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4.03.00 Impeller

4.03.01 Impeller shall be closed, semi-closed or open type, and it shall be designed in conformance with the detailed analysis of the liquid being handled.

4.03.02 The impeller shall be secured to the shaft, and shall be retained against circumferential movement by keying, pinning or lock rings. On pumps with overhung shaft, impellers shall be secured to the shaft by a lockout or cap screw which tightness in the direction of normal rotation.

4.04.00 Impeller/Casing Wearing Rings

4.04.01 Replaceable type wearing rings shall be provided at suitable locations of pumps. ~~Suitable method~~ of locking the wearing ring shall be used. Wearing rings shall be provided in pump casing and/or impeller as per manufacturer's standard practice.

4.05.00 Shaft

4.05.01 The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed.

4.05.02 The shaft shall be ground and polished to final dimensions and shall be adequately sized to withstand all stresses from rotor weight, hydraulic loads, vibration and torques coming in during operation.

4.06.00 Shaft Sleeves

4.06.01 Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the outer faces of gland packing of seal end plates so as to distinguish between the leakage between shaft and shaft sleeve and that past the seals/gland.


4.06.02 Shaft sleeve shall be fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.

4.07.00 Bearings

4.07.01 Heavy duty bearings, adequately designed for the type of service specified in the enclosed pump data sheet and for long, trouble free operation shall be furnished

4.07.02 The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. In case, sleeve bearings are offered additional thrust bearings shall be provided. Antifriction bearings of standard type, if provided, shall be selected for a minimum life 16,000 hrs. of continuous operation at maximum axial and radial loads and rated speed.

4.07.03 Proper lubricating arrangement for the bearings shall be provided. ~~The design shall be such that~~ the bearing lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearings assembly.

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4.07.04 Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearings housing.

4.08.00 Stuffing Boxes

4.08.01 Stuffing box design should permit replacement of packing without removing any part other than the gland.

4.08.02 Stuffing boxes of packed ring construction type shall be provided wherever specified. Packed ring stuffing boxes shall be properly lubricated and sealed as per service requirements and manufacturer's standards. If external gland sealing is required, it shall be done from the pump discharge. The Bidder shall provide the necessary piping valves, fittings etc. for the gland sealing connection.

4.09.00 Mechanical Seals

4.09.01 Wherever specified in pump data sheet, mechanical seals shall be provided. Unless otherwise recommended by the tenderer, mechanical seals shall be of single type with either sliding gasket or bellows between the axially moving face and shaft sleeves or any other suitable type. The seating faces should be highly lapped surfaces of materials known for their low frictional coefficient and resistance to corrosion against the liquid being pumped.

4.09.02 The pump supplier shall coordinate with the seal maker in establishing the seal chamber of circulation rate for maintaining a stable film at the seal face. The seal piping system shall form an integral part of the pump assembly. For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure even when the pumps are not operating. Necessary provision for seal water supply along with complete piping fittings and valves as required shall form integral part of pump supply.

4.10.00 Pump Shaft Motor Shaft Coupling


4.10.01 The pump and motor shafts shall be connected with an adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guards shall also be provided.

4.11.00 Base Plate

4.11.01 A common base plate mounting both for the pump and motor shall be provided. The base plate shall be fabricated steel and of rigid construction, suitably ribbed and reinforced: ~~Base plate and~~ pump supports shall be so constructed and the piping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, internal differential thermal expansion and hydraulic piping thrust. Suitable drain troughs and drip lip shall be provided.

4.12.00 Assembly and Dismantling

4.12.01 Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouting base plate or alignment.

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4.13.00 Drive Motor (Prime Mover)

4.13.01 The kW rating of the drive shall be based on continuously driving the connected equipment for the conditions specified. In case, where parallel operation of the pumps are specified, the actual motor rating is to be selected by the tenderer considering overloading of the pumps in the event of tripping of operating pumps. All the drive motor of each pump will be Energy Efficient-1 as per IS 12615.

5.00.00 TESTING FOR HORIZONTAL CENTRIFUGAL PUMPS

The manufacturer shall conduct all tests required to ensure that the equipment furnished shall conform to the requirements of this specification and in compliance with the requirement of applicable Codes and Standards. The particulars of the proposed tests shall be submitted to the Owner for approval before conducting the tests.

5.01.00 Hydrostatic Tests

All pressure parts shall be hydraulically tested at 200% of pump rated head or at 150% shut off head whichever is higher. The test pressure shall be maintained for 1/2 hr. and no leakage shall be permitted. While arriving at the above pressure, the maximum suction head specified in Data Sheet shall be taken into account.

5.02.00 Performance Tests


- (a.) All the pumps shall be tested in the Manufacture's Works at rated speed for capacity, efficiency and brake horse power. Pumps shall be given running test over the entire operating range covering from the shut off head to the maximum flow. The duration of test shall be minimum one (1) hour. A minimum of seven readings approximately equidistant shall be taken for plotting the curves with one point at design flow. Testing of pumps shall be in accordance with stipulations of Hydraulic Institute Standards or as applicable equivalent
- (b.) The test shall be preferably conducted with the actual motor being furnished.
- (c.) Only those pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level and excessive vibration is observed during the performance test. Otherwise strip down examination is limited to bearing inspection only.
- (d.) The pump accessories e.g. the thrust bearing, couplings etc. shall be subjected to tests as per manufacturer's standards.

5.03.00 Mechanical Balancing

All rotating components of the pumps shall be statically balanced. In addition to static balancing, rotating components of the pumps shall be balanced dynamically at or near the operating speed. Tenderer shall furnish acceptance norm for this test.

5.04.00 Visual Inspection

Pumps shall be offered for visual inspection by the bidder before shipment. The components of the pumps shall not be painted before inspection.

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5.05.00 NPSH Test

NPSH test shall be conducted with water as medium if required. NPSH shall not be mandatory in case type test certificates are furnished for the similar rating of pumps.

5.06.00 Noise and Vibration Measurement

Noise and vibration shall be measured during the performance testing at shop as well as during the site test.

- (a.) The noise level shall not exceed 85 dBA. Noise level measurement will be made as per applicable internationally acceptable standard. The measurement shall be carried out with calibrated integrating sound level meter meeting the requirement of IEC:651 or BS:6051 or IS:9779. Sound pressure level will be measured all round the pump and motor set at a distance of one meter from the nearest surface of the machine and at a height of 1.5 m from the floor level. A minimum of six (6) points should be covered for measurement. The measurement shall be done with a slow response on the A-weighted scale. The average of the A-Weighted sound pressure measurements expressed in decibels to a reference 0.0002 microbars shall not exceed the specified value.

The tests shall be carried out on the machine operating at rated speed and as near as possible to the rated power. Corrections for background noise and correction on account of test environment will be considered in line with applicable standard. For this purpose all the additional data required should necessarily be collected during the test.


- (b) Vibration check will also be done as per HIS. Vibration would be checked at thrust bearing locations on horizontal, radial and vertical direction. The acceptance limits would be as per HIS. The instrument used would be IRD 308 or equivalent with velocity pick-up. Vibration limits to be specified as per the speed of the pump.

5.07.00 Material Test Certificate

- (a) Material of the various pump components shall be tested in accordance with the relevant standards. Test certificates for these shall be furnished for the Owner's approval.
- (b) Where stage inspection is desired by BHEL/customer all material test certificates shall be correlated and verified with the actual material used for construction before starting fabrication by BHEL/customer's inspector who will stamp the material. In case mill test certificate for the material are not available, the supplier shall carry out physical and chemical tests at his own cost from a testing agency, approved by BHEL/Customer, as per the requirement of specified material standard. The sample for physical and chemical testing shall be drawn up in presence of BHEL/Customer's inspector who shall also witness the testing.


5.08.00 Non Destructive Testing

- (a) UT shall be carried out on shafts of diameter more than 50 mm.
- (b) DP tests shall be carried out on shaft and impeller.
- (c) No weld repair shall be allowed on cast iron.


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5.08.00 Field Testing

- 5.08.01 After installation, the pumps offered shall be operated to prove satisfactory performance as as individual equipment as well as a system run. If the performance at site is found not to the requirements then the equipment shall be rectified or replaced by the Vendor, at no extra cost to the Owner. The procedure of the above testing will be mutually agreed between the Owner and the contractor. Noise and vibration tests shall also be repeated at site.
- 5.08.02 Based on observation of the trial operation, if modifications and repairs are necessary, the same shall be carried out by the contractor to the full satisfaction of the engineer and then the performance and guarantee tests to be repeated at site as per relevant clauses of the specification.

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TECHNICAL SPECIFICATION FOR METERING PUMPS

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1.00.0 GENERAL

1.01.01 Specification cover the design, material, construction features, manufacture, inspection, testing the performance at the vendor's/sub-vendor's works, delivery to site, erection, commissioning and testing of metering pumps.

2.00.0 GENERAL DESIGN FEATURES

2.00.01 Pumps shall be simplex positive displacement hydraulically operated diaphragm design, driven by squirrel cage induction motor through suitable speed reduction unit. Maximum pump stroke speed shall not exceed 100 per minute.

2.00.02 The stroke shall be continuously adjustable to give a capacity variation 0-100% range while the pump is running or stopped. Adjustment of capacity shall be done by manual control facility (micrometric adjusting type) to be provided locally for each of the pump. The capacity & head of each pump will be selected with 20% over all margin.

2.00.03 The stroke shall be continuously adjustable to give a capacity variation 0-100% range while the pump is running or stopped. Adjustment of capacity shall be done by manual control facility (micrometric adjusting type) to be provided locally for each of the pump.

2.00.04 Capacity variation may be effected by changing eccentricity of the driving crank or by suitable hydraulic circuit. Pump accuracy shall be industry standard $\pm 1\%$ of capacity setting.

2.00.05 Pumps shall be provided with an integral relief valve, spring operated to release pressure when delivery line blockage occurs.

2.00.06 Crankcase shall be constructed of high quality cast iron, which will also house the gearbox and guides of cross head.

2.00.07 Guided, controlled travel, double-ball check valves or equivalent, shall be provided both on the suction and discharge side.

2.00.08 Material of construction of the various parts shall be as per the details furnished elsewhere in the specification. However all parts coming in contact with acid shall be of Haste alloy 'B' and for alkali it should be of SS-316 only.


2.00.09 Suitable gland seal shall be provided to prevent leakage.

2.00.10 Electric drive motor particulars should follow enclosed electrical chapters.

3.00.00 TESTING

3.01.00 Testing and Inspection at Manufacturer's Works

3.01.01 The manufacturer shall conduct all tests required to ensure that the equipment furnished conforms to the requirements of this Specification and is in compliance with requirements of the applicable codes. The particulars of the proposed tests and the procedures for the tests shall be submitted to Owner for approval before conducting the tests.

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- 3.01.02 The Owner's representatives shall be given full access to all tests for which the Manufacturer shall inform the Owner allowing adequate time so that if the Owner so desires, his representatives can witness the test.
- 3.01.03 All materials and castings used for the equipment shall be of tested quality. The test certificates shall be made available to Owner.
- 3.01.04 The pump casing shall be hydraulically tested at 200% pump operating pressure or 150% of design pressure whichever is higher. The test pressure shall be maintained at least for ½ an hour.
- 3.01.05 The rotating parts of pump drive shall be subjected to static balancing.
- 3.01.06 All pumps shall be tested at the shop for capacity, volumetric accuracy, repetitive accuracy, power and volumetric efficiency. The tests are to be done according to the requirements of the "Hydraulic Institute" of U.S.A. and Indian Standards as applicable.
- 3.01.07 The pump accessories e.g. gear box, speed reduction unit etc. will be subjected to tests as per manufacturer's standards. The test results shall be furnished to the Owner.
- 3.01.08 The combined variation of the pump and motor should be restricted within limits specified by Hydraulic Institute Standard, USA when the pump operated singly or in parallel.
- 3.01.09 All pumps shall be subject to strip down examination visually to check for mechanical damages after performance testing at shop.
- 3.01.10 Diaphragm of the metering pump shall be type tested as per applicable code/standard.
- 3.01.11 Performance test shall be carried out for the setting of pressure relief valve.
- 3.01.12 Test reports and certificates of all the above-mentioned tests to ensure satisfactory operation of the system shall be submitted to the Owner for approval before dispatch.

3.02.00 Test at Site

After erection at site pumps as detailed under different groups shall be operated to prove satisfactory performance as individual equipment as well as a system. If the performance at site is found to be not to the requirements, then the equipment shall be rectified or replaced by the Vendor at no extra cost to the Owner.



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CONDENSATE POLISHING UNIT**

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SECTION -D2

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SECTION – D2
(ELECTRICAL)



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS


SPECIFICATION NO.
PE-SS-999-506-E101
VOLUME NO. : **II-B**
SECTION : **D**
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GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

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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.

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- 4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.
- 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.
- 4.6. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.
- 4.7 Terminals and Terminal Boxes**
- 4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.

Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".
- 4.7.2 unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.
- 4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.
- 4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.
- 4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.
- 4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.
- 4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.
- 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.
- 4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.
- 4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

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- 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.

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	MOTORS	

1.0 A.C. MOTORS

- 1.1 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.
- 1.2 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.
- 1.3 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.
- 1.4 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.
- 1.5 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.
- 1.6 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.
- 1.7 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.
- 1.8 All HT motors shall be provided with vibration pads for mounting vibration detectors.
- 1.9 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	SECTION: D2.23 VOLUME-IV SHEET 2 OF 6
MOTORS		
1.10 1.11 1.12 1.13 1.14 1.15 1.16 2.0 2.1 3.0 3.1 3.2 3.3 3.4	<p>Wherever provided, the ring oiling system shall be adequate for starting and continuous operation of the motor for at least one half hour without pressure oiling system in operation.</p> <p>For 11kV & 3.3kV motors, 6 nos. duplex/ 12 nos. simplex RTDs for winding shall be provided. Each bearing shall be provided with one no. PT-100 duplex type RTDs for temperature monitoring. These motors shall be designed to withstand at least 5% harmonics in the supply voltage.</p> <p>The maximum double amplitude vibrations for motors shall be as per IS:12075 .</p> <p>Maximum noise level measured at a distance of 1 metre from the outer surface of the motor shall not exceed 85 dB (A).</p> <p>Cable boxes of all 11kV & 3.3kV motors shall be provided with quick disconnecting type terminal connectors to facilitate easy disconnection and removal of the motors without requiring unsealing or otherwise disturbing the external cable connections and leaving the phase segregated terminal box intact.</p> <p>The insulation system for 11000V & 3300 V AC motors shall withstand the negative or positive 0.3 / 3.0 microsecond wave (2.7 pu rated peak line to earth operating voltage) switching surges originating from non-effectively earthed power system. All 11000V & 3300 V AC motors shall have BIL and withstand frequency voltage as per relevant standards.</p> <p>DC MOTORS</p> <p>DC motors shall be suitable for the DC system voltage available in the plant. Motor shall be capable of starting and accelerating the load with the applicable method of starting, without exceeding acceptable winding temperatures, when the supply voltage is in the range of 85% to 110% of rated motor voltage. The field windings for the motors shall be continuously rated without forced ventilation.</p> <p>ACTUATOR MOTORS</p> <p>The actuator motors shall be designed for short time duty (S2) in accordance with IEC 60034-1.</p> <p>Hand wheel operation shall be provided in addition to motor drive.</p> <p>The DC and AC actuator shall be provided with accessories viz., Torque limit switch, end of travel switch, adjustable limit switch, hand wheel motor, thermostat, integral starter, valve position indicator, Manual-Auto lever with suitable locking arrangement, etc.. Complete actuator shall be tested at factory as per IS 9334.</p> <p>Two normally open and two normally closed or two changeover potential free contacts corresponding to open and close positions of the valve shall be provided.</p>	

RPCLYTPS 	RAICHUR POWER CORPORATION LIMITED YERAMARUS TPS - 2x800 MW	SECTION: D2.23 VOLUME-IV SHEET 3 OF 6
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			

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

RPCLYTPS 	RAICHUR POWER CORPORATION LIMITED YERAMARUS TPS - 2x800 MW	SECTION: D2.23 VOLUME-IV
	MOTORS	SHEET 4 OF 6


	(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			

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

RPCLYTPS 	RAICHUR POWER CORPORATION LIMITED YERAMARUS TPS - 2x800 MW	SECTION: D2.23 VOLUME-IV
	MOTORS	SHEET 5 OF 6

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		

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

RPCLYTPS 	RAICHUR POWER CORPORATION LIMITED YERAMARUS TPS - 2x800 MW	SECTION: D2.23 VOLUME-IV SHEET 6 OF 6
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.

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

QUALITY PLAN		CUSTOMER : RAICHUR POWER CORP LTD		PROJECT:2X800 MW YERMARUS STPP		SPECIFICATION : PE-TS-362-155-A001				
		TITLE		TITLE		NUMBER :				
		QUALITY PLAN		QUALITY PLAN		SPECIFICATION :				
		NUMBER PED-506-00-Q-006/0		NUMBER PED-506-00-Q-006/0		TITLE : CONDENSATE POLISHING UNIT				
		ITEM AC ELECT. MOTORS BELOW 75KW (LV)		ITEM AC ELECT. MOTORS BELOW 75KW (LV)		SECTION VOLUME III				
		REFERENCE DOCUMENT		ACCEPTANCE NORM		AGENCY				
		EXTENT OF CHECK		100%		REMARKS				
		TYPE/METHOD OF CHECK		VISUAL		P W V				
		CAT.		4		5				
		3		4		6				
		3		7		8				
		3		9		10				
		3		9		11				
1	2	3	4	5	6	7	8	9	10	11
		3-NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	3	1
NOTES:										
1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE										
2 SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON										
3 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.										
FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW, ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.										
BHEL										
PARTICULARS										
NAME										
SIGNATURE										
DATE										
BIDDER/VENDOR										
BIDDER'S/VENDORS COMPANY SEAL										

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

QUALITY PLAN		SPECIFICATION : PE-TS-362-155-A001									
SHEET 2 OF 9		NUMBER :									
SHARED		SPECIFICATION :									
TITLE		TITLE : CONDENSATE POLISHING UNIT									
BIDDER/ VENDOR		SECTION VOLUME III									
SYSTEM		REMARKS									
CAT.		AGENCY									
TYPE/ METHOD OF CHECK		P W V									
EXTENT OF CHECK		9 10 11									
METHOD OF CHECK		8									
RECEIVED DOCUMENT		7									
ACCEPTANCE NORM		6									
FORMAT OF RECORD		5									
ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		4									
QUALITY PLAN NUMBER PED-506-Q-007/2		3									
PROJECT: 2X800 MW YERMARUS STPP		2									
CUSTOMER : RAICHUR POWER CORP LTD.		1									
1	2	3	4	5	6	7	8	9	10	11	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND. 2. CHEM. & PHYSICAL PROPERTIES 3. DIMENSIONS 4. INTERNAL FLOWS	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTDS	1. MAKE & RATING 2. PHYSICAL COND. 3. DIMENSIONS (WHEREVER APPLICABLE) 4. PERFORMANCE/ CALIBRATION	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2
			MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	-
			CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1 FOR DIA OF 55 MM & ABOVE
			MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	-
			MA	-DO-	-DO-	-	NO BREAKAGE ON OTHER PHY. DESIGN	-DO-	3	-	-
			MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	-
			MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	-
BHEL		BIDDER/VENDOR									
		NAME									
		SIGNATURE									
		DATE									
		BIDDER'S/VENDORS COMPANY SEAL									

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

QUALITY PLAN		CUSTOMER : RAICHUR POWER CORP LTD. PROJECT:2X800 MW YERMARUS STPP										SPECIFICATION : PE-TS-362-155-A001		
SL. NO.	COMPONENT/OPERATION	SHEET 3 OF 9	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION		REMARKS	
											P	W		V
1	2	3	4	5	6	7	8	9	10	11				
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. 2. OTHER CHARACTERISTICS	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	-			
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND. 2. DIMENSIONS INCLUDING BURS HEIGHT 3. ACCEPTANCE TESTS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2			
1.9	CONDUCTORS	1. SURFACE FINISH 2. ELECT. PROP. & MECH. PROP	MA	VISUAL	100%	MANUF'S DRG. .	MANUF'S DRG.	LOG BOOK	3	-	2		FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT	
BHEL														
PARTICULARS														
NAME														
SIGNATURE														
DATE														
BIDDER/VENDOR														
BIDDER'S/VENDORS COMPANY SEAL														

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

QUALITY PLAN		PROJECT: 2X800 MW YERMARUS STPP										SPECIFICATION : PE-TS-362-155-A001	
SHEET 4 OF 9		TITLE										NUMBER :	
QUALITY PLAN		QUALITY PLAN										SPECIFICATION :	
BIDDER/ VENDOR		NUMBER PED-506-00-Q-007/2										TITLE : CONDENSATE POLISHING UNIT	
SYSTEM		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)										SECTION	
CAT.		REFERENCE DOCUMENT										AGENCY	
CHARACTERISTIC CHECK		ACCEPTANCE NORM										P	
W		V										REMARKS	
METHOD OF CHECK		EXTENT OF CHECK										10	
TYPE/ METHOD OF CHECK		FORMAT OF RECORD										11	
CAT.		7										9	
3		8										10	
4		6										11	
5		5										11	
6		4										11	
7		3										11	
8		2										11	
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SL. NO.		COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
										P	W	V	
CUSTOMER : RAICHUR POWER CORP LTD. PROJECT:2X800 MW YERMARUS STPP TITLE : BIDDER/ VENDOR : SYSTEM : QUALITY PLAN : NUMBER PED-506-00-Q-007/2 ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV) SPECIFICATION : PE-TS-362-155-A001 NUMBER : SPECIFICATION : TITLE : CONDENSATE POLISHING UNIT SECTION : VOLUME III													
1	2	IN PROCESS	3	4	5	6	7	8	9	10			11
2.0													
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	-DO-	GOOD FINISH	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	-DO-	GOOD FINISH	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	-DO-	RELEVENT SPEC./ASTM-E165	MANUF'S SPEC./BHEL SPEC./	-DO-	3	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	-DO-	MANFR'S SPEC./BHEL RELEVANT STAND	BHEL SPEC./SAME AS COL.7	LOG BOOK	3	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	-DO-	3	-	2	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	-	
BHEL				PARTICULARS	BIDDER/VENDOR								
				NAME									
				SIGNATURE									
				DATE									
BIDDER'S/VENDORS COMPANY SEAL													

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

QUALITY PLAN		CUSTOMER : RAICHUR POWER CORP LTD. PROJECT:2X800 MW YERMARUS STPP		TITLE		SPECIFICATION : PE-TS-362-155-A001				
SHEET 6 OF 9		BIDDER/ VENDOR		NUMBER :		SPECIFICATION :				
SYSTEM		NUMBER PED-506-00-Q-007/2		TITLE : CONDENSATE POLISHING UNIT		VOLUME III				
CAT.		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		SECTION		REMARKS				
TYPE/METHOD OF CHECK		EXTENT OF CHECK		AGENCY		P W V				
3		6		8		10				
4		5		7		9				
11										
1	2	3	4	5	6	7	8	9	10	11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	3	-
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	3	-
		3.CORE LOSS & HOTOPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	3	-
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	3	-
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	-
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	3	-
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	-
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	2
		6.SURGE WITH STAND AND TAN DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	2
		1.VISCOSITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	3	-
2.6	IMPREGNATION	2.TEMP. PRESSURE VACCUUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	3	-
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	3	-
										2
										THREE DIPS TO BE GIVEN
BHEL		PARTICULARS		BIDDER/VENDOR						
		NAME								
		SIGNATURE								
		DATE								
										BIDDER/SVENDORS COMPANY SEAL

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

QUALITY PLAN		CUSTOMER : RAICHUR POWER CORP LTD. PROJECT:2X800 MW YERMARUS STPP		TITLE		SPECIFICATION : PE-TS-362-155-A001					
SHEET 7 OF 9		BIDDER/ VENDOR SYSTEM		QUALITY PLAN NUMBER PED-506-00-Q-007/2		SPECIFICATION : TITLE : CONDENSATE POLISHING UNIT					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS	
1	2	3	4	5	6	7	8	9	P	W	V
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	2
2.8	BRAZING/COMPRESSION JOINT	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	3	-	-
		1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	-
		2.SOUNDNESS	CR	MALLET TEST & MV TEST	-DO-	-DO-	-DO-	Log Book	3	-	-
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	3	-	-
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG DWG.	Log Book	3	2	1
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	3	2	-
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	3	-	-
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	3	-	-
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	3	-	2
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	3	-	-
		5.CORRECTNESS, COMPLETENESS, TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	3	-	-
11											
BHEL											
PARTICULARS											
BIDDER/VENDOR											
NAME											
SIGNATURE											
DATE											
BIDDER'S/VENDORS COMPANY SEAL											


THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

SL. NO.		COMPONENT/OPERATION		CHARACTERISTIC CHECK		QUALITY PLAN		CUSTOMER : RAICHUR POWER CORP LTD. PROJECT:2X800 MW YERMARUS STPP		SPECIFICATION : PE-TS-362-155-A001			
						BIDDER/ VENDOR	TITLE	NUMBER :					
SHEET 8 OF 9		SYSTEM CAT.		TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SPECIFICATION TITLE : CONDENSATE POLISHING UNIT				
3.0		1	2	3	4	5	6	7	8	9	10	11	
		1	2	3	4	5	6	7	8	9	10	11	
3.0	TESTS	MA	MA	ELECT. TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	IS-325/ BHEL SPEC./ DATA SHEET	3	1	1,2	NOTE - 1
		MA	MA	-DO-	100%	-DO-	-DO-	-DO-	-DO-	3	1,2	1,2	NOTE - 2
		MA	MA	-DO-	100%	IS-12075	IS-12075	-DO-	IS-12075	3	1,2	-	
		MA	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET	INSPC. REPORT	APPROVED DRG/DATA SHEET & RELEVANT IS	3	2,1	-	
		MA	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	RELEVANT IS	TC	BHEL SPEC. AND DATA SHEET	3	-	2,1	TC FROM AN INDEPENDENT LABORATORY NOTE-3
		MA	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	IS-325 & DATA SHEET	3	2,1	-	
		MA	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	IS-3682 IS-8239 IS-8240	3	-	2,1	NOTE-3
		MA	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	BHEL SPEC. & DATA SHEET	3	2,1	-	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY
BHEL		PARTICULARS		BIDDER/VENDOR									
		NAME											
		SIGNATURE											
		DATE											
				BIDDER/SVENDORS COMPANY SEAL									


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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

SPECIFICATION : PE-TS-362-155-A001 NUMBER :		CUSTOMER : RAICHUR POWER CORP LTD, PROJECT:2X800 MW YERMARUS STPP		TITLE		SPECIFICATION : PE-TS-362-155-A001 NUMBER :	
QUALITY PLAN		BIDDER/ VENDOR SYSTEM		QUALITY PLAN		SPECIFICATION : TITLE : CONDENSATE POLISHING UNIT	
SHEET 9 OF 9		CAT.		NUMBER PED-506-00-Q-007/2		SECTION	
COMPONENT/OPERATION		TYPE/ METHOD OF CHECK		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		AGENCY	
CHARACTERISTIC CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT		P W V	
3		4		7		10	
2		5		8		11	
1		6		9		11	
<p>NOTES:</p> <p>1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.</p> <p>2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.</p> <p>3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.</p> <p>4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION WITH THE CUSTOMERS, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.</p>							
BHEL		PARTICULARS		BIDDER/VENDOR		BIDDER'S/VENDORS COMPANY SEAL	
		NAME					
		SIGNATURE					
		DATE					

	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT 2X800 MW YERMARUS STPP	BHEL DOCUMENTS NO.: PE-TS-362-155-A001	
		VOLUME-IIB	
		SECTION -D3	
		REV. NO. 00	DATE: 14/12/11

SECTION – D3
(CONTROL & INSTRUMENTATION)

	TITLE: SPECIFICATION FOR PROGRAMMABLE LOGIC CONTROLLER SYSTEM	SPECIFICATION NO. PES-145-36
		VOLUME II-B
		SECTION: D
		REV. NO. 02 DATE: July 19, 2008
		SHEET 1 OF 9

1. SCOPE

This specification covers the Design, Manufacture, Assembly, Inspection and Testing at manufacturer's works, proper packing and delivery to site, erection and commissioning 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.

	TITLE: SPECIFICATION FOR PROGRAMMABLE LOGIC CONTROLLER SYSTEM	SPECIFICATION NO. PES-145-36	
		VOLUME II-B	
		SECTION D	
		REV. NO. 02	DATE: July 19, 2008
		SHEET 2	OF 9

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 with provision for mimic display, push-button stations, control switches, indicating lamps, metering instruments like Indicators, ammeters etc. and facia windows for critical alarms.

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 facia window type, driven by the PLC. Audible alarm, Acknowledge, Reset and lamp test facility shall be provided as per ISA sequence – S18.1, M.


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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.

3.4. INPUT / OUTPUT Modules

- 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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		VOLUME II-B	
		SECTION D	
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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 hardwired/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. Alternatively the serial communication shall be MODBUS protocol on RS 485 network.
- 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-999-145-001~~, sh-08 of 08. Each UPS shall have 30 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 control desk, 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.
- 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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	SPECIFICATION FOR PROGRAMMABLE LOGIC CONTROLLER SYSTEM	VOLUME II-B	
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- Block logic diagrams.
- Annunciation list.
- PLC control room layout drawing.
- List of soft signal exchange with Plant DCS.
- List of mandatory spares
- 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. Mandatory Spares

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

7.3. Recommended Spares

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

7.4. 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.

7.5. 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:

All equipment/materials shall be suitably packed and protected for the entire period of dispatch, storage and erection against impact, abrasion, corrosion, incidental damage due to vermin, sunlight, high temperature, rain, moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in transit and storage in open.

9. PERFORMANCE AND GUARANTEE

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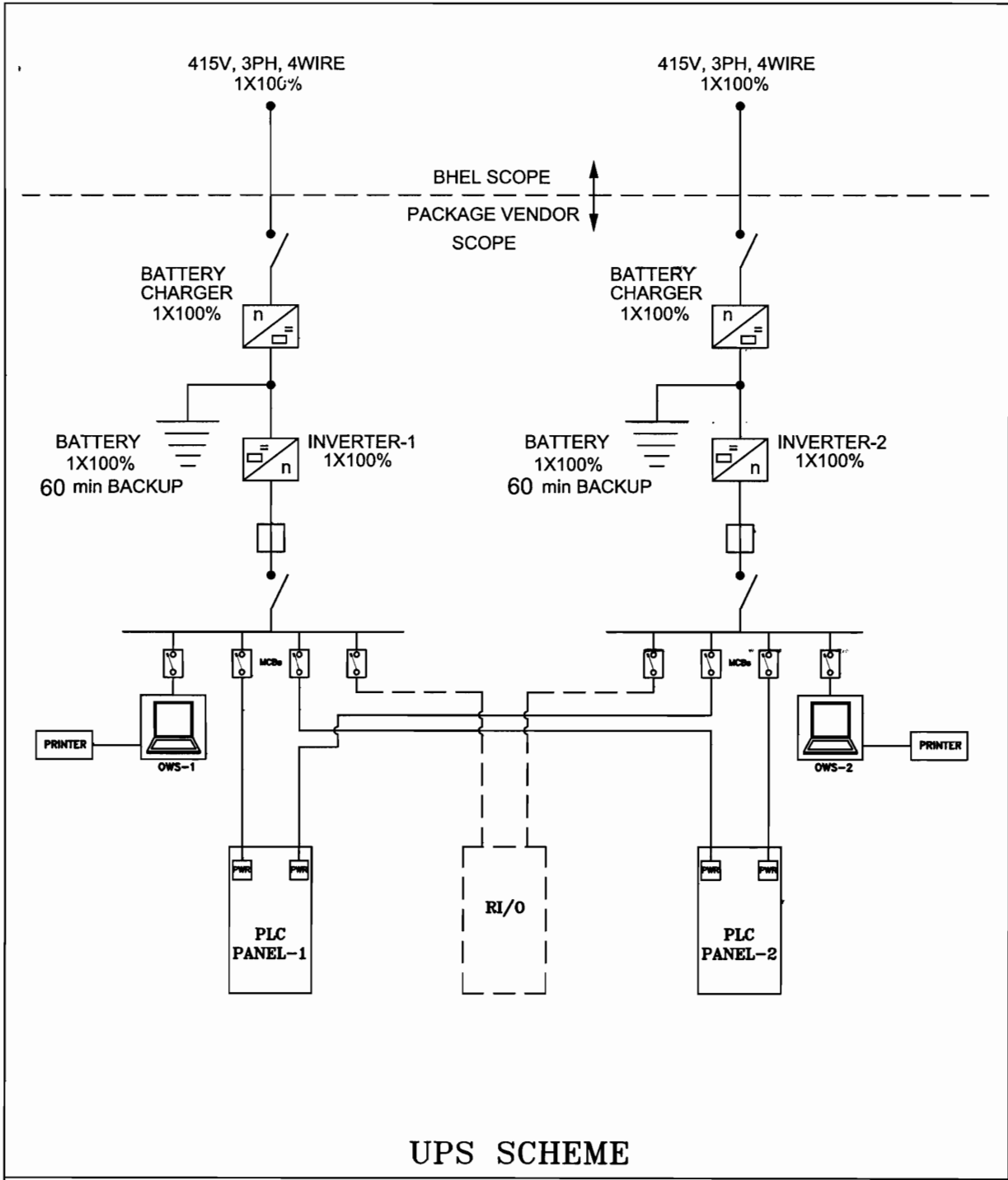
The PLC system shall be guaranteed to meet the performance requirement as specified and also for trouble-free continuous operation for 12 months from the date of commissioning or 18 months from the date of delivery at site whichever is later unless specified otherwise in Vol-IIB Section - B or Section - C.

10. APPLICABLE DATA SHEET FORMS

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


- Data Sheet A & B for PLC system - PE-DC-999-145-I036-1
- Data Sheet C for PLC system - PE-DC-999-145-I036-2

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001



UPS SCHEME


TYPICAL POWER SUPPLY ARRANGEMENT FOR PLC BASED CONTROL SYSTEM

	BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECTS ENGINEERING MANAGEMENT NEW DELHI	DEPT CODE	NAME	SIGN	DATE
		I	DRN CA		26.08.07
			DSGN SSB		26.08.07
			CHD AK		26.08.07
			APPD AK		26.08.07
		DRG. NO. PE-SD-999-145-001			
		SHEET 09 OF 09		REV 00	

Layer1


THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

FORM NO. PEM-666-0

	DATA SHEET FOR PLC SYSTEM		SPECIFICATION NO.:
			VOLUME II B
			SECTION 7
	REV. NO. 02	DATE: 19.07.2008	
	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	2X800 MW - Yermarus STPP	
	SERVICE		
	QUANTITY	<input type="checkbox"/> UNITISED <input checked="" type="checkbox"/> COMMON	
	LOCATION	<input checked="" type="checkbox"/> INDOOR <input type="checkbox"/> OUTDOOR	
PLC EQUIPMENT	MAKE / MODEL NO.	BIDDER TO INDICATE	
	PROCESSOR	REDUNDANT WITH HOT STANDBY	
	DATA BUS (HMI)	<input type="checkbox"/> COPPER WIRE <input type="checkbox"/> FIBRE OPTIC	
	DATA BUS (I/O - CPU)	<input type="checkbox"/> COPPER WIRE <input type="checkbox"/> FIBRE OPTIC	
	DATA BUS (REMOTE I/O - CPU)	<input type="checkbox"/> COPPER WIRE <input type="checkbox"/> FIBRE OPTIC	
	FIELD CONTACTS INTERROGATION VOLTAGE	<input checked="" type="checkbox"/> 24 V <input type="checkbox"/> 48 V	
	LOCATION OF COUPLING RELAYS	<input type="checkbox"/> MCC <input checked="" type="checkbox"/> PLC PANEL	
	DESKTOP OWS QUANTITY	<input type="checkbox"/> ONE <input checked="" type="checkbox"/> TWO <input type="checkbox"/> _____	
	DESKTOP MONITOR TYPE	<input type="checkbox"/> 19" <input checked="" type="checkbox"/> 21" TFT/CRT MONITOR	
	PRINTER (A4) - QUANTITY	INKJET _____ LASER B/W _____ COLOR INKJET _____ COLOR LASER <u>01</u>	
	PRINTER (A4) - MODEL	INKJET _____ LASER B/W _____ COLOR INKJET _____ COLOR LASER <u>01</u>	
PROGRAMMING / CONFIGURATION FACILITY	A) <input type="checkbox"/> HAND HELD B) <input checked="" type="checkbox"/> ENGINEERING SOFTWARE <input checked="" type="checkbox"/> ONE OWS <input type="checkbox"/> ALL OWS <input type="checkbox"/> _____		
SAFETY STANDARD	_____		
	COMPUTER FURNITURE	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
PANEL	QUANTITY	BIDDER TO INDICATE	
	CLASS OF PROTECTION	<input checked="" type="checkbox"/> IP-55	
	REMOTE I/O PANEL	<input type="checkbox"/> YES <input type="checkbox"/> NO	
	COLOUR	AS PER IS-5 SHADE <u>RAL7032</u>	
	BACK-UP DESK	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	MIMIC	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	CONTROL HARDWARE	<input type="checkbox"/> PB <input type="checkbox"/> INDICATORS <input type="checkbox"/> FACIAS _____ Nos. <input type="checkbox"/> OTHERS	
COMMUNICATION TO OTHER SYSTEM	HARDWIRED	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
	PURPOSE	<input type="checkbox"/> CONTROL <input checked="" type="checkbox"/> MONITORING	
	MEDIUM	<input type="checkbox"/> UTP <input type="checkbox"/> FIBRE OPTIC <input type="checkbox"/> OTHERS	
	TIME SYNCHRONIZATION SIGNAL FORMAT	<input type="checkbox"/> PULSE <input type="checkbox"/> RS-485 <input checked="" type="checkbox"/> IRIG-B	
	SOFTLINK	<input type="checkbox"/> MODBUS <input checked="" type="checkbox"/> OPC	
	SERIAL LINK	COMMUNICATION PORT TYPE _____	
POWER SUPPLY INPUT FEEDER	PLC PANEL	BIDDER TO INDICATE LOAD DATA	
	REMOTE I/O PANEL	BIDDER TO INDICATE LOAD DATA	

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

FORM NO. PEM-6666-0

	DATA SHEET FOR PLC SYSTEM	SPECIFICATION NO.:	
		VOLUME II B	
		SECTION D	
		REV. NO. 02	DATE: 19.07.2008
		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 (A4) - QUANTITY		
	PRINTER (A4) - 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		

**STANDARD QUALITY PLAN
FOR
PROGRAMMABLE LOGIC CONTROLLER**

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FACTORY ACCEPTANCE TEST (FAT) PROCEDURE

This document covers procedure to conduct/witness PLC system functional tests in order to demonstrate conformity to purchase specifications and related engineering documents. The test shall be conducted at the system suppliers works. The system supplier shall conduct all functional tests before commencing FAT and test results shall be made available during FAT. Vendor must furnish following relevant drawings, duly approved by BHEL Engineering, for reference during FAT.

- a) Technical Specification of PLC.
- b) PLC System Configuration
- c) General Assembly Drawings.
- d) Panel Wiring Diagrams.
- e) Bill of Quantity for PLC System.
- f) Logic Diagram.
- g) HMI Schematics.
- h) Input / Output List.

Further the vendor shall furnish applicable product specification, datasheets, catalogues, test-certificates, and internal inspection records to enable FAT. Vendor shall also submit, to the inspecting agency, his standard test procedure, for clauses given below; where vendor's standard practice has been referred.

APPLICABLE TEST PROCEDURE:

1. Input/Output Functional Verification.

Check for correctness of addressing of racks, slots and I/O modules as per applicable PLC configuration diagram. Appropriate signal generators shall be used to simulate Inputs and outputs to check operation and SCAN time. Check online replacement of cards, processors, power supply etc.

2. Processor Verification

PLC Configuration drawing to be referred for ascertaining

- i) Redundancy

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ii) Type (Hot or Cold)

Both the processors are to be checked for healthiness in case of redundant configuration as per vendor's standard practice. In case of hot redundancy, switchover of control from primary processor to standby processor shall be demonstrated for uninterrupted control and data processing as per vendor's standard practice. Switchover shall be witnessed, by manual power off or resetting the Primary CPU or simulating failure of primary processor. Checking should be by witnessing the lighting up of Processor's LEDs as per manufacturer's product standard.

Vendor shall demonstrate, as per Vendor's standard practice, adequate Loading (Spare Capacity) of Processors, as mentioned in contract specs. This shall be done, by simulating worst load operation of fully integrated PLC system.

3. Power Supply Module Verification

Check if PSM is in redundant mode as per specification. Check the healthiness of power supply from both the modules' lamp indication/measurement. Simulate failure of one PSM and verify that standby PSM has taken over without any interruption.

4. Communication System Verification

Communication system has to be in line with approved PLC Configuration Diagram. Verify that both the communication buses are intact and connected. Communication between PLC processors, I/O rack, OWS etc. is to be checked through simulation of input data. Simulate the bus failure by disconnection of working bus. Check that the communication continues without interruption or loss of data.

Following response times are to be demonstrated as per vendor's standard practice for conformance to contract specifications:

1. Screen update time
2. I/O scan time
3. SOE resolution time
4. Data transfer time with third party system using Communication Protocol as per Contract specification and as per quantum of data as per approved signal exchange list.

5. Diagnostic Verification

Product Catalogue/Literature shall be referred for checking of all diagnostic features. Hardware failure to be simulated by removing an I/O

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6. Control Panel /Desk Verification

- i) PLC driven annunciation system should be checked by alarm signal simulation.
- ii) Push Button and selector switch operation should be checked by verification of corresponding change of status of Data Base point.
- iii) Indicating lamp / MIMIC should be checked by corresponding Data Base point simulation.

7. Software Verification

- i). Control Logics:- Software switches, lamps and Analog sources shall be used for simulation of field conditions .Control logics shall be checked for its correct functionality as per approved logic schemes
- ii). Engineering features:-
 - a) Online changing of parameters, set points.
 - b) Online modification in Control Logic Diagrams.
 - c) Online configuration of Graphics, Trends, Logs, HSR.
- iii). HMI features:-
Check for configuration & operation of Graphics, Trends, Logs, HSR and Alarms, in the form of Displays and Printouts, by simulation of Inputs as per approved documents.

8. Burn in Elevated Temperature test

Electronic equipments shall be subjected to Burn in elevated temperature test as per the procedure detailed below:

- a) (i) PLC modules are kept at 50 Deg c under continuous energized condition for 48 hours.

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**STANDARD QUALITY PLAN
FOR
PROGRAMMABLE LOGIC CONTROLLER**

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23.03.2005	
SHEET 8	OF 8

ii) 48 hours test period shall be divided into 4 equal time segment of 12 hours duration each. For every 12 hours duration segment, after lapse of first 11 hours 110% of nominal voltage shall be applied to the panel under test for a period of 30 minutes followed by application of 90% of nominal voltage for the next 30 minutes.


b) Assembled Panels with complete wiring shall be kept under continuous energized condition for 120 hours at ambient temperature. Temperature rise in panels should be below 10 Deg C above ambient.

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		QUALITY PLAN NO.: PE-QP-999-145-1036 VOLUME IIB SECTION D		REV. NO. 01 SHEET 1 OF 8		DATE: 24.08.2007		Agency \$ P W V		Remarks	
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	P	W	V
1.0	Materials /Components										
1.1	Panels & Control Desks	Physical Inspection for Dimensions, Painting, Cutouts, Lifting / Locking Arrangements, Components, Drawing Pocket, Mounting accessories, Plinth & AV Pads, Cable Gland Plates, Hardwares, Hinges, Louvers & Filters, Fans & Panel Lamps	MA	Visual	100%	Contract specifications, Approved GA Drawings, BOQ	As per ref documents. No physical damage.	BHEL Quality Inspection Report.	3/2	2	1
1.2	Power Supply/Packs, Battery & Battery charger, Transformer, UPS.	Physical Inspection Physical Damages Dimensions Mounting Accessories	MA	Visual	100%	Contract specifications, BOQ.	As per reference documents, Test Report	BHEL Quality Inspection Report.	3/2	2	1
1.3	Indicating Lamp, Annunciator, Meters, Transducers, Signal Converters, Instruments, Single Loop Controllers	Physical Verification Physical Damages Dimensions Accessories	MA	Visual	100%	Contract specifications, BOQ.	As per ref documents No physical damage. Test/ Calibration report.	BHEL Quality Inspection Report	3/2	2	1
1.4	PLC processors, I/O modules, Power Supply modules, Communication modules, Mounting Racks, Ethernet	Physical Inspection • Identification Labels • Physical Damages • Quantity • Spare Capacity	MA	Visual	100%	Product Catalogue, Data sheets, Approved Configuration diagram, BOQ	As per ref documents. Test Certificates	BHEL Quality Inspection Report.	3/2	2	1

LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics	P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor
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		STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER										
		QUALITY PLAN NO.: PE-QP-999-145-1036										
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		REV. NO. 01		DATE: 24.08.2007								
SHEET 2		OF 8										
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
1.5	CPU, Monitor, Keyboard, Mouse, CD Drives, Printers, OS, System Software, Engineering software in the form of Licensed CD.	Physical Inspection Identification Labels, Tech. Specification Physical Damages Accessories Installation arrangements for Computers & Printers	MA	Visual	100%	Contract specifications, Product Catalogue, Approved GA/ Configuration drawing, BOQ.	As per reference documents.	BHEL Quality Inspection Report.	P	W	V	
									3/2	2	1	


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1 - BHEL
 2 - Vendor
 3 - Sub-vendor

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$				Remarks
									P	W	V		
2.0	Assembly												
2.1	Functional Test for HMI/OVS devices such as Monitors, Keyboards, Mouse, Printers etc.	Operation	MA	Functional	100%	Approved Configuration Diagram & BOQ and FAT	Correct Operation of interconnected Devices of HMI system.	BHEL Quality Inspection Report.	2	1	1		
2.2	Hardware Functional Verification.	Physical arrangement, Wiring check & labeling, Continuity Checking, IR & HV test	MA	Visual/ Electrical	100%	Approved GA Drawing, Panel Wiring Diagram, IR & HV as per relevant International standard	Test Certification	BHEL Quality Inspection Report.	2	2	1		
2.3	Powering Up	Healthiness of all the modules/equipment, associated with Powering of PLC system	MA	Visual /Electrical	100%	Approved power supply scheme	All equipment to be healthy on power ON	BHEL Quality Inspection Report.	2	1	1		
2.4	Burn in test for PLC modules	Healthiness of PLC modules on Continuous Energisation, Temperature maintenance	MA	Visual/ Electrical	100%	FAT Procedure	Test certification as per FAT	BHEL Quality Inspection Report.	2	2	1		


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\$

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 V - Agency Verifying the Test.

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 3 - Sub-vendor


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 PEM :: C&I	STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER	QUALITY PLAN NO.: PE-QP-999-145-1036	VOLUME IIB	SECTION D	REV. NO. 01	DATE: 24.08.2007				
		SHEET 4	OF 8							
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$	Remarks
							P	W	V	

3.0	Factory Acceptance Test (FAT)									
3.1	Input Output Functional Verification	I/O configuration, I/O operation	MA	Visual/Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1 1	
3.2	Processor Verification	Processor configuration, Powering up, standby operation (as applicable) and Loading	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1 1	
3.3	Power Supply Module Verification	Redundancy Operation	MA	Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1 1	
3.4	Communication System Verification	Redundancy operation of Communication System, Measurement of Response Time, Communication with third party system	MA	Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1 1	
3.5	Diagnostic Verification	Self Diagnostic features of PLC system	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1 1	
3.6	Control Panel/Desk Verification	Operation of PLC driven annunciation system, Mosaic, Push buttons & selector switches, Indicating lamps	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1 1	
3.7	Software Verification	(i) Control Logics (ii) Engineering Features (iii) HMI Features	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2 1 1	

LEGEND:	* CR - Critical characteristics	P - Agency Performing the Test.	1 - BHEL
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 PEM :: C&I		STANDARD QUALITY PLAN FOR PRESSURE AND DIFFERENTIAL PRESSURE GAUGES										QUALITY PLAN NO.: PE-QP-999-145-1026 VOLUME IIB SECTION D REV. NO. 01 DATE: 16.05.2007 SHEET 1 OF 2			
		Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
									P	W	V				
1.0	Material / Components														
1.1	Casing, Bourdon_tube, and Movement	1. Chemical composition 2. Workmanship, finish and dimensions	MA	Chemical Test	One Sample from each lot	Approved drg. / data sheet / BHEL Spec.	Relevant raw material std.	Test Certificate	3/2	---	2,1#	# Compliance certificate to be verified.			
1.2	Switch⊕	Contact type & number	MA	Visual, Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report / Log Book	3/2	---	2,1#				
2.0	Assembly	1. Marking – Tag No., Model, Range 2. Workmanship 3. Dial size, scale graduation 4. End connections ⊕5. Switch – contact type & nos.	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate/ Inspection Report	3	---	2,1#	⊕Applicable for gauge with switch device			
3.0	Routine Test	1. Calibration, accuracy, Hysteresis, overload, set point adjustment⊕ / repeatability	CR	Visual, Measurement	100%	- do -	- do -	Inspection Report	2	1	1				
									2	1**	1	**10% of total quantity with minimum of 2 piece / type & size			

LEGEND:	
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\$ P	- Agency Performing the Test.
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V	- Agency Verifying the Test.
1	- BHEL
2	- Vendor
3	- Sub-vendor

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.		Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
										P	W	V	
STANDARD QUALITY PLAN FOR PRESSURE AND DIFFERENTIAL PRESSURE GAUGES													
QUALITY PLAN NO.: PE-QP-999-145-I026 VOLUME IIB SECTION D REV. NO. 01 DATE: 16.05.2007 SHEET 2 OF 2													
4.0	Type Test		2. Hydraulic Test ø3. IR, HV	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec. Relevant standard	No Leakage Relevant standard	Inspection Report - do -	2	1**	1	
4.0	Type Test		1. Enclosure Protection Class 2. Blow out disc ø3. Switch contact rating	CR	Verification	Each type	Approved drg. / data sheet / BHEL Spec. - do - - do -	Approved drg. / data sheet / BHEL Spec. - do - - do -	Test Certificate - do - - do -	2	---	1*	• Type Test Certificate to be verified
5.0	Painting		Shade & Finish	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec. / Manufacturer's std.	Approved drg. / data sheet / BHEL Spec. / Manufacturer's std.	Inspection Report	2	---	2	
6.0	Packing		Soundness	MA	Visual	100%	- do -	- do -	- do -	2	---	---	

LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics	P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.
1 - BHÉL 2 - Vendor 3 - Sub-vendor	

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency §			Remarks
									P	W	V	
STANDARD QUALITY PLAN FOR PRESS AND DIFF PRESS SWITCHES												
QUALITY PLAN NO.: PE-QP-999-145-1031 VOLUME IIB SECTION D REV. NO. 01 DATE: 13.05.2007 SHEET 1 OF 3												
1.0	Raw Material/ Component Sensing Element, Casing, Contact, Process Connection	1. Chem. Composition 2. Make, Marking, Damage and Cracks 3. Leakage (Element Conn.)	MA	Chemical Analysis	1 sample from each lot	BHEL Spec. / Approved data sheet	Relevant material standard	Test Report	3/2	---	2,1	Relevant compliance certificate to be verified.
		2. Make, Marking, Damage and Cracks	MA	Visual	100%	BHEL spec. / manufacturer standard	BHEL spec. / manufacturer standard	Log Book	2	---	---	
		3. Leakage (Element Conn.)	MA	Pressure Test	100%	Manufacturer standard	No Leak	Log Book	2	---	---	
	Micro Switch	1. No. and type of contacts	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Log Book	3/2	---	2,1	
		2. Continuity	CR	Electrical	100%	Manufacturer standard	To have continuity	Log Book	3/2	---	2,1	
2.0	Final Inspection											
2.1	Assembly	1. Marking: Range, Model, Tag No. Sl.No. 2. Correct assembly, workmanship and finish	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---	10% to be witnessed by BHEL
			MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	1	---	- do -

LEGEND:	* CR	- Critical characteristics	§	P	- Agency Performing the Test.	1	- BHEL
	MA	- Major characteristics		W	- Agency Witnessing the Test.	2	- Vendor
	MI	- Minor characteristics		V	- Agency Verifying the Test.	3	- Sub-vendor

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Sl. No.		Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
										P	W	V		
<p>QUALITY PLAN NO.: PE-QP-999-145-1031</p> <p>VOLUME IIB</p> <p>SECTION D</p> <p>REV. NO. 01 DATE: 16.05.2007</p> <p>SHEET 2 OF 3</p>														
<p>STANDARD QUALITY PLAN FOR PRESS AND DIFF PRESS SWITCHES</p>														
2.2			3. Connection	MA	Visual & Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---	10% to be witnessed by BHEL	
			4. Scale Marking	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---	- do -	
			5. Cleanliness	MA	Visual	100%	Manufacturer standard	Free from scratches dirt etc.	Log Book	2	1	---	- do -	
			6. Overall Dimension	MA	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---	- do -	
		Routine Test		1. Overload	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	- do -
				2. Repeatability	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	- do -
			3. Set point adjustment	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	- do -	
			4. Differential	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	- do -	

LEGEND: *	CR	- Critical characteristics	1	- BHEL
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	MI	- Minor characteristics	3	- Sub-vendor
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
		5. Contact Rating	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	---	1	Manufacturer compliance certificate to be verified.
		6. Insulation Resistance & HV	CR	Electrical	100%	Relevant standard	Relevant standard	Test Report	2	1	1	10% to be witnessed by BHEL
		7. Calibration Test	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	- do -
		8. Accuracy Test	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	- do -
2.3	Type Test	1. Weatherproofness	CR	Measurement	1 sample / design	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	3/2	---	1	Vendor to furnish test report for verification
3.0	Packing	Soundness of packing	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	3/2	2	---	

QUALITY PLAN NO.: PE-QP-999-145-1031
 VOLUME IIB
 SECTION D
 REV. NO. 01 DATE: 16.05.2007
 SHEET 3 OF 3

**STANDARD QUALITY PLAN
 FOR
 PRESS AND DIFF PRESS SWITCHES**



LEGEND: * CR - Critical characteristics
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 MI - Minor characteristics


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 V - Agency Verifying the Test. 3 - Sub-vendor

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$				Remarks	
									P	W	V			
1.0	Raw Material / Component													
1.1	Resistance sheath	Material composition	CR	Chemical testing	Sample	Approved data sheet, BHEL Spec.	Relevant material std.	Test Certificate	3,2	---	2,1*	---	2,1*	▲ Relevant compliance certificate to be verified.
1.2	Protective Sheath	Material composition	MA	Chemical testing	Sample	Approved data sheet, BHEL Spec.	Relevant material std.	Test Certificate	3,2	---	2,1*	---	2,1*	
1.3	Terminal Head	Material composition	MA	Chemical testing	Sample	Approved data sheet, BHEL Spec.	Relevant material std.	Test Certificate	3,2	---	2,1*	---	2,1*	
1.4	Thermowell⊕	1. Chemical properties 2. Dimensions (wall thickness concentricity of bore, OD & length) 3. Threading 4. Leak Test	CR MA MA CR	Chemical composition Measurement Thread matching Hydro test at 1.5 times design press.	One sample / Lot 100% 100% 100%	Approved data sheet, BHEL Spec. Approved data sheet/drg., BHEL Spec. Approved data sheet, BHEL Spec. Approved data sheet, BHEL Spec.	Relevant material std. Approved drg., BHEL Spec. Approved data sheet/drg., BHEL Spec. Approved drg., BHEL Spec.	Test Certificate Inspection report Inspection Report Inspection Report	3,2 2 2 3,2	---	1* 2,1* 2,1* ---	---	1 1 1 ---	◆ BHEL to witness 25% Samples ⊕IBR certificate wherever specified to be verified.
2.0	Final Inspection													
2.1	RTD Assembly	1. Workmanship 2. Marking	MA MA	Visual Visual	100% 100%	BHEL Spec. BHEL Spec.	BHEL Spec. BHEL Spec.	Log Book Log Book	2 2	2,1* 2,1*	1 1	---	1 1	

LEGEND: *	CR	- Critical characteristics	\$	P	- Agency Performing the Test.	1	- BHEL
	MA	- Major characteristics		W	- Agency Witnessing the Test.	2	- Vendor
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 STANDARD QUALITY PLAN FOR RESISTANCE TEMPERATURE DETECTOR AND THERMOWELL		QUALITY PLAN NO.: PE-QP-999-145-1025										
		VOLUME IIB	SECTION D									
REV. NO. 00		DATE: 15.03.99										
SHEET 2		OF 2										
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
2.2	Routine Tests	3. Dimensions	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	2,1*	1	
		1. Calibration (Resis Vs. Temp.)	CR	Measurement	100%	Approved drg. IS:2848	BHEL Spec. IS:2848	Test Report	2	2	1	
		2. Insulation Resistance	MA	Electrical	100%	IS:2848	IS:2848	Test Report	2	1	---	
		3. Resistance Tolerance	MA	Thermal Elect.	100%	IS:2848	IS:2848	Test Report	2	1	---	
2.3	Type Test	4. Thermal Response time	CR	Measurement	Sample	IS:2848	IS:2848	Test Certificate	2	1	---	
		1. Immersion error Test	MA	Measurement	Sample	IS:2848	IS:2848	Test Certificate	3/2	---	1	
		2. Thermoelectric Effect	MA	Measurement	Sample	IS:2848	IS:2848	Test Certificate	3/2	---	1	
		3. Vibration Test	CR	Measurement	Sample	IS:2848	IS:2848	Test Certificate	3/2	---	1	
3.0	Packing	4. Enclosure protection test	CR		Sample	BHEL Spec.	BHEL Spec., Approved data sheet.	Test Certificate*	3/2	---	1	* Just certificates to be verified.
		Soundness of packing	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	3/2	2	---	

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

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

\$ 1 - BHEL
 2 - Vendor
 3 - Sub-vendor

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.		Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
										P	W	V	
STANDARD QUALITY PLAN FOR LEVEL SWITCHES													
		QUALITY PLAN NO.: PE-QP-999-145-I033 VOLUME IIB SECTION D REV. NO. 00 DATE: 15.03.99 SHEET 1 OF 3											
1.0	Raw Material/ Component												
1.1	Non Wetted Parts	Physical, Chemical properties	MA	Physical, Chemical Analysis	1/ Cast	BHEL Spec/ Approved data sheet	Relevant material standard	Test Report	3/2	---	2,1*	*Relevant compliance certificate to be verified.	
1.2	Float Assembly & Wetted Parts	Physical for float only & chemical properties for all wetted parts including float assembly	MA	Physical, Chemical Analysis	1/ Batch	AISI:316 / BHEL spec. / drg. / Approved data sheet	AISI:316 / BHEL spec. / drg. / Approved data sheet / Relevant material std.	Test Certificate	3/2	---	2,1*		
1.3	Chamber	Dimensions & leak tightness	MA	Measurement, visual, hyd. test	100%	BHEL Spec/ Approved data sheet	BHEL Spec/ Approved drg. / data sheet	Internal inspection report	3/2	2	1		
1.4	Float	Leak tightness	MA	Hyd. test	100%	BHEL Spec/ Approved data sheet	No leakage	Internal inspection report	3/2	2	1		
1.5	Switch	1.. Make, type and rating	MA	Visual	100%	BHEL / Mfr. spec.	BHEL / Mfr. spec.	Internal inspection report	3/2	---	2,1		
		2. Contact Continuity	CR	Electrical	100%	BHEL / Mfr. spec.	BHEL / Mfr. spec.	To have continuity	3/2	---	2,1		
2.0	Final Inspection												
2.1	Assembly	1. Marking: Range, Model, Tag No. Sl.No.	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---		

LEGEND: * CR - Critical characteristics	P - Agency Performing the Test.	1 - BHEL
MA - Major characteristics	W - Agency Witnessing the Test.	2 - Vendor
MI - Minor characteristics	V - Agency Verifying the Test.	3 - Sub-vendor

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records			Agency \$			Remarks
								P	W	V	P	W	V	
		2. Correct assembly, workmanship and finish	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	1	---	---		
		3. Connection	MA	Visual & Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---	---		
		4. Scale Marking	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---	---		
		5. Cleanliness	MA	Visual	100%	Manufacturer standard	Free from scratches dirt etc.	Log Book	2	1	---	---		
		6. Overall Dimension	MA	Measurement	100%	BHEL Spec. / Approved drg.	BHEL Spec. / Approved drg.	Inspection Report	2	1	---	---		
2.2	Routine Test	1. Overload	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	1	❖ BHEL to witness 25% sample.	
		2. Repeatability	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	1		
		3. Set point adjustment	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	1		

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

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

1 - BHEL
 2 - Vendor
 3 - Sub-vendor

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
2.3	Type Test	4. Differential 5. Contact Rating 6. Insulation Resistance & HV 1. Weatherproofness	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	Manufacturer compliance certificate to be verified.
3.0	Packing	Soundness of packing	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	3/2	2	---	Vendor to furnish test report


QUALITY PLAN NO.: PE-QP-999-145-1033
 VOLUME IIB
 SECTION D
 REV. NO. 00 DATE: 15.03.99
 SHEET 3 OF 3

STANDARD QUALITY PLAN FOR LEVEL SWITCHES



LEGEND:	* CR - Critical characteristics	P - Agency Performing the Test.	1 - BHEL
	MA - Major characteristics	W - Agency Witnessing the Test.	2 - Vendor
	MI - Minor characteristics	V - Agency Verifying the Test.	3 - Sub-vendor

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

 PE :: C&I		STANDARD QUALITY PLAN FOR THERMOCOUPLE WITH THERMOWELL										QUALITY PLAN NO.: PE-QP-999-145-1003 VOLUME IIB SECTION D REV. NO. 00 DATE: 15.03.99 SHEET 1 OF 2		
		Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$	Remarks	P	W
1.0	Raw Material / Component													
1.1	Thermocouple wires	Material composition	CR	Chemical testing	Sample	BHEL Specs. / Appd. data sht.	Relevant material standards	Test Certificate	3/2	2,1▲	▲ Relevant compliance certificate to be verified.			
1.2	Protective Sheath	Material composition	MA	Chemical testing	Sample	BHEL Specs. / Appd. data sht.	Relevant material standards	Test Certificate	3/2	2,1▲				
1.3	Terminal Head	Material composition	MA	Chemical testing	Sample	---	Relevant material standards	Test Certificate	3/2	2,1▲				
1.4	Thermowell φ	1. Chemical properties 2. Dimensions (wall thickness, concentricity of bore, OD and length) 3. Threading 4. Leak Test	CR	Chemical test	Sample	BHEL Specs / Approved data sheet	Relevant material standard	Test Certificate	3/2	2,1▲				
			MA	Measurement	100%	BHEL Specs / Approved drgs.	BHEL Specs / Approved drgs.	Log Book	2	1▲				
			MA	Thread matching	100%	BHEL Specs / Approved data sheet.	BHEL Specs / Approved data sheet.	Inspection Report	2	2,1▲				
			CR	Hyd. test at 1.5 times design press.	100%	BHEL Specs / Approved data sheet.	BHEL Specs / Approved data sheet.	Inspection Report	3/2	2,1	⊕ IBR certificate if specified to be verified.			

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

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

1 - BHEL
 2 - Vendor
 3 - Sub-vendor

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.		Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
										P	W	V	
STANDARD QUALITY PLAN FOR THERMOCOUPLE WITH THERMOWELL													
		QUALITY PLAN NO.: PE-QP-999-145-1003 VOLUME IIB SECTION D REV. NO. 00 DATE: 15.03.99 SHEET 2 OF 2											
2.0	Final Inspection												
2.1	Thermocouple Inspection	Workmanship Marking Dimensions	MA MA MA	Visual Visual Measurement	100% 100% 100%	BHEL Specs BHEL Specs BHEL Specs / Approved drgs.	BHEL Specs. BHEL Specs / Approved drgs. BHEL Specs / Approved drgs.	Log Book Log Book Log Book	2 2 2	2,1 2,1 2,1	1 1 1	1 1 1	• BHEL to witness 25% samples.
2.2	Routine Tests	1. Continuity and Polarity 2. Accuracy Test (EMF vs. Temp. 3. Insulation resistance between Element and sheath 4. Response Time Test	MA CR MA MA	Measurement Thermal & Elect Thermal & Elect Thermal & Elect	100% 100% 100% 10%	----- BHEL Specs ----- BHEL Specs / Approved data sheet	Compliance Relevant standards Relevant standards Relevant standards	Test Report Test Report Test Report Test Report	2 2 2 2	2,1 2,1 1 2	--- --- --- 1	--- --- --- 1	
2.3	Type Tests	Enclosure protection test for Head	CR	Testing	Sample	BHEL Specs	BHEL Specs / Approved data sheet	Test Certificate	3/2	---	---	1	
3.0	Packing	Soundness of packing	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	3/2	2	---	---	

LEGEND: * CR - Critical characteristics
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 V - Agency Verifying the Test.
 \$ 1 - BHEL
 2 - Vendor
 3 - Sub-vendor

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.		Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$				Remarks	
										P	W	V	V		
STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER															
QUALITY PLAN NO.: PE-QP-999-145-I001 VOLUME IIB SECTION D REV. NO. 00 DATE: 12.10.99 SHEET 1 OF 7															
1.0		RAW MATERIAL INSPECTION													
1.1		Body/Casing, Cable Gland and Mounting Bracket	1. Chemical & Mech. Properties 2. Dimensions 3. Visual 4. Degree of Protection (If applicable) 5. Leak Tightness	MA	Analysis	1 / Lot	Tech. Specn. Data Sheet, Mfr. standard	Tech. Specn. Data Sheet, Mfr. standard	Test certificate	3	---	2	---	2	Compliance report verification by BHEL.
				MA	Measurement	10% Min. 3 Nos.	Manufacturer drg.	Manufacturer drg.	Log Book	2	---	---	---	---	
				MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Log Book	2	---	---	---	---	
				CR	IS-2147 IS-2148	1 / Type	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	3	---	2	---	2	
				MA	Hydro Test	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Log Book	2	---	---	---	---	
1.2		Sensor (Diaphragm, Capsule, Bellows, Strain, Gauge, Capacitance etc.)	1. Material Properties (Chemical & Mechanical) 2. Dimension 3. Performance 4. Type Test	MA	Analysis	1 / Lot	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	3/2	---	2	---	2	
				MA	Measurement	1 / Lot	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	2	---	---	---	---	
				CR	Function	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	2	---	---	---	---	
				CR	Mech. & Elect.	1/Type	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	3/2	---	2	---	2	

* CR - Critical characteristics
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 MI - Minor characteristics

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

1 - BHEL or their agent
 2 - Vendor
 3 - Sub-vendor

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
1.3	Gasket	1. Dimension	MA	Measurement	Sample	Manufacturer standard	Manufacturer standard	Test certificate	3/2	---	2	
1.4	Electrical & Electronic Components	2. Sheer Hardness	MA	Analysis	Sample	Manufacturer standard	Manufacturer standard	Test certificate	3/2	---	2	
		1. Marking & Rating	MA	Visual	10%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
		2. Electrical Parameters	CR	Electrical Tests	10%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
		3. Dimensions	MA	Measurement	10%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
1.5	PCBs	4. Solderability	MA	Electrical	3 / Type	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
		1. Visual	MA	Visual	100%	---	---	---	3/2	---	2	
		2. Dimensions	MA	Measurement	10%	Manufacturer standard	Manufacturer standard	Log Book	3/2	---	2	
		3. Type Test	CR	Mech. & Elect. Tests	1 / Type / Batch	IS:7405 BS:4025	IS:7405 BS:4025	Test certificate	3/2	---	2	

<p>QUALITY PLAN NO.: PE-QP-999-145-1001</p> <p>VOLUME IIB</p> <p>SECTION D</p> <p>REV. NO. 00 DATE: 12.10.99</p> <p>SHEET 2 OF 7</p>	<p>STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER</p>	<p>PEM :: C&I</p>
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<p>LEGEND: * CR - Critical characteristics</p> <p>MA - Major characteristics</p> <p>MI - Minor characteristics</p>	<p>\$</p> <p>P - Agency Performing the Test.</p> <p>W - Agency Witnessing the Test.</p> <p>V - Agency Verifying the Test.</p>	<p>1 - BHEL or their agent</p> <p>2 - Vendor</p> <p>3 - Sub-vendor</p>
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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.		Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks		
										P	W	V			
2.0	In-Process Inspection	Electrical Unit	1. Dimension – Trade width, Gap etc. 2. Defect of undercuts 3. Quality and plating of plating through holes. 4. Screen printing	MA MA CR CR	Measurement Visual Visual Visual	Sample Sample 100% 100%	Manufacturer standard Manufacturer standard Manufacturer standard Manufacturer standard	Manufacturer standard Manufacturer standard Manufacturer standard Manufacturer standard	Inspection report Inspection report Inspection report Inspection report	2 2 2 2	---	---	---	Compliance verification report by BHEL	
2.1	Etched PCB														
2.1.1															
2.1.2	Component Mounting and soldering		1. Correctness of components 2. Mounting and orientation 3. Soldering defects and finish	MA MA CR	Visual Visual Visual	100% 100% 100%	Manufacturer standard Manufacturer standard Manufacturer standard	Manufacturer standard Manufacturer standard Manufacturer standard	Inspection report Inspection report Inspection report	2 2 2	---	---	---		
2.1.3	Assembled PCBs		Functional check	CR	Electrical checks before & after soaking*	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	---	---	---		

*Soaking means subjecting PCBs (Assembled) at 70 Deg. C for 72 hours at energised condition and rapid temperature cycle test at 70 Deg. C and (-) 20 Deg. C for 30 minutes at each temp. (Five such cycles).

LEGEND: * CR - Critical characteristics
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 1 - BHEL or their agent
 2 - Vendor
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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
2.1.4	Conformal coating	Uniformity and finish of conformal coating on both sides	CR	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	---	---	
2.2	Mounting, Fitting, Assembly of various mechanical parts	1. Correct Mounting 2. Defects 3. Dimensions	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
2.3	Interconnection – Sensor to Electronic unit	Correctness of Interconnection	MA	Measurement	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	Compliance verification report by BHEL
2.4	Interconnection – Pneumatic unit / Electronic unit and output / Local indicator.	Correctness of Interconnection	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	



**STANDARD QUALITY PLAN
FOR
PRESSURE / DP/LEVEL TRANSMITTER**

QUALITY PLAN NO.: PE-QP-999-145-1001
 VOLUME IIB
 SECTION D
 REV. NO. 00 DATE: 12.10.99
 SHEET 4 OF 7

LEGEND:	* CR	- Critical characteristics	P	- Agency Performing the Test.	1	- BHEL or their agent
	MA	- Major characteristics	W	- Agency Witnessing the Test.	2	- Vendor
	MI	- Minor characteristics	V	- Agency Verifying the Test.	3	- Sub-vendor

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.		Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
										P	W	V	
STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER													
QUALITY PLAN NO.: PE-QP-999-145-I001 VOLUME IIB SECTION D REV. NO. 00 DATE: 12.10.99 SHEET 6 OF 7													
3.2	Acceptance Tests	1. Accuracy	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1		
		2. Repeatability	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1		
		3. Dead Band	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1		
		4. Hysteresis	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1		
		5. HV & IR	CR	Electrical	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	1	1		
		6. Linearity	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1		
		7. Supply voltage variation effect	CR	Electrical	100%	BHEL Spec.	BHEL Spec.	Inspection report	2	1	1		
		8. Temperature variation effect over range	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1		
		9. Over range	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1		

LEGEND: * CR - Critical characteristics
 MA - Major characteristics
 MI - Minor characteristics
 P - Agency Performing the Test.
 W - Agency Witnessing the Test.
 V - Agency Verifying the Test.
 1 - BHEL or their agent
 2 - Vendor
 3 - Sub-vendor

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks		
									P	W	V			
3.3	Type Test	1. Surge withstand capability 2. Radio frequency interference 3. Vibration effect 4. Electro Magnetic field effect 5. Degree of protection 6. Explosion proofness (If applicable) 7. Dry Heat 8. Damp Heat	CR	Elect. & Mech	1 / Type	ANSI-C.37	ANSI-C.37	Inspection Report	3	--	2,1			
4.0	Packing	1. Packing Material	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	--	2			
		2. Packaging and Marking	MA	Visual & Measurement	100%	Manufacturer standard	Manufacturer standard	Log Book	2	--	2			
			CR	Thermal	1 / Type	IS:9000	ANSI-C.37	Inspection Report	3	--	2,1	85 Deg. C for 1R Hrs.		
			CR	Thermal	1 / Type	IS:9000	ANSI-C.37	Inspection Report	3	--	2,1	40 Deg. C, 6 cycle		
			CR	Damp Heat	1 / Type	IS:9000	ANSI-C.37	Inspection Report	3	--	2,1			
			CR	Dry Heat	1 / Type	IS:9000	ANSI-C.37	Inspection Report	3	--	2,1			
			CR	Explosion proofness (If applicable)	CR	Mech. & Elect.	1 / Type	IS:2148	BHEL Spec.	Inspection Report	3	--	2,1	
			CR	Degree of protection	CR	Mech. & Elect.	1 / Type	IS:2147	BHEL Spec.	Inspection Report	3	--	2,1	
			CR	Electro Magnetic field effect	CR	Elect. & Mech	1 / Type	BHEL Spec.	BHEL Spec.	Inspection Report	3	--	2,1	
			CR	Vibration effect	CR	Elect. & Mech	1 / Type	BHEL Spec.	BHEL Spec.	Inspection Report	3	--	2,1	

* CR - Critical characteristics MA - Major characteristics MI - Minor characteristics	P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL or their agent 2 - Vendor 3 - Sub-vendor
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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

 PE :: C&I		STANDARD QUALITY PLAN FOR LEVEL GAUGES										QUALITY PLAN NO.: PE-QP-999-145-1028			
		Volume	SECTION		REV. NO.	SHEET	OF	Agency \$	Remarks						
SI. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	P	W	V				
1.0	Material / Components														
1.1	Body, Cover, Interns, Flanges, Gaskets	1. Physical, Chemical Properties 2. Workmanship, finish and dimensions	MA	Physical, Chemical Test	One Sample from each lot	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate	3/2	---	2,1#	# Compliance certificate to be verified.			
1.2	Glass Tube	Strength, Transparency, dimensions	MA	Visual, Measurement	100%	Manufacturing standards / drgs.	Manufacturing standards / drgs.	Inspection Report / Log Book	3/2	---	2,1#				
2.0	Assembly														
		1. Marking – Tag No., Model, Range	MA	Toughness & Thermal shock, Visual, Measurement	one sample from each lot	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate/ Inspection Report	3	---	2,1#				
		2. Workmanship	MA	Visual	100%	- do -	- do -	Inspection Report	2	1	---				
		3. Scale graduation	MA	Visual	100%	- do -	- do -	- do -	2	1	---				
		4. Glass Opaque painting	MA	Visual	100%	- do -	- do -	- do -	2	1	---				
		5. Dimensions and end connections	MA	Measurement	100%	- do -	- do -	- do -	2	1	---				
3.0	Routine Test	1. Calibration	CR	Measurement	100%	- do -	- do -	- do -	2	1**	1	For Reflex type			
		2. Hydro Test	CR	Measurement	100%	- do -	No Leakage	- do -	2	1**	1	**10% quantity with minimum of 1 piece / type & size			

LEGEND: * CR - Critical characteristics
 MA - Major characteristics
 MI - Minor characteristics
 P - Agency Performing the Test.
 W - Agency Witnessing the Test.
 V - Agency Verifying the Test.
 1 - BHEL
 2 - Vendor
 3 - Sub-vendor

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

		STANDARD QUALITY PLAN FOR LEVEL GAUGES										
		Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$	Remarks
QUALITY PLAN NO.: PE-QP-999-145-1028 VOLUME IIB SECTION D REV. NO. 00 DATE: 01.11.2000 SHEET 2 OF 2										P	W	V
4.0	Painting	Shade & Finish	MA	Visual	100%	Approved dfg. / data sheet / BHEL Spec.	Approved dfg. / data sheet / BHEL Spec.	Inspection Report	1**	2	1	
5.0	Packing	Soundness	MA	Visual	100%	- do -	- do -	- do -	---	2	---	---

LEGEND:

* CR	- Critical characteristics	P	- Agency Performing the Test.	1	- BHEL
MA	- Major characteristics	W	- Agency Witnessing the Test.	2	- Vendor
MI	- Minor characteristics	V	- Agency Verifying the Test.	3	- Sub-vendor

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001


 PEM :: C&I	STANDARD QUALITY PLAN FOR TEMPERATURE GAUGE AND THERMOWELL		QUALITY PLAN NO.: PE-QP-999-145-I027
	VOLUME	IIB	
	SECTION	D	
	REV. NO.	01	DATE: 16-05-2007
SHEET	1	OF	4

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records				Remarks
								P	W	V	Agency \$	
1.0	Raw Material / Component											
1.1	Capillary Bulb and Thermowell	1. Chemical composition	CR	Chemical analysis	one sample/lot	BHEL spec. / approved data sheet	Relevant raw material std.	Test report	3/2	--	2,1	Relevant compliance certificate to be verified by BHEL
		2. Marking,	MA	Visual	100%	BHEL spec. / Mfr. Standard	BHEL spec. / Mfr. Standard	Log Book	2	--	--	
		3. Dimensions	MA	Measurement	100%	BHEL spec. / approved doc	BHEL spec. / approved doc	Log Book	2	--	--	
1.2	Casing and Bezel	1. Material	MA	Chemical analysis	Sample	BHEL spec.	BHEL spec.	Test report	3/2	--	2,1	Relevant compliance certificate to be verified by BHEL
		2. Defects	MA	Visual	100%	Mfr. Standard	Mfr. Standard	Log Book	2	--	--	
		3. Dimension	MA	Measurement	Sample	BHEL spec. / approved doc.	BHEL spec. / approved doc.	Log Book	2	--	--	
		4. Threading	MA	Thread matching	100%	-----do-----	-----do-----	Log Book	2	--	--	
1.3	Dial	1. Size, range, scale length, least-count, spacing and graduation.	MA	Measurement and Visual	Sample	BHEL spec.	BHEL spec.	Log Book	2	--	--	
		2. Colour	MA	Visual	100%	BHEL spec.	BHEL spec.	Log Book	2	--	--	
		3. Resistance to dry heat and hot water	MA	Oven & Bath	Sample	Mfr. Standard	Mfr. Standard	Test report	3/2	--	--	

LEGEND: * CR - Critical characteristics
 MA - Major characteristics
 MI - Minor characteristics
 P - Agency Performing the Test
 W - Agency Witnessing the Test
 V - Agency Verifying the Test
 1 - BHEL
 2 - Vendor
 3 - Sub-vendor

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

 PE :: C&I		STANDARD QUALITY PLAN FOR TEMPERATURE GAUGE AND THERMOWELL										QUALITY PLAN NO.: PE-QP-999-145-1027			
		Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
											P	W	V		
1.4	Complete sensing element	1. Correct assembly and workmanship. 2. Dimensions 3. Welding & other defects	MA	Visual	100%	Mfr. Standard drawing	Mfr. Standard drawing	Log Book	2	---	---	---			
1.5	Thermowell ⊕	1. Dimensions of wall thickness, concentricity of bore OD & Length.	MA	Measurement	100%	BHEL spec. / approved data sheet / Drg.	BHEL spec. / approved data sheet / Drg.	Log Book	2	1	1	1	BHEL to witness 10% random samples.		
		2. Leak Test	CR	Hyd. test at 1.5 times of design pressure.	100%	BHEL spec. / approved data sheet / Drg.	BHEL spec. / approved data sheet / Drg.	Inspection report	3/2	2,1	1	1	⊕ IBR cert. wherever specified to be verified.		
		3. Threading	MA	Thread matching	100%	BHEL spec. / approved data sheet / Drg.	BHEL spec. / approved data sheet / Drg.	Inspection report	2	2,1	1	1	BHEL to witness 10% samples.		
2.0	Final Inspection														
2.1	Assembly	1. Correct assembly, workmanship and finish	MA	Visual	100%	BHEL spec. / approved data sheet	BHEL spec. / approved data sheet	Inspection report	2	1	---	---			

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records			Agency \$			Remarks
								P	W	V	P	W	V	
		2. Mounting and connection	MA	Visual ad measurement	100%	-----do-----	-----do-----	2	1	---	2	1	---	
		3. Dial Scale	MA	Visual	100%	-----do-----	-----do-----	2	1	---	2	1	---	
		1. Cleanliness	MA	Visual	100%	-----do-----	Free from scratches, dirt etc.	2	---	2	---	---	2	
		5. Marking (S.No., Tag No.)	MA	Visual	100%	BHEL spec. / approved data sheet	BHEL spec. / approved data sheet	2	1	---	2	1	---	
2.2	Routine Test	1. Accuracy	MA	Measurement	100%	BHEL spec. / Approved data Sheet.	BHEL spec. / Approved data Sheet.	2	1	---	2	1	---	BHEL to witness 10% random Samples.
		2. Overload	CR	Measurement	10%	125% of FSD for range upto 400 Deg. C. 110% of FSD for range between 400 to 500 Deg. C. 100% of FSD for range above 500 Deg. C.	No Damage	2	1	---	2	1	---	



**STANDARD QUALITY PLAN
FOR
TEMPERATURE GAUGE AND THERMOWELL**

QUALITY PLAN NO.: PE-QP-999-145-1027
 VOLUME IIB
 SECTION D
 REV. NO. 01 DATE: 16-05-2007
 SHEET 3 OF 4

LEGEND: * CR - Critical characteristics
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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001


Sl. No.		Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
										P	W	V	
STANDARD QUALITY PLAN FOR TEMPERATURE GAUGE AND THERMOWELL													
QUALITY PLAN NO.: PE-QP-999-145-4027 VOLUME IIB SECTION D REV. NO. 01 DATE: 16-05-2007 SHEET 4 OF 4													
2.3	Type Test	3. Response Time	MA	MA	Measurement	10%	ASME PTC19.3	ASME PTC19.3	Test Report	2	1	1	BHEL to witness 10% random samples.
		1. Ambient temperature compensation 0-60 Deg. C	MA	MA	Measurement	Sample	Bulb at constant temp. & case temp varied 0-60 Deg. C	No variation in measurement	Test Certificate	2	---	1	Existing test certificate (Not more than 5 year old) shall be furnished.
		2. Weather proofness	CR	CR	Measurement	Sample	BHEL spec. / Approved data sheet.	BHEL spec. / Approved data sheet.	Test Certificate	3/2	---	1	---
3.0	Packing	Soundness of packing	MA	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	3/2	2	---	Refer Note-1

Note: 1. In the absence of BHEL specification for painting, vendor to obtain BHEL's approval on their painting specification / procedure.

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1 - BHEL 2 - Vendor 3 - Sub-vendor	

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

 PEM :: C&I		STANDARD QUALITY PLAN FOR TEMPERATURE SWITCH										QUALITY PLAN NO.: PS-QP-999-145-1032 VOLUME IIB SECTION D REV. NO. 00 DATE: 02.11.2000 SHEET 1 OF 2		
		Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V			
1.0	Material / Components													
1.1	Casing, Sensing Element and Thermowell	1. Physical, Chemical Properties 2. Workmanship, finish and dimensions	MA	Physical, Chemical Test	One Sample from each lot	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate	3/2	---	2,1#	# Compliance certificate to be verified.		
1.2	Switch	1. Marking – Tag No., Model, Range 2. Workmanship 3. Scale graduation 4. Dimensions and end connections	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report / Log Book	3/2	---	2,1#			
2.0	Assembly	1. Marking – Tag No., Model, Range 2. Workmanship 3. Scale graduation 4. Dimensions and end connections	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1	---			
		1. Calibration, accuracy, repeatability, overload, set point adjustment, differential	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1	---			
3.0	Routine Test	1. Calibration, accuracy, repeatability, overload, set point adjustment, differential	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1**	1	**25% quantity with minimum of 1 piece / type & size		

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
									2	1**	1	
									2	1**	1	
4.0	Type Test	2. HydroTest 3. IR, HV 1. Enclosure Protection Class (weather proof-ness, explosion proof-ness, etc.) 2. Ambient temperature compensation (0 - 60°C) 3. Switch contact rating	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec. - do -	No Leakage	Inspection Report	2	1**	1	
									2	---	1•	•Type Test Certificate to be verified
5.0	Painting	Shade & Finish	MA	Verification	Each type	- do -	- do -	- do -	2	---	1•	
6.0	Packing	Soundness	MA	Verification	Each type	- do -	- do -	- do -	2	---	1•	
									2	1**	1	
									2	---	---	

QUALITY PLAN NO.: PS-QP-999-145-I032
 VOLUME IIB
 SECTION D
 REV. NO. 00 DATE: 02.11.2000
 SHEET 2 OF 2

STANDARD QUALITY PLAN FOR TEMPERATURE SWITCH




LEGEND: * CR - Critical characteristics
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 MI - Minor characteristics

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 V - Agency Verifying the Test.

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 2 - Vendor
 3 - Sub-vendor

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001


 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										QUALITY PLAN NO.: PE-QP-999-145-1056			
		Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks		
Sl. No.									P	W	V				
1.0	INCOMING Sheet Steel (CRCA & HR)	1. Chemical Composition 2. Bend Test 3. Surface finish 4. Waviness 5. Thickness 6. Mill marking	MA CR MA MA MA MA	Chemical analysis Mech. test Visual Visual Measurement Visual	Sample Sample 100% 100% 100% 100%	IS:1079 IS:513 IS:1079 IS:513 Factory Standard / Sample Factory Standard BHEL Spec. BHEL Spec.	IS:1079 IS:513 IS:1079 IS:513 Factory Standard / Sample No Waviness BHEL Spec. BHEL Spec.	Test Certificate Log Book Log Book Log Book Log Book Log Book	3 2 2 2 2 2	--- --- --- --- --- ---	2 --- --- --- --- 1				
2.0	Flats / Angles / Channels	1. Dimensions 2. Surface Defects 3. Straightness 4. Mill marking	MA MA MA MA	Measurement Visual Measurement Visual	Sample 100% 100% 100%	IS:2062 Factory Standard / Sample Factory Std. IS:2062	IS:2062 Factory Standard / Sample Factory Std. IS:2062	Log Book Log Book Log Book Log Book	2 2 2 2	--- --- --- ---	--- --- --- 1				
3.0	Cables / Wires	1. Visual / Surface defects 2. IR and HV	MA MA	Visual Electrical	100% 100%	BHEL Spec. and IS:1554 or IS:694 BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694 BHEL Spec. and IS:1554 or IS:694	Log Book Log Book	2 2	--- ---	--- ---	--- ---			

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001


Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$				Remarks
									P	W	V		
STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL													
QUALITY PLAN NO.: PE-QP-999-145-1056 VOLUME IIB SECTION D REV. NO. 01 DATE: 18-05-2007 SHEET 2 OF 7													
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	3. Conductor a) Resistance b) Size c) Sheet colour 4. Type / Routine Test Certificates 1. Verification at make and Type 2. Verification of Test Certificates 3. Operation / Functional check 4. I.R. 5. H.V. 6. Calibration 7. Pick up / Drop off Voltage	MA MA MA MA CR CR CR MA MA MA MA	Electrical Measurement Visual Verification Visual Scrutiny of Type / Routine T.Cs. Electrical Electrical Electrical Electrical	100% 100% 100% 100% Sample 100% Sample+ 100% 100% 100% 100% 100%	BHEL Spec. and IS:1554 or IS:694 BHEL Spec. and IS:1554 or IS:694 BHEL Spec. and BOM Relevant IS Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	BHEL Spec. and IS:1554 or IS:694 BHEL Spec. and IS:1554 or IS:694 BHEL Spec. and BOM Relevant IS Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	Log Book Log Book Log Book Log Book Log Book Log Book Log Book Log Book Log Book Log Book	2 3 2 2 2 2 2 2 2 2	--- --- --- --- --- --- --- --- 1 ---	--- 2 --- --- --- --- --- --- --- ---	+ for relay & contactors only @ for all components except relays & contactors.	
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 PE :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										QUALITY PLAN NO.: PE-QP-999-145-1056 VOLUME IIB SECTION D REV. NO. 01 DATE: 18-05-2007 SHEET 3 OF 7			
		Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
									P	W	V				
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make 2. Surface defects 3. IR / HV on Terminal Blocks	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---				
6.0	IN PROCESS Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---				
		2. Surface defects after bending	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	---				
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---				
		2. Deburring	MA	Visual	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---				
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2				
		2. Alignment	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2				
		3. Welding Quality	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2				
		4. Surface defects	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2				

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		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										QUALITY PLAN NO.: PE-QP-999-145-1056		
		Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
										P	W	V		
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	--	1			
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	--	1			
		3. Dipping / Removal Time	MA	Measurement	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	--	1			
		4. Surface quality after every dip	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	--	1			
		5. Primer after phosphating	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	--	1			
		6. Putty Application & Rubbing after primer	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	--	1			
		7. Paint first coat	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	--	1			
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	--	1			
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	--	1			

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 PEM : C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										QUALITY PLAN NO.: PE-QP-999-145-1056				
		Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks		
										P	W	V				
10.	Panel Wiring	1. Wiring Layout 2. Wiring Termination (Crimped Lugs) 3. Ferrule numbers 4. Colour of wiring 5. Size of Conductor	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	---				
			MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	---				
			MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	---				
			MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	1				
			MA	Measurement	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	1				
11.	Component Mounting	1. Correct components 2. Fixing	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	---				
			MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	---				
12.	FINAL Final Inspection	1. Workmanship	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.			
		2. Component layout (neatness, accessibility & safety)	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	1				
		3. Components identification Marking / Name plates	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	1				

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Sl. No.		Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
										P	W	V	
QUALITY PLAN NO.: PE-QP-999-145-I056 VOLUME IIB SECTION D REV. NO. 01 DATE: 18-05-2007 SHEET 6 OF 7													
STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL													
			4. Mounting / Proper fixing of all components	MA	Visual	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
			5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	
			6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
			7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
			8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
			9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	
			10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1	
			11. Wire Termination	MA	Pulling manually	Sample	-----	Firm termination	Inspection Report	2	1	1	
			12. Continuity	MA	Electrical	100%	-----	Continuity OK	Inspection Report	2	1	1	

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										QUALITY PLAN NO.: PE-QP-999-145-1056		
		Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
Sl. No.									P	W	V			
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	Type Test Certificate	3	--	1			
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant IS.	BHEL approved spec., drg., BOM & relevant IS.	Test Report	2	1	1			
15	FUNCTIONAL TEST	1. Control Logic Operation 2. Instrument Calibration 3. Temperature rise	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1			
					10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1			
					100%	BHEL approved spec/drg. & relevant IS.	BHEL approved spec/drg & relevant IS.	Inspection Report	2	1	1			

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THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001



DATA SHEET FOR LOCAL PANELS

VOLUME

SECTION

REV. NO.

DATE:

SHEET 1 OF 2

TAG No. Qty.....

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

Data Sheet A & B

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

GENERAL	MANUFACTURER		
	CONSTRUCTION	<input checked="" type="checkbox"/> FOLDED (As per requirement)	<input type="checkbox"/> WELDED
TECHNICAL	INPUT POWER SUPPLY	<input type="checkbox"/> 240V 50 Hz AC <input checked="" type="checkbox"/> 415V 3 PHASE (4 wires)	<input type="checkbox"/> 220V DC
	NO. OF FEEDERS	<input type="checkbox"/> ONE	<input type="checkbox"/> TWO
	CONTROL SUPPLY	<input type="checkbox"/> 110V AC <input type="checkbox"/> 220V DC (As per requirement)	<input type="checkbox"/> 220V AC
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)	_____ NOS. (AS REQUIRED)	
	PAINT TYPE	<input checked="" type="checkbox"/> EPOXY <input type="checkbox"/> POWER COATED	<input type="checkbox"/> SYNTHETIC ENAMEL
	PANEL COLOUR (EXTERNAL)	<input checked="" type="checkbox"/> LIGHT GREY (Shade 631 IS-5) <input type="checkbox"/> OPALINE GREEN (Shade 275) <input type="checkbox"/>	
	FINISH	<input type="checkbox"/> SEMI MAT <input type="checkbox"/> GLOSSY	<input type="checkbox"/> MATT <input checked="" type="checkbox"/> SEMI GLOSSY
	PANEL COLOUR (INTERNAL)	<input checked="" type="checkbox"/> WHITE <input type="checkbox"/> OFF WHITE	<input type="checkbox"/> CREAM
	FINISH	<input type="checkbox"/> SEMI MAT <input type="checkbox"/> GLOSSY	<input type="checkbox"/> MATT <input checked="" type="checkbox"/> SEMI GLOSSY
	CLASS OF PROTECTION	<input checked="" type="checkbox"/> IP-54 <input type="checkbox"/> _____	
	CONTROL HARDWARE	<input type="checkbox"/> RELAY BASED As per Requirement	<input checked="" type="checkbox"/> PLC
	FOUNDATION ARRANGEMENT	<input checked="" type="checkbox"/> FOUNDATION BOLTS <input type="checkbox"/> ANCHOR FASTENERS	
	WEIGHT OF PANEL (Kg.)		
	PANEL TYPE	<input checked="" type="checkbox"/> PRESSURISED As per Requirement	<input type="checkbox"/> UNPRESSURISED
CABLE GLAND	<input type="checkbox"/> SINGLE COMPRESSION <input checked="" type="checkbox"/> DOUBLE COMPRESSION		
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY
	COMPANY SEAL		
	NAME		
	SIGNATURE		
	DATE		

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

FORM NO. PEM-5686-0



DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.:	
VOLUME	
SECTION	
REV. NO.	DATE:
SHEET 1	OF 2

TAG No. Qty.....

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


Data Sheet C

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

GENERAL	MANUFACTURER			
	CONSTRUCTION			
TECHNICAL	INPUT POWER SUPPLY			
	NO. OF FEEDERS			
	CONTROL SUPPLY			
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)			
	PAINT TYPE			
	PANEL COLOUR (EXTERNAL)			
	FINISH			
	PANEL COLOUR (INTERNAL)			
	FINISH			
	CLASS OF PROTECTION			
	CONTROL HARDWARE			
	FOUNDATION ARRANGEMENT			
	WEIGHT OF PANEL (Kg.)			
	PANEL TYPE			
CABLE GLAND				
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME SIGNATURE DATE

THIS IS A PART OF THE SPECIFICATION NO. PE-TS-362-155-A001

FORM No. PEM - 6100 -0

	DOCUMENT TITLE	DOCUMENT NUMBER	PE-GL-999-145-1003A	
	GUIDELINE FOR SELECTION OF INSTRUMENTATION CABLE FOR MAUX PACKAGES	REVISION NUMBER	00	DATE 29-05-2008
	PROJECT :STANDARD	SHEET	1	OF 1


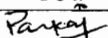
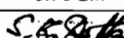
- The sizes of cable (in term of no. of pairs) has been rationalized in order to achieve greater standardization and better management of quantities, therefore selection shall be generally done in accordance with the following table , based on the requirement for a given application.
- For PLC based LCP, 0.5mm² screened cables (Type-F, G) to be used. The cable type shall be selected as 0.5mm² type-F (Individual and overall screened) for analog signals and 0.5mm² type-G (Overall screened) for Binary signals.
- However analog signals like, current and position feedback, 2P type-G cable shall be used, wherein one pair shall remain spare.
- For selection of cable between instrument to JB/LCP, refer the enclosed interconnection diagram.
- For drive's cable between PLC and MCC/ actuator , refer project specific drive control philosophy
- The cables related to Relay based local control panels (Between field, LCP and MCC) to be selected as 1.5mm² control cable from the sizes rationalized by Pem-Elect (3C,5C,7C,12C,19C,24C), after confirming the availability for the given project
- 3C, 2.5mm² cable shall be used between interposing relays and sol valve.

Type-F (0.5mm², Individual and overall screened)

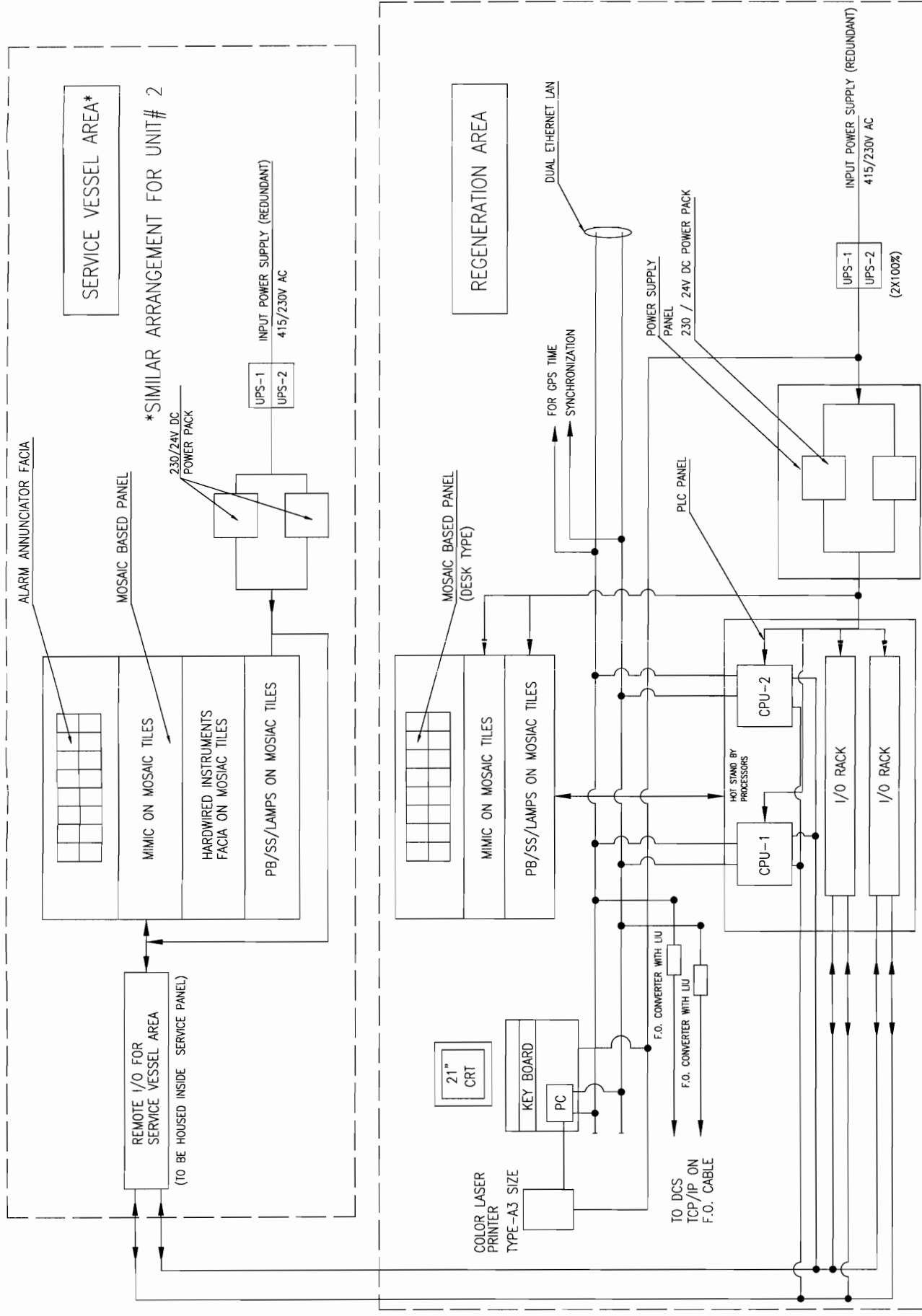
Size	Purpose	Remark
4P	Control valve's demand and feedback, Field I/O	
8P	Field I/O	
12P	HT motor brg, winding, Field I/O	(when 3 pt. Of motor winding are monitored)
20P	HT motor brg, winding, Field I/O	(when 6 pt. Of motor winding are monitored)

Type-G (0.5mm², Overall screened)

Size	Purpose	Remark
2P	Motor Current , Position feedback signals, Field sensors	
4P	BID, LT drives, sol vlv fb, field I/O	Depending upon drive control philosophy
8P	BID, LT, HT drives, field I/O	
12P	HT drives, field I/O	
16P	LCPs , field I/O	

PARTICULARS	PREPARED BY	REVIEWED BY	APPROVED BY
NAME	MA MANSOORI	PANKAJ JAIN	S.K. DATTA
DESIGNATION	Manager	DGM	Sr. DGM
SIGNATURE			
DATE	29-05-2008	29-05-2008	29-05-2008

200 



JOB No. : 362
 STATUS: CONTRACT
 DISTRIBUTION

TO	NO. OFF	REV	DATE	ALTD	CHD	APPD

RAICHUR POWER COMPANY LTD.
 2X800 MW YERMARUS STPP

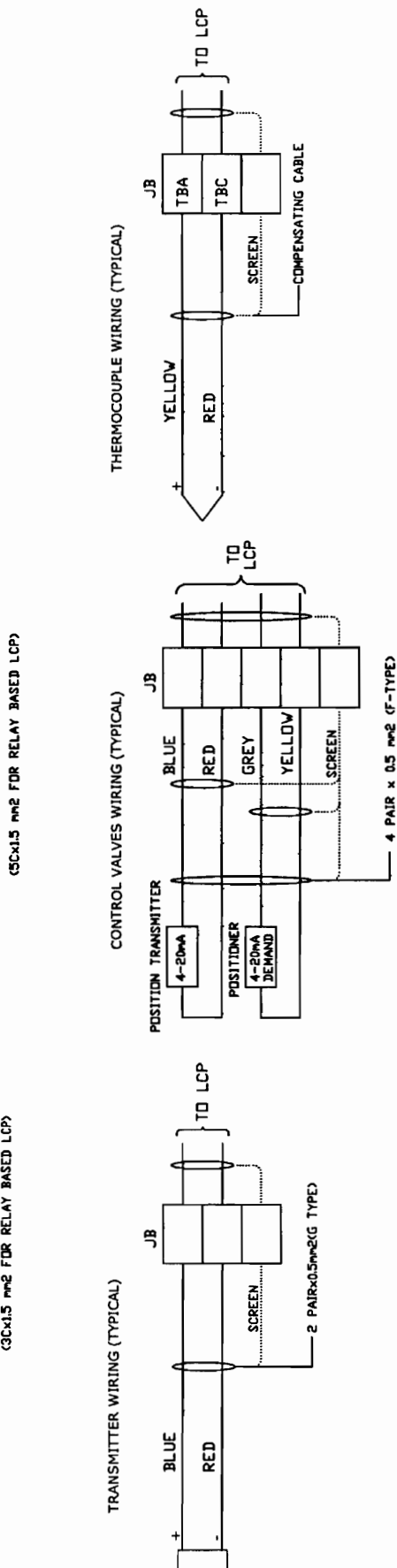
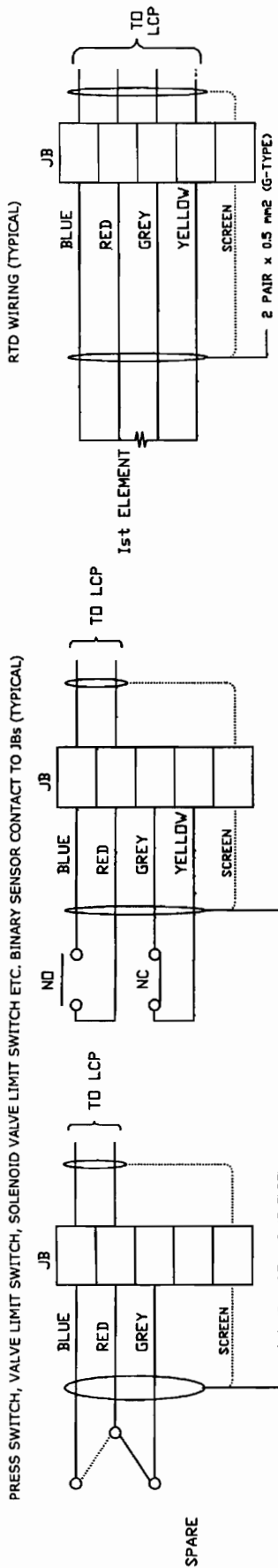
BELECTRA
 BHARAT HEAVY ELECTRICALS LTD
 POWER SECTOR
 PROJECT ENGINEERING MANAGEMENT
 NOIDA

TITLE
 SYSTEM CONFIGURATION DIAGRAM FOR
 CONSENSATE POLISHING UNIT

DEPT	SIGN	DATE	SCALE	DRAWING No.

SHEET	DF	REV
1	1	00

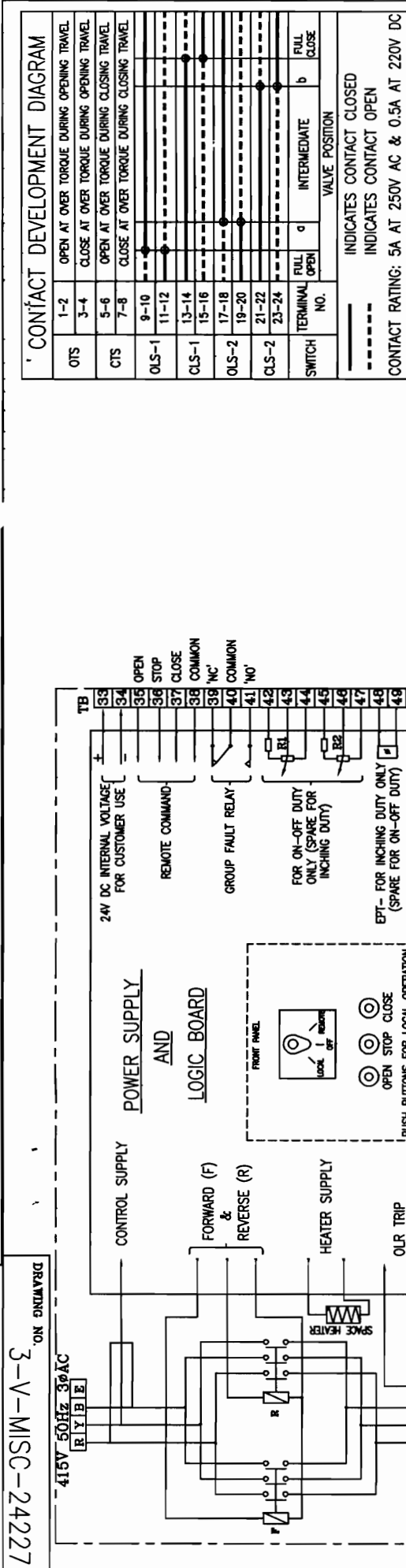
STANDARD INTERCONNECTION DIAGRAM



NOTES:

1. FROM JB TO LCP MULTIPAIR CABLE SHALL BE SELECTED BASED ON EXTENT OF GROUPING.
2. CABLE SCREENS TO BE FARTHED AT ONE END (PANEL END) ONLY.

REV. NO. 000		REV. DATE		REV. BY		REV. DATE		REV. BY		REV. DATE	
STANDARD INTERCONNECTION DIAGRAM											
DRAWING NO. PE-DG-999-146-1003A											
SHEET 01 OF 00											



CONTACT DEVELOPMENT DIAGRAM

OTS	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24
CTS												
OLS-1												
CLS-1												
OLS-2												
CLS-2												
SWITCH	TERMINAL NO.	FULL OPEN	c	INTERMEDIATE	b	FULL CLOSE	VALVE POSITION					

INDICATES CONTACT CLOSED
 - - - - - INDICATES CONTACT OPEN
 CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

VALVES	OPEN			CLOSE		
	MAIN	BACK UP	MAN	BACK UP	MAN	BACK UP
GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	OLS	CTS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS	OLS	CTS	#

- CLS NOT TO BE CONNECTED IN TRIP CIRCUIT
 * - BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)

TYPE OF PRODUCT ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS
 (DRAWN FOR INTERMEDIATE POSITION OF VALVES)

CUSTOMER/PROJECT
 BHARAT HEAVY ELECTRICALS LTD.,
 UNIT: HIGH PRESSURE BOILER PLANT,
 TIRUCHIRAPPALLI-620014.

DEPT: 365-121
 CODE: VL
 SCALE:

WEIGHT (KG):
 REFERENCE INFORMATION

NAME: N.P.ESWAR
 SIGN: N.P.
 DATE: 07.10.04

DRN: D.DINAKARAN
 D.D: D.D
 DATE: 07.10.04

APPD: K.ARUNACHALAM
 K.A
 DATE: 07.10.04


CARD CODE: U 01
 DRAWING NO. 3-V-MISC-24227
 REV: 0


TITLE: WIRING DIAGRAM (TERMINAL PLAN)
 FOR ACTUATOR WITH INTEGRAL STARTER


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


REV	DATE	ALTERED	CHD & APPD


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


RPCLYTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	SHEET 1 OF 10
TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC		
<p>1.00.00 <u>Technical Specifications for Field instruments:</u></p> <p>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.</p> <p>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.</p> <p>2.00.00 <u>Smart Electronic Transmitters for Measurement of Pressure, Differential Pressure(DP) & Flow/Level(DP Type):</u></p> <p>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.</p> <p>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.</p> <p>2.00.03 <u>In Detail Technical Specification:</u> 1) Type of Transmitter: Microprocessor based 2 wire type HART protocol compatible,</p>		

RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	SHEET 2 OF 10
	TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC	
<p>2) Accuracy : - +/- 0.1 % of span</p> <p>3) Output Signal Range: 4-20 mA DC(Analog) <i>Superimposed digital on HART protocol</i></p> <p>4) Turn Down Ratio : 10:1 for vacuum/very low pressure applications 30:1/100:1 for other applications</p> <p>5) Stability: +/-0.1% of calibrated span for 6 months up to 70 KSC &</p> <p>6) Zero and Span Drift: +/- 0.015% per Deg.C at max. span and 0.11% per Deg.C at Minimum Span</p> <p>7) Load Impedance: 500 ohm (Min)</p> <p>8) Housing: Weather proof as per IP-65 with durable corrosion resistant coating</p> <p>9) Over Pressure - 150 % of Max. operating pressure</p> <p>10) Connection(Electrical)- Plug and socket type</p> <p>11) Process Connection - 1/2 inch NPT (F)</p> <p>12) Span and Zero: Continuous, tamper proof, Remote Adjustability as well as manual from instrument with zero suppression and elevation facility.</p> <p>13) Accessories a) Diaphragm seal, pulsation dampeners syphon etc. as required by service and operating condition. b) 2/3/5 Valve manifold as applicable</p> <p>14) Diagnostics: Self Indicating Feature</p> <p>15) Power Supply: 24 V DC +/- 10%</p> <p>16) Adjustment : Calibration facility via Centralized PC based HART management system.</p> <p>3.00.00 <u>Displacement Type Level Transmitters:</u></p> <p>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.</p> <p>Microprocessor based smart type, displacement type level transmitters of float length of 14 inches or 32 inches with an accuracy of <i>+/-0.5% of span</i>, 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.</p>		


RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	SHEET 3 OF 10
TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC		
4.00.00	<p><u>Thermocouple Assembly with Thermowell</u></p> <p>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.</p> <p>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.</p> <p>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.</p> <p><u>Thermo wells</u> shall be provided along with Temperature elements of RTD & Thermocouples except for metal/bearing/winding temperature measurements.</p> <ol style="list-style-type: none"> 1. For measurement of flue gas temperature, Inconal 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.	
8.00.00	<u>Pressure Switches:</u> Non indicating type, field mounted Pressure Switches of aluminium casing (epoxy coated), and 316 SS element and accuracy of +/-1% 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. Auto reset micro switch with internal adjustment for set values with 2 SPDT contacts rated for 0.2 A at 220 V DC. IP 65 or equivalent degree of protection for enclosure. Over range protection 50% above maximum pressure. Scale for setting shall be provided.	


RPCLYTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	SHEET 5 OF 10
TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC		
<p>9.00.00 <u>Differential Pressure Indicators:</u></p> <p>Direct reading type, pipe mounted, bellows or diaphragm operated differential pressure indicators; aluminium casing (epoxy coated) with six (6) inch dial (white dial with black numerals), with micrometer type pointer, 316 SS pressure element; an accuracy of +/-0.5% of span including accessories like snubbers for pump discharge application, chemical diaphragm with 15 m PVC covered SS armoured capillary for each limb for corrosive and oil services and 5 way manifold. Material of accessories will be SS. IP 65 or equivalent degree of protection. Over range protection will be 50% above maximum pressure.</p> <p>10.00.00 <u>Differential Pressure Switches:</u></p> <p>Bellows or diaphragm operated non-indicating field mounted type; aluminium casing (epoxy coated); 316 SS pressure element nylon movement; an accuracy of +/-1% of span with an adjustable contact including accessories like snubbers for pump discharge applications, chemical diaphragm with 15 m capillary for each limb for all corrosive and oil services and 5 way manifold. Material of accessories will be SS. Auto reset micro switch with adjustable set values with 2 SPDT contacts rated for 0.2 A at 220 V DC. IP 65 or equivalent degree of protection over range protection 50% above maximum pressure. Repeatability shall be + 0.5% FSR.</p> <p>11.00.00 <u>Thermometers:</u></p> <p>Indicating type, field mounted, filled system with 5metre capillary and six (6) inch dial housed in aluminium casing (epoxy coated) with an accuracy of +/-1% of span, response time of 2-4 seconds, auto temperature calibration, linear calibration over the range and 316 SS thermowell having a process connection of M33 x 2 thread. 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. The thermowell construction shall meet the ANSI 19.3-1994 (latest) requirements.</p> <p>12.00.00 <u>Temperature Switch:</u></p> <p>Non Indicating type, field mounted, filled system with 5 metre capillary housed in Aluminium casing (epoxy coated) with an accuracy of +/-1% span, auto temperature calibration, linear calibration over the range and 316 SS thermowell having a process connection of M33x2 thread. Micro switch with reset type with adjustable set values with 2 SPDT contacts rated for 0.2 A, 220 DC. 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. Material of accessories will be SS. The thermowell construction shall</p>		


RPCLYTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	SHEET 6 OF 10
TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC		
<p>meet the ANSI 19.3-1994 (latest) requirements.</p> <p>13.00.00 <u>Level gauges:</u></p> <p>Tubular type level gauges for low pressure upto 7 kg/cm² & reflex type for high pressure water & steam services & vacuum services with automatic ball check valves, illuminator (240 AC), pyrex / borosilicate glass, mica shield, brass guard rods & brass holders. Material of accessories (name plate, etc.) will be SS. Tubular glass OD will be 5/8". Vent & drain valves shall be provided. Connection shall be screwed or flanged (ANSI class 150 RF). Enclosure shall be IP 65.</p> <p>14.00.00 <u>Level Switches:</u></p> <p>External float operated level switches for tanks and vessels and top mounted level switches and underground tanks. The top mounted level switches shall be supplied with steel tubes to suit Purchaser's requirement. Micro switch with 2 SPDT contacts rated for 0.2 A, 220 V DC. Material of float & float chord will be 316 SS & cage material shall be fabricated steel and the material of accessories will be SS. IP 65 or equivalent degree of protection for enclosure.</p> <p>Accessories like name plate, drain valve for external case type level switches, mating flange, gaskets (asbestos), fasteners, bolts & nuts, etc. shall be supplied.</p> <p>15.00.00 <u>Flow Glasses:</u></p> <p>Online flow glasses for pipe size up to 4" with a rotary wheel (not a flapper type) suitable for installation on vertical or horizontal pipe lines, material pyrex tempered glass. Body material will be carbon steel, rotor & wetted parts will be bronze. The material of accessories will be SS. IP 65 or equivalent degree of protection for enclosure. Upto 50 NB size, connection shall be screwed above 50 mm NB size it shall be flanged - ANSI, 150 RF. Accessories like name plate, mating flanges with gaskets (neoprene), bolts & nuts, etc. shall be supplied. Enclosure shall be IP65.</p> <p>16.00.00 <u>Flow Elements:</u></p> <p>SS 316 flow nozzles for all steam and feed water services with D and D/2 pressure tapplings; 316SS flow orifice plate assembly for all water services with flange tap connections; B ratio of 0.5 & 0.7. Element material of SS 316. The material of accessories will be SS. All the flow elements shall have 3 pairs of differential pressure tapplings complete with root valves. Orifice plate shall not be less than 3 mm thick for nominal pipe diameter upto</p>		



RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	
	TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC	SHEET 7 OF 10
<p>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.</p> <p>17.00.00 <u>Flow Switches:</u></p> <p>Indicating, Differential pressure, flapper type on line flow switches for line sizes up to 80 mm with an accuracy of +/-2% of span and dial size of min. 50 mm having 316 SS flapper housed in die cast aluminium. Micro switch with adjustable range with 2 SPDT contacts rated for 0.2 A, 220 V DC. IP 65 or equivalent degree of protection for enclosure. The material of accessories will be SS.</p> <p>18.00.00 <u>Solenoid Valves:</u></p> <p>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.</p> <p>19.00.00 <u>Local Instrument Enclosure & Racks/CJCB,s:</u></p> <p>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.</p> <p>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</p>		

RPCL/TPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	SHEET 8 OF 10
TITLE	SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC	
<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>		

RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	SHEET 9 OF 10
TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC		
<p>20.00.00 <u>Junction Boxes:</u></p> <p>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.</p> <p>21.00.00 <u>Inter Posing Relays (IPR):</u></p> <p>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.</p> <p>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.</p>		

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 Local Panels:

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.


23.00.00 Programmable Logic Controllers (PLC):

The microprocessor shall be based on 32 bit processing. The programme memory shall be non-volatile memory. The PLC shall perform protection logic, interlock and sequential control functions such as binary logic operation, set/reset operation, timers, counters, logic blocks, maths functions, boolean functions & timer functions. PLC shall complete with processor, I/O cards, memory modules, racks, mounting accessories. The scan time for digital inputs shall not be more than 60msec and execution 120msec. The system shall be loaded to maximum 60% under worst loading conditions.

The redundant processors, redundant communication cards, redundant bus, redundant Power Supply cards for PLC system shall be considered. Further, I/O cards shall be redundant for critical inputs and outputs used for protection, interlock & commands for critical services.

The system shall have self diagnosis features. The operation, monitoring and programming shall be performed from the MMI Monitor station. The system shall be connected to DCS using hot redundant bi-directional OPC communication link and shall have time synchronisation with master clock system. The required hardware for this connectivity shall be included.

Independent redundant UPS with 1 hour Battery backup shall be provided for each of local PLC systems. PLC system with MMI, laser printer shall be included. For PLC system without MMI OWS, a hand held programmer shall be provided.

RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW	SHEET 11 OF 10
TITLE SPECIFICATIONS FGR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC		
<p>Input/Output Modules as required in the control system for all type of field input (4-20 mA, RTD, T/C, Digital contacts etc.) and output from the control system are to be provided as per requirement. Electrical isolation for 1.5 KV with optical coupler between the plant put/output and surge protection as per IEEE 472. The hardware design shall be such that it is able to withstand power line disturbance. The system shall conform to ANSI/IEEE C 62.4 (Immunity to power supply line disturbance).</p> <p>Contractor shall provide at least 20% wired spare capacity of input/output modules over and above the system requirement. Contractor shall provide built in diagnostic for easy fault detection.</p> <p>System shall be able to operate in non air conditioned area. However where PLC panels/ I-O racks are located at local areas in dusty and hot zone, PLC panels/I-O racks shall be provided with air condition with suitable protection class. Contractor may provide Annunciation System as integral part of PLC. Field contacts shall be acquired through PLC only. The Annunciation sequence logic shall be implemented as a part of PLC controllers. The No. of Annunciation facia windows and provision of original input will be on as required basis.</p> <p>Contractor shall provide electronic grounding for PLC which shall be separate from Electrical grounding as per IS or IEEE Standard.</p> <p>The Factory Acceptance Test for PLC system shall consist of a) Hardware & Software as per BOM b) Spare capacity in cabinet for new module c) Current & Power Consumption d) Power Failure Test e) Healthiness of Hardware/all module f) On line removal of I/O card g) Accuracy Test h) Diagnostic Test i) Functional Test j) Verification of Software k) Redundancy Test of Controller l) Redundancy Test of power supply m) CPU loading duty cycle n) Power failure auto restart. Any other Test as per QAP. The Type test reports also shall be submitted for review.</p>		

Automatic switch-over to back-up sensor on primary sensor failure. –

Accepts any combination of two sensor types (RTDs, T/Cs, mV or ohms) –

Ambient temperature compensation –

Fault detection for electronics & sensors with fail-safe alarming. –

IP 65 or better –


Built in CJC provision


5. Transmitters to be used for RTD sensors shall be provided with RTD EMF correction features so that it shall detect and eliminate EMF errors which are the result of small voltage produced by RTD sensing elements.

6. The product and make shall be selected so that with one make of transmitter all applications with respect to measuring range, temperature sensor (resistance thermometer / thermocouple) and connection type (2/3/4) wire connection of resistance thermometers) shall be covered.

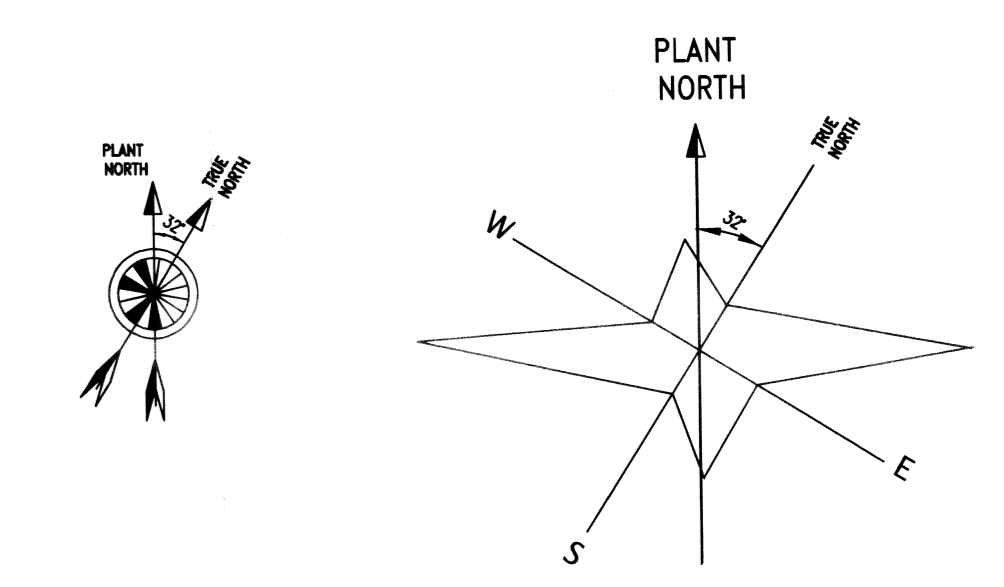
7. Transmitters shall be capable of communication with HART (Highway Addressable Remote Transducer) communicator. HART communicator shall be provided with transmitters for tuning / configuring / diagnosing / maintenance of the transmitters. It shall meet the intrinsic safety requirement if required depending upon the application.

8. All transmitters' cases shall be dust-tight and rugged. Weather-proof and explosion-proof cases shall be used in outer and hazardous areas respectively.

	RAICHUR POWER CORPORATION LIMITED YERAMARUS TPS - 2x800 MW SPECIFICATIONS FOR DDCMIS/INSTRUMENTS TO BE SUPPLIED	SECTION: D 3.4 VOLUME-IV Page 1 of 1
<p>36.00.00 <u>PH Measurement:</u></p> <p>Microprocessor based system with system accuracy of 0.02 pH, auto temperature compensation, auto zero check, manual zero and span calibration, integral indicator, automatic ultrasonic cleaner, isopotential adjustment having flow type cells. Housing for electrode and analyser shall be IP65. Output shall be isolated 4-20 mA DC linear signal connected to DCS. Accessories shall include preamplifier, screened junction box for electrode.</p> <p>37.00.00 <u>Conductivity Measurement:</u></p> <p>Micro-processor based system with an accuracy of +/-1 FSD, auto temperature compensation, auto calibration, zero check and integral indicator having gate valve insertion type (withdrawable) cell for hotwell conductivity measurements and flow line (screwed) type cell for other services. Housing for cell and analyser shall be weather and water proof. Output shall be isolated 4-20 mA DC linear signal connected to DCS.</p> <p>38.00.00 <u>Dissolved Oxygen Measurement:</u></p> <p>Micro-processor based system with an accuracy of +/-1 ppb, having features like auto temperature compensation, auto zero & span calibration and integral indicator. Fault diagnosis data shall include faults in analogue/digital circuits, faults in calibrated values, power supply failure and sample failure. Housing for cell and analyser shall be IP65 or equal. Output shall be isolated 4-20 mA DC linear signal connected to DCS.</p>		

	RAICHUR POWER CORPORATION LIMITED YERAMARUS TPS - 2x800 MW	SECTION: D 3.4 VOLUME-IV
	SPECIFICATIONS FOR DDCMIS/INSTRUMENTS TO BE SUPPLIED	Page 1 of 2
<p>39.00.00 <u>Silica Analyser:</u></p> <p>Micro-processor based system with an accuracy of +/-2 ppb, response time better than 12 min for 90% change, six/three numbers of sample streams having features like auto zero & span calibration, ambient temperature compensation and integral indicator. Self diagnostic features shall include alarm for no reagent, calibration fault and silica concentration low/high. Analyser housing shall be weather and water proof. Output shall be isolated 4-20 mA DC linear signal connected to DCS.</p> <p>40.00.00 <u>Hydrazine Analyser:</u></p> <p>Polaro graphic type, Solid state/micro-processor based system with an accuracy of +/-5% FSD, repeatability of +/-2% FSD, response time of 90% of any change indicated in 6 min having features like auto zero & span calibration, ambient temperature compensation, and integral indicator etc. Fault diagnosis data shall include faults in analog/digital circuits, faults in calibrated valves, power supply failure and sample failure. Analyser housing shall be weather and water proof. Output shall be isolated 4-20 mA DC linear signal connected to DCS.</p> <p>41.00.00 <u>Sodium Analyser:</u></p> <p>The Analyser shall be continuous flow through sample, single stream with accuracy + / - 10 and response time less than 2 minutes for 90% of full scale readings. The range shall be 0-20 /0-200 ppb. The analyser shall have features like auto zero & span calibration, ambient temperature compensation, and integral indicator etc. Fault diagnosis data shall include faults in analog/digital circuits, faults in calibrated valves, power supply failure and sample failure. Analyser housing shall be weather and water proof. Output shall be isolated 4-20 mA DC linear signal.</p> <p>42.00.00 <u>Oxygen Analyser:</u></p> <p>Direct insertion, insitu type analyser with an accuracy of +/- 1% FSD, repeatability of 0.5 FSD, response time of 90% within 5 secs, auto and manual calibration having zirconia probe sensing element, IP 65 or equivalent degree of protection for enclosure. output shall be isolated 4-20 mA DC linear signal to DCS. Accessories like back purge system shall be provided.</p>		

S.NO	TERMINAL POINT	DESCRIPTION	COORDINATES	AGENCY 1	AGENCY 2
1	T1	ASH SLURRY PIPE LINE	15M FROM ASH SLURRY PUMP HOUSE	AHP VENDOR	GMW VENDOR
2	T2	BOTTOM ASH OVER FLOW PIPE LINE	15M FROM BOTTOM ASH OVERFLOW SUMP	AHP VENDOR	GMW VENDOR
3	T3	NDCT CHANNEL FOR UNIT#1 (COLD WATER)	10M AWAY FROM COOLING TOWER	BHEL	NDCT VENDOR
4	T4	NDCT CHANNEL FOR UNIT#2 (COLD WATER)	10M AWAY FROM COOLING TOWER	BHEL	NDCT VENDOR
5	T5	COOLING WATER PIPE LINE FOR UNIT#1 (HOT WATER)	10M AWAY FROM COOLING TOWER	BHEL	NDCT VENDOR
6	T6	COOLING WATER PIPE LINE FOR UNIT#2 (HOT WATER)	10M AWAY FROM COOLING TOWER	BHEL	NDCT VENDOR
7	T7	RAW WATER	LOW INLET OF CONTROL STATION OF RAW WATER MICROFILTRATION SYSTEM	GMW VENDOR	PWS VENDOR
8	T8	RECOVERED ASH WATER SYSTEM	INLET OF CONTROL STATION OF ASH WATER MICROFILTRATION SYSTEM	GMW VENDOR	PWS VENDOR
9	T9	NEUTRALIZED EFFLUENT FROM RO/DM PLANT	AT INLET OF CMB	BHEL	PWS VENDOR
10	T10	TREATED WATER FROM SLUDGE THICKENER	INLET TO ASH WATER SUMP	PWS VENDOR	AHP VENDOR
11	T11	FILTER WATER STORAGE TANK	INLET FLANGE OF ASH WATER PUMP	PWS VENDOR	AHP VENDOR



SL	DESCRIPTION	SCOPE
1.	SWITCH YARD	BHEL
2.	SWITCH YARD CONTROL ROOM	BHEL
3.	TRANSFORMER YARD	BHEL
4.	TURBINE BUILDING	BHEL
5.	BOILER STRUCTURE	BHEL
6.	ESP	BHEL
7.	ESP CONTROL ROOM	RPCL/NDCT+CHIMNEY
8.	CHIMNEY	RPCL/CHP+MRHS
9.	JUNCTION TOWER	RPCL
10.	FGD SPACE	BHEL
11.	FO/LDO UNLOADING AND HANDLING	BHEL
12.	CAR PARKING (56X18)	RPCL/GCW
13.	ADMINISTRATION BUILDING (56X20X6)	RPCL/GCW
14.	CANTEEN (20X12X4)	RPCL/GCW
15.	SECURITY & TIME OFFICE (10X7.5X3.5)	RPCL/AHP
16.	ASH HANDLING SILOS	RPCL/GCW
17.	WARE HOUSE (CENTRAL STORE) (60X50X6)	BHEL
18.	SERVICE BUILDING	BHEL
19.	MAINTENANCE BAY	BHEL
20.	NATURAL DRAFT COOLING TOWER	RPCL/NDCT+CHIMNEY
21.	CW SUMP & PUMP HOUSE	BHEL
22.	WATER TREATMENT PLANT	RPCL/PWS
23.	BLOW DOWN PUMP HOUSE	RPCL
24.	FIRE WATER PUMP HOUSE (45X10)	BHEL
25.	ACW PUMP HOUSE	BHEL
26.	MEDICAL CENTER (PART OF ADMIN. BUILDING)	RPCL/GCW
27.	FIRE STATION (20X15X9)	RPCL/GCW
28.	CONDENSATE STORAGE TANK	BHEL
29.	WATCH TOWER	RPCL/GCW
30.	PRIMARY CRUSHER HOUSE	RPCL/CHP+MRHS
31.	FILTERED WATER STORAGE TANK OVER GROUND (140X35X10 HT.)	RPCL/PWS
32.	FILTER WATER PUMP HOUSE & MCC (50X10X6)	RPCL/PWS
33.	ASH SLURRY PUMP HOUSE	RPCL/CHP+MRHS
34.	RO/DM PLANT	RPCL/CHP+MRHS
35.	SECONDARY CRUSHER HOUSE	RPCL/GCW
36.	SERVICE WATER OVER HEAD TANK (12DIAX5M HEIGHT 500cum)	RPCL/UNIRAIL
37.	LOCO SHED (20X25)	BHEL
38.	FUEL OIL HEATING AND PUMPING UNIT	RPCL/GMW
39.	WORKSHOP BUILDING (75X30X7)	RPCL/AHP
40.	SILO UTILITY BUILDING & MCC	BHEL
41.	CW TREATMENT PLANT / CW ACID DOSING	RPCL
42.	POST OFFICE & BANK (PART OF ADMIN. BUILDING)	BHEL
43.	IA/SA COMPRESSOR HOUSE	BHEL
44.	DM TRANSFER PH	RPCL/PWS
45.	CHEMICAL LAB GROUND+FIRST FLOOR (18X14X4 EACH FLOOR)	RPCL/CHP+MRHS
46.	CHP MCC	RPCL/CHP+MRHS
47.	MILL REJECT SILO	RPCL/CHP+MRHS
48.	WAGON TIPPLER MCC	RPCL/CHP+MRHS
49.	EMERGENCY RECLAIM HOPPER	RPCL/PWS
50.	PRETREATMENT PLANT RAW WATER MICRO FILTER (10X15)	RPCL/PWS
51.	CENTRAL MONITORING BASIN (25X25X4)	RPCL/PWS
52.	EFFLUENT TREATMENT PLANT (20X40)	RPCL/PWS
53.	SLUDGE THICKENER UNIT (10X10)	RPCL/AHP
54.	VACUUM PUMP HOUSE (30X10)	RPCL/AHP
55.	ASH WATER PUMP HOUSE (40X6.5)	RPCL/CHP+MRHS
56.	MILL REJECT COMPRESSOR HOUSE (20X10)	RPCL/CHP+MRHS
57.	VACUUM PUMP SWITCH GEAR (30X20)	RPCL/AHP
58.	AHP SWITCH GEAR (25X12)	RPCL/AHP
59.	11 KV CONSTRUCTION POWER SUPPLY SUB STATION	RPCL
60.	SEAL WATER PUMP HOUSE (10X6)	RPCL/AHP
61.	BOTTOM ASH OVER FLOW SUMP (7X5)	RPCL/AHP
62.	FLY ASH INTERMEDIATE HOPPER (6M DIA) & FA DRAIN PIT	RPCL/AHP
63.	WATER TREATMENT PLANT MCC (12X12)	RPCL/PWS
64.	ASH WATER RECOVERY MICRO FILTER	RPCL/PWS
65.	MANUAL UNLOADING HOPPER	RPCL/CHP+MRHS
66.	H2 & CO2 CYLINDER STORAGE AREA (10X25X4)	RPCL/GCW
67.	MARSHALING YARD STAFF ROOM (EXISTING ADMIN BUILDING)	RPCL
68.	AHP COMPRESSOR HOUSE	RPCL/GCW
69.	WEIGH BRIDGE	RPCL/GCW

S.NO	AREA	DESCRIPTION	FGL IN M	REMARK
1	SWITCH YARD	365.0	-	
2	TRANSFORMER YARD	361.4	-	
3	TURBINE BLDG	361.5	-	
4	BOILER & ESP	361.3	-	
5	CW PUMP HOUSE	366.5	-	
6	COOLING TOWER	366.5	-	
7	WATER TREATMENT AREA	361.5	-	
8	ROOM & DMTR PH	361.5	-	
9	PRESERVATION	361.5	-	
10	FUEL / LDO AREA	361.5	-	
11	MARSHALING YARD	358.0	HECK	TO BE DECIDED BY CHP VENDOR
12	CHP (STOCK) AREA	364.0	-	

- NOTES:-
- EXISTING NALA INDICATED INSIDE PLANT TO BE MODIFIED TO SUIT PLANT DRAINAGE SYSTEM.
 - CHP/AHP LAYOUT IS INDICATIVE AND SHALL BE FINALISED BY CHP/AHP VENDOR.
- HOLD-UP-
- RPCL TO CONFIRM WEATHER REVISED PLANT BOUNDARY INDICATED (IN BLACK COLOR) IS FINAL AS PETROL ROAD ROUTING & GREEN BELT ALONG IT IS UNDER HOLD.

CLIENT: **RAICHUR POWER CORPORATION LTD.**

CLIENT'S CONSULTANT: **steag** STEAG ENERGY SERVICES (INDIA) PVT. LTD.
Corporate Office
A-29, Sector-16, Noida-201301, India.

PROJECT: **YERMARUS THERMAL POWER STATION**
2 X 800 MW

TITLE: **PLOT PLAN**

DEPT	DRN	NAME	SIGN.	DATE
M	YOGI	YOGI	-SD-	30.03.2011
M	K.B.P.	K.B.P.	-SD-	30.03.2011
M	APPD	APPD	-SD-	30.03.2011

DEPT. SCALE 1:5000 DRAWING NO. RPCL-YTPS-LAYOUT-001
SHEET 1 OF 1 REV 03

SYMBOL	DESCRIPTION
○	COMPASS W/ W. W. T. W. T.
○	FOOTING PITCHER BOUNDARY
○	PERIMETER BOUNDARY
○	EDGE STRUCTURE, BHP
○	FOOT PATH, MESH
○	COMPASS W/ W. W. T. W. T.
○	W. W. T. W. T. W. T.
○	POWER LINE, TRANSFORMER
○	W. W. T. W. T. W. T.
○	REINFORCING WALL
○	ROAD PERIMETER, TYPICAL
○	EDGE W/ W. W. T. W. T. W. T.
○	DIAMETER EDGE, RAINY SORE
○	REINFORCING T.B.M.

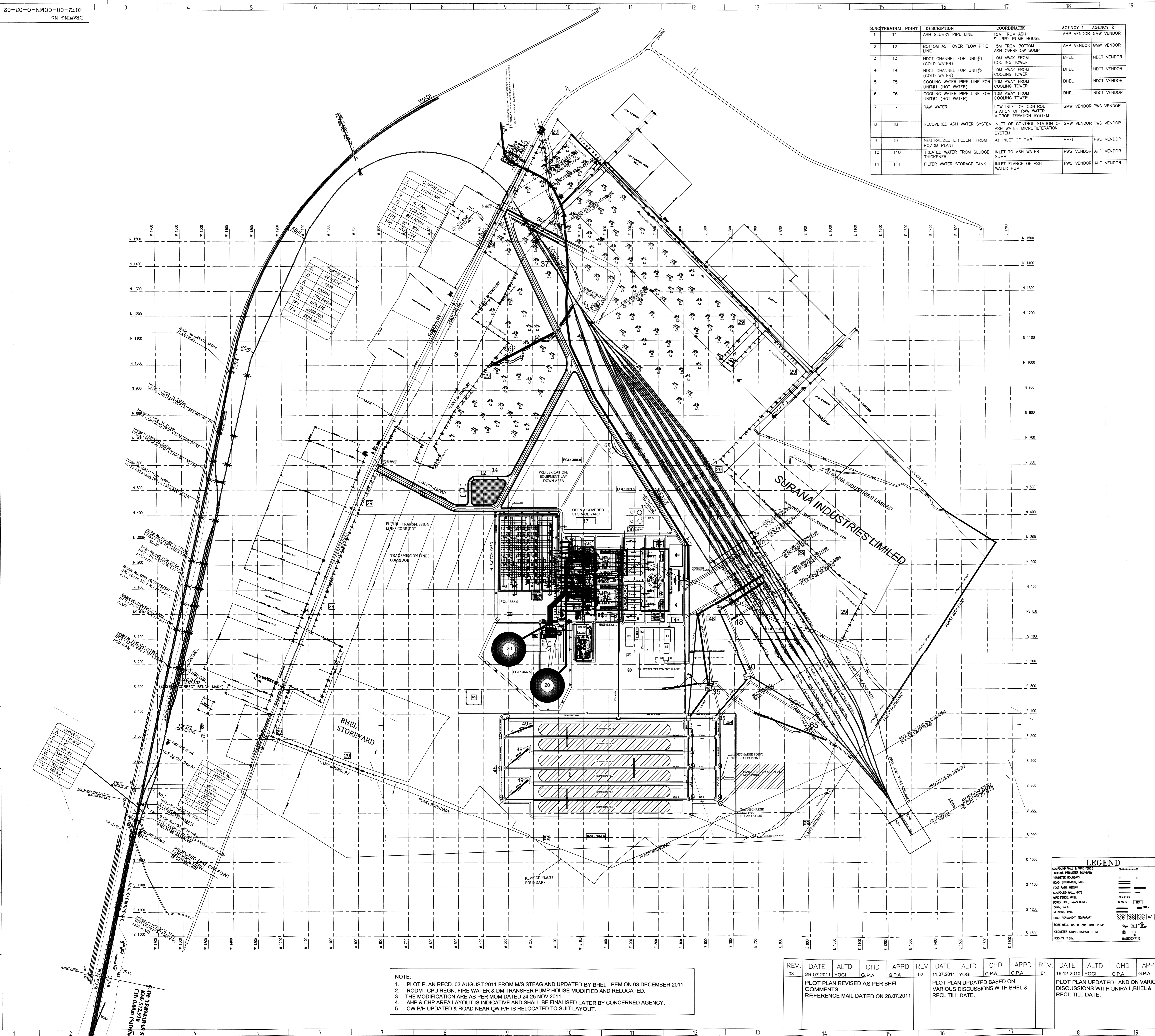
- NOTE:
- PILOT PLAN RECD. 03 AUGUST 2011 FROM M/S STEAG AND UPDATED BY BHEL - PEM ON 03 DECEMBER 2011.
 - ROOM, CPU REGN, FIRE WATER & DM TRANSFER PUMP HOUSE MODIFIED AND RELOCATED.
 - THE MODIFICATION ARE AS PER MOM DATED 24-25 NOV 2011.
 - AHP & CHP AREA LAYOUT IS INDICATIVE AND SHALL BE FINALISED LATER BY CONCERNED AGENCY.
 - CW PH UPDATED & ROAD NEAR QW PH IS RELOCATED TO SUIT LAYOUT.

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD
03	29.07.2011	YOGI	G.P.A.	G.P.A.	02	11.07.2011	YOGI	G.P.A.	G.P.A.
					01	16.12.2010	YOGI	G.P.A.	G.P.A.

COMMENTS:
PLOT PLAN REVISED AS PER BHEL COMMENTS. REFERENCE MAIL DATED ON 28.07.2011

COMMENTS:
PLOT PLAN UPDATED BASED ON VARIOUS DISCUSSIONS WITH BHEL & RPCL TILL DATE.

COMMENTS:
PLOT PLAN UPDATED LAND ON VARIOUS DISCUSSIONS WITH UNIRAIL, BHEL & RPCL TILL DATE.





TITLE
* SCHEDULE OF DECLARATIONS

SPECIFICATION NO. PE-TS-362-155-A001

VOL IIB SECTION D

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.

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



TITLE:
**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT**

2X800 MW YERMARUS STPP

BHEL DOCUMENTS NO.: PE-TS-362-155-A001

VOLUME-III

SECTION

REV. NO. 00

DATE: 14/12/11

VOLUME III



SCHEDULE OF TECHNICAL DEVIATION

- () From conditions of contract (Volume-I)
- () From general technical conditions (Volume – IIA)
- () From technical specification (Volume-II B)

BHEL DOCUMENTS NO.: PE-TS-362-155-A001

VOLUME-III

SECTION

REV. NO. 00

DATE: 14/12/11

NOTE: Please furnish the specification clause No. with page No. against which the deviation is sought. No general deviation (without mention of the specification clause No. with page No.) shall be entertained and shall be treated as null and void.

WE THE UNDERSIGNED HEREBY CERTIFY THAT THE ABOVE MENTIONED ARE THE ONLY DEVIATION				
PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

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