



2X800 MW YERMARUS THERMAL POWER STATION

BASIC TECHNICAL FEATURES FOR HT / LT MOTORS

4.5.9 Cable glands and cable lugs as per selected cable sizes shall be provided in line with cable erection philosophy. For single core cable termination, gland plates shall be of non-magnetic material.

4.6 Grounding

Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

4.7 General

4.7.1 Motors provided for similar drives shall be interchangeable.

4.7.2 An arrow block shall be screwed on the body of the motors on the non-driving end to indicate the direction of rotation of the motors.

4.7.3 Motors for Fuel oil unloading and drain oil pumps located in hazardous areas shall be with flame-proof enclosures in accordance with IS 2148 / IEC 60079.

5.0 ACCESSORIES

5.1 SPACE HEATERS

All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.

The leads from space heaters of each motor shall be brought out to a separate terminal Box. Space heaters shall be mounted inside the motor in accessible places so that their removal and replacement is simple.

5.2 RESISTANCE TEMPERATURE DETECTORS (RTDs)

5.2.1 HT motors stator windings shall be provided with 12 nos. (2 per phase) Simplex 3 wire Platinum RTDs with 100 ohms resistance at 0 deg C for remote monitoring of winding temperature. The leads from RTDs of each motor shall be brought out to a separate terminal Box.

5.2.2 For HT motors, each bearing shall be provided with 1 no. Duplex 3 wire Platinum RTDs with 100 ohms resistance at 0 deg C for remote monitoring of bearing temperature. The leads from these RTDs shall be brought out to a separate terminal Box or the terminal box same as for winding RTDs.

5.3 DIAL TYPE TEMP. INDICATORS

5.3.1 For HT motors, each bearing shall be provided with 1 no. Mercury-in-steel Dial type temperature indicator for local indication of bearing temperature. The indicators shall have 2 nos. NO contacts rated for 5A, 240 V AC and 0.5 A, 220 V DC for alarm/trip purpose.

5.4 Vibration monitoring pads

5.4.1 Provision shall be made in all HT motors for mounting vibration detectors.



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FOR HT / LT MOTORS**

6.0 NAME PLATE

Motors shall have stainless steel name plate with all particulars as per IS: 325. In addition bearing identification number and type of lubricant is to be indicated.

7.0 PAINTING

The paint shall be epoxy based. The colour of finish shall be light grey to Shade No. 631 as per IS: 5 for motors.

8.0 TESTING

8.1 Type Tests

For HT motors, type test as per IS: 325 shall be conducted on one motor of each type and rating.

Type test certificates for tests carried out earlier on similar ratings, frame size and make shall be submitted for type tests as per IS:325. However, if such reports are not available, one motor of each type and rating shall be subjected to type tests as per IS: 325.

8.2 Routine Tests

All motors shall be subjected to routine tests as per IS: 325. In addition, following shall be conducted as routine test:

- a) Vibration measurement on all motors.
- b) Polarisation index test on all HT motors.



TITLE :
GENERAL TECHNICAL REQUIREMENTS
FOR
LV MOTORS

1.0 INTENT OF SPECIFICATION

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.



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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	
4.4. 4.5 4.6 4.7 4.7.1 4.7.2 4.7.3 4.7.4 4.7.5 4.7.6 4.7.7 4.7.8. 4.7.9 4.8 4.9	Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point. 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. Terminals and Terminal Boxes 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”. 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. 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. 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. 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. Degree of protection for terminal boxes shall be IP 55 as per IS 4691. 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. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors. 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. 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. General	



TITLE :
GENERAL TECHNICAL REQUIREMENTS
FOR
LV MOTORS

- 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.

RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERAMARUS TPS - 2x800 MW MOTORS	
1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9	A.C. MOTORS All HT motors shall be suitable for 11kV / 3.3kV, 3 phase, 50 Hz and LV motors shall be suitable for 415V, 3 Phase, 50 Hz power supply. The motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher. Motors shall be capable of starting and accelerating the load with the applicable method of starting without exceeding acceptable winding temperatures when supply voltage is 80% of the rated voltage for motors. HT motors shall also be capable of satisfactory operation at full load at a supply voltage of 80% of the rated voltage for 5 min. commencing from hot condition. Motors shall be capable of developing the rated full load torque even if the supply voltage drops to 70% of the rated voltage. If such operation is envisaged for a period of one second, the pull out torque of the motor shall be atleast 205% of full load torque. Motors shall withstand for 1 second the voltage and torque stresses developed due to the vector difference between the motor residual voltage and the incoming supply voltage equal to 150% of the rated voltage during fast change over of buses. Locked rotor current of the HT motors except BFP motors shall be limited to 600% inclusive of 20% tolerance of the full load current of the motors. For BFP motors starting current shall be limited to 500% (inclusive of 20% tolerance) of full load current of the motor. Locked rotor current of the LV motor shall not exceed 600% of full load current subject to 20% tolerance. The locked rotor withstand time under hot condition at 110% rated voltage shall be more than the starting time at minimum permissible voltage specified above by atleast three seconds or 15% of the accelerating time whichever is greater. Provision of speed switch shall be avoided to the extent possible. The degree of protection for the motor enclosure shall be IP-55 and IP-54 for outdoor & indoor respectively and terminal boxes shall be provided with atleast IP-55. For single core cable termination, gland plates shall be of non-magnetic material. All motors located in hazardous area shall have flame proof design. All HT motors shall be provided with vibration pads for mounting vibration detectors. Motors rated 1000 kW and above shall be provided with differential protection. These motors shall be provided with star connected stator windings. The 3 nos. current transformers, one for each phase shall be mounted in a separate compartment in the neutral side terminal box. The three phases shall be connected to form the star point after they pass through the CTs. The CTs shall be of relay accuracy and the CT characteristics shall be compatible with the differential relay. The additional 3 nos. CTs of identical characteristics shall be provided in the 11kV / 3.3 kV switchgear panel. kWh measurement shall be provided on all HT motor feeders.	

RPCL/YTPS



RAICHUR POWER CORPORATION LIMITED

YERAMARUS TPS - 2x800 MW

MOTORS

3.5

Degree of protection for actuator motor enclosure shall be IP-55 and IP-67 for indoor and outdoor respectively.

4.0

TESTS

4.1

Tests on all types of motors shall be conducted as per relevant standard.

4.2

All type, routine & acceptance tests as per relevant IS shall be conducted on 11 kV & 3.3 kV motors. For LT motors, type test certificates for tests carried out earlier for each rating and frame size & make shall be furnished, and for all motors routine and acceptance tests shall be conducted as per relevant standards.

4.3

For 11000V and 3300V AC motors, in addition to all the tests specified above, polarisation index test shall be carried out as a routine test on each motor (the minimum value of polarisation index for all motors shall be 2 when determined according to IS : 7816).

4.4

Noise level measurement and vibration test as per standards shall be conducted on all motors.

4.5

Di-electric tests to establish the insulation withstand level of motors as indicated in Clause 1.15 shall be performed on a sample coil (identical to those to be used in the motor quoted for) for each type of motor. These tested sample coils shall not be used in the motors to be supplied.

4.6

All characteristic curves for the motors above 55kW including hot and cold withstand characteristics, starting time vs current, current vs speed, speed vs torque at 110%, 100% and 90% of rated voltage, negative withstand characteristics, rotor voltage vs rotor current curves(for wound motors), Efficiency, power factor, slip, current Vs output curve etc., shall be furnished.

5.0

TECHNICAL REQUIREMENTS

The motors shall comply with the particulars indicated below and CONTRACTOR shall furnish the details in respective column given below (to be separately submitted for different type & rating of the motor).

SL. NO.	DESCRIPTION	UNIT	SPECIFICATION REQUIREMENT	CONTRACTOR
I	AC Motors			
1.0	Application/Designation		*	
2.0	Manufacturer		*	
3.0	Type of motors/ frame size		Squirrel cage except for cranes	
4.0	Rated			

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	MOTORS	

	(a) Output	kW	*	
	(b) Speed	rpm	*	
	(c) Voltage	V	*	
	(d) No.of Phases / Frequency		*	
	(e) System neutral		*	
5.0				
5.1	Type of Duty (IS-325 or equivalent)		*	
5.2	Duty designation (IS-325 or equivalent)		*	
6.0	Supply Conditions			
	(a) Allowable variations in			
	(i) Voltage	%	± 10	
	(ii) Frequency	%	± 5	
	(iii) Combined	%	10(sum of absolute values)	
	(b) Permissible unbalance in supply voltage	%	2	
7.0	Current		*	
	(a) Full load	Amps	*	
	(b) Starting	% FL	*	
8.0	Method of starting		DOL	
8.1	Starting time	Sec		
	With rated Voltage			
	With min. Voltage			
	With Max. Voltage			
8.2	Safe stall time under hot/cold condition	Sec		
	With rated Voltage			
	With min. Voltage			
	With Max. Voltage			
9.0	Insulation			

RPCL/YTPS		RAICHUR POWER CORPORATION LIMITED			
		YERAMARUS TPS - 2x800 MW			
		MOTORS			
9.1	Class of insulation		Class F with temperature rise limited to Class B		
9.2	Temperature rise by winding resistance method	Deg. C	temp. rise limited to Class B		
10.0	Type of cooling (IS : 6362)	Deg. C	TEFC for LV, TEFC / TETV/CACA/CAC W for 11/3.3 KV motors.		
11.0	Degree of protection (IS:4691 or equivalent)		Refer Clause 1.7		
12.0	Suitable for outdoor operation	Yes / No	*		
13.0	Normal winding connection	Star / Delta	*		
14.0	Permissible No. of equally spread starts per hour under normal service conditions		*		
15.0	Efficiency (%)	%			
	Full load				
	75 % Load				
	50 % Load				
	25 % Load				
16.0	Power Factor				
	Full Load				
	75 % Load				
	50 % Load				
	25 % Load				
17.0	Torque				
	Starting				
	Maximum (Pullout)				
	Pull up				
18.0	Motor reactance (pu)				
	Subtransient				
	Transient				
	Steady state				

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	MOTORS	

15.0	Fault level	kA/sec	*	
II	DC MOTORS			
16.0	Rated Voltage	V	220 V DC	
17.0	Class of Insulation	:	Class F with temperature rise limited to class B	
18.0	Temperature rise	:	--- do -----	
19.0	Method of starting	:	*	
Items under AC motors which are applicable for DC motors shall also be listed				

NOTE :

- 1.0 '*' Information shall be filled furnished by CONTRACTOR along with offer.



TITLE:

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OZONE GENERATION PLANT

2X800 MW YERMARUS THERMAL POWER STATION

BHEL DOCUMENTS NO.: PE-TS-362-174-14000A-A001

VOLUME II-B

SECTION -D2

REV. NO. 01

DATE: 04/12/2014

DATA SHEET – C OF MOTORS

S. No.	Description	Data to be filled by successful bidder
A.	vi) 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.	vii) 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	



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S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	viii) 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.	ix) 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	



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REV. NO. 01

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CABLE ERECTION PHILOSOPHY**1.0 Scope****1.1 Reference standards/ documents.**

- 1) IS: 1255 (Code of practice for installation and maintenance of power cables)

2.0 Cable Raceway System

- 2.1 Cables shall generally be laid in galvanised (minimum thickness of galvanisation shall be 75 microns) MS cable trays in multi-tier arrangement. The trays shall in turn be supported on fixed (welded) type cable tray support systems, along structural members/ concrete surfaces inside plant buildings, cable trenches below switchboards/ MCCs in auxiliary plant buildings. Cable trays shall be fixed to the horizontal/vertical arm of supporting structure. Cables can be routed through cable duct bank wherever required.
- 2.2 Generally cable trays shall be oriented horizontally in all areas. Cable trays may be oriented vertically in other areas also if so required due to reasons such as space restriction, accessibility, plant aesthetics, operational clearances, etc. as per approved layout drawings.
- 2.3 Cable trays shall be generally ladder type of widths 600mm, 450 mm, 300 mm, 150 mm. Perforated type cable trays of 600mm, 450mm, 300 & 150 mm size and below shall be used where required. For instrumentation and control purpose, some perforated type cable trays of width 100 mm may be used.
- 2.4 Suitable cable tray accessories such as horizontal and vertical bends, crosses, tees, reducers etc. shall be used in conjunction with straight runs of cable trays wherever required to ensure a continuous and break-free tray support system for cables.

Tray accessories shall be generally factory fabricated. However the same may also be fabricated at site from the straight length of respective sizes if required.

- 2.5 Cable trays of width 600 mm shall be subjected to deflection test as under: -
- A 2.5 metre straight section of cable trays shall be simply supported at the two ends. A uniformly distributed load of 100 Kg per meter for 600mm tray will be applied along the length of the tray. The maximum deflection at the mid span shall not exceed 7 mm.
- 2.6 The cable tray support system shall comprise of galvanised MS channel/ angle as main supports, cable trays shall be directly fixed to galvanised MS angles.
- 2.7 The main supports MS members shall be fixed by welding in any of the following ways:
- Welded to steel inserts available in the concrete surface.
 - Welded to steel structural members.

Support system shall be site fabricated as per requirement from galvanised MS structural members.

- 2.8 Horizontal runs of cable trays shall be supported at intervals of 1500mm approximately. Vertical runs (risers) shall be supported at approximately every 1000mm interval. Spacing between cable trays shall normally be kept 300mm for



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cable laying convenience and effective heat dissipation. The cable tray numbering shall be provided at every 30 meter and at each end of cable tray & branch connection.

- 2.9 All galvanisation damaged due to cutting/ welding operation required to be carried out for the installation of the support system, cable trays & accessories shall be made good with application of two coats of cold galvanisation paint.
- 2.10 For laying cables along concrete walls, ceilings, building steel structures or masonry structures etc., the cables shall be clamped with GI saddles screwed to the GI flats welded to the inserts. Where inserts are not available the saddles may be directly fixed to the walls using anchor bolts.
- 2.11 Local cabling near equipment shall be done using embedded conduits & cable pits or local cable trenches as per layout conditions.
- 2.12 The trays shall be stopped approximately 200mm short of the wall on both sides and cables passed through the opening. This method is adopted for smooth passage of cables and effective sealing of cable openings
- 2.13 Cables for redundant equipment shall be run in separate trays/ separate route, as far as possible.

3.0 General Philosophy of Cable Installation

- 3.1 Laying, dressing, clamping and jointing/ termination process of power, control and instrumentation cables shall follow the requirements of IS: 1255.
- 3.2 For the purpose of cable laying, the cables are categorised as under:
- LT: Power cables of 1.1kV grade, catering to loads at 415V AC/ 230V AC/ 220V DC/ 24V DC
 - Control: Control cables of 1.1kV grade generally carrying control signals at 220V DC/ 110V AC.
 - Instrumentation: (Also called screened control cables): Screened cables of 225 V grade with minimum cross section of 0.5 sq mm generally carrying very low voltage very low current signals.
- 3.3 All cables will be provided with identification tags indicating the cable numbers in accordance with the cable circuit schedule. Cable tags shall be fixed at terminal ends, at tray intersection / bend and at each side of floor/ wall/ duct crossings etc and at every 30m in cable trench/tray or buried run.
- 3.4 1100 V grade multi-core power cables carrying continuous current when laid on trays shall be placed in single layer, touching and clamped by means of nylon cable ties. Cables of sizes indicated below, shall be clamped individually.
- Multi-core cables : 95 sq mm or higher
- 3.5 Control and instrumentation cables shall be laid in multi layers, but not exceeding three layers in any section. Special purpose cables shall be laid as per system manufacturer/ supplier recommendations.
- 3.6 Cables shall be placed on trays on the basis of their types and functions as under for horizontal formations:



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- a) LT power cables: in the top tier(s) of ladder type trays.
- c) Control cables: in the ladder tray(s) next below to the LT power cable tray(s).
- d) Instrumentation cables (screened control cables): in the bottom most perforated tray(s).
- 3.7 For vertical formations, the outermost tray shall be considered as the topmost tray and the order as indicated shall be followed. In rare cases, where there is no clear distinction of bottom/ top trays, the order convenient for linking the horizontal and vertical formations avoiding criss-crossing, or exit of cables shall be followed.
- 3.8 To facilitate pulling of cables in conduits, powdered soft stone, plastic soap or other dry inert lubricant may be used where required. However any material harmful to the cable sheaths shall not be used.
- 3.9 Conduit/pipe occupancy (ratio of total cable area to conduit area shall not exceed the following: -
- 1) One Cable: 53 %
 - 2) Two Cables: 31 %
 - 3) Three Cables & Up: 40 %
- Exposed pipes/ conduits if used in corrosive areas shall have anti-corrosive coating both inside & outside.
- 3.10 Conduits shall be of rigid steel, hot dip galvanised, furnished in standard length of 5 metres, which shall be as per IS:9537.
- 3.11 Wherever specific cable routes are not shown in cable schedules, cables may be laid through the shortest route as per the above criteria, as directed by site Engineer.
- 4.0 Cable Termination & Jointing**
- 4.1 Termination of cables shall conform to the requirements of IS: 1255 and shall be carried out as per the recommendations of termination kit supplier. Cable terminations at various electrical and electronic equipment terminals shall be done as per approved scheme/ interconnection diagrams.
- 4.2 All cable entries in the equipment shall be sealed by cable glands supplied with the equipment. Types of glands to be used are as under.
- I. Material: Tinned brass conforming to BS: 6121
 - II. Type: Double compression
- 4.3 LT power cable termination kits shall be of heat-shrinkable tested as per IS: 13573.
- 4.4 Termination of aluminium/ copper conductor cables shall be done as indicated below:
- i) Aluminium conductor cables:- Heavy duty Aluminium tubular terminal end for solderless crimping.
 - ii) Copper conductor control cables:- Copper Cable lugs for control cable termination shall be PVC insulated sleeve type.



TITLE:

TECHNICAL SPECIFICATION FOR
OZONE GENERATION PLANT

2X800 MW YERMARUS THERMAL POWER STATION

BHEL DOCUMENTS NO.: PE-TS-362-174-14000A-A001

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4.5 Screened control cables of small cross sectional area, (0.5 sq mm) shall be terminated by means of cage clamp termination system.

4.6 Junction boxes may be used, wherever required, for jointing/ marshalling of control and instrumentation cables.

5.0 Testing Of Cable Installation

5.1 Testing and electrical measurement of cable installations shall generally conform to the requirement of IS: 1255 & shall be listed below.

5.2 Prior to installation, cables shall be tested for

- a) Continuity of conductors for all cores of cables.
- b) Insulation resistance between conductors and earth.
- c) Insulation resistance between conductors of multi core cables.

5.3 Pre installation checks for cable tray installation shall be as under:

- a) Availability of clear passage/ path for the cable tray network as per approved drawings.
- b) Cold galvanisation paint treatment for all damaged portions of galvanisation due to cutting / repairs etc.
- c) Correctness of installation of number and type of tray / tray accessories /support material as per approved drawings.
- d) Firmness/ tightness of all welded joints.
- e) Alignment / inter tray separation as per approved layout drawings.
- f) Grounding connections for trays / cable boxes / marshalling boxes.

5.4 After installation cables shall be tested for

- a) Continuity of conductors for all cores of cables.
- b) Insulation resistance between conductors.
- c) Insulation resistance between conductors & earth.
- d) Check for earth continuity for armour / screen (where applicable), and proper earth connection for cable glands, cable boxes etc.
- e) Check for correct polarity & phasing of cable connections
- g) Firmness/ tightness of terminations.
- h) For correctness of all connections as per relevant wiring diagram.
- i) For provision of correct cable tags, core ferrules etc.

5.5 All documents/ records regarding test data and all other measured values shall be duly vetted by the site Engineer before energizing the circuit and kept for future record and reference. The results of all tests shall conform to the specification requirements as well as any other specific performance guarantee.



TITLE:

**TECHNICAL SPECIFICATION FOR
OZONE GENERATION PLANT**

2X800 MW YERMARUS THERMAL POWER STATION

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REV. NO. 01

DATE: 04/12/2014

SECTION – D3

GENERAL TECHNICAL REQUIREMENTS FOR C&I

BHEL – PS - PPEI: NOIDA, SECTOR-16A, U.P. – 201301



TITLE:

**TECHNICAL SPECIFICATION FOR
OZONE GENERATION PLANT**

2X800 MW YERMARUS THERMAL POWER STATION

BHEL DOCUMENTS NO.: PE-TS-362-174-14000A-A001

VOLUME II-B

SECTION –D3

REV. NO. 01

DATE: 04/12/2014

GENERAL TECHNICAL REQUIREMENTS FOR PLC

BHEL – PS - PPEI: NOIDA, SECTOR-16A, U.P. – 201301

	TITLE: SPECIFICATION FOR PROGRAMMABLE LOGIC CONTROLLER SYSTEM	DESCRIPTION NOTED IN 10.00	
		VOLUME II-B	
		SECTION D3	
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1. SCOPE

This specification covers the Design, Manufacture, Assembly, Inspection and Testing at manufacturer's works, proper packing and delivery to Mumbai port CHA Godown of the PLC Control & Monitoring System comprising PLC Control panel/Remote I/O panel (housing Processors, I/O cards, power supply packs etc.), Operator workstations(OWS), Printers, Annunciation system, UPS, cables and all other equipments and accessories required for completeness of the system as mentioned in different sections of this specification.

2. GENERAL

- 2.1. The PLC shall perform protection logic, interlock and sequential control functions such as binary logic operation, set/reset operation, timers, counters, logic blocks, math functions, input quality checking engineering unit conversion, Boolean functions & PID control (Analog logic function).
- 2.2. The system shall be redundant in processor, power supply and communication interfaces unless otherwise specified. The system shall have self-diagnostic features. The control of all drives and equipment shall be effected through the keyboard/mouse / panel mounted push button / control switches as per Data sheets-A&B.
- 2.3. The system shall have facility for connecting to Main Plant's Distributed control system (DCS) using hardware / software interface for two-way transfer of signals.
- 2.4. The mimic shall be displayed on the OWS screen and may also be provided on the control desk/panel (as per Data sheets).
- 2.5. In case OWS is provided, HMI functions like Trends, Curves, Bar charts, Historical storage of Data, Logs and reports etc. shall be provided in addition to Plant-schematics. The necessary catalogue / literature elaborating the features of HMI shall be supplied along with the bid.
- 2.6. It shall be possible to use the same OWS as programming station.
- 2.7. The PLC system shall be sized to meet process/system requirements as per the approved P&IDs and Control write-up.
- 2.8. The PLC system shall be designed to ensure that no single device failure should result in failure of any other device.
- 2.9. Signal multiplication where required shall be done in PLC. Use of relays for multiplication of contacts (for control, monitoring and alarm) is not acceptable. The control/ monitoring components on the control panel/ desk shall be driven through I/O modules.

3. TECHNICAL REQUIREMENTS

Details of various PLC system components shall be inclusive of but not limited to the following:

3.1. CODES AND STANDARDS

3.1.1. The equipment covered under this specification shall meet the requirements of latest edition of all applicable codes and standards like ANSI, NEMA, IEEE, IEC, NEC & IS.

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3.1.2. PLC shall conform to IEC: 1131

3.1.3. The offered PLC shall comply with safety standards as per Data sheet-A&B.

3.2. CONTROL PANEL

3.2.1. PLC control panel shall be freestanding type

3.2.2. 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 2.0 mm for load bearing sections (mounted with instruments) and Not less than 1.6 mm for others
 Gland plate thickness: 3.0mm
 Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

3.2.3. Each panel shall be identified by a name plate, which shall be of non-rusting metal or three ply lamicold, with engraved lettering.

3.2.4. 25 x 6 mm Copper ground bus to be provided for each panel.

3.2.5. 240V AC single phase, thermostatically controlled space heaters shall be provided. Each free standing panel shall have a door switch operated fluorescent lamp and a 240V AC plug point.

3.2.6. Painting treatment shall be as per IS: 6005. Two coats of lead oxide primer shall be followed by powder coating. Paint shade shall be as specified in the "Data sheet for PLC system"-Data Sheet-A&B.

3.2.7. The annunciation system shall be provided in OWS driven by the PLC. Audible alarm, Acknowledge, Reset and lamp test facility shall be provided as per ISA sequence – S18.1, M.

3.2.8. Bidder shall provide electronic grounding for PLC which shall be separate from Electrical grounding as per IS or IEEE standard.

3.3. PROCESSORS

- 3.3.1. The microprocessors shall be 32 bit, and Hot redundant.
- 3.3.2. Hot redundancy: PLC shall be provided with two processors (Main processing unit and memories) one for normal operation and one as hot standby. In case of failure of working processor, there shall be an appropriate alarm and simultaneously the hot standby processor shall take over the complete operation automatically. This transfer from main processor to standby processor shall be bump less and shall not cause any disturbance whatsoever. In the event of both processors failing, the system shall revert to fail safe mode. It shall be possible to keep any of the processor as master and other as standby.
- 3.3.3. An authorized forcing facility shall be provided for changing the status of inputs and outputs, timers and flags to facilitate fault finding and other testing requirements.
- 3.3.4. The standby processor shall be updated automatically in line with the changes made in the working processor.
- 3.3.5. In the event of any replacement of the processor, synchronization of the replaced processor shall be automatic upon live insertion.
- 3.3.6. The cycle time for input scanning, execution of logics, overheads and output scan shall not exceed 120 m sec.
- 3.3.7. The processor & memory shall be loaded up to 50% at normal conditions and maximum up to 60% under worst loading conditions.
- 3.3.8. The memories shall be field expandable.
- 3.3.9. The programme memory shall be non-volatile memory.

3.4.1. Input/output card assignments shall be modular i.e. no single card shall be assigned with more than one drive of a particular sub-system. The maximum number of channels per I/O module shall be as follows.

- Analog Input Module: 16
- Analog Output Module: 16
- Binary Input Module: 32
- Binary Output Module: 32
- Analog Input/output combined: 16
- Binary Input/output combined: 32

- 3.4.2. On line I/O replacement: All I/O cards shall have quick disconnect terminations allowing for card replacement without disconnection of external wiring and without switching off the power supply.
- 3.4.3. 10% spare capacity shall be ensured in each card channel assignment. Overall minimum 20% spare channels shall be provided.

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3.4.4. Output command to MCC/Switchgear shall be through coupling relays, whose mounting location shall be as per "Data sheet A & B for PLC System". In case coupling relays are located in PLC Panel, the same shall be in PLC vendor's scope of supply.

3.4.5. Status feedback from MCC shall be in the form of potential free contact.

3.5. DATA BUS/ I/O BUS

3.5.1. The Data bus connecting PLC and HMI work stations shall be TCP/IP on Ethernet.

3.5.2. The Data bus and I/O bus communication medium shall be twisted pair shield copper conductor for indoor locations and those areas not subjected to induced signals. Repeaters/signal amplifiers shall not be used. Copper conductor cable used shall be Category-5 or better. The communication medium shall be Fibre optic cable in the event any portion of communication cable run is in outdoor or where distances are beyond 500 meters.

3.6. OPERATOR WORK STATION (OWS)

3.6.1. The OWS and Keyboard shall be desktop mounted and shall be used for controlling, monitoring and programming function.

3.6.2. Colour CRT(s) with keyboard and mouse shall be as per Data Sheet-A&B. CRT shall have graphic display facility.

3.6.3. The OWS shall be with Windows based operating system having necessary Engineering/Configuring software.

3.7. PRINTER

Printers shall be provided as per Data Sheet-A&B.

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3.8. COMMUNICATION WITH PLANT DCS

3.8.1. The PLC system shall be provided with serial interface for communication with plant DCS.

3.8.2. Serial communication to / from DCS where provided shall be engineered to ensure that signal communication time from / to DCS shall not exceed 1 seconds for control / feedback.

3.8.3. Serial communication to DCS shall be OPC (Data access 2.0), Ethernet based TCP/IP Protocol.

3.8.4. Data transmitted from PLC to DCS shall include all information necessary for the DCS graphic displays to monitor and control the process equipment and PLC. Such data may include pertinent analog and digital status information, interlock, alarms and maintenance conditions. Data transmitted from DCS to the PLC shall include necessary signals to provide operator control interface from DCS for the process/ equipment being controlled by PLC.

3.8.5. Bidder to include 'Light interface units, converters, Ethernet switch, accessories at PLC end for connectivity to other system. The bidder's terminal point shall be Ethernet port in case of copper medium connection to DCS or LIU in case of Fiber optic medium for connectivity with plant DCS. In case distance between PLC & DCS is greater than 1.8 Km, single mode of optical fiber cable with compatible accessories shall be used. For distance less than 1.8 Km multimode optical fiber ports shall be used.

3.9. POWER SUPPLY Scheme

3.9.1. PLC Panel and I/O Cabinets: PLC system shall be provided with 2x100% UPS fed from Two Nos. redundant 415V, 3-ph feeders, as per the scheme PE-SD-145-I001, Each UPS shall have 60 minutes back up. Input feeder failure shall be monitored in the PLC system. Necessary redundant power pack and transformers shall be provided (in the PLC panel) to derive the power supply for PLC panel and input / output cabinets etc.

3.9.2. Remote I/O panels: Similar power supply arrangement as for PLC panels shall be provided if it is not possible to extend the power cable form UPS of PLC panels(if applicable).

3.9.3. Each OWS and associated HMI peripherals shall be provided with a feeder from either one of the UPS.

4. DRAWING/DOCUMENT AND DATA TO BE FURNISHED AFTER AWARD OF THE CONTRACT:

4.1. For Approval:

- PLC system configuration drawing along with functional write-up.
- Input/Output signal list.
- BOM of PLC
- List of PLC controlled devices
- Control panel/control desk GA drawings.
- Control desk/panel component layout drawing.
- Control panel/control desk Foundation detail and cutout drawings
- Power distribution scheme.

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- Block logic diagrams.
- Annunciation list.
- PLC control room layout drawing.
- List of soft signal exchange with Plant DCS.
- Quality plan
- Data Sheet-C
- CRT display
- Power supply scheme for PLC system, HMI & peripherals, Remote I/O etc.

4.2. For Information:

- Cable schedule and cable interconnection drawing(in BHEL approved format)
 - Between Field and PLC
 - Between Field and MCC
 - Between MCC and PLC
- Electronic earthing requirements.
- Panel Heat dissipation data
- Product/component catalogues.
- Operation & Maintenance Manual on CDs.
- Softcopy of Final/As-built drawings on CDs.
- Calculation for Processor, Memory & Data bus loading

The above list is the minimum requirements. Additional documents/calculations required shall be finalized during contract stage.

5. DRAWINGS AND DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID

- Proposed PLC system configuration drawing with write-up
- Product catalogues and specifications for PLC as well as HMI application.
- Proposed power supply schemes for PLC system, peripherals, and Remote I/O panels.

6. TESTING AND INSPECTION

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

6.2. BHEL's standard Quality Plan for PLC 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.

6.3. The complete PLC system, including all instrument and devices shall be subjected to standard factory tests (i.e. Type Tests and Routine Tests) as per relevant IS, NEMA, IEEE, IEC.

6.4. Factory Acceptance Test-FAT (Functional Tests) shall be performed prior to shipment and Owner/Purchaser shall be notified 15 days before the schedules dates of the test.

6.5. The certificates for following type tests, as per IEC Standard, shall be submitted: -

- Surge protection test as per IEC-225-4
- Dry heat test as per IEC-68-2-2
- Damp Heat test as per IEC-68-2-3

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- Vibration Heat test as per IEC-68-2-6
- Electrostatic discharge test as per IEC-801-2 or equivalent
- Radio frequency Immunity test as per IEC-801-6 or equivalent
- Electromagnetic Immunity test as per IEC-801-3 or equivalent

7. SPARES AND CONSUMABLES

7.1. 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.

7.2. Special Tools & Tackles

The bidder shall supply all Special Tools & Tackles 'as required' during Start-up and further maintenance of the system, as part of the main equipment supply.

7.3. Spares, Service support

Bidder shall provide availability of spares and service support for minimum 10 years after guarantee period.

8. MARKING AND PACKING

8.1. Marking:

A stainless steel name-plate shall be permanently fixed on each equipment giving its Tag/serial Number and salient technical specification.

8.2. Packing:

Sea worthy packing capable of performing all necessary functions like prevention of damage to the contents, sufficient to support frequent handling and lengthy period of outdoor storage in adverse weather conditions are required. Workmanship and materials used shall be of high standard meeting the technical requirements and in accordance with best commercial export packing practices. Vendor shall be responsible for sea worthy export packing. Equivalent or better packing methods may be deployed subject to approval of the BHEL. Vendor shall submit the packing procedure for its equivalent for BHEL's approval during detailed engineering.

9. PERFORMANCE AND GUARNTTEE

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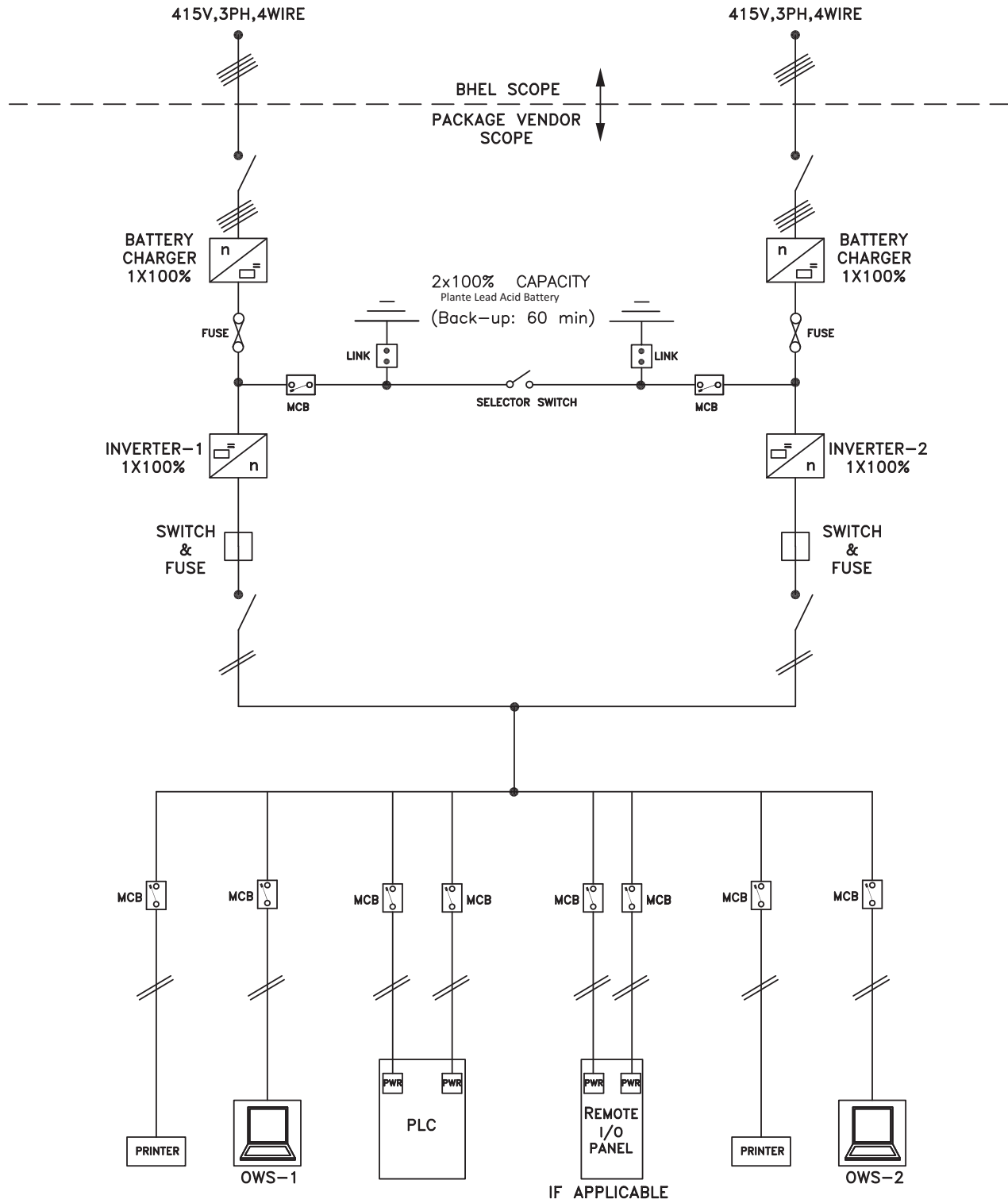
	TITLE: SPECIFICATION FOR PROGRAMMABLE LOGIC CONTROLLER SYSTEM	DESCRIPTION PE-TS-362-174-14000A	
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The PLC system shall be guaranteed to meet the performance requirement as specified and also for trouble-free continuous operation for 12 months from the date of commissioning or 18 months from the date of delivery at site whichever is later unless specified otherwise in Vol-IIB Section - B or Section - C.

10. APPLICABLE DATA SHEET FORMS

This document shall be read with the following data sheet forms :

- Data Sheet A & B for PLC system - PES-145-36-DS1-0
- Data Sheet C for PLC system - PES-145-36-DS2-0



LEGEND:-

1) - 24V,DC,POWER PACK



2X800MW YERMARUS STPP

DRG.
NO.

PE-DG-362-174-14000A-A004

TITLE:- TYPICAL POWER SUPPLY ARRANGEMENT
FOR PLC BASED CONTROL SYSTEM

REV.
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SHEET

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	DATA SHEET FOR PLC SYSTEM		SPECIFICATION NO.:	
			VOLUME II B	
			SECTION D3	
			REV. NO. 02	DATE 10.07.2022
		SHEET 1 OF 1		
Data Sheet No.: PES-145-36-DS1-0				
Data Sheet A & B				
DATA SHEET-A FOR PLC SYSTEM (TO BE FILLED BY PURCHASER)			DATA SHEET – B (TO BE FILLED BY BIDDER)	
GENERAL	PROJECT			
	SERVICE			
	QUANTITY	☐ UNITISED ☒ COMMON		
	LOCATION	☒ INDOOR ☐ OUTDOOR		
PLC EQUIPMENT	MAKE / MODEL NO.	BIDDER TO INDICATE		
	PROCESSOR	REDUNDANT WITH HOT STANDBY		
	DATA BUS (HMI)	☐ COPPER WIRE ☐ FIBRE OPTIC		
	DATA BUS (I/O - CPU)	☐ COPPER WIRE ☐ FIBRE OPTIC		
	DATA BUS (REMOTE I/O - CPU)	☐ COPPER WIRE ☐ FIBRE OPTIC		
	FIELD CONTACTS INTERROGATION VOLTAGE	☒ 24 V ☐ 48 V		
	LOCATION OF COUPLING RELAYS	☒ MCC ☐ PLC PANEL		
	DESKTOP OWS QUANTITY	☐ ONE ☒ TWO ☐ _____		
	DESKTOP MONITOR TYPE	☐ 19" ☒ 21" TFT/CRT MONITOR		
	PRINTER (A3) - QUANTITY	INKJET _____ LASER B/W _____ COLOR INKJET _____ COLOR LASER 1 no.		
	PRINTER (A3) - MODEL	INKJET _____ LASER B/W _____ COLOR INKJET _____ COLOR LASER _____		
PROGRAMMING / CONFIGURATION FACILITY	A) ☐ HAND HELD B) ☐ ENGINEERING SOFTWARE ☒ ONE OWS ☐ ALL OWS ☐ _____			
SAFETY STANDARD	_____			
	COMPUTER FURNITURE	☒ YES ☐ NO		
PANEL	QUANTITY	BIDDER TO INDICATE		
	CLASS OF PROTECTION	☒ IP-32		
	REMOTE I/O PANEL	☐ YES ☐ NO As required		
	COLOUR	AS PER IS-5 SHADE _____		
	BACK-UP DESK	☒ YES ☐ NO		
	MIMIC	☒ YES ☐ NO		
	CONTROL HARDWARE \$	☐ PB ☐ INDICATORS ☐ FACIAS _____ Nos. ☐ OTHERS		
COMMUNICATION TO OTHER SYSTEM	HARDWIRED	☐ YES ☒ NO		
	PURPOSE	☐ CONTROL ☒ MONITORING		
	MEDIUM	☐ UTP ☒ FIBRE OPTIC ☐ OTHERS		
	TIME SYNCHRONIZATION SIGNAL FORMAT	☐ PULSE ☐ RS-485 ☒ IRIG-B		
	SOFTLINK @	☐ MODBUS ☒ OPC for DCS connectivity ☒ IEC-61850 for numerical connectivity		
	SERIAL LINK	COMMUNICATION PORT TYPE OPC ON TCP/IP		
POWER SUPPLY INPUT FEEDER	PLC PANEL	BIDDER TO INDICATE LOAD DATA		
	REMOTE I/O PANEL	BIDDER TO INDICATE LOAD DATA		

\$-As required during detail engineering.
@ LIU, Converter etc. shall be in bidder scope.

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	<u>DATA SHEET FOR PLC SYSTEM</u>		SPECIFICATION NO.:	
			VOLUME II B	
			SECTION D3	
			REV. NO. 00	DATE 10-07-2000
			SHEET 1	OF 1
Data Sheet No.: PES-145-36-DS2-0				
Data Sheet C				
DATA SHEET – C (TO BE FILLED BY BIDDER AFTER AWARD OF CONTRACT)				
GENERAL*	PROJECT			
	SERVICE			
	QUANTITY			
	LOCATION			
PLC EQUIPMENT	MAKE / MODEL NO.			
	PROCESSOR			
	DATA BUS (HMI)			
	DATA BUS (I/O - CPU)			
	DATA BUS (REMOTE I/O - CPU)			
	FIELD CONTACTS INTERROGATION VOLTAGE			
	LOCATION OF COUPLING RELAYS			
	DESKTOP OWS QUANTITY			
	DESKTOP MONITOR TYPE			
	PRINTER (A3) - QUANTITY			
	PRINTER (A3) - MODEL			
	PROGRAMMING / CONFIGURATION FACILITY			
	SAFETY STANDARD			
		COMPUTER FURNITURE		
PANEL	QUANTITY			
	CLASS OF PROTECTION			
	REMOTE I/O PANEL			
	COLOUR			
	BACK-UP DESK			
	MIMIC			
	CONTROL HARDWARE			
COMMUNICATION TO OTHER SYSTEM	HARDWIRED			
	PURPOSE			
	MEDIUM			
	TIME SYNCHRONIZATION SIGNAL FORMAT			
	SOFTLINK			
	SERIAL LINK			
POWER SUPPLY INPUT FEEDER	PLC PANEL			
	REMOTE I/O PANEL			

RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	SHEET 1 OF 10
	TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC	

1.00.00 Technical Specifications for Field instruments:

All instruments 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 as mentioned in design criteria. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance. They shall comply with the acceptable international standards and shall be subject to Employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specifications.

The Contractor shall furnish all Instrumentation/ Control equipment & accessories under this specification as per technical specification, ranges, makes & model as approved by the Employer during detailed engineering. The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/ erection of these transmitters shall be furnished, even if not specifically asked for, on as required basis. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.

2.00.00 Smart Electronic Transmitters for Measurement of Pressure, Differential Pressure(DP) & Flow/Level(DP Type):

2.00.01 Micro-processor based indicating type (LCD display), rack mounted with accuracy of +/- 0.1% of span, Repeatability : +0.05% of FSR or better, Linearity :+0.1% of FSR or better. Hysteresis: +0.1% of FSR or better. external zero and span adjustment, self diagnostics, temperature sensor for compensation. Power supply 24 V DC; output signal of 4- 20 mA DC. IP 65 or equivalent degree of protection with epoxy coating, 316 SS/ haste alloy/ other suitable sensing element. Accessories like snubbers for pump discharge applications and chemical diaphragm with 15 m PVC covered SS armoured capillary for corrosive and oil services, etc. Material for accessories will be SS. HART protocol output shall be available in each transmitter.

In case it becomes necessary to use a DP transmitter for pressure measurement then a 3-valve manifold should be used in place of 2-valve manifold. LVDT type is not acceptable.

2.00.02 Wherever, 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.

2.00.03 In Detail Technical Specification:

1) Type of Transmitter: Microprocessor based 2 wire type HART protocol compatible,

RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	
	TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC 2) Accuracy : - +/- 0.1 % of span 3) Output Signal Range: 4-20 mA DC(Analog) <i>Superimposed digital on HART protocol</i> 4)Turn Down Ratio : 10:1 for vacuum/very low pressure applications 30:1/100:1 for other applications 5) Stability: +/-0.1% of calibrated span for 6 months up to 70 KSC & 6) Zero and Span Drift: +/- 0.015% per Deg.C at max. span and 0.11% per Deg.C at Minimum 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 Adjustability as well as manual from instrument with zero suppression and elevation facility. 13) Accessories a) Diaphragm seal, pulsation dampeners syphon etc. as required by service and operating condition. b) 2/3/5 Valve manifold as applicable 14 Diagnostics: Self Indicating Feature 15) Power Supply: 24 V DC +/- 10% 16) Adjustment : Calibration facility via Centralized PC based HART management system. 3.00.00 <u>Displacement Type Level Transmitters:</u> Displacement/DP Type Smart Electronic Level Transmitters shall be provided for level measurement of condenser hotwell level, LP Heaters, HP Heaters and other vacuum services, shall be considered by the Contractor. If any more transmitters over and above the quantity indicated are required for the safe and efficient operation and maintenance the same shall be included. The type/ranges/make of transmitters and services for which these transmitters are required shall be as decided and approved by the owner during detailed engineering. Microprocessor based smart type, displacement type level transmitters of float length of 14 inches or 32 inches with an accuracy of +/-0.5% of span, 4-20 mA DC output (2 wire system), +24 V DC supply, isolated and ungrounded electrical circuits, zero adjustment (100% of sensing element) for control application and measurement purposes for all services of condensate and drains, particularly where two phases of steam and water are present. IP 65 or equivalent degree of protection for enclosure. Displacer/float material of 316SS. The material of accessories will be SS.	SHEET 2 OF 10

RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC	SHEET 3 OF 10
4.00.00	<u>Thermocouple Assembly with Thermowell</u> Duplex type with accuracy of +/-0.5% of span (as per IEC-584 class-I for turbine applications) response time of 2 to 6 sec, Spring loaded mineral insulated thermocouple assembly with 316 SS thermowell housed in aluminium casing (epoxy coated) having a process connection of M33 x 2 thread or 150 RF flanged. Material of accessories will be SS. IP 65 or equivalent degree of protection for enclosure. Thermowell with hex head of fabricated assembly for air and flue gas system, for rest of the services bar stock assembly ungrounded. Thermowell material shall be solid tungsten carbide for mill outlet temperature measurement. For Air & Flue Gas measurements, thermowells shall be made of Inconel. For metal temperature measurement, thermocouple pads weldable to M.S pipes shall be provided with 15 m thermocouple extension wires. Element size shall be 18 AWG. Insulation resistance at 540°C shall not be less than 5 M ohms. For Turbine applications process connection shall be welded as per DIN 43763. Temperature devices provided with thermowell shall be calibrated with the associated thermowell as an assembly. The thermowell construction shall meet the ANSI 19.3-1994 (latest) requirements. Thermocouple termination head shall be 300 mm above the pipe insulation to avoid cable damage in hot zones. <u>Thermo wells</u> shall be provided along with Temperature elements of RTD & Thermocouples except for metal/bearing/winding temperature measurements. 1. For measurement of flue gas temperature, Inconel coated with tungsten carbide or suitable abrasion resistant thermo wells shall be provided. 2. For measurement of pulveriser outlet temperature tungsten carbide block thermo wells abrasion resistant not tungsten carbide coated thermowell shall be used. Also the terminals of Thermocouple shall not be at the top of Mills itself. The thermocouple wires are to be laid up to JB through SS tubing of required diameter and the head shall be placed nearer to the JB. Compensating cable exposed to atmosphere in the conventional method melts away due to high temperature at the top of Mill. 3. For measurement of water & steam temperature SS thermo wells or better, shall be used	

RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	SHEET 4 OF 10
	TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC	
5.00.00 <u>Resistance Temperature Detectors (RTD) with Thermowell:</u>		
Duplex type with accuracy of +/-0.5% of span, response time 1-2 seconds; Spring loaded mineral insulated three (3) wire RTD assembly with 316 SS Thermowell housed in aluminium casing (epoxy coated) having a process connection of M33 x 2 thread or 150 RF flanged. IP 65 or equivalent degree of protection for enclosure. Material of accessories will be SS. Thermowell with hex head with screwed cover & SS chain, barstock assembly. Element lead size will be 18 AWG. The insulation resistance at 540° shall not be less than 5M ohms. Repeatability over full range shall be better than 0.02%. RTDs shall be ungrounded. RTD shall be supplied as an assembly complete with thermowell meeting ANSI 19.3-1994 (latest) requirements.		
6.00.00 <u>Test Thermowells:</u>		
Pipe/equipment mounted temperature test wells of 316 SS with a process connection of M33x2 thread, except for Turbine applications process connection shall be welded as per DIN 43763. Material of accessories will be SS. Thermowell with hex head of fabricated assembly for air and flue gas system, for rest of the services bar stock assembly. The thermowell construction shall meet the ANSI 19.3-1994 (latest) requirements. The thermowells shall be hardfaced/sterlited to avoid erosion for boiler area applications		
7.00.00 <u>Pressure Indicators:</u>		
Direct reading, pipe mounted Pressure gauges of aluminium casing with six (6) inch phenolic dial (white dial with black numerals), 316 SS Bourdon tube, AISI304 /nylon movements and micrometer type adjustable pointer with an accuracy of +/-0.5% of span including accessories like syphons for steam services, snubbers for pump discharge applications and chemical diaphragm for corrosive and oil services and name plate. Material of accessories will be SS. IP65 or equivalent degree of protection for enclosure. Over range protection will be 50% above maximum pressure.		

RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	SHEET 7 OF 10
	TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC	
300 mm & not less than 6 mm thick for pipe diameter > 300 mm. The flow elements shall be supplied as assemblies with High/low pressure tappings, root valves as required. Performance Guarantee flow elements shall be provided separately. Butt welded edges shall be prepared as per ANSI 16.25 & flanged connections shall be as per ANSI 16.5 standards. Orifice assembly complete with nipples & valves to be supplied by Bidder shall be one metre long with ANSI class 150 RF SS flanges at the ends including gaskets, bolts & nuts. Isolating valves shall have SW end connection. Accessories like name plate, gaskets, bolts & nuts, reservoirs (condensing chambers), 6 nos.shut off valves per assembly, nipple, welding adapters, etc. shall supplied. Bidder shall submitted certified flow calculation and differential pressure Vs. flow curves for each element for OWNER's approval. Sizing calculation, precise flow calculation for all the flow elements, fabrication and assembly drawings and installation drawings shall be submitted for OWNER's approval. Bidder shall provide three Tappings per flow elements.		
18.00.00 Solenoid Valves:	Direct operated single/dual coil solenoid valves with shut off class (leakage) IV or better, body material of bronze, plunger material of 316 SS rated for continuous duty. IP 65 or equivalent protection class for enclosure. Insulation class of 'F' for the solenoid. Body ratings shall suit the pressure and temperature conditions. The operating voltage shall be for 24VDC/ 220VDC/230VAC/110VAC depending on the service.	
19.00.00 Local Instrument Enclosure & Racks/CJCB,s:	Transmitters mounted in the field shall be suitably grouped together and mounted in Local Instrument Racks (LIR). These local instrument racks shall be furnished as per the actual requirements finalised during detailed engineering stage. The exact grouping of instruments in a particular instrument rack shall be as finalised during detailed engineering stage subject to Employer's approval. The internal layout shall be such that the impulse piping/ blowdown lines are accessible from backside of the rack and the transmitters etc. are accessible from front side for easy maintenance. Bulkheads especially	

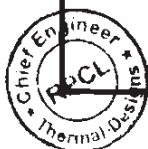
RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW		SHEET 8 OF 10
	TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC		
designed to provide isolation from process line vibration shall be installed on instrument racks to meet the process sensing line connection requirement. Vibration dampeners shall be installed for each rack. The instrument racks shall be free standing type constructed of suitable 5 mm thick channel frame of steel and shall be provided with a canopy to protect the equipment mounted in racks from falling objects, water etc. The canopy shall not be less than 3 mm thick steel, and extended beyond the ends of the rack. Bulk heads, especially designed to provide isolation from process line vibration shall be provided. Exact fabrication details shall be as finalised during detailed engineering stage. The junction box for racks also shall conform to IP 65 protection class. Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein. Centre posts or any member which would reduce access shall not be provided. Each transmitter rack housing instruments requiring purge air for continuous air purging, shall be provided with common purge air header, redundant air filter regulators of sufficient capacity, required pressure gauges, valves, fittings, SS tubings and individual purge meters for each purge line etc. as required. A 15 mm NB service air header shall be furnished in each rack housing air & flue gas and coal mill instruments. The header shall be furnished complete with a pressure regulating valve, pressure gauge, and valve quick disconnect connections. A hose for connecting each header to the draft instrument line four-way valves shall be furnished. The hose shall be self-storing nylon tubing having a burst pressure of 15 kg/sq.cm. The size of the hose shall be 1/2" minimum. The service air header shall originate at a bulkhead penetration or fitting located on one of the bulkhead plates. The contractor shall prepare the piping drawings and the general arrangement layout drawings for each of the racks. Special attention shall be given in the piping layout to avoid air traps in liquid filled piping or water pockets in piping intended to be dry. Drawings shall indicate the arrangement of all equipment, piping, valves and fittings within, the racks and shall be subject to Employer's approval. All liquid filled blow down lines, except those measuring vacuum shall be connected to a two inch header which is extended through one end of the enclosure and turned downward for directing the blowdown into a drain. The material of the blow down header shall be carbon steel as per ASTM A 106 Gr C.			

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20.00.00	<u>Junction Boxes:</u> Wall/column mounted junction boxes having 12/24/36/48 terminals and cable entry only at the bottom and sealed with fire proof compound; Cage clamp terminals suitable for cable terminations up to 2.5 sqmm.; IP 65 or equivalent degree of protection for enclosure. Separate terminal blocks shall be used for analog and digital signal signals. Separate JBs for different voltage levels shall be supplied. Removable gland plate shall be supplied. JB shall have single lockable door with gasket, able to open side ways, with common keys. Painting inside will be glossy white & outside - IS-5 shade 631. Shield bus for screw connection shall be provided. Terminal size shall be suitable for 0.5 mm² to 2.5 mm² wire. Terminal blocks shall be vertical. JB shall have provision to add 20% additional terminals. Accessories like metal tag (SS), clamps, fixtures, bolts (SS), nuts (SS), gaskets (neoprene), lock & key, fire proof compound for sealing, etc. shall be supplied. The grouping of instruments in JBs is subject to Purchaser's approval. All the field Junction boxes shall have double doors. All JBs shall be provided with individual canopies to avoid ingress of water. The case, cover/door constructed from cold rolled sheet steel of 3 mm thick and shall have gland plate of 3 mm CRCA at the bottom. 21.00.00 <u>Inter Posing Relays (IPR):</u> Electro magnetic type IPRs with plug-in type connections, suitable for channel/rail mounting in cabinets; coil rating 24V D.C; 2 set of silver plated change over contacts rated for 0.2A 220 V DC. Free wheeling diode across relay coil(copper) and self reset type status indicator flag (electronic) shall be provided. Neon/LED indicating lamps shall be provided to indicate energise condition of relay. All commands to the Drives viz., Unidirectional drives, Bi-Directional drives, Solenoids and critical output contacts between systems for interlock and protection shall be though IPR. All relays shall be mounted on relay base (silver plated) internally wired to the external cabling termination block in cabinet. Wiring connection shall be screwed & termination shall be suitable for 0.5 mm² to 2.5 mm² size wiring. Facility to simulate relay operation manually shall be provided. Relays of different contact interrogation voltages shall be separated by a barrier in IPR cabinet. Accessories like name plate (SS) with tag & service inscription, relay base mounting rail/channel, nuts & bolts, etc. shall be supplied. Three nos. change over contacts shall be wired to external TB with screwed terminations only. Status lamps shall be provided.	

RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	SHEET 10 OF 10
	TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC	
22.00.00	<u>Local Panels:</u> Indoor/Outdoor located, free standing vertical type local panels with 3 mm thick sheet material of cold rolled steel; antivibration pads of 15 mm thick; fluorescent lighting; Double doors with neoprene gaskets at every 1.5 m; blower & louvers in each section with brass mesh; fire proof compound (50 mm thick)for sealing cable entry (bottom); fire detector for each section; space heater with thermostatic control for each section (strip type). IP 65 degree of protection for enclosure. Removable cover plates with locking facility shall be provided along the bottom of the front desk continuously to facilitate maintenance work. The length of each cover plate shall not exceed 1 m. CFL of 40 W shall be provided from one end of the panel to the other end at continuous length and shall be operated by the door switches as well as by manual switches. Name plates shall be provided for all instruments/inserts with Tag. No.& short description of service engraved. These shall be phenolic overlays(1.6mmthick), black background with white lettering & shall be fixed to the panel by stainless steel screws (counter sunk). Each section of the panels shall be provided with one each 3 pin receptacles for 240V, 1P 50 c/s & 110 V, 1P, 50 c/s. Panel shall be delivered totally wired. All instruments, inserts and annunciation windows shall be mounted & wiring connections at these hardwares shall be terminated at site by vendor. Quantity shall be as required.	

	RAICHUR POWER CORPORATION LIMITED YERAMARUS TPS - 2x800 MW SPECIFICATIONS FOR DDCMIS/INSTRUMENTS TO BE SUPPLIED	SECTION - 01 INSTRUMENTS Page 01 of 03
49.00.00		
Control Valves:		
49.00.01	Multistage, anticavitation, Balanced, modulating, globe type, cage guided, single ported, diaphragm type of actuator with hand wheel, Pneumatic positioners, air filter regulator, air lock device, solenoid valve, limit switches and position transmitters completely tubed with junction box. E/P converters suitable for accepting 4-20mADC signal. Pneumatic (copper) tubing complete with accessories, fittings, positioners shall be provided with input/output/bypass gauges. Local position indicator & LVDT type position transmitter with 2 wire, 4-20mA DC output. All limit switches/position transmitters, E/P converter signals etc., shall be wired out to external block of actuator and respective junction boxes.	
49.00.02	Control valves shall be sized to have an opening of 15% at minimum flow condition and 85% at maximum flow condition. Noise level shall not exceed 85 dB at a distance of about 1.5 M from the valve. In case of predicted noise level above 85dBA, suitable low noise trim shall be provided.	
49.00.03	Leakage class for double seated valve shall not exceed 0.05%, and single seated valve shall not exceed 0.01%. Either extended type bonnet or cooling fin type bonnet shall be provided for service above 200°C and for other service the bonnet type shall be standard.	
49.00.04	The end connections shall be socket welded for sizes below 50 NB and butt welded for sizes 50 NB and above. Flanged connection shall be provided for DM water services, with suitable rubber lined interfaces. Water seal shall be provided for valves that could be subjected to below atmospheric conditions.	
49.00.05	Generally stem and guide material (trim) shall be SS 316 sterlited, and plug and seat material will be 17-4 PH SS, except for specific applications like DM water, HP bypass services. Refer to Table-5 for selection of control valve body material and actuator type. The noise abatement shall be obtained by valve body and trim design and not by use of silencer. The trims supplied shall be suitable for quick changing. Actuator housing shall be of pressed steel construction.	
49.00.06	In Vibration prone areas, positioners shall be located away from the control valve/damper and location shall be approved by OWNER/ENGINEER. Position transmitter shall be non-contact type.	
49.00.07	The control valve design shall be suitable for the required fail-safe conditions, of process / equipment. The valves shall be supplied and commissioned as per the fail-safe philosophy required for the process. Wherever the required turndown is not possible with a standard single valve, specially designed trims shall be customised and used. Pressure regulators upstream of control valves would not be envisaged.	

 RPCL RAICHUR POWER CORPORATION LTD	RAICHUR POWER CORPORATION LIMITED YERAMARUS TPS - 2x800 MW SPECIFICATIONS FOR DDCMIS/INSTRUMENTS TO BE SUPPLIED	SECTION - 2.3.1 VOLUME - IV Page 139 of 150
	49.00.08 All final Control elements (Control valves & control dampers) shall be with pneumatic or electric actuators. All actuators would be sized so that the final control elements operate properly even when the upstream pressure exceeds 110% of maximum value. Pneumatic actuators would be provided with air failure lock and remote release, limit switches, adjustable minimum and maximum stops, load position indicators, positioners, non-contact type electronic position transmitters and solenoid valves in accordance with the system requirements. 49.00.09 SMART positioners shall be provided for all pneumatic operated control valves/dampers. For the services in heat prone area Integral type positioners shall be offered. For SADC positioners conventional pneumatic positioners shall be provided The type of actuator shall be pneumatic type except Governing valves, HP/LP bypass services for which hydraulic actuator shall be used.	





RAICHUR POWER CORPORATION LIMITED

YERAMARUS TPS - 2x800 MW

OZONE GENERATION PLANT

SEC-'D'

3.1.1.1 Motor Operated Valve Actuators

- (i) The actuator motors shall be designed for short time duty (S2) in accordance with IEC 34-1. Degree of protection for actuator motor enclosure shall be IP-65 and IP-67 for indoor and outdoor respectively.
- (ii) The actuator shall be electrically operated electronically controlled type. It shall be sized to achieve valve/damper closure at the specified differential pressure.
- (iii) The actuator motor shall be time rated for at least 15 minutes or twice the valve stroking time, whichever is higher at an average load of at least 33% of the maximum valve torque. For regulating service, the actuator shall be suitably time-rated for the duty cycle involved with necessary number of starts per hour, but in no case less than 150 starts per hour. It shall be capable of starting at 85% of rated voltage. Torque switch must trip at maximum driven equipment torque at 90% rated voltage.
- (iv) Motor shall have minimum class 'F' insulation with temperature rise restricted to class 'B'.
- (v) Motor shall be suitable for operation under voltage variation of + 10%, frequency variation of + 5% and combined voltage & frequency variation of 10% absolute.
- (vi) Motor shall be suitable for direct on-line (DOL) starting and starter shall be integral to the motor.
- (vii) The actuator shall be complete with all accessories viz. torque limit switch, endof- travel switch, adjustable position limit switch, hand-wheel etc.
- (viii) Complete actuator shall be tested at factory as per IEC before dispatch.

FORM NO. PEM-5656-0

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-TS-362-174-14000A	
			VOLUME II B	
			SECTION D3	
			REV. NO. 00	DATE: 07/10/19
			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	2X800 MW YERMARAS STPS		
	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, WEATHER PROOF, IP:55		
	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(REGULATING) SERVICE 150 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 SIX TIMES THE RATED CURRENT.		
	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		
	COLOUR SHADE	☐ BLUE (RAL 5012) ENAMEL ☐		
	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, 3PH, AC		
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V		
	@ ENCLOSURE CLASS OF MOTOR	☐ IP 65 ☐ IP 67 ☐ FLAME PROOF ☐ IP 55, TOTALLY ENCL, SELF VENTILATED.		
	@ INSULATION CLASS	☐ CLASS-B ☒ CLASS-F		
	@ WINDING TEMP PROTECTION	☒ THERMOSTAT (3 Nos., 1 IN EACH PHASE) ☐ -----		

\$-as applicable

FORM NO. PEM-6666-0

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-TS-362-174-14000A	
			VOLUME II B	
			SECTION D3	
			REV. NO. 00	DATE: 07.12.10
			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)	
	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 ☐ TCP/IP ☐		
	c) SERIAL LINK MEDIA	☐ TWISTED PAIR Cu-CBL ☐ CO-AXIAL Cu-CBL ☐ OFC		
	d) HAND HELD PROGRAMMER	☐ REQUIRED ☐ NOT REQUIRED		
	e) MASTER STATION	☐ REQUIRED ☐ NOT REQUIRED		
	f) MASTER STN INTRFACE WITH DCS	☐ MODBUS ☐ TCP/IP		
	g) 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 (Applicable for integral Starter)	INTERPOSING RELAYS	REQUIRED		
	INTERPOSING RELAY (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)	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 for Smart Actuator)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN : INT : CLOSE	☒ 1 No. ☐ 2 Nos.	2 Nos. (ADJ.)	☒ 1 No. ☐ 2Nos.
	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC		

FORM NO. PEM-6666-0

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO. PE ID 3/3 115 1003	
		VOLUME	II B
		SECTION	D3
		REV. NO.	00
		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)	

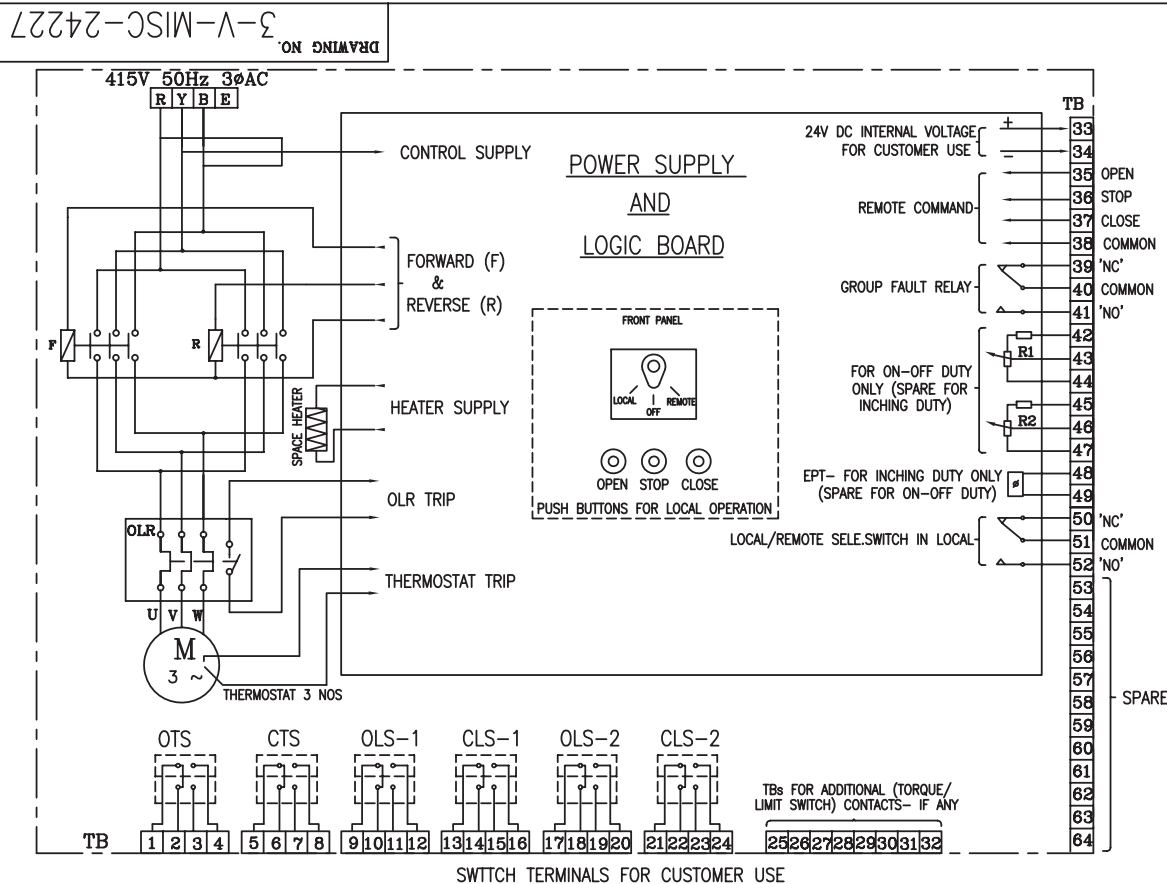
POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty)	☒ REQUIRED ☐ NOT REQUIRED		
	MFR & MODEL NO.	BIDDER TO SPECIFY		
	TYPE	☒ ELECTRONIC (2 WIRE) R/I CONVERTER ☐ ELECTRONIC (2 WIRE) CONTACTLESS		
	SUPPLY	☒ 24V DC ☐		
	OUTPUT	☒ 4-20mA		
	ACCURACY	$\pm$ 1% FS		
SPACE HEATER	@SPACE HEATER	REQUIRED		
	@ POWER SUPPLY			
	@ RATING			
TERMINAL BOX	MOTOR TERMINAL BOX	REQUIRED		
	ACTUATOR TERMINAL BOX	REQUIRED		
	ENCL CLASS MTR T.B. / ACTUATOR T.B.	☐ IP 65 ☐ ☐ IP65 ☐		
	@ 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:**
- 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 INTERNATION STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
 - 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.

NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	VENDOR COMPANY SEAL
	VENKAT AGRAWAL	RAVINDER RAINA	M A MANSOORI	NAME
				SIGNATURE
				DATE

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

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



CONTACT DEVELOPMENT DIAGRAM				
OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL		
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL		
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL		
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL		
OLS-1	9-10			
	11-12			
CLS-1	13-14			
	15-16			
OLS-2	17-18			
	19-20			
CLS-2	21-22			
	23-24			
SWITCH	TERMINAL NO.	FULL OPEN	INTERMEDIATE	FULL CLOSE
		a		b
VALVE POSITION				
INDICATES CONTACT CLOSED				
INDICATES CONTACT OPEN				
CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC				

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

NOTE:-

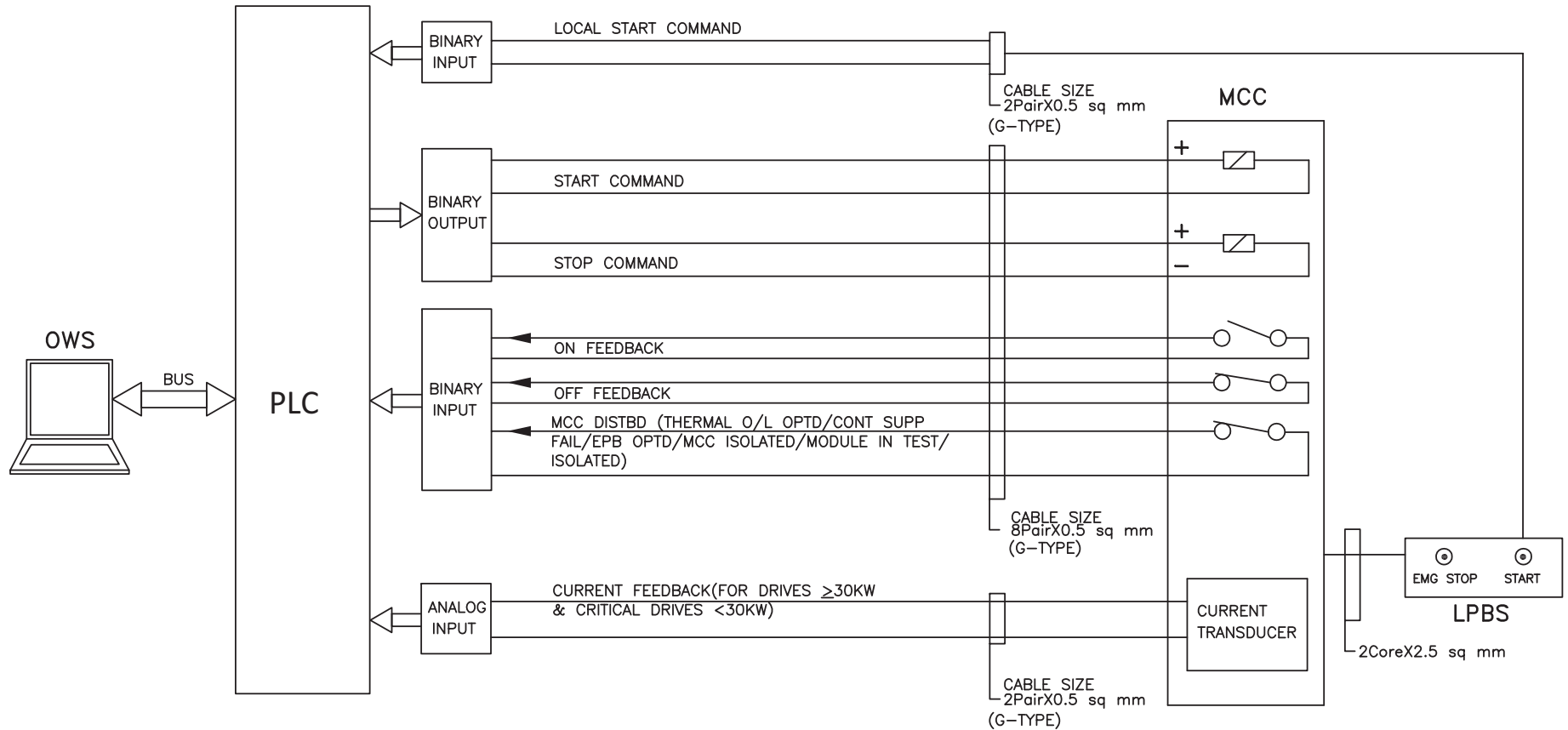
- ALL TORQUE AND LIMIT SWITCHES (OTS,CTS,OLS1&2, CLS1&2) ARE WITH 2NO+2NC CONTACTS
'1NO+1NC' IS TERMINATED IN TBS 1-24, REMAINING CONTACTS ARE FOR INTERNAL USE.
ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25-32
- CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
- OTS - TORQUE 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
(POTENTIOMETRIC 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 3 ϕ 415V 50 Hz AC SUPPLY

REV	DATE	ALTERED
		CHD & APPD

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)						
 365-121		BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI-620014.		DRN	NAME N.P.ESWAR	SIGN N.P	DATE 07.10.04	NO.OF VAR.
				CHD	D.DINAKARAN	D.D	07.10.04	
				APPD	K.ARUNACHALAM	K.A	07.10.04	
DEPT VL		SCALE	WEIGHT (KG).	REFERENCE INFORMATION				NO. OF ITEMS
CODE								
TITLE WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER			CARD CODE U 01	DRAWING NO. 3-V-MISC-24227				REV 0

PLC INTERFACE FOR UNIDIRECTIONAL LT DRIVE-CONTACTOR OPERATED



PROJECT:

2X800 MW YERAMARUS STPS

DRG.NO. PE-DM-362-145-I002

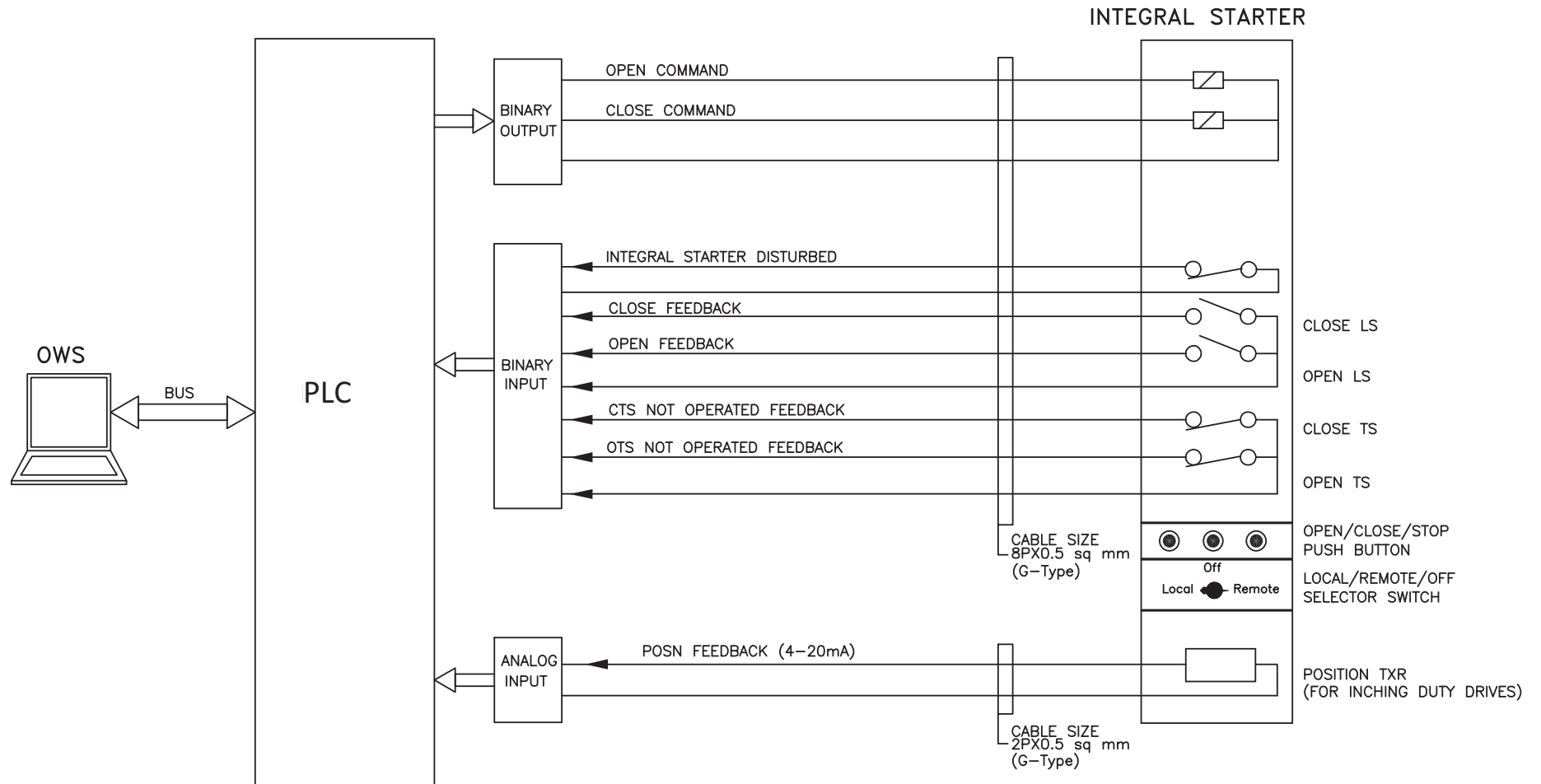
DATE 15.03.2012

TITLE
PLC INTERFACE FOR
UNIDIRECTIONAL LT DRIVE-CONTACTOR OPERATED

REV.NO. 02

SHT

PLC INTERFACE FOR BIDIRECTIONAL DRIVE (WITH INTEGRAL STARTER)



NOTE:

1. DISTURBED= Loss of Power supply (1 Phase/3 Phase),
Loss of control supply, Motor thermostate trip,
Thermal over load relay trip etc.



PROJECT:

2X800 MW YERAMARUS STPS

DRG.NO. PE-DM-362-145-I002

DATE 14.12.2010

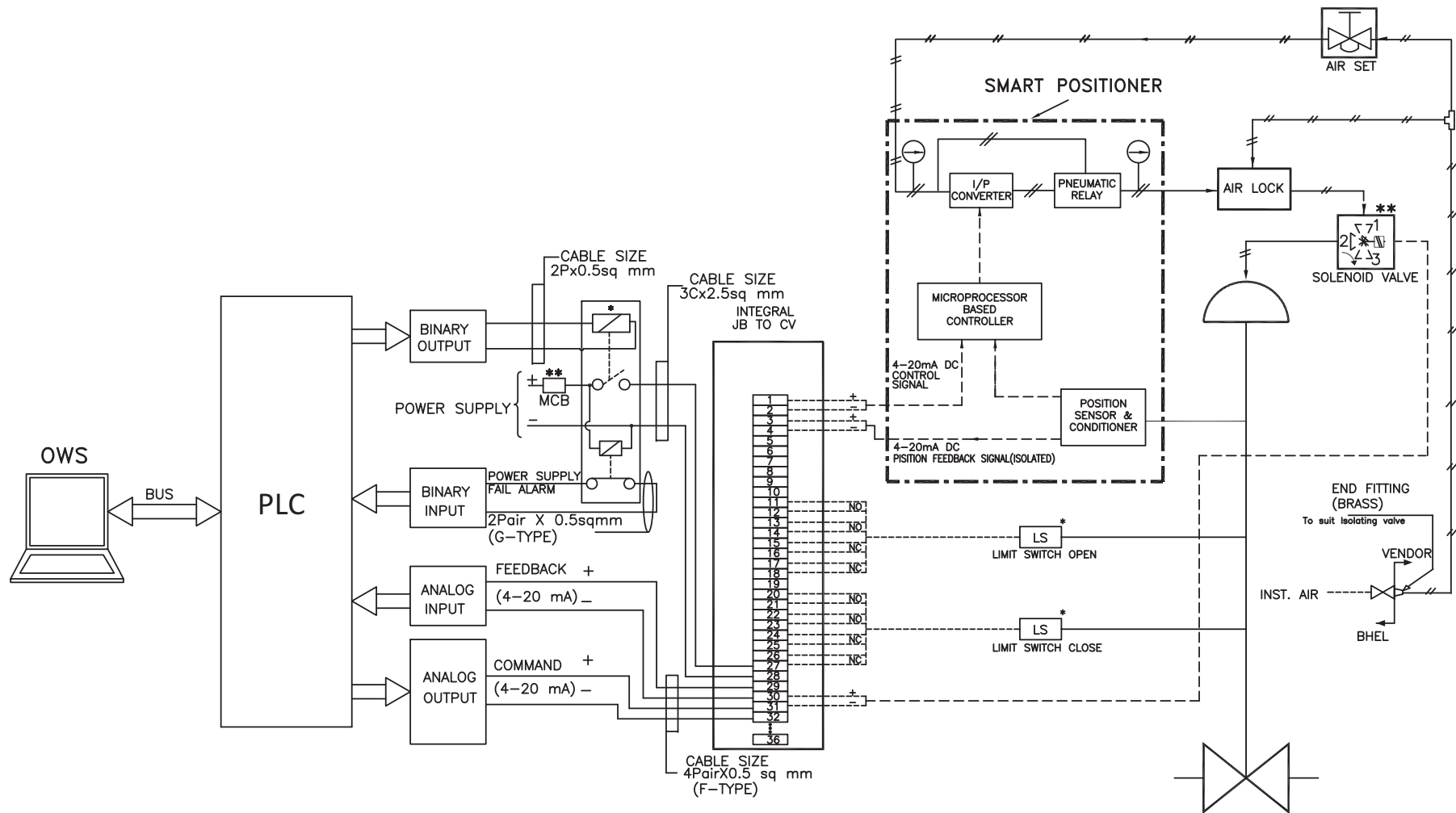
TITLE

PLC INTERFACE FOR
BIDIRECTIONAL DRIVE

REV.NO. 00

SHT

PLC INTERFACE FOR ANALOG DRIVE



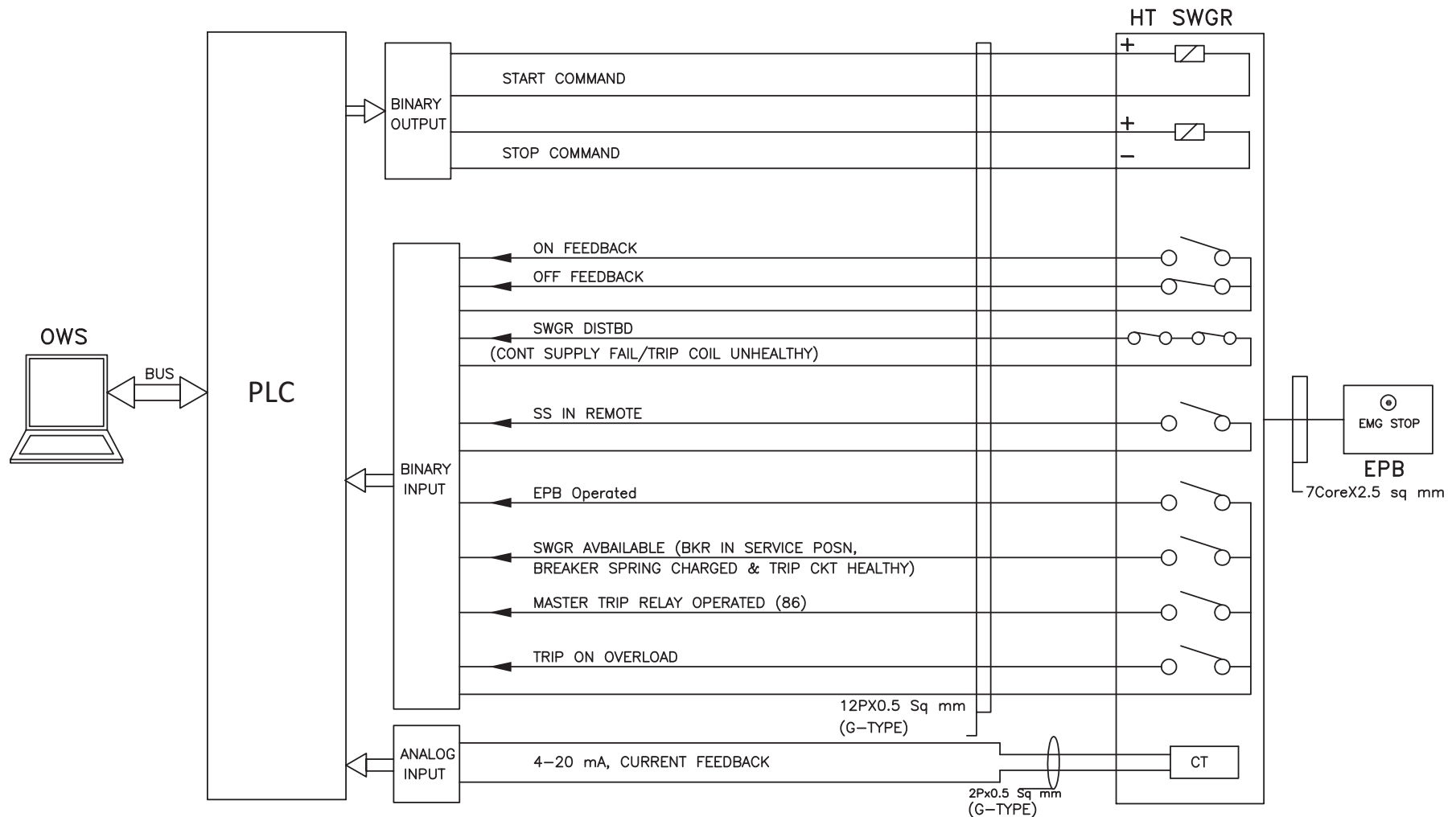
NOTE:-

- ** WHEREVER REQUIRED
- * WHEREVER REQUIRED LIMIT SWITCHES SHALL BE WIRED TO PLC FOR INTERLOCK (RECIRCULATION VALVES, ON/OFF DUTY CONTROL VALVES & WHEREVER REQUIRED FOR INTERLOCK).



PROJECT:	2X800 MW YERAMARUS STPS	DRG.NO.	PE-DM-362-145-I002
TITLE	TYPICAL HOOK-UP DIAGRAM ANALOG DRIVE	DATE	11.06.2012
		REV.NO.	03
		SHT	

PLC INTERFACE FOR UNIDIRECTIONAL HT/LT DRIVE-BREAKER OPERATED



PROJECT:

2X800 MW YERAMARUS STPS

DRG.NO.

PE-DM-362-145-I002

DATE

15.03.2012

TITLE

PLC INTERFACE FOR
UNIDIRECTIONAL HT/LT DRIVE-BREAKER OPERATED

REV.NO.

02

SHT

Annexure (Protocol OPC)							
The following information required if interface protocol is OPC:							
A)	Name of the Auxiliary Plant:						
	PLC Make/Model:						
	Name of the OPC Server						
	Number of physical links envisaged for interface to DCS(maxDNA):						
B)	HARDWARE related:						
						Default/Standard	Confirmation (YES/NO)
	B.1)	If Fiber Cable , type Single or Multimode?					
	B.2)	Confirmation that other accessories supplied for both ends : e.g., FO connector/LIU with Coupler/Media converter etc. Matching with the cable supplied					
C)	SOFTWARE related :						
	C.1)	BASIC COMM PARAMETERS:					
		IP address used in PLC side:					
		Lan speed set(100 mbps)					
	C.2)	Confirmation that DCOM Setting performed in OPC station?					YES
	C.3)	OPC PC WorkGroup name?					WORKGROUP
	C.4)	OPC server registration ID ?(Soft file to be provided)					
	C.5)	Signal list to be provided as per below Format:					
		SL NO.	SIGNAL TYPE	Signal DESCRIPTION	OPC_TAG	OPC_TAG Attribute	Engg Unit
		1					
		2					



TITLE:

**TECHNICAL SPECIFICATION FOR
OZONE GENERATION PLANT****2X800 MW YERMARUS THERMAL POWER STATION****BHEL DOCUMENTS NO.: PE-TS-362-174-14000A-A001****VOLUME III**

REV. NO. 01

DATE: 04/12/2014

LIST OF SCHEDULES



TITLE:

**TECHNICAL SPECIFICATION FOR
OZONE GENERATION PLANT**

2X800 MW YERMARUS THERMAL POWER STATION

BHEL DOCUMENTS NO.: PE-TS-362-174-14000A-A001

VOLUME **III**

REV. NO. 01

DATE: 04/12/2014

SUGGESTIVE PRICE FORMAT FOR OZONE GENERATION PLANT: 2X800 MW YERMARUS THERMAL POWER STATION

Sl. No.	DESCRIPTION OF EQUIPMENT / ITEM	TOTAL PRICE FOR "FOR" SITE
(1)	(2)	(3)
1.00	Total lump sum firm price on FOR site basis for design, engineering, manufacturing, painting, inspection & testing, supply, delivery, installation, packing and forwarding of equipments to site, loading, unloading, storage and handling at site, in site transportation, complete with all accessories including start up and commissioning spares, essential spares, site testing, erection, testing & commissioning, trial run, demonstration test and handing to customer inclusive of all prevailing taxes, duties and other levies as required of OZONE GENERATION PLANT and as defined in the technical specification (PE-TS-362-174-14000A-A001 REV 01) for 2X800 MW YERMARUS THERMAL POWER STATION .	
	NOTES:	
a	Bidder to note that total price indicated above at 1.00 shall be considered for evaluation and hence, should be complete in all respect for the full scope defined and considering all terms and conditions agreed.	
b	In case, price indicated above does not match with item wise break-up given at 2.00, the highest price so calculated shall be considered for evaluation but in case of order, the same shall be placed at the lowest price.	
2.00	BREAK-UP OF PRICES GIVEN IN 1.00 ABOVE	
2.01	Total lump sum firm price for EQUIPMENT (SUPPLY) for design, engineering, manufacturing, painting, inspection & testing, supply, delivery, installation, packing and forwarding of equipments to site, complete with all accessories including start up and commissioning spares, inclusive of all taxes & duties for the complete scope of supply of OZONE GENERATION PLANT and as defined in the technical specification (PE-TS-362-174-14000A-A001 REV 01) for 2X800 MW YERMARUS THERMAL POWER STATION .	
2.02	Total lump sum firm price for all services including unloading, handling & transportation at site, insite transportation, Erection & Commissioning, trial run, preparation & submission of "As Built" drawings, etc, required for completion of OZONE GENERATION PLANT and as defined in the technical specification (PE-TS-362-174-14000A-A001 REV 01) for 2X800 MW YERMARUS THERMAL POWER STATION .	
2.03	Essential spares as indicated in Section C1- Annexure – XI.	
3.00	Break-up (%) of prices given at Sl No-2.01 above (To be used during contract execution for payment)	
3.01	Lumpsum firm price for supply of Ozonators with accessories inclusive of all taxes, duties and other levies as applicable.	35% of sl no 2.01 above.
3.02	Lumpsum firm price for supply of Compressor with accessories inclusive of all taxes, duties and other levies as applicable.	15% of sl no 2.01 above.
3.03	Lumpsum firm price for supply of Oxygen Generation plant (air receiver, air dryer, oxygen generator, oxygen receiver) with accessories inclusive of all taxes, duties and other levies as applicable.	20% of sl no 2.01 above.
3.04	Lumpsum firm price for supply of Tanks, Pumps, Valves, piping and chillers with accessories inclusive of all taxes, duties and other levies as applicable.	13% of sl no 2.01 above.
3.05	Lumpsum firm price for supply of PLC and instruments with accessories inclusive of all taxes, duties and other levies as applicable.	15% of sl no 2.01 above.
3.06	Lumpsum firm price for supply of Miscellaneous scope with accessories inclusive of all taxes, duties and other levies as applicable.	2% of sl no 2.01 above.

	TITLE: TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT 2X800 MW YERMARUS THERMAL POWER STATION	BHEL DOCUMENTS NO.: PE-TS-362-174-14000A-A001	
		VOLUME III	
		REV. NO. 01	DATE: 04/12/2014

COMPLIANCE CUM CONFIRMATION SCHEDULE

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

- a.) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
- b.) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
 QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.
 The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder
- c.) All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
- d.) There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'
- e.) The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
- f.) The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).
- g.) All sub vendors shall be subject to BHEL/CUSTOMER approval
- h.) Any special tools & tackles, if required, shall be in bidder's scope.
- i.) Demonstration parameters shall stand valid till the satisfactory completion of demonstration test and its acceptance by BHEL/Customer.



TITLE:

**TECHNICAL SPECIFICATION FOR
OZONE GENERATION PLANT****2X800 MW YERMARUS THERMAL POWER STATION**

BHEL DOCUMENTS NO.: PE-TS-362-174-14000A-A001

VOLUME **III**

REV. NO. 01

DATE: 04/12/2014

SCHEDULE OF PRE-BID CLARIFICATION

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

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

DEVIATION SHEET (COST OF WITHDRAWAL)**PROJECT:-2X800 MW YERMARUS THERMAL POWER STATION****PACKAGE:- OZONE GENERATION PLANT****TENDER ENQUIRY REFERENCE:-****NAME OF BIDDER:-**

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

COMMERCIAL DEVIATIONS

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATIONS	SIGN & DATE	
------	--------------	-------------	--

NOTES:

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

	TITLE * SCHEDULE OF DECLARATIONS	BHEL DOCUMENTS NO.: PE-TS-362-174-14000A-A001
		VOL III
		SHEET..... OF.....

*** Bidder shall include this schedule both in technical and Price offers**

DECLARATION

Icertify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated and there is no deviation to the specification (except indicated in the deviation sheet (cost of withdrawal).

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

Biders Company Name

Authorised representative's Signature

Name

Bider's Name

.....

.....

.....

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

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