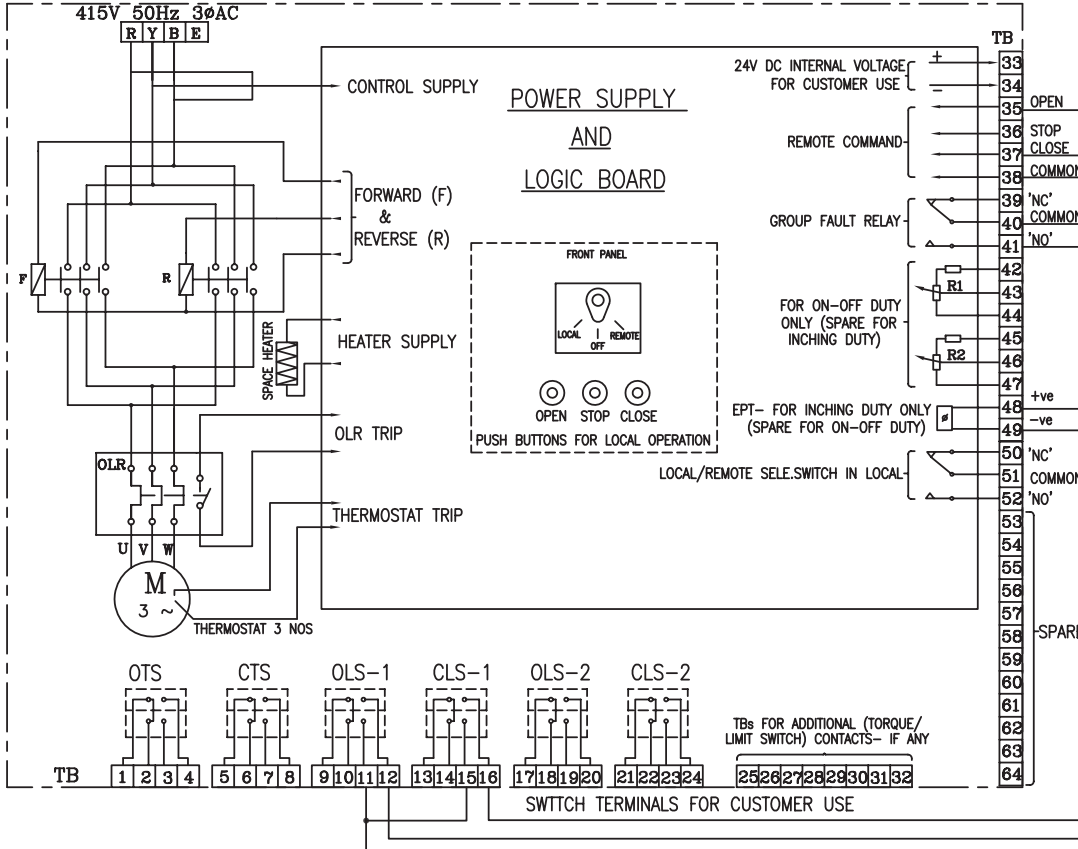


	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-SS-421-145-I007	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE: 06.10.16
			SHEET 1	OF 3
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL *	* PROJECT	2X660MA BIFPCL, MAITREE BANGLADESH		
	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 0-55 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, DUST TIGHT, WEATHER PROOF, SUITABLE FOR OUTDOOR USE WITHOUT CANOPY, IP:65		
	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 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.		
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 SEVEN TIMES THE RATED CURRENT as per IEC-60034-30		
	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	☒ BLUE (RAL 9003) ☐		
	PAINT TYPE (## Refer Notes)	☐ ENAMEL ☒ EPOXY ☐		
	SHAFT RPM	BIDDER TO SPECIFY		
	OLR SET VALUE	BIDDER TO SPECIFY		
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY		Starting current shall not exceed 7 times rated current as per IEC 60034 for IE-3 motors.
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-SS-421-145-I007			
			VOLUME II B			
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			SHEET	2	OF	3
Data Sheet A & B						
DATA SHEET-A (TO BE FILLED BY PURCHASER)					DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC				
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V				
	@ ENCLOSURE CLASS OF MOTOR	☐ IP 67 ☐ FLAME PROOF				
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B				As per IEC-60034
	@ 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 ☐ 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 / CLOSE PB	☒ REQUIRED ☐ NOT REQUIRED				
	STOP PB	☒ REQUIRED ☐ NOT REQUIRED				
	INDICATING LAMPS	☒ REQUIRED ☐ NOT REQUIRED				
	LOCAL REMOTE S/S	☒ REQUIRED ☐ NOT REQUIRED				
	STATUS CONTACTS FOR MONITORING	☒ REQUIRED ☐ NOT REQUIRED				
INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)					
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	☒ INTERPOSING RELAY ☐ OPTO COUPLER ☐ EITHER				The coils of interposing relays shall be connected to freewheeling diode.
	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 240V 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)	MFR & MODEL NO.	BIDDER TO SPECIFY				
	OPEN : INT : CLOSE	☒ 1 No ☐ 2 Nos.	2 Nos. (ADJ.)	☒ 1 No. ☐ 2Nos.		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-SS-421-145-I007	
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			SHEET 3	OF 3
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
for Smart Actuator) (\$\$ Refer Notes)	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC		
POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	☒ REQUIRED ☐ NOT REQUIRED		
	MFR & MODEL NO.	BIDDER TO SPECIFY		
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ☒ ELECTRONIC (2 WIRE) CONTACTLESS		
	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 @ ☐		
	@ EARTHING TERMINAL	REQUIRED		
	PLUG & SOCKET (9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	☒ REQUIRED ☐ NOT REQUIRED ☒ 2 NOS. ☐		
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:-----		
	@ SPACE HEATER CABLE GLAND	SIZE:-----		
	OTHER CONTROL CABLE GLANDS-1	☐ 1No. for BFV of CW PUMP (Cable size 2Px1.5mm2)		
	OTHER CONTROL CABLE GLANDS-2	QUANTITY & SIZE :-----		
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY		_____ Kg.
NOTES: 1. SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY. 2. CODES & STANDARDS: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST INTERNATIONAL STANDARD (INDIAN CODES ARE NOT ACCEPTABLE). 3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C. 4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED. 5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE. 6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -6% TO +4% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%. 7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING. \$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE. ## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.				
NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @ = TO BE FILLED BY ES				

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- NOTE:-
- 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
 - CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
 - OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
 - OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN
 - CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE
 - EPT - ELECTRONIC POSITION TRANSMITTER (CONTACTLESS TYPE, FOR INCHING DUTY)
 - R1-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
 - FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
 - M - MOTOR 3φ 415V 50 Hz AC SUPPLY
 - TORQUE SWITCH BYPASS WITH LIMITSWITCH BOTH ON OPEN & CLOSE DIRECTION TO BE DONE INTERNALLY.

REV	DATE	ALTERED
		CHD & APPD

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)			
DEPT	VL	SCALE	WEIGHT (KG).	REFERENCE INFORMATION	NO. OF ITEMS
CODE	-	NTS	-		-
TITLE WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET				CARD CODE U 01	REV 0
Bharat Heavy Electricals Ltd. UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI-620014.		DRN CHD APPD	NAME N.P.ESWAR D.DINAKARAN K.ARUNACHALAM	SIGN N.P D.D K.A	DATE 17.03.05 17.03.05 17.03.05
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CONTACT DEVELOPMENT DIAGRAM			
OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL	
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL	
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL	
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL	
OLS-1	9-10		
	11-12		
CLS-1	13-14		
	15-16		
OLS-2	17-18		
	19-20		
CLS-2	21-22		
	23-24		
SWITCH	TERMINAL NO.	VALVE POSITION	
	FULL OPEN	a	INTERMEDIATE
		b	FULL CLOSE
CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC			

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH			
VALVES	OPEN		CLOSE
	MAIN	BACK UP	MAIN
GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS
# - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT			
* - BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)			



Technical specification
for
2X660 MW MAITREE STPP, BANGLADESH

SECTION: D

REV. NO. 00

DATE : 05.12.2017

LCP SPECIFICATION & DATASHEET



SPECIFICATION FOR LOCAL PANELS

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

VOLUME II B

SECTION D

REV. NO. 03

DATE : 20-11-2017

SHEET 1 OF 5

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 International standards as mentioned in codes and standard section of this specification.

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.
- 3.1.7 The class of protection shall be in accordance with Cl. No. B0.6.18.4 – "Installation conditions and protection class for electrical operational equipment and control and monitoring equipment" under section IA-Customer's general technical specification – B0. Also refer Cl. No. B0.6.18.15 for Local control points.
- 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.



SPECIFICATION FOR LOCAL PANELS

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- 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 along with 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 colored 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 colored 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 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 an ac environment) of each panel.



SPECIFICATION FOR LOCAL PANELS

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VOLUME II B

SECTION D

REV. NO. 03

DATE : 20-11-2017

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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.

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.



SPECIFICATION FOR LOCAL PANELS

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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

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.

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



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A		
VOLUME	II B	
SECTION	D	
REV. NO. 03	DATE : 20-11-2017	
SHEET	5	OF 5

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 along with 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 Sheet No. PES-145A-DS2-0
2. GA Drawing indicating layout of instruments, construction details, foundation details, cable gland plate along with 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 dispatch, 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 |



DATA SHEET FOR LOCAL PANELS

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

VOLUME

SECTION

REV. NO.

DATE: 05.12.2017

SHEET 1 OF 2

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
	ENCLOSURE SHEET THICKNESS	FRONT	☒ 2.0 mm
		OTHER	☒ 2.0 mm
		DOOR	☒ 2.0 mm
		HEIGHT	☒ 2365 mm for stand-alone panels
OTHER		☒ Load bearing sheet front shall have 3.0 mm thickness	
TECHNICAL	INPUT POWER SUPPLY (ANY OTHER POWER REQUIREMENT TO BE DERIVED FROM THIS SUPPLY ONLY)		☒ 240 V AC (Supply feeder)/ 415V 3 PHASE 4W ☐ 415V 3 PHASE 3W Kindly refer electrical scope between BHEL & Vendor
	NO. OF FEEDERS		☐ ONE ☐ TWO Kindly refer electrical scope between BHEL & Vendor
	STARTER WITH MCC		☒ REQUIRED (IN VENDOR'S CONTROL PANEL) ☐ NOT REQUIRED
	IPR POSITION		☒ STARTER CUM CONTROL PANEL (IN VENDOR'S SCOPE)
	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, to be decided during detailed engg.)
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		Shall be decided during detailed Engg.
	TEMP SCANNER		☐ REQUIRED ☒ NOT REQUIRED
	MIMIC (TYPE OF MIMIC- MATERAIL, THICKNESS TO BE SPECIFIED DURING DETAILED ENGG.)		☐ REQUIRED ☒ NOT REQUIRED
	PAINT TYPE		FOR PAINT TYPE & COLOR: - REFER Cl. No. B0.6.9 – SIGNS & COLOUR CODE GIVEN UNDER CUSTOMER SPECIFICATION B0.
	PANEL COLOUR (EXTERNAL)		
	FINISH (EXTERNAL)		
	PANEL COLOUR (INTERNAL)		
	FINISH (INTERNAL)		
	CLASS OF PROTECTION		REFER Cl. No. B0.6.18.4 of Customer spec B0
	CONTROL HARDWARE		☒ Push buttons along with status indications
	FOUNDATION ARRANGEMENT		☐ FOUNDATION BOLTS ☐ ANCHOR FASTENERES
	WEIGHT OF PANEL (Kg.)		(Vendor to specify)
	PANEL TYPE		☐ PRESSURISED ☒ UNPRESSURISED
	CABLE GLAND		☒ DOUBLE COMPRESSION Kindly refer electrical scope between BHEL & Vendor
	AMMETER (TYPE OF INPUT)		☐ 1 Amp CT ☐ 4-20 mA
	SCOPE OF SUPERVISION FOR ERECTION & COMMISSIONING		☐ APPLICABLE ☒ NA



DATA SHEET FOR LOCAL PANELS

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

VOLUME

SECTION

REV. NO.

02

DATE: 05.12.2017

SHEET

2

OF

2

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			
	CONSTRUCTION		☐ FOLDED	☐ WELDED
	ENCLOSURE SHEET THICKNESS	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 MIMIC			
	THICKNESS OF MIMIC			
	PANEL COLOUR (INTERNAL)			
	FINISH (INTERNAL)			
	CLASS OF PROTECTION			
	CONTROL HARDWARE			
	FOUNDATION ARRANGEMENT			
	WEIGHT OF PANEL (Kg.)			
	PANEL TYPE			
	CABLE GLAND			
	AMMETER (TYPE OF INPUT)			
	SCOPE OF SUPERVISION			



Technical specification
for
2X660 MW MAITREE STPP, BANGLADESH

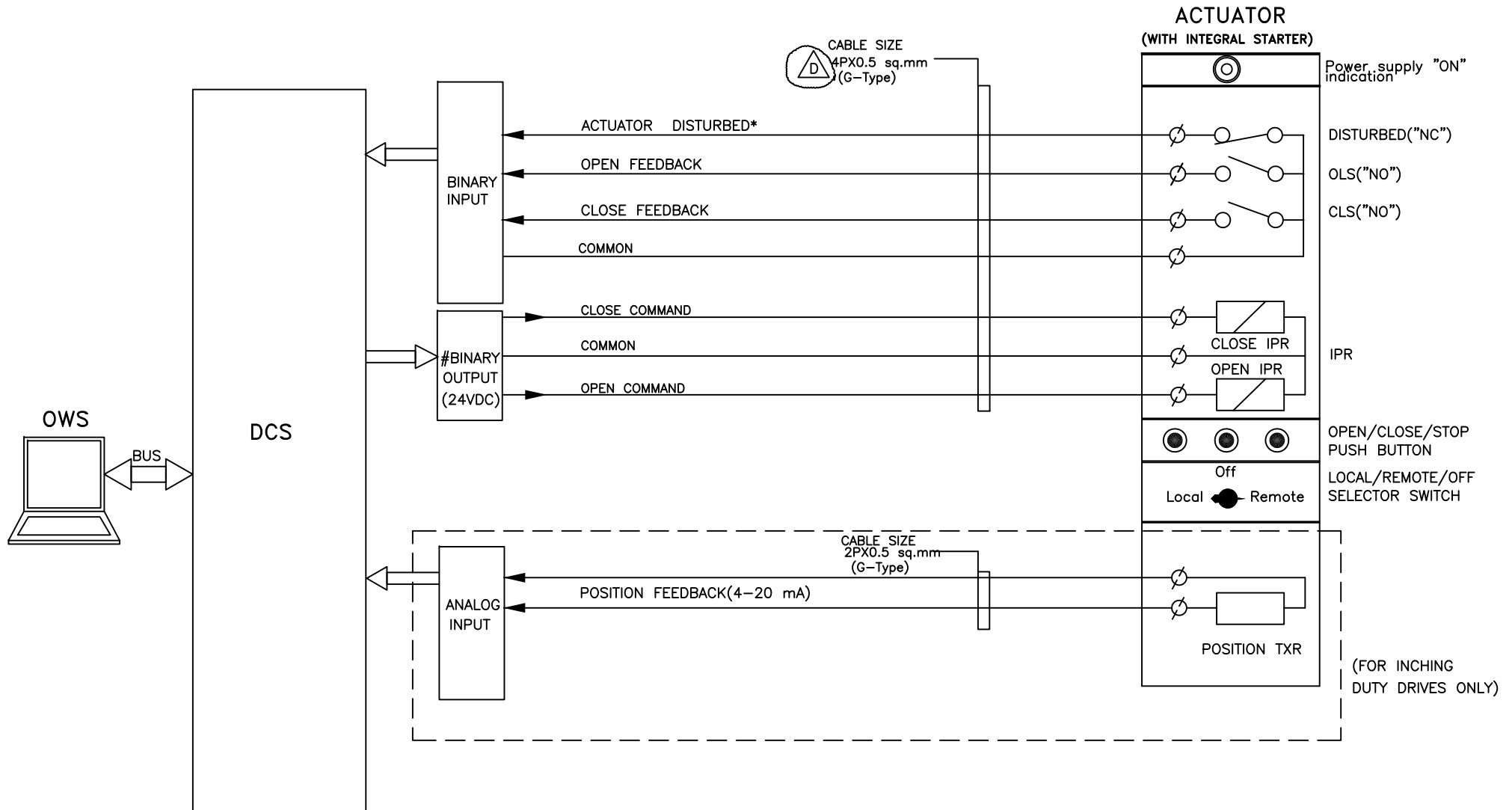
SECTION: D

REV. NO. 00

DATE : 05.12.2017

DRIVE CONTROL PHILOSOPHY

DCS INTERFACE FOR BIDIRECTIONAL DRIVE(WITH INTEGRAL STARTER)



NOTE:

- * DISTURBED= Loss of Power supply (1 Phase/3 Phase)/
Loss of control supply/ Motor thermostat trip/
Thermal over load/
Local/Off/Remote Sel. switch in local or off mode/
Stop PB optd.

#BINARY=
OUTPUT

Redundant output shall be provided



PROJECT: 2X660MW BIFPCL MAITREE

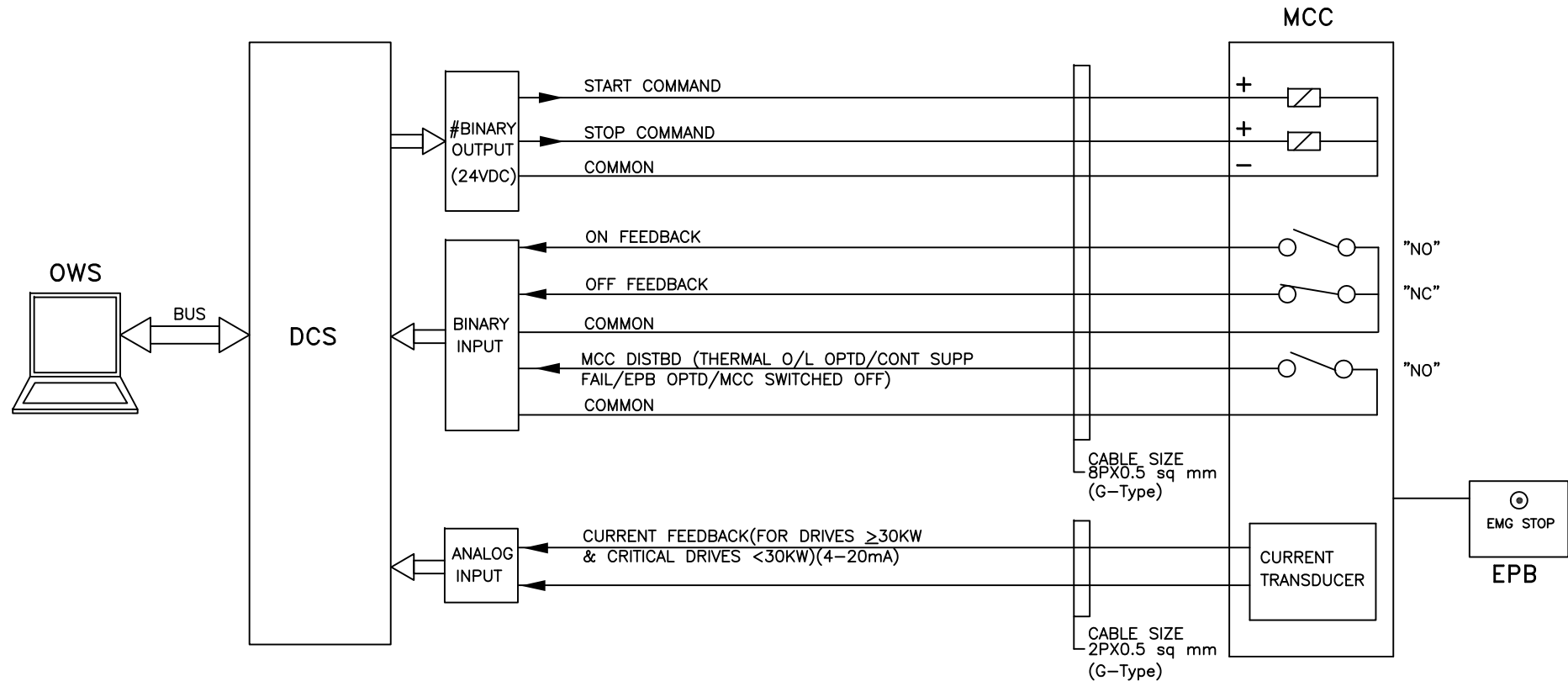
TITLE
DDCMS INTERFACE FOR
BIDIRECTIONAL DRIVE

DRG.NO. Maitree-01-CD-FF-
123002-PEM-D

DATE 10.08.2017

SHT 7 OF 11

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE



NOTE:

#BINARY=
OUTPUT

Redundant output shall be provided



PROJECT: 2X660MW BIFPCL MAITREE

TITLE

DDCMIS INTERFACE FOR
UNIDIRECTIONAL LT DRIVE

DRG.NO. Maitree-01-CD-FF-
123002-PEM-D

DATE 10.08.2017

SHT 8 OF 11



Technical specification
for

2X660MW STPP, MAITREE-BANGLADESH

SECTION D

REV. NO. 00

DATE : 05.12.2017

APPLICABLE C&I CABLE TYPES



Technical specification
for
2X660MW STPP, MAITREE-BANGLADESH

SECTION D

REV. NO.

00

DATE : 05.12.2017

S. No.	C&I Cable Type
G-TYPE	
1	2P X 0.5 sq.mm
2	4P X 0.5 sq.mm
3	8P X 0.5 sq.mm
4	12P X 0.5 sq.mm
F-TYPE	
1	4P X 0.5 sq.mm
2	8P X 0.5 sq.mm
3	12P X 0.5 sq.mm
4	20P X 0.5 sq.mm
CONTROL CABLE	
1	3C X 2.5 sq.mm



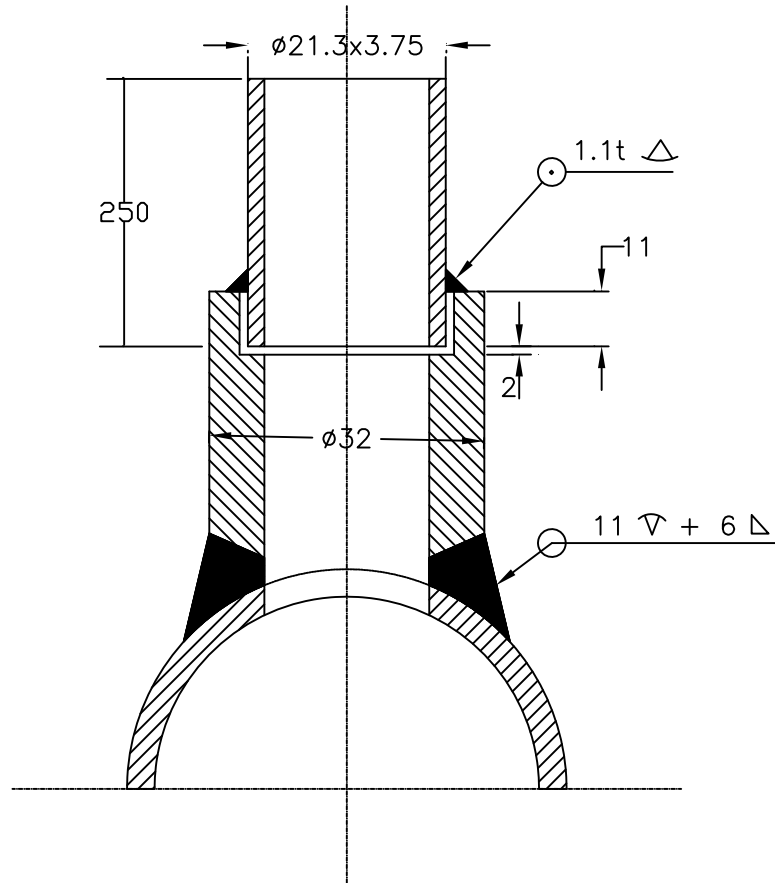
Technical specification
for
2X660 MW MAITREE STPP, BANGLADESH

SECTION: D

REV. NO. 00

DATE : 05.12.2017

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 SHOULD BE 250 MM.
3. STUB LENGTH SHALL BE 64mm UPTO 200Nb PIPE, 45mm ABOVE 200Nb PIPE SIZE.
4. STUB AND NIPPLE SHALL HAVE IBR CERTIFICATION, AS APPLICABLE, ACCORDING TO PROCESS DATA



TITLE :
INSTRUMENT STUB DETAILS
FOR PRESSURE MEASUREMENT
 (SYSTEM PRESS UPTO 40Kg/Cm², CLASS 3000#)

DRG. NO.

REV. 00



Technical specification
for
2X660 MW MAITREE STPP, BANGLADESH

SECTION: D

REV. NO. 00

DATE : 05.12.2017

INSTRUMENT INSTALLATION DIAGRAM

INSTALLATION NOTES

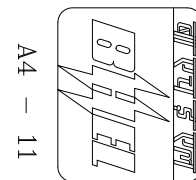
01. HORIZONTAL PIPE RUNS SHALL HAVE A SLOPE OF 50 MM'S IN ONE METER

02. LEGEND/ABBREVIATIONS USED IN THE INSTALLATION SCHEMES.

- A/R : AS REQUIRED
- PT : PRESSURE TRANSMITTER
- DPT : DIFFERENTIAL PRESSURE TRANSMITTER (FT or LT or DPT type).
- DFDC : DOUBLE FERRULE DOUBLE COMPRESSION
- INST : INSTRUMENT

03. DRAIN PIPE INSIDE LIE / LIR SHALL BE OF A106 Gr. C– 2" NB Sch. 80 ALONGWITH WITH SUITABLE ADAPTER / ELBOW ON ONE SIDE & CAP ON OTHER SIDE.

04. DRAIN FROM LIE / LIR SHALL BE CONNECTED TO NEAREST PLANT DRAIN THROUGH OPEN FUNNEL (1/2" SIZE).

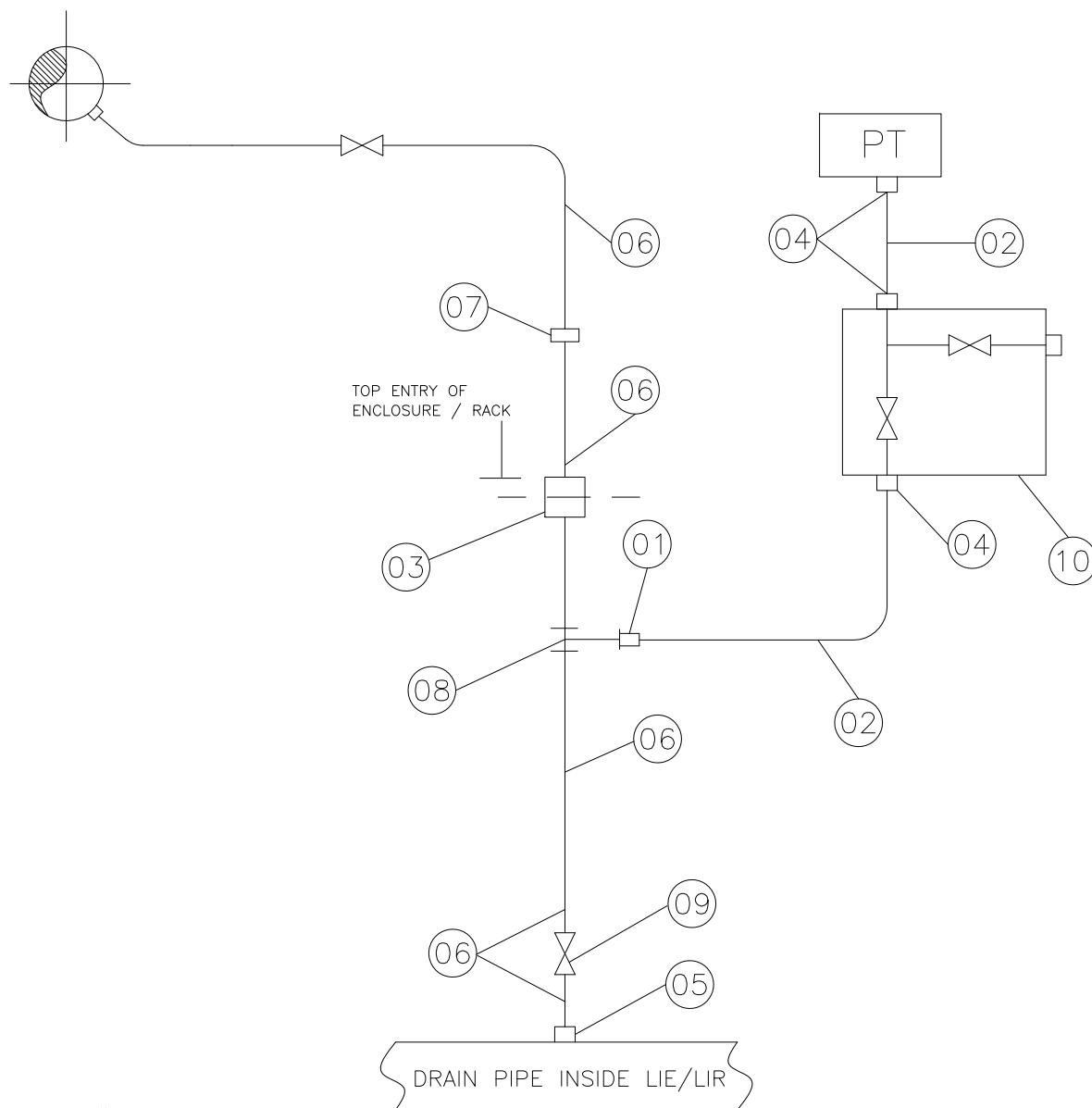
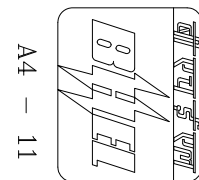


A4 – 11

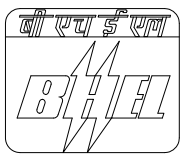
PE-DG-421-145-1555

REV. NO. 00

PAGE : 02

NOTE:

1. " TRANSMITTER BELOW SOURCE"
2. FOR BILL OF MATERIAL REFER PAGE 8



A4 - 11

PE-DG-421-145-I555

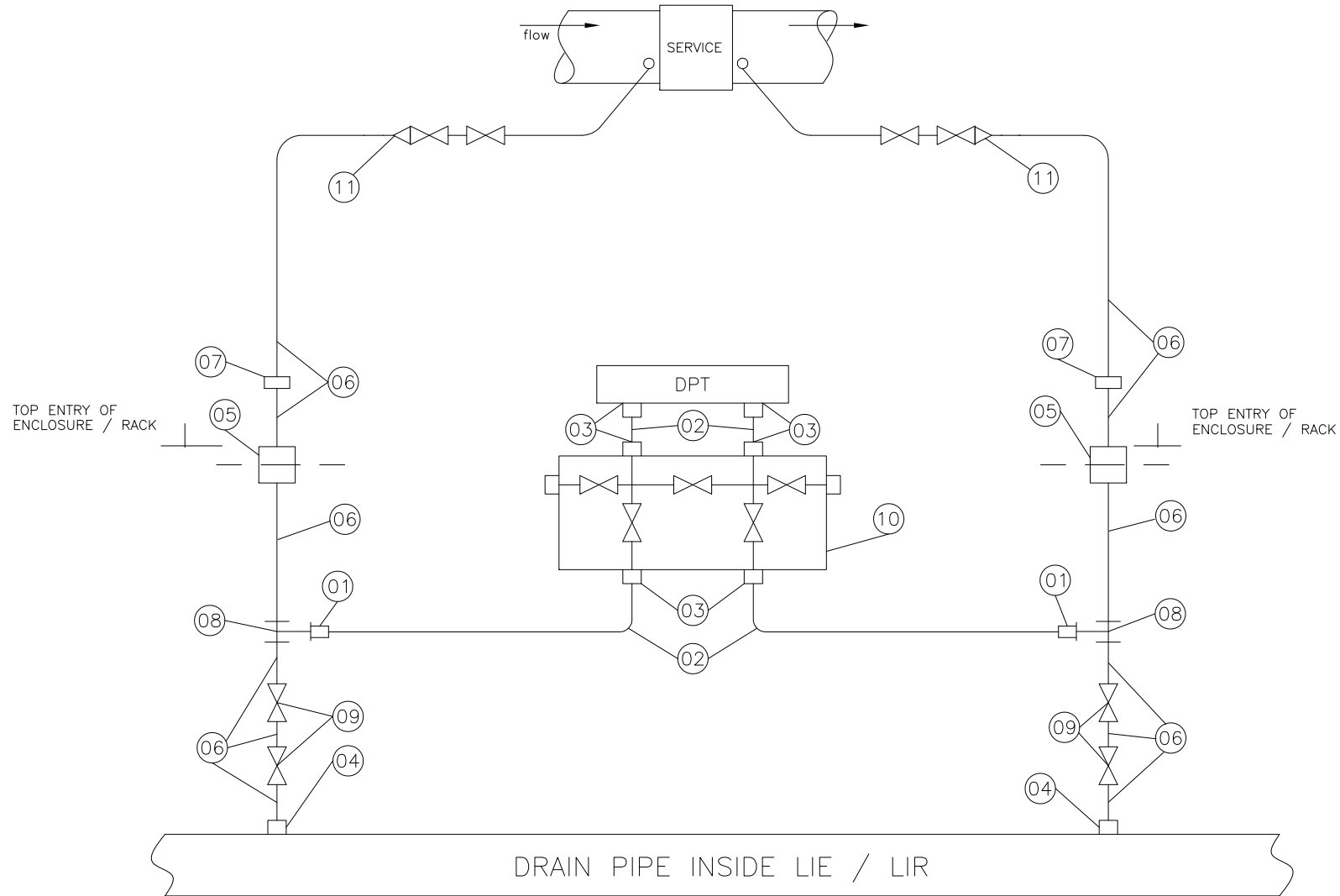
REV. NO. 00

PAGE : 8

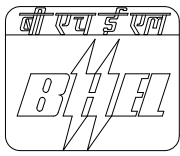
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10	TWO VALVE MANIFOLD WITH VENT PLUG PORT SIZE : 1/2" NPTF / MATL : SS316 PR. TESTING : 3000PSI	01
09	FORGED GLOBE VALVE BODY : ASTM A105 SIZE : 1/2" NB-SW / CL : 800	01
08	FORGED TEE / AS PER ANSI B16.11 MATL. : ASTM A105 SIZE : 1/2" NB-SW / CL : 3000	01
07	FORGED COUPLING / AS PER ANSI B16.11 MATL : ASTM A105 SIZE : 1/2" NB-SW / CL. 3000	A/R
06	IMPULSE PIPE MATL : ASTM A106 Gr. C SIZE : 1/2" NB-SCH 80	A/R
05	HALF COUPLING / 1/2" NB-SW /AS PER ANSI B16.11 MATL : ASTM A105 /CL. 3000	01
04	TUBE FITTING / DFDC MATL. : SS316 SIZE : 1/2" NPTM X TO SUIT 1/2" OD SS TUBE	03
03	BULK HEAD UNION / COUPLING CL : 3000 LBS / 1/2" NB-SW MATL : ASTM A105/AS PER ANSI B16.11	1No.
02	TUBE / MATL. : SS316 ASTM A 213 TP 316 H SIZE : 1/2" OD X 2.1 mm THK.	A/R
01	TEE TUBE UNION / MATL. : SS316 SIZE : OD OF 1/2" NB - PIPE X TO SUIT TO 1/2" OD SS TUBE	01
ITEM NO.	ITEM DESCRIPTION	QTY/INST.

**NOTE:**

1. " TRANSMITTER BELOW SOURCE"
2. FOR BILL OF MATERIAL REFER PAGE 10



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PE-DG-421-145-I555

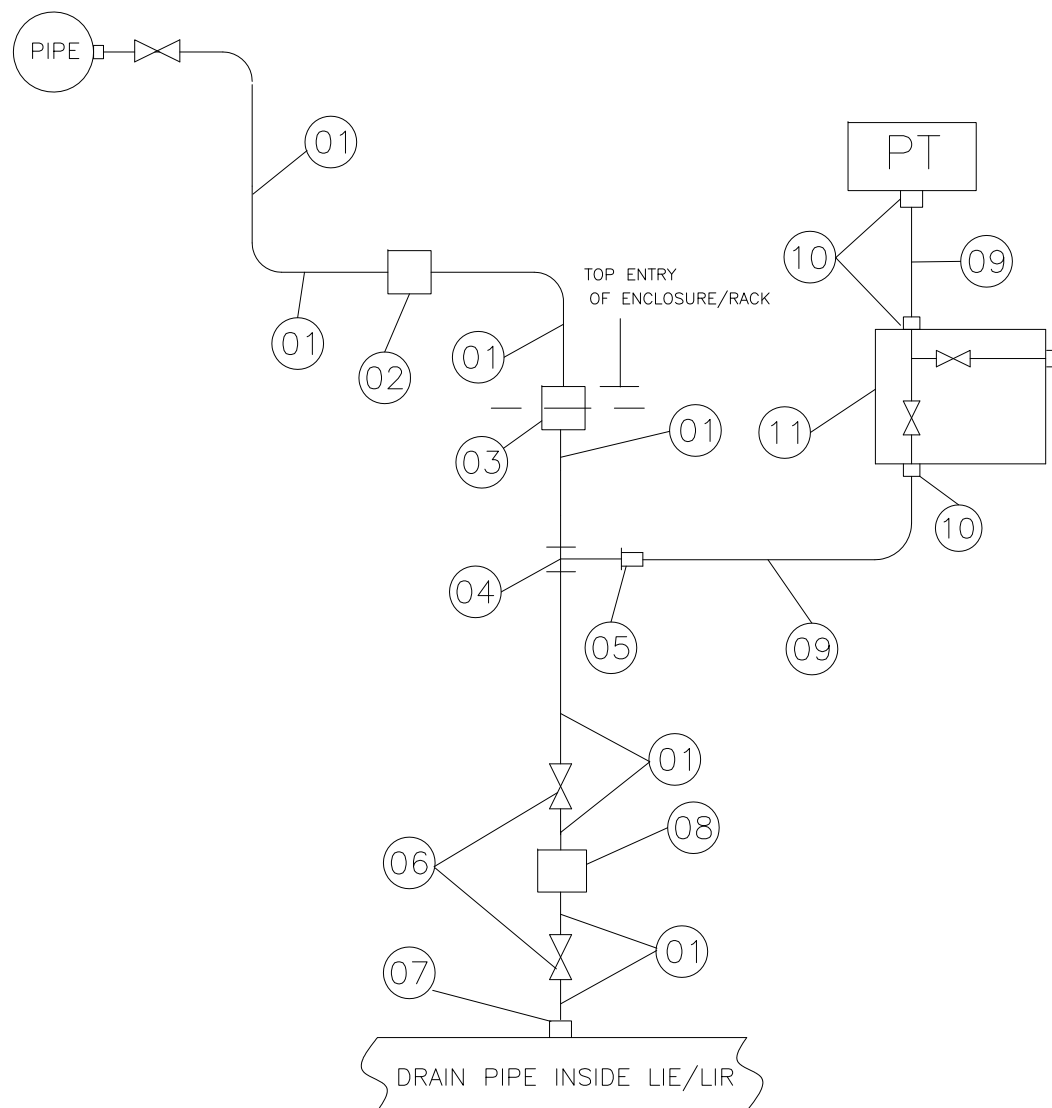
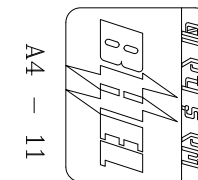
REV. NO. 00

PAGE : 10

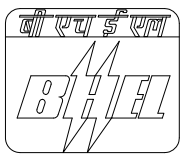
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11	FORGED REDUCER / AS PER ANSI B16.11 MATL.: ASTM A105 SIZE: OD OF 1" NB TO 1/2" NB - SW CL 6000	02
10	FIVE VALVE MANIFOLD WITH VENT PLUG PORT SIZE : 1/2" NPTF / MATL. : SS316 PR. TESTING : 6000PSI	01
09	FORGED GLOBE VALVE BODY MATL. : ASTM A105 SIZE : 1/2" NB-SW / CL. 2500	04
08	FORGED TEE / AS PER ANSI B16.11 MATL. ASTM A105 SIZE : 1/2" NB-SW /CL : 6000	02
07	FORGED COUPLING / AS PER ANSI B16.11 MATL. : ASTM A105 SIZE : 1/2" NB-SW / CL. 6000	A/R
06	IMPULSE PIPE MATL. ASTM A106 Gr.C SIZE : 1/2" NB-SCH 160	A/R
05	BULK HEAD UNION COUPLING / AS PER ANSI B16.11 MATL. : ASTM A105/ 1/2" NB-SW CL : 6000	02
04	HALF COUPLING / AS PER ANSI B16.11 MATL. : ASTM A105 / 1/2" NB-SW /CL.6000	02
03	TUBE FITTING / DFDC MATL. : SS316 SIZE : 1/2" NPTM X TO SUIT 1/2" OD SS TUBE	06
02	TUBE / MATL. : ASTM A 213 TP 316 H SIZE : 1/2" OD X 2.1 THK.	A/R
01	TEE- TUBE UNION MATL. : SS316 / SIZE : OD OF 1/2" NB X TO SUIT 1/2" OD SS TUBE	02
ITEM NO.	ITEM DESCRIPTION	QTY/INST.

NOTE:

1. " TRANSMITTER BELOW SOURCE"
2. FOR BILL OF MATERIAL REFER PAGE 16



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PE-DG-421-145-I555

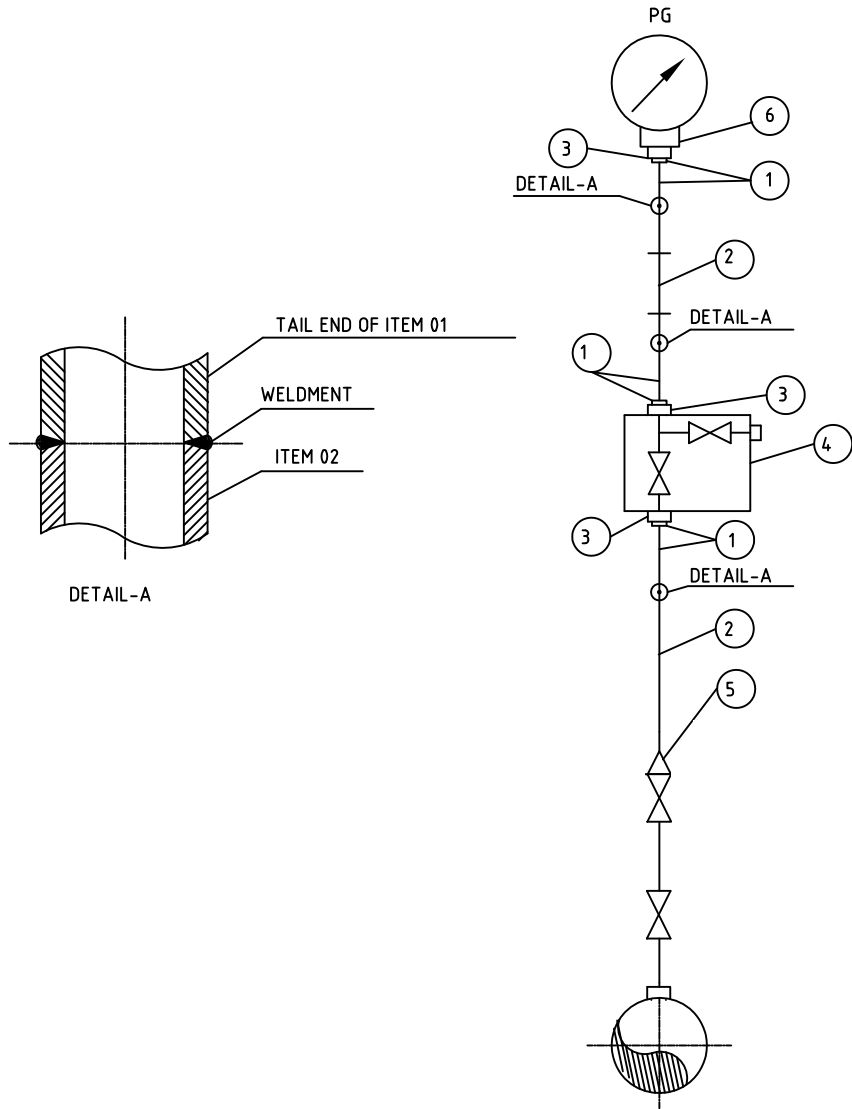
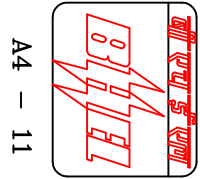
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11	TWO VALVE MANIFOLD + VENT PLUG / PR.TESTING: 3000 PSI MATL. : SS316, PORT SIZE : 1/2" NPTF	01
10	TUBE FITTING/DFDC/, MATL. : SS316 SIZE : 1/2" NPTM x TO SUIT 1/2" OD SS TUBE.	03
09	TUBE MATL. : ASTM A213 TP 316 H SIZE : 1/2" OD x 1.13 mm THK.	A/R
08	DRAIN POT: 2" NB Sch 80 BODY: A106 Gr. C / CONN. 3/4" NB - SW	01
07	HALF COUPLING / 3/4" NB-SW /AS PER ANSI B16.11 MATL : ASTM A105 /CL. 3000	01
06	GLOBE VALVE / CL. 800 SIZE : 3/4" NB-SW BODY: ASTM A105	02
05	TEE TUBE UNION; MATL. : SS316 SIZE : OD OF 3/4" NB PIPE x SUIT TO 1/2" OD - TUBE RATING : 3000	01
04	FORGED EQUAL TEE/AS PER ANSI B16.11/RATING : CL 3000 SIZE : 3/4" NB-SW ; MATL. : ASTM A105	01
03	FORGED BULK HEAD UNION / AS PER ANSI B16.11 RATING : ANSI CL. 3000 SIZE : 3/4" NB - SW/MATL. : ASTM A105	01
02	FORGED COUPLING/AS PER ANSI B16.11 SIZE : 3/4" NB - SW / RATING : ANSI CL 3000 MATL. : ASTM A105	A/R
01	IMPULSE PIPE; SIZE : 3/4" NB - SCH 80 MATL. : ASTM A106 Gr. C	A/R
ITEM NO.	ITEM DESCRIPTION	QTY/INST.



ITEM No.	ITEM DESCRIPTION	QUANTITY/INST. (Nos.)
1	NUT & TAIL FITTING + COPPER WASHERS MATL : ASTM A105 / SIZE: NUT : 3/4" BSPF TAIL : ID= 9 mm / OD= 19 mm	03
2	IMPULSE PIPE SIZE : 1/2" NB - SCH 160 MATL : ASTM A106 Gr.C	A/R
3	ADAPTER MATL:ASTM A105 SIZE : 1/2" NPTM x 3/4" BSPM	03
4	TWO VALVE VALVE MANIFOLD+VENT PLUG RATING : 6000 LBS/ MATL: SS304 PORT CONNECTION : 1/2" NPTF	01
5	FORGED REDUCER/ RATING CL. 6000LBS SIZE: OD of 1" NB x 1/2" NB-SW/AS PER ANSI B16.11 SMATL : ASTM A105	01
6 ##	SNUBBER MATL. ASTM A105 SIZE : 1/2" NPTM X 1/2" NPTF FLOW DIRECTION- 1/2" NPTF TO 1/2" NPTM	01

ONLY FOR SERVICES WITH PULSATING FLOW (DISCHARGE SERVICES)

NOTE :-
1. PRESSURE INDICATOR MOUNTED LOCAL AT SOURCE



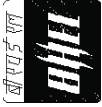
Technical specification
for
2X660 MW MAITREE STPP, BANGLADESH

REV. NO.

00

DATE : 05.12.2017

QUALITY PLAN LOCAL CONTROL PANEL



STD QUALITY PLAN NO.: PE-QP-999-145-I056

VOLUME IIB

SECTION D

REV. NO. 01 DATE: 22-02-2008

STANDARD QUALITY PLAN
FOR
LOCAL CONTROL PANEL

SHEET 1 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	
1.0	INCOMING Sheet Steel (CRCA & 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 - Agency Performing the Test.

W - Agency Witnessing the Test.

V - Agency Verifying the Test.

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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VOLUME	IIB
--------	-----

SECTION

REV. NO.	01	DATE: 22-02-2008
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SHEET 2 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency's			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 Contactors 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	---	---	+ for relay & contactors only
		4. I.R.	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	@ for all components except relays & contactors.
		5. H.V.	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	
		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												

 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 Factory Standard & Relevant standard Factory Standard & Relevant standard	Log Book Log Book Log Book Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2 2 2 2	--- --- --- --- --- --- --- ---	1 1 1 1 1 1 1 1	
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												



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 5 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		
10.	Panel Wiring	1. Wiring Layout 2. Wiring Termination (Crimped Lugs) 3. Ferrule numbers 4. Colour of wiring 5. Size of Conductor	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	---	
			MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	---	
			MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	---	
			MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	1	
			MA	Measurement	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	1	
11.	Component Mounting	1. Correct components 2. Fixing	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	---	
			MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	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	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
			MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	1	
			MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	1	

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

भारतीय भेल भारतीय भेल 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 6 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 ^s			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 MA - Major characteristics MI - Minor characteristics		\$ P W V		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			
										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 ^s			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		P	- Agency Performing the Test.	1	- BHEL
	MA	- Major characteristics		W	- Agency Witnessing the Test.	2	- Vendor
	MI	- Minor characteristics		V	- Agency Verifying the Test.	3	- Sub-vendor



Technical specification
for
2X660 MW MAITREE STPP, BANGLADESH

REV. NO.

00

DATE : 05.12.2017

INSTRUMENTS CHECK LIST



Technical specification
for
2X660 MW MAITREE STPP, BANGLADESH

REV. NO. 00 DATE : 05.12.2017

Important notes for Quality assurance and checks shall be as follows:

- 1) The requirement indicated in the check list is minimal. Vendor has to submit Quality Plans/ Checklists for addressing the minimal requirement indicated in the check list and also those indicated under **clause B0.7** in the specification under **Section-IA**- customer's General Technical Specification – B0, as relevant to instruments. Vendor submitted quality plans shall be subject to customer approval during detail engineering without any commercial and time implication. For instruments for which checklist is not attached, vendor's Quality Plan for such items will also be subject to customer approval during detail engineering without any commercial and delivery implication.
- 2) The inspection agencies indicated in the Checklists in specification may be ignored. These will be aligned in line with approved Inspection categorization plan during detail engineering without any commercial and delivery implication.



STANDARD CHECK LIST FOR C&I INSTRUMENTS

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

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

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.

2 X 660 MW MAITREE STPP					
LIST OF DELIVERABLES (C&I) FOR COLTCS / SCS /DF					
S.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CATEGORY	SCH. SUBMISSION WEEK FROM LOI	Resubmission after incorporating comments
1	PE-V0-421-XXX-I901	CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM	A	5	1 week
2	PE-V0-421-XXX-I902	INSTRUMENT & DRIVE LIST WITH SET POINTS	A	8	1 week
3	PE-V0-421-XXX-I903	FIELD JB/LIE/LIR,DRIVES TERMINATION DETAILS	A	9	1 week
4	PE-V0-421-XXX-I904	DATASHEETS FOR INSTRUMENTS, JBs, etc. along with CATALOGUES*	A	8	1 week
5	PE-V0-421-XXX-I905	INPUT / OUTPUT SIGNAL LIST (ANALOG & BINARY)	A	8	1 week
6	PE-V0-421-XXX-I906	ANNUNCIATION & SOE LIST	A	8	1 week
7	PE-V0-421-XXX-I907	QUALITY PLANS (INSTRUMENTS,LCP etc.)	A	6	1 week
8	PE-V0-421-XXX-I908	INSTRUMENT INSTALLATION/ HOOK-UP DRAWING	A	6	1 week
9	PE-V0-421-XXX-I909	& INTERCONNECTION DETAILS	A	8	1 week
10	PE-V0-421-XXX-I910	O & M MANUAL	A	10	1 week
11	PE-V0-421-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**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-421-165-N002**

SECTION: **III**

SUB-SECTION:

REV. NO. **00** DATE 02.01.2018

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

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER

	TITLE : COMPLIANCE CERTIFICATE FOR COLTCS	SPEC. NO.	PE-TS- 421-165-N002
	2 X 660 MW MAITREE BANGLADESH	DATE:	02.01.2018
		SHEET	1 OF 2

COMPLIANCE CERTIFICATE

The bidder 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 offer 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.

	TITLE : COMPLIANCE CERTIFICATE FOR COLTCS	SPEC. NO.	PE-TS- 421-165-N002
	2 X 660 MW MAITREE BANGLADESH	DATE:	02.01.2018
		SHEET	2 OF 2

p) Electrical/ C&I :

- 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 oversize 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.

q) For design & standards of Self-cleaning strainers (Materials specification, pumps, piping, flanges, valves, testing procedures etc) please refer clause no B.0.6.2 of Appendix-1(C)/SECTION-1A (SPECIFIC TECHNICAL REQUIREMENT-MECHANICAL)

r) Indian Standards and Chinese Standards are NOT acceptable. Wherever international standards have been mentioned same shall not include Indian and Chinese standards.

s) Wherever 'IS' code is indicated in this specification, equivalent international code is to be used inline with the above.

	TITLE : SCHEDULE OF PERFORMANCE GUARANTEES FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM (COLTCS)	SPEC. NO. PE-TS- 421-165-N002	
		VOLUME : III	
		Sheet 1 of 1	Date- 02.01.2018

S.NO.	DESCRIPTION	UNITS	2X660 MW MAITREE BANGLADESH
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 (minimum)	%	
3	Life of sponge rubber balls	Weeks	

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

[illegible]

CLAUSE NO.	Bidder's Name		
	DE-	LT MOTORS	
	A.	GENERAL	
	1.	Manufacturer & Country of origin. (Shall be as per approved QA make)	
	2.	Equipment driven by motor	
	3.	Motor type	
	4.	Quantity	
	B.	DESIGN AND PERFORMANCE DATA	
	1.	Frame size	
	2.	Type of duty	
	3.	Type of enclosure /Method of cooling/ Degree of	
	4.	Applicable standard to which motor generally	
	5.	Efficiency class as per IS	
	6.	(a)Whether motor is flame proof	Yes/No
		(b)If yes, the gas group to which it conforms as per	
	7.	Type of mounting	
	8.	Direction of rotation as viewed from DE END	
	9.	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)	
	10.	Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
	11.	Maximum continuous load demand of driven	
	12.	Rated Voltage (volts)	
	13.	Permissible variation of :	
		a. Voltage (Volts)	
		b. Frequency (Hz)	
		c. Combined voltage and frequency	
	14.	Rated speed at rated voltage and	
	15.	At rated Voltage and frequency:	
		a. Full load current	

CLAUSE NO.	Bidder's Name	
		b. No load current
	16.	Power Factor at
		a. 100% load
		b. NO load
		c. Starting.
	17.	Efficiency at rated voltage and frequency,
		a.100% load
		b. 75% load
		c. 50% load
	18.	Starting current (amps) at
		a. 100 % voltage
		b. 85% voltage
		c. 80% voltage
	19.	Minimum permissible starting Voltage (Volts)
	20.	Starting time with minimum permissible voltage
		a. Without driven equipment coupled
		b. With driven equipment coupled
	21.	Safe stall time with 100% and 110% of rated
		a. From hot condition
		b. From cold condition
	22.	Torques :
		a. Starting torque at min. permissible voltage(kg-
		b. Pull up torque at rated voltage.
		c. Pull out torque
	d. Min accelerating torque (kg.m) available	
	e.Rated torque (kg.m)	
23.	Stator winding resistance per phase (ohms at 20	
24.	GD2 value of motors	

CLAUSE NO.	Bidder's Name	
	25.	No of permissible successive starts when motor is in hot condition
	26.	Locked Rotor KVA Input
	27.	Locked Rotor KVA/KW
	28.	Vibration limit :Velocity (mm/s)
	29.	Noise level limit (dBA)
	C.	CONSTRUCTIONAL FEATURES
	1.	Stator winding insulation
		a. Class & Type
		b. Winding Insulation Process
		c. Tropicalised (Yes/No)
		d. Temperature rise over specified maximum ambient temperature of 50 deg C
		e. Method of temperature measurement
		f. Stator winding connection
	2.	Main Terminal Box
		a. Type
		b. Location(viewed from NDE side)
		c. Entry of cables(bottom/side)
		d. Recommended cable size(To be matched with cable size envisaged by owner)
		e. Fault level (MVA),Fault level duration(sec)
		f. Cable glands & lugs details (shall be suitable for
	3.	Type of DE/NDE Bearing
	4.	Motor Paint shade
	5.	Weight of
		a. Motor stator (KG)
		b. Motor Rotor (KG)
		c. Total weight (KG)

CLAUSE NO.	Bidder's Name	
	D.	List of accessories.
	1.	Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)
	2.	Terminal Box for Space Heater (Yes/No)
	3.	Speed switch (Yes/No)
	4.	Insulation of bearing (Yes/No)
	5.	Noise reducer(Yes/No)
	6.	Grounding pads
		i) No and size on motor body
		ii) Nos on terminal Box
	7.	Vibration pads
		i) Nos and size
		ii) Location
	8.	Any other fitments
	E.	List of curves.
	1.	Torque speed characteristic of the motor
	2.	Thermal withstand characteristic
	3.	Starting. current Vs. Time
	4.	Starting. current Vs speed
	5.	P.F. and Effi. Vs Load
	F.	Additional Data to be filled for each rating of DC Motor
	1.	Rated armature voltage (Volt)
	2.	Rated field excitation (Amp)
	3.	Permissible % variation in voltage
	4.	Minimum Permissible Starting voltage (volt)
	5.	At rated voltage
		i)Full load Armature current.(Amp)

CLAUSE NO.	Bidder's Name	
		ii)Full load Field current (Amp)
		iii)No load Armature current (Amp)
	6.	Full load Field current (Amp)
	7.	No load Aramature current (Amp)
	8.	Minimum permissible field current(Amp) to avoid
		i) Maximum permissible voltage
		ii) Rated voltage
		iii) Minimum Permissible Voltage
	9.	Resistance (indicative Values) in ohm
		i)Armature winding(Arm + IP + Series) at 25
		ii) Field Winding at 25 deg. C
	10..	Inductance (indicative values)
		i) Armature winding
		ii) Field winding
	11	Value of trimmer resistance (ohm) to be connected in series with the shunt field to
		i) 220 V DC
		ii) 250 V DC
		iii) 187 V DC
	12	Value of the external resistance (ohm)required to be connected in series with armature during starting only
	13	Technical data sheet for external resistance box
	14	GA drawing of motor
	15	Starting time calculation
	16	Starter resistance design calculation
	17	Electrical connection diagram of motor

	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		1	OF	13
INSTRUCTION TO BIDDER							
1. This data sheet shall be read in conjunction with Specification No. PE-TS-421-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)							
SL.NO.	ITEM		UNIT				
PARTICULARS							
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	M ³ /hr					
	a) Normal						
	b) Maximum allowable						
2.6	Flow rate through ball collector	M ³ /hr					
	a) Normal						
	b) Maximum allowable						
Name of Bidder/ Vendor							
Revision 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		2	OF	13
INSTRUCTION TO BIDDER							
1. This data sheet shall be read in conjunction with Specification No. PE-TS-421-165-N002. 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							
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	3	OF	13	
INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PE-TS-421-165-N002.					
		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	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		4	OF	13
INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PE-TS-421-165-N002.					
		2. Items which deviate from Specification shall be marked with an asterisk (*)					
SL.NO.	ITEM		UNIT				
PARTICULARS							
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	Mos.					
6.2	Design discharge flow	M ³ /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		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		5	OF	13
INSTRUCTION TO BIDDER							
1. This data sheet shall be read in conjunction with Specification No. PE-TS-421-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)							
SL.NO.	ITEM					UNIT	
PARTICULARS							
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						
8.2	Whether differential Pressure gauge is provided for manual observation.						
8.3	Diffrential Pressure Gauge :						
	a) Type						
	b) Make and Model						
	c) Range						
Name of Bidder/ Vendor							
Revision 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					
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			SHEET		6	OF	13	
INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PE-TS-421-165-N002.						
		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 g) Dial size h) Enclosure i) Mounting		Nos. mm					
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 a) 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.				YES/ NO			
Name of Bidder/ Vendor								
Revision 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		7	OF	13
INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PE-TS-421-165-N002.					
		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	abrassive 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							
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			VOLUME		III	PART A	
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INSTRUCTION TO BIDDER							
1. This data sheet shall be read in conjunction with Specification No. PE-TS-421-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)							
SL.NO.	ITEM			UNIT			
PARTICULARS							
12.2	a) OD x thicknes b) Material c) Length of piping being supplied Ball Transport Piping	mm x mm M					
12.3	a) OD x thicknes b) Material c) Length of piping being supplied Differential pressure measuring system flushing piping.	mm x mm M					
12.4	a) OD x thicknes b) Material c) Length of piping being supplied Any other	mm x mm M					
13.0	Valves (Indicate Type of Valves)						
13.1	Sizes	: mm					
13.2	Nos. provided per set	Nos.					
13.3	Materials						
	a) Body b) Disc/ Trim c) Shaft						
14.0	Distributors						
14.1	Nos. provided per set	Nos.					
14.2	Materials :						
	a) Body b) Sight glass c) Sight glass flanges d) Internal parts						
Name of Bidder/ Vendor							
Revision Number		0	1	2	3	4	
Signature of Bidder/ Vendor							
Authorised Representative							
Date :							

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			VOLUME		III	PART A	
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INSTRUCTION TO BIDDER							
1. This data sheet shall be read in conjunction with Specification No. PE-TS-421-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)							
SL.NO.	ITEM				UNIT		
PARTICULARS							
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	0	1	2	3	4		
Signature of Bidder/ Vendor Authorised Representative							
Date :							

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			VOLUME		III	PART A	
			SHEET		10	OF	13
INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PE-TS-421-165-N002.					
		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						
Name of Bidder/ Vendor							
Revision 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	
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INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PE-TS-421-165-N002.					
		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							
Revision Number		0	1	2	3	4	
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			VOLUME		III	PART A	
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INSTRUCTION TO BIDDER							
1. This data sheet shall be read in conjunction with Specification No. PE-TS-421-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)							
SL.NO.	ITEM		UNIT				
PARTICULARS							
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						
	c) Finish						
25.2	Internal Surfaces :						
	a) Surface Preparation						
	b) Primer						
	c) Finish						
26.0	Weights :						
26.1	Empty Weight		Kg.				
	a) Ball Separator						
Name of Bidder/ Vendor							
Revision Number			0	1	2	3	
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INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PE-TS-421-165-N002.						
		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)							
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Name of Bidder/ Vendor								
Revision Number			0	1	2	3		
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Date :								