	Manufacturing Drawing	ASME Sec.VIII Div.1	Log book	-	P	--	--								
2.2.7	Weld quality for Pressure Parts																			
	[a] Root run	Surface defects	Major	Penetrant test / Visual	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Operation Process Sheet	*	P	V	V								
2.2.8	[a] Completed butt welds	1.Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V								
		2.Sub-surface defects	Critical	Radiography test	10% of total weld length & 100% T Joints	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 4 / UW 52	Radiographs and inspection report	*	P	V	V	RT films will be reviewed by BHEL							
	[b] Completed fillet welds	Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V								
2.2.9	Fabricated Shell	1.Dimensions, Orientation	Major	Measurement	100%	Manufacturing Drawing	Manufacturing Drawing	Inspection report	*	P	V	V								
		2. Hydro test for Ball Vessel	Critical	Hydrostatic Pr. @ 1.5 times design pr. (positive) [Duration 30 minutes]	100%	ASME Sec.VIII Div.1	No leakage	Inspection report	*	P	W	V	Hydrostatic test shall be conducted along with Recirculating skid Assy for Ball Vessel.							
2.2.10	Pickling and Passivation	Protection Layer	Major	Visual	100%	IS : 10117	IS : 10117	Log Book		P	--	--								
2.2.11	Ball Injection Pipe	Chemical & Physical properties	Major	Chemical mechanical tests	One sample/heat	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Lab test report / raw material flow sheet	*	P	V	V								
		Surface defects	Minor	Visual	100%	Approved drg/ Data sheet	Approved drg/ Data sheet	MTC / Inspection report	-	P	V	V								
		Leak Tightness	Major	Hydrostatic test	100%	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's Test Certificate	*	P	V	V								
LEGEND																				
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C : Contractor O : Owner																				
Indicate : "P" - Perform, "W" - Witness and "V" - Verification																				
Signature																				
Reviewed By																				
Name & Sign, Of approving authority & Seal																				

		Manufacturer's Name & Address		STANDARD QUALITY PLAN					BHEL Doc No.: PE-QP-999-165-N008					
		P.O. No.		Item : RECIRCULATING PUMP		Vendor Q.P. NO:		PROJECT:						
						PACKAGE : COLTCS		CUSTOMER:						
						Date :		PURCHASER:						
						Page 9 of 15		CONSULTANT:						
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency				Remarks	
1	2	3	4	5	6	7	8	9	D*	M	C	O	11	
2.3.0	Raw material control													
2.3.1	Casing	Chemical, Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / Heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's Certificate	Test	*	P	V	V	
		Surface defects	Minor	Visual	100%	Approved drg/ Data sheet	Approved drg/ Data sheet	MTC / Inspection report		-	P	V	V	
2.3.2	Impeller, Sleeve	Physical, and Chemical properties	Major	Physical and Chemical analysis	One Sample/Cast / Heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's Certificate	Test	*	P	V	V	
2.3.3	Shaft	Physical, and Chemical properties	Major	Physical and Chemical analysis	One Sample/Cast / Heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's Certificate	Test	*	P	V	V	
		Sub-Surface defects	Major	Ultrasonic Test	100%	ASME SA 745	ASME SA 745	MTC / Inspection report		*	P	V	V	Only for shaft >= 50mm
2.3.4	In-process control													
2.3.5	Casing	Leak tightness	Critical	Hydro, test @ 1.5 times design pr. (positive) (Duration 30 minutes)	100%	Manufacturing Standard	No Leakage	Inspection report		*	P	V	V	
2.3.6	Shaft	Surface defects	Critical	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report		*	P	V	V	
2.3.7	Impeller	Residual, static, dynamic unbalance	Major	Static, dynamic balancing	100%	ISO: 1940	ISO: 1940, Gr 6,3	Inspection report		*	P	V	V	
2.3.8	All components	Workmanship, finish and dimensions	Major	Measurement, visual examination	100%	Manufacturing drawing	Manufacturing drawing	Log book / job card		-	P	--	-	
2.3.9	Assembly, control, final inspection / test													
	Performance Test	a) Q Vs. Head, Q Vs. Pumps efficiency / overall efficiency, Q Vs. Power, Vibration and Noise	Critical	Performance test	100%	Approved curve, data sheet, IS: 5120	Approved data sheet	Inspection report, plotted curves	*	P	V	V		
		b) Dimensions, workmanship and finish	Major	Measurement, visual	100%	Data sheet	Data sheet							
		c) Noise level	Major	-	-	-	85 db at 1 meter distance							
2.3.10	Complete pump	Completeness, correctness, cleanliness	Major	Visual examination	100%	Approved data sheet / Mfg. Drg.	Approved data sheet / Mfg. Drg.	Check list / inspection report	*	P	V	V		
		LEGEND												
Manufacturer / Sub-Contractor		Contractor		Indicate : "P" - Perform, "W" - Witness and "V" - Verification										
Signature								Reviewed By				Name & Sign. Of approving authority & Seal		

		Manufacturer's Name & Address		STANDARD QUALITY PLAN				BHEL Doc No.:		PE-QP-999-165-N008			
		P.O. No.		Item : BALL VALVES		Vendor Q.P. NO:		PROJECT:					
						PACKAGE : COLTCS		CUSTOMER:					
						Date :		PURCHASER:					
						Page 10 of 15		CONSULTANT:					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency			Remarks	
1	2	3	4	5	6	7	8	9	D*	M	C	O	10
2.4.0	Ball valves												
2.4.1	Materials												
	Body and Tail end pieces	Chemical, Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's T.C.	*	P	V	V	
2.4.2	Ball	Chemical, Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's T.C.	*	P	V	V	
2.4.3	Stem	Chemical, Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's T.C.	*	P	V	V	
2.4.4	In-process inspection												
2.4.5	Machining of body, end, pieces, ball	Dimension	Major	Measurement	100%	Approved drg/Data sheet	Approved drg/Data sheet	Log book	-	P	V	V	
2.4.6	Ball	a) Surface defects	Critical	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V	
		b) Hardness	Major	Hardness testing	Random	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report	*	P	V	V	
2.4.7	Assembly	a) Dimensions	Major	Measurement	100%	EN ISO 17292	EN ISO 17292	Manufacturer's T.C.	*	P	V	V	
		b) Opening / Closing	Major	Operation	100%	--	As per approved data sheet	-	-	P	V	V	Test at works for opening / closing time of actuator operated valves.
2.4.8	Testing												
	[a] Body	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API 598/Appd data sheet	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[b] Seat test	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API 598/Appd data sheet	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[c] Seat	Leakage	Critical	Air test	100%	EN 12266-1&2/API 598/Appd data sheet	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
			LEGEND										
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			C : Contractor O : Owner										
Manufacturer / Sub-Contractor			Contractor		Indicate : "P" - Perform, "W" - Witness and "V" - Verification				Reviewed By		Name & Sign. Of approving authority & Seal		
Signature													

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[illegible]

[illegible]

		Manufacturer's Name & Address		STANDARD QUALITY PLAN					BHEL Doc No.: PE-QP-999-165-N008			
		P.O. No.		Item : Starter Panel		Vendor Q.P. NO:		PROJECT:				
				PACKAGE : COLTCS		CUSTOMER:						
				Date :		PURCHASER:						
				Page 14 of 15		CONSULTANT:						
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency			Remarks
1	2	3	4	5	6	7	8	9	M	C	O	11
8.0.0	Starter panel											
08.1.0	Incoming Material											
08.1.1	Fabricated & Painted Panel	Dimension	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--
		Panel G.A.	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--
		Paint colour	Major	Visual	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--
		Paint thickness	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--
		Paint Shade, Adhesion	Major	Visual	Sample	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--
08.1.2	Wire	Size / Colour / Rating / Surface Defects	Major	Visual / Dimension	Sample	IS 694	Specification drawings	Inspection report	-	P	--	--
08.1.3	Panel Mounting	Make, Functional, Type & Rating	Major	Visual / Electrical	100%	Approved BOM	Approved BOM	---		P	V	V
08.2.0	In Process Inspection											
10.2.1	Name Plate, Component Mounting, Etc.	Workmanship, Finish, Correctness	Major	Visual	100%	Approved Drgs.	Approved drawings	Inspection report	-	P	--	--
08.2.2	Electrical Wiring of Panels	Continuity, Colour of wires, Bunching and Grouping	Major	Visual	100%	Mounting Drawing	Approved drawings	Inspection report	-	P	--	--
08.2.3	Ferruling of Cables	Start & End	Major	Visual	100%	Manufacturer's drawing	Manufacturer's drawing	Inspection report	-	P	--	--
08.3.0	Final Inspection											
08.3.1	Workmanship, Finish & Paint shade / Thickness	Visual	Major	Visual	100%	G.A Drawing	Approved drgs.	Inspection report	*	P	W	V
08.3.2	Overall Dimension, G.A of starter panel	Measurement	Major	Visual	100%	G.A Drawing	Approved drgs.	Test Certificate	-	P	W	V
08.3.3	Component Identification	Visual	Major	Visual	100%	G.A Drawing	Approved drgs.	Inspection report	-	P	W	V
08.3.4	Degree of Protection	Ingress Protection IP55	Critical	Environmental	Verification	Approved drgs.	IS 2147	Inspection Report		P	V	V
08.3.5	IR - HV - IR	Electrical	Critical	Electrical	100%	Approved Procedure	Approved Pcedure	Inspection report	-	P	V	V
08.3.6	Functional & Continuity	Functional	Major	Functional	100%	Appd Drawing	Appd Drawing	Inspection report	*	P	W	W
LEGEND * Records identified with "STAR" shall be essentially included by contractor in QA Documentation. ** M : Manufacturer/ Sub-contractor C : BHEL O : Owner Indicate : "P" - Perform, "W" - Witness and "V" - Verification												
Manufacturer / Sub-Contractor		Contractor										
Signature										Name & Sign. Of approving authority & Seal		

										Manufacturer's Name & Address				STANDARD QUALITY PLAN				BHEL Doc No.: PE-QP-999-165-N008	
P.O. No.										Item : FASTENERS				Vendor Q.P. NO:		PROJECT:			
										PACKAGE : COLTCS				CUSTOMER:					
										Date :				PURCHASER:					
										Page 15 of 15				CONSULTANT:					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks						
1	2	3	4	5	6	7	8	9	D*	M	C	O	11						
9.1.0	Internal Fasteners (Duplex Steel)	Chemical & Physical properties	Major	Chemical Mechanical analysis	1 Per heat/HT Batch	Approved sheet	drg/Data sheet	Approved sheet	drg/Data sheet	Mfr TC / Lab report	*	P	V	V					
		Visual workmanship finish	Major	Visual	Sample	Approved sheet	drg/Data sheet	Approved sheet	drg/Data sheet		—	P	V	V					
		Dimensions	Major	Measurement	Sample	Approved sheet	drg/Data sheet	Approved sheet	drg/Data sheet		—	P	V	V					
9.2.0	Main Fasteners	Visual	Major	Visual	Sample	Approved sheet	drg/Data sheet	Approved sheet	drg/Data sheet	Inspection report / Mfr TC	*	P	V	V					
		Dimensions	Major	Measurement	Sample	Approved sheet	drg/Data sheet	Approved sheet	drg/Data sheet	Inspection report / Mfr TC	*	P	V	V					
		Chemical & Physical properties	—	Chemical & Physical test	1 sample per heat	Approved sheet	drg/Data sheet	Approved sheet	drg/Data sheet	Mfr TC/Lab report	*	P	V	V					
				a) Tensile															
				b) Yield															
				c) Elongation															
				d) Proof load															
LEGEND																			
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C : Contractor O : Owner																			
Manufacturer / Sub-Contractor Signature		Contractor		Indicate : "P" - Perform, "W" - Witness and "V" - Verification						Reviewed By		Name & Sign. Of approving authority & Seal							



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-426-165-N002**

SECTION: **II**

SUB-SECTION: **IIB**

REV. NO. **0** DATE 10.05.2019

SHEET **1** OF **1**

SUB-SECTION - IIB

STANDARD TECHNICAL SPECIFICATION (ELECTRICAL)



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO. PE-SS-999-506-E101
VOLUME NO. : II-B
SECTION : D
REV NO. : 00 DATE : 29/08/2005
SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00

बी एच ई एल BHEL	TITLE : GENERAL TECHNICAL REQUIREMENTS	SPECIFICATION NO. PE-SS-999-506-E101
	FOR LV MOTORS	VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 1 OF 4

1.0

INTENT OF SPECIFIATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer’s work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0

CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement for rotating electrical machines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0

DESIGN REQUIREMENTS

3.1

Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2

Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3

Starting Requirements

3.3.1

Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2

Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 2 OF 4
The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.		
3.3.3 The following frequency of starts shall apply i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature. ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour) iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor		
3.4 Running Requirements		
3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.		
3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.		
3.5 Stress During bus Transfer		
3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.		
3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.		
3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.		
3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.		
4.0 CONSTRUCTIONAL FEATURES		
4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy		
4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.		
Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled		
4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.		

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 3 OF 4
4.4.	Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.	
4.5	Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.	
4.6	In case Class ‘F’ insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class ‘B’ insulation. In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.	
4.7	Terminals and Terminal Boxes	
4.7.1	Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A. Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet “A”.	
4.7.2	unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.	
4.7.3	Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.	
4.7.4	Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.	
4.7.5	Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.	
4.7.6	Degree of protection for terminal boxes shall be IP 55 as per IS 4691.	
4.7.7	Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.	
4.7.8.	Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.	
4.7.9	Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.	
4.8	Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.	
4.9	General	

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 4 OF 4
4.9.1 Motors provided for similar drives shall be interchangeable. 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors. 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above. 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956. 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz. 4.9.6 Name plate with all particulars as per IS: 325 shall be provided 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions. 5.0 INSPECTION AND TESTING 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied. 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser. 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan. 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A. 6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT a) OGA drawing showing the position of terminal boxes, earthing connections etc. b) Arrangement drawing of terminal boxes. c) Characteristic curves: (To be given for motor above 55 kW unless otherwise specified in Data Sheet). i) Current vs. time at rated voltage and minimum starting voltage. ii) Speed vs. time at rated voltage and minimum starting voltage. iii) Torque vs. speed at rated voltage and minimum voltage. For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling. iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.		

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :					
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION TITLE					
		SHEET 1 OF 2		SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS		
1	2	3	4	5	6	7	8	9	10	P	W	V	11	
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-			
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-			
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-			
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-			
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1				NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-			NOTE -1 & NOTE-3
BHEL			PARTICULARS			BIDDER/VENDOR								
			NAME											
			SIGNATURE											

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION : TITLE :			
		SHEET 2 OF 2		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	
NOTES: 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS		BIDDER/VENDOR				BIDDER'S/VENDORS COMPANY SEAL			
			NAME									
			SIGNATURE									
			DATE									



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-426-165-N002**

SECTION: **II**

SUB-SECTION: **IIC**

REV. NO. **0** DATE 10.05.2019

SHEET **1** OF **1**

SUB-SECTION - IIC

STANDARD TECHNICAL SPECIFICATION (C &I)



Technical specification for
CONDENSER ON LOAD TUBE CLEANING SYSTEM
1X660MW PANKI TPS EXTN.

SECTION D

REV. NO. 00

DATE : 04.04.2019

INSTRUMENTS CHECK LIST



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR TRANSMITTER

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECKS FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	VISUAL.						
	MODEL/TAG No						
2	PROCESS CONNECTION			P	W	V	
3	ACCURACY			P	W	V	
4	REPEATABILITY			P	W	V	
5	HYSTERESIS			P	W	V	
6	EFFECT OF TEMP VARIATION ON ACCURACY			P	W	V	
7	SPAN / ZERO ADJUSTMENT	ONE / TYPE		P	W	V	
8	EFFECT OF SUPPLY VOLTAGE VARIATION			P	W	V	
9	EFFECT OF LOADING (500 OHM METERS)			P	W	V	
10	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
11	BURN-IN TEST	ONE / TYPE		P	W	V	
12	DEGREE OF PROTECTION			P	W	V	
13	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- When material corelation are not available manufacturer's compliance to be provided.
- Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR PRESSURE & DP GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks	
				M	C	B		
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V		
	SENSOR TYPE							
	DIAL SIZE							
	MODEL NO/TAG NO							
	RANGE/SCALE							
	SWITCH CONTACT RATING & NOS.							
	END CONNECTION							
2	CALIBRATION				P	W	V	
	ACCURACY							
	REPEATABILITY							
	SET POINT ADJUSTMENT							
3	OVER PRESSURE & LEAK TEST			P	W	V		
4	OPERATION OF PRESSURE. RELIEF DEVICE	ONE			P	W	V	
5	REVIEW OF TC FOR	FOR LOT			V	V	V	
	MATERIALS OF SENSOR							
	MOVEMENT							
	PROCESS CONNECTION							
	HOUSING							
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V	V		
7	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V		

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- When material correlation is not available, MFR's compliance to be provided
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR LEVEL GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS / DRWGS	P	W	V	
	TYPE						
	MODEL/ TAG NO.						
	DAIL SIZE						
	RANGE/SCALE						
	END CONNECTION						
2	DIMENSIONS, PROCESS CONNECTION	ONE / LOT		P	W	V	
3	ACCURACY			P	W	V	
4	MATERIAL TC FOR			P	V	V	
	BODY ISO.						
	VALVE						
	GAUGE GLASS						
5	HYD. TEST	SEE NOTE-1 BELOW		P	W	V	
6	ACCESSORIES AS APPLICABLE			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR ANNUNCIATORS

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE/ MODEL						
	DIMENSIONS OF HARDWARE						
	MODULARITY						
	SEQUENCE						
	FACIA DETAILS						
2	FUNCTIONAL TEST	100%		P	W	V	
3	IMMUNE TO STEP VARIATIONS IN THE POWER SUPPLY	SEE NOTE-1 BELOW		P	W	V	
4	DEGREE OF PROTECTION FOR ENCLOSURE	TYPE TEST		P	W	V	
5	I/R CHECK	SEE NOTE-1 BELOW		P	W	V	
6	RESPONSE			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-I056						
										VOLUME		IIB				
										SECTION		D				
										REV. NO.		01		DATE: 22-02-2008		
										SHEET		1		OF 7		
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks				
									P	W	V					
INCOMING																
1.0	Sheet Steel (ORCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	Relevant standard	Relevant standard	Test Certificate	3	---	2					
		2. Bend Test	CR	Mech. test	Sample	Relevant standard	Relevant standard	Log Book	2	---	---					
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---					
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---					
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---					
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	1					
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	Relevant standard	Relevant standard	Log Book	2	---	---					
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---					
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---					
		4. Mill marking	MA	Visual	100%	Relevant standard	Relevant standard	Log Book	2	---	1					
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---					
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---					
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics													\$ P W V 1 - BHEL 2 - Vendor 3 - Sub-vendor			



PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	PE-QP-999-145-I056
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SHEET 2 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
		3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measurement Visual	100% 100% 100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	----	----	----
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	3	----	----	2
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Relays Timers Space Heaters Thermostat Indicating meters etc.	1. Verification at make and Type	CR	Visual	Sample	BHEL Spec. and BOM	BHEL Spec. and BOM	Log Book	2	----	----	----
		2. Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs.	100%	Relevant standard	Relevant standard	Log Book	2	----	----	----
		3. Operation / Functional check	CR	Electrical	Sample+ 100%@	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	----	----	+
		4. I.R.	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	----	----	@
		5. H.V.	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	----	----	components except relays & contactors.
		6. Calibration	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	----	----	1
		7. Pick up / Drop off Voltage	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	----	----	----
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. \$ 1 - BHEL 2 - Vendor 3 - Sub-vendor												

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

- P - Agency Performing the Test.
- W - Agency Witnessing the Test.
- V - Agency Verifying the Test.

- 1 - BH&E
- 2 - Vendor
- 3 - Sub-vendor

 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL						STD QUALITY PLAN NO.: PE-QP-999-145-I056 VOLUME IIB SECTION D REV. NO. 01 DATE: 22-02-2008 SHEET 4 OF 7				
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
9.0	Pre-treatment and Painting	1. Pretreatment Process 2. Process parameters like bath temp. concentration etc. 3. Dipping / Removal Time 4. Surface quality after every dip 5. Primer after phosphating 6. Putty Application & Rubbing after primer 7. Paint first coat 8. Putty Application and Rubbing after first coat of paint 9. Paint second coat	MA MA MA MA MA MA MA	Visual Measurement Measurement Visual Visual, Thickness Visual Visual, Thickness, Scratch test Colour adhesion	100% Periodic 100% 100% 100% 100% 100%	Factory Standard & Relevant standard Factory Standard & Relevant standard Factory Standard & Relevant standard Factory Standard & Relevant standard Factory Standard & Relevant standard Factory Standard & Relevant standard Factory Standard & Relevant standard	Factory Standard & Relevant standard Factory Standard & Relevant standard Factory Standard & Relevant standard Factory Standard & Relevant standard Factory Standard & Relevant standard Factory Standard & Relevant standard Factory Standard & Relevant standard	Log Book Log Book Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2 2 2	--- --- --- --- --- --- ---	1 1 1 1 1 1 1	

LEGEND: * CR
MA
MI

- Critical characteristics
- Major characteristics
- Minor characteristics

\$ P
W
V

- Agency Performing the Test.
- Agency Witnessing the Test.
- Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-I056					
										VOLUME		IIB			
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										SHEET		5		OF 7	
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
10.	Panel Wiring	1. Wiring Layout 2. Wiring Termination (Crimped Lugs) 3. Ferrule numbers 4. Colour of wiring 5. Size of Conductor	MA MA MA MA MA	Visual Visual Visual Visual Measurement	100% 100% 100% 100% 100%	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2	--- --- --- --- ---	--- --- --- 1 1				
11.	Component Mounting	1. Correct components 2. Fixing	MA MA	Visual Visual	100% 100%	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Log Book Log Book	2 2	--- ---	--- ---				
12.	FINAL Final Inspection	1. Workmanship 2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components 3. Components identification Marking / Name plates	MA MA MA	Visual Visual Visual	100% 100% 100%	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Inspection Report Inspection Report Inspection Report	2 2 2	1 1 1	1 1 1	At Random by BHEL, based on 100 % internal test reports by Mfr.			
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics															
\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test															
1 - BHEL 2 - Vendor 3 - Sub-vendor															

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-I056					
										VOLUME		IIB			
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Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.			
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1				
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1				
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1				
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1				
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1				
		11. Wire Termination	MA	Pulling manually	Sample	----	Firm termination	Inspection Report	2	1	1				
		12. Continuity	MA	Electrical	100%	----	Continuity OK	Inspection Report	2	1	1				

LEGEND: * CR - Critical characteristics
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MI - Minor characteristics

\$ P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL												STD QUALITY PLAN NO.: PE-QP-999-145-I056			
PEM :: C&I												VOLUME IIB			
												SECTION D			
												REV. NO. 01 DATE: 22-02-2008			
												SHEET 7 OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IEC-60947, IEC-60079	BHEL approved spec., drg relevant IEC-60947, IEC-60079	Type Test Certificate	3	---	1				
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant standard	BHEL approved spec., drg., BOM & relevant standard	Test Report	2	1	1				
15	FUNCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1				
		2. Instrument Calibration	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1				
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant standard	BHEL approved spec/drg & relevant standard	Inspection Report	2	1	1				

LEGEND: * CR - Critical characteristics
 MA - Major characteristics
 MI - Minor characteristics

\$ P W V
 - Agency Performing the Test.
 - Agency Witnessing the Test.
 - Agency Verifying the Test.

1 - BHEL
 2 - Vendor
 3 - Sub-vendor



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-426-165-N002**

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 10.05.2019

SHEET **1** OF **1**

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER

	TITLE : SCHEDULE OF PERFORMANCE GUARANTEES FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM (COLTCS)	SPEC. NO. PE-TS- 426-165-N002	
		SECTION: III	
		Sheet 1 of 1	Date- 10.05.2019

S.NO.	DESCRIPTION	UNITS	PANKI TPS EXTENSION – 1X660 MW
1.	Pressure drop across the ball collecting Strainers (i.e. between inlet & outlet nozzle) under clean condition and Normal flow condition	MWC	
2	Percentage of ball recovery	%	
3	Life of sponge rubber balls	Weeks	

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	
				COMPANY SEAL

	COMPLIANCE CERTIFICATE FOR COLTCS	SPEC. NO.	PE-TS- 426 -165-N002
		DATE:	10.05.2019
		SHEET	1 OF 2

COMPLIANCE CERTIFICATE

The bidders shall confirm compliance with following by signing/ stamping this compliance certificate and furnish 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 with regard to same.
- b) There are no other deviations w.r.t. specification other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ Customer/Customer's Consultant approval and 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. Charges for 3rd party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself.
- d) Any drawing/ document/ data-sheet/ calculation/ Quality plan/ Instrumentation etc. submitted along with the offers shall be considered for reference only, same shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification. For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.
- f) The commissioning spares including balls shall be supplied on 'As Required Basis' and to be supplied at the time of commissioning of COLTCS system & prices for same included in the base price itself.
Prices for special tools & tackles, if any, shall also be included in the base price.
Recommended spares for 3 years shall be quoted separately with price indicated separately.
- g) Charges for Installation Checks, Commissioning of equipments, Trial runs and Performance Testing at site shall be included by bidder as per the price format.
- h) The main flanges for Ball separator shall be suitable for the forces and moments as per the specification.
- j) Injection nozzles – 2/4 numbers of stubs of 100 NB or size as informed by bidder shall be provided by BHEL. The injection nozzles, counter flanges for the stubs along with nuts, bolts and gaskets shall be supplied by the bidder.
- k) Number of balls (Normal as well as abrasive) for COLTCS shall be as specified i.e Number of balls per charge shall be @ 10% of no. of tubes per condenser section.
- l) The hydrostatic test pressure shall be 1.5 times the design pressure.
- m) All sub - vendors shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
- n) The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Customer/Customer's Consultant.
- o) The orientation of piping around COLTCS shall be finalised during detailed Engg.
- p) Electrical/ C&I :

	COMPLIANCE CERTIFICATE FOR COLTCS	SPEC. NO.	PE-TS- 426 -165-N002
		DATE:	10.05.2019
		SHEET	2 OF 2

- All selected motor ratings have minimum 15 % margin over maximum continuous demand of the driven equipment including voltage and frequency variations, temperature rise and other factors.
- Supply of electrical viz. LT power cables, instrumentation and control cables, cable glands, lugs, cable trays etc. shall be as per specification. Their erection shall be done by BHEL
- The junction boxes for termination of DPT/ DPS/ Actuator LS / solenoid valves/ Ball valve monitor/ Ball recirculating monitor are included in bidder's scope. The instrumentation cable and cabling from instruments/ actuators to junction boxes is also included in bidder's scope.
- Valve actuators and controls shall be provided as specified in Data Sheet-A and Project specific requirements as specified in Sub-Section IB & Section IC.
- Alarms/ annunciations/ instruments shall be finalised during detailed engineering in the event of order which shall be subject to BHEL/ Customer/Customer's Consultant approval and shall be without any commercial implications to BHEL.



Title

DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.

PE-TS-999-165-N001

VOLUME III

PART A

SHEET I

OF 13

INSTRUCTION
TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PES-179-01

Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.

PARTICULARS

ITEM

UNIT

1.0

General :

1.1

Number of Tube Cleaning System sets
being supplied.

Nos.

1.2

Type

1.3

Liquid handled

1.4

Manufacturer

1.5

Country of origin

2.0

Design :

2.1

Design Pressure

Bar (g)

a) Ball Separator

b) Ball Recirculating Pump

c) Ball Collector

d) Piping

e) Valves

f) Distributors

g) Injection Nozzles

2.2

Design Temperature

°C

2.3

Operating pressure at condenser inlet

Bar (g)

2.4

Design differential pressure

Bar (g)

2.5

Flow rate through ball separator

M³/hr

a) Normal

b) Maximum allowable

2.6

Flow rate through ball collector

M³/hr

a) Normal

b) Maximum allowable

Name of

Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor

Authorised Representative

Date



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME	III	PART	A
SHEET	2	OF	13

INSTRUCTION TO BIDDER 1. This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
3.0	Guaranteed Performance	
3.1	Whether condenser back pressure/overall heat transfer coefficient is guaranteed that it will be permanently maintained as long as the tube cleaning system is in operation.	YES/NO
3.2	Pressure drop across the ball separator (i.e., between inlet and outlet connections) :	
	a) Normal flow condition	
	b) Maximum allowable flow condition	
3.3	Power consumption by ball recirculating pump during :	KW
	a) Normal operation	
	b) Ball collection operation	
	c) Ball sorting operation	
3.4	Quantity of cleaning balls required per set for an operating period of one year	Nos.
4.0	Operation :	
	Whether tube cleaning system is designed for the following operation modes :	
4.1	Automatic start-up initiated by push button.	YES/NO
4.2	Automatic shut-down with ball collection effected by :	
	a) Push button	YES/NO
	b) Adjustable timer	YES/NO
	Ball monitoring system	YES/NO

Name of Bidder/ Vendor					
Revision Number	0	1	2	3	4
Signature of Bidder/ Vendor Authorised Representative					

	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001			
			VOLUME III		PART A	
			SHEET 3		OF 13	
INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PES-179-01. Section - D, Volume - IIB. 2. Items which deviate from Specification shall be marked with an asterisk (*)				
SL.NO.	ITEM	UNIT				
PARTICULARS						
4.3	Automatic backwashing of ball separator with ball collection effected by :					
	a) Differential pressure measuring system				YES/ NO	
	b) Adjustable timer				YES/ NO	
	c) Push button				YES/ NO	
4.4	Automatic emergency backwashing of ball separator effected by differential pressure measuring system.				YES/ NO	
4.5	Automatic flushing of differential pressure measuring system.				YES/ NO	
4.6	Automatic ball sorting initiated by push button.				YES/ NO	
4.7	Whether provision for manual operation of the complete tube cleaning system is made in case of control system failure.				YES/ NO	
5.0	Ball Separator :					
5.1	Make					
5.2	Nos. provided per set		Nos.			
5.3	Code/ Standard					
5.4	Body outer diameter		mm			
5.5	Body thickness		mm			
5.6	Manhole type & size		mm			
5.7	Whether sight glass is provided					
5.8	No. of screens/ strainers provided per each ball separator		Nos.			
5.9	Type of arrangement provided to prevent lodging of the debris at the entrance of ball extraction pipes.					
Name of Bidder/ Vendor						
Revision Number		0	1	2	3	
Signature of Bidder/ Vendor						
Authorised Representative						
Date						



Title

DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.

PE-TS-999-165-N001

VOLUME

III

PART A

SHEET

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OF

13

INSTRUCTION
TO BIDDER

1

This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.

PARTICULARS

ITEM

UNIT

5.10

Clearance between screen/ strainer
bars.

mm

5.11

Materials :

a) Body/ Housing

b) screen/ Strainer section

c) Screen/ Strainer shaft

d) Hardware for fixing the screen/
Strainer

e) Other internal hardware

f) External hardware

5.12.

Lining material (if applicable)

6.0

Ball Recirculating Pump :

6.1

Make

6.2

Nos. provided per set

Nos.

6.2

Design discharge flow

M³/hr

6.4

Design discharge pressure

Bar

6.5

Design pump Speed

RPM

6.6

Design pump efficiency

%

6.7

Seal for the pump

6.8

Materials :

a) Casing

b) Impeller

c) Shaft

7.0

Ball Collector :

7.1

Nos. provided per set

Nos.

Name of
Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor

Authorised Representative



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III PART A
SHEET 5 OF 13

INSTRUCTION TO BIDDER 1. This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO. PARTICULARS	ITEM	UNIT
7.2	Code/ Standard	
7.3	Whether inspection window/ sight glass is provided.	YES/ NO
7.4	Materials : a) Shell/ Body b) Internals	
7.5	Lining material (if applicable)	
7.6	Whether provision for separating and collecting the undersized balls, is made	YES/ NO.
8.0	Differential Pressure Measuring System:	
8.1	Differential Pressure Switch/ Transmitter a) Type b) Make and Model c) Range d) Accuracy e) Material of sensing element f) No. of contacts g) Contact rating h) Enclosure i) Mounting	Nos.
8.2	Whether differential Pressure gauge is provided for manual observation.	
8.3	Differential Pressure Gauge : a) Type b) Make and Model c) Range	

Name of
Bidder/ Vendor

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Signature of Bidder/ Vendor
Authorised Representative



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III **PART** A
SHEET 6 **OF** 13

INSTRUCTION TO BIDDER 1. This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
d) Accuracy		
e) Material of sensing element		
f) No. of contacts	Nos.	
g) Dial size	mm	
h) Enclosure		
i) Mounting		
8.4	Whether the contacts for differential pressure gauge and switch/ transmitter are independent.	YES/ NO
9.0	Timer for Backwashing	
9.1	Timer make	
9.2	Range of duration setting	
9.3	Range of frequency	
10.0	Ball Monitoring System :	
10.1	Type	
10.2	Maake & Model	
10.3	Whether ball monitoring system is designed to perform the following functions :	
	a) Continuously counting the balls in circulation and giving an alarm calling for investigation of ball losses, when the number of circulating balls falls below a set value	YES/ NO
	b) Continuously measuring the size of the balls in circulation and initiating the shut-down of the tube cleaning system with alarm calling for replacement of balls, when the number of oversized balls falls below a set value.	

Name of Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor
Authorised Representative

Date



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001
VOLUME III PART A
SHEET 7 OF 13

INSTRUCTION TO BIDDER 1. This data sheet shall be read in conjunction with Specification No. PES-179-01 Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
10.4	Whether electronic processor of the ball monitoring system is provided with the following a) Indicators for ♦ Required basic ball charge ♦ Recirculating Ball quantity ♦ Oversized ball quantity b) Time counters for ♦ Total cleaning system operating hours ♦ Cleaning system operating hours with sufficient number of oversized balls c) Recorder for ball consumption	YES/ NO YES/ NO YES/ NO YES/ NO. YES/NO YES/NO
10.5	Whether provision for Self-testing and Self Calibration are made	YES/NO
11.0	Cleaning Balls :	
11.1	Type	
11.2	Size	mm
11.3	Specific gravity	
11.4	Material	
11.5	Hardness	
11.6	Total Ball recirculation quantity per set	Nos.
11.7	abrasive coated ball recirculation quantity per set - (if any)	No.s
12.0	Piping :	
12.1	Ball Extraction Piping	

Name of Bidder/ Vendor					
Revision Number	0	1	2	3	4
Signature of Bidder/ Vendor					
Authorised Representative					

	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)	SPECIFICATION NO. PE-TS-990-165-N001			
		VOLUME III		PART A	
		SHEET 8 OF 13			

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PES-179-01 Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	PARTICULARS	ITEM	UNIT
12.2	Ball Transport Piping	a) OD x thicknes b) Material c) Length of piping being supplied	mm x mm M
12.3	Differential pressure measuring system flushing piping.	a) OD x thicknes b) Material c) Length of piping being supplied	mm x mm M
2.4	Any other		
3.0	Valves (Indicate Type of Valves)		
3.1	Sizes		: mm
3.2	Nos. provided per set		Nos.
3.3	Materials		
	a) Body b) Disc/ Trim c) Shaft		
4.0	Distributors		
4.1	Nos. provided per set		Nos.
4.2	Materials :		
	a) Body b) Sight glass c) Sight glass flanges d) Internal parts		

Name of Bidder/ Vendor					
Division Number	0	1	2	3	4
Signature of Bidder/ Vendor					
Authorised Representative					
Date :					



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III **PART** A
SHEET 9 **OF** 13

INSTRUCTION TO BIDDER
1. This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO. PARTICULARS	ITEM	UNIT
14.3	Lining material (if applicable)	
15.0	Injection Nozzles :	
15.1	Nos. provided per each CW inlet pipe	Nos.
15.2	Size of the stubs to be provided in CW inlet pipe for installing the injection nozzles.	mm
15.3	Material	
15.4	Lining material (if applicable)	
16.0	Actuators :	
16.1	Actuators for ball separator :	
	a) Nos. provided per ball separator	No.s
	b) Type & make	
	c) Motor rating	KW
16.2	Actuators for ball collector	
	a) Nos. provided per ball collector.	No.s
	b) Type & make	
	c) Motor rating	KW
16.3	Actuators for Valves:	
	a) Nos. provided per set	No.s
	b) Type & motor	
	c) Motor rating	KW
16.4	Any other	

Name of Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor
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Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III **PART** A
SHEET 10 **OF** 13

INSTRUCTION TO BIDDER 1. This data sheet shall be read in conjunction with Specification No. PES-179-0:
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
17.0	Electric Drive Motors	
17.1	Drive motor for recirculating pump :	
	a) Type and make	
	b) Rating	KW
17.2	Drive motor for differential pressure measuring system flushing pump (if applicable)	
	a) Type and make	
	b) Rating	KW
17.3	Any other.	
18.0	Control Panel	
18.1	Type	
18.2	Model & Manufacturer	
18.3	Operating Voltage/ frequency	V/ Hz
18.4	Control Voltage/ frequency	V/ Hz
18.5	Materials of housing and door	
18.6	Protections/ interlocks provided for :	
18.7	Class of Protection	
18.8	Control Hardware	
18.8	Alarms/ Annunciations provided for :	
18.9	Indicators provided for :	
18.10	Whether interconnecting control and power cabling between the control panel and various drive is included in the offer.	
19.0	Pressure gauges :	
19.1	Manufacturer & Type, Model	

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Signature of Bidder/ Vendor

Authorised Representative

Date



Title **DATA SHEET - B**
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO. **PE-TS-999-165-N001**

VOLUME III PART A
SHEET 11 OF 13

INSTRUCTION
TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PES-179-01 /
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
19.2	Nos. provided per set	Nos.
19.3	Location	
19.4	Dial size	mm
19.5	Range & Accuracy	
19.6	Materials of construction : a) Sensing element b) Movement c) Casing	
19.7	Enclosure	
19.8	Mounting	
20.0	Counter Flanges :	
20.1	Whether counter flanges complete with gaskets, bolts and nuts etc. for all terminal points are included in the offer.	YES/ NO
20.2	Type	
20.3	Rating	
20.4	Materials a) Flanges b) Bolts and Nuts c) Gaskets	
20.5	Code/ Standard	
21.0	Whether lifting arrangement is provided for various equipments.	YES/ NO.
22.0	Whether ball recirculating pump, ball collector with interconnecting piping and valves are mounted on a single frame.	YES/ NO
23.0	Whether supports (wherever necessary) complete with foundation plates, bolts, nuts, inserts etc. are included in the offer.	YES/ NO

Name of
Bidder/ Vendor

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Signature of Bidder/ Vendor
Authorised Representative

Date :



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
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VOLUME III **PART** A
SHEET 12 **OF** 13

INSTRUCTION
TO BIDDER

1. This data sheet shall be read in conjunction with Specification No PES-179-01
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	PARTICULARS	ITEM	UNIT
24.0	Shop Inspection and Tests		
24.1	Whether all the tests and inspections as detailed in the specification/ quality plan are carried out.		YES/NO
24.2	Hydrostatic Test :		
	a) Test Pressure	Bar (g)	
	♦ Ball Separator		
	♦ Recirculating Pump		
	♦ Ball Collector		
	♦ Distributors		
	♦ Injection nozzles		
	♦ Piping & Valves		
	a) Test duration	Minutes	
24.3	Lekage Test :		
	a) Test Pressure	Bar (g)	
	b) Test duration	Minutes	
25.0	Painting :		
25.1	External Surfaces :		
	a) Surface Preparation		
	b) Primer		
	a) Finish		
25.2	Internal Surfaces :		
	a) Surface Preparation		
	b) Primer		
	a) Finish		
26.0	Weights :		
26.1	Empty Weight	Kg.	
	a) Ball Separator		

Name of
Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor
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Title

DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.

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INSTRUCTION
TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PES-179-01

Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
b) Recirculating pump c) Ball collector d) recirculating unit		
26.2 Operating weight	kg	
a) Ball Separator b) Recirculating pump c) Ball collector d) recirculating unit		
26.3 Weight of the heaviest equipment/ assembly to be handled.	kg.	
27.0 Overall Dimensions		
27.1 Ball Separator		
27.2 Recirculating Unit		
28.0 Other information (if any)		
G:\MSEVASH\DS-COTCS.RTF		

Name of

Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor

Authorised Representative

	TITLE MOTORS DATA SHEET – C (TO BE FILLED FOR EACH TYPE)	TECHNICAL SPECIFICATION NO: PE-TS-426-165-N002
		SECTION III
		REV NO. 00 DATE 05.04.17
		SHEET 1 OF 2

S. No.	Description		Data to be filled by successful bidder
A.	General		
1	Manufacturer & country of origin		
2	Motor type		
3	Type of starting		
4	Name of the equipment driven by motor & Quantity		
5	Maximum Power requirement of driven equipment		
6	Rated speed of Driven Equipment		
7	Design ambient temperature		
B.	Design and Performance Data		
1	Frame size & type designation		
2	Type of duty		
3	Rated Voltage		
4	Permissible variation for		
5	a	Voltage	
6	b	Frequency	
7	c	Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)		
9	Synchronous speed & Rated slip		
10	Minimum permissible starting voltage		
11	Starting time in sec with mechanism coupled		
12	a) At rated voltage		
13	b) At min starting voltage		
14	Locked rotor current as percentage of FLC (including IS tolerance)		
15	Torque		
	a) Starting		
	b) Maximum		
16	Permissible temp rise at rated output over ambient temp & method		
17	Noise level at 1.0 m (dB)		
18	Amplitude of vibration		
19	Efficiency & P.F. at rated voltage & frequency		
	a) At 100% load		
	c) At 75% load		

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTORS DATA SHEET – C (TO BE FILLED FOR EACH TYPE)	TECHNICAL SPECIFICATION NO: PE-TS-426-165-N002
		SECTION III
		REV NO. 00 DATE 05.04.17
		SHEET 2 OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating $\geq 55KW$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			