



सत्यमेव जयते
GOVERNMENT OF INDIA
BHABHA ATOMIC RESEARCH CENTRE
RESEARCH REACTOR MAINTENANCE DIVISION

TENDER NOTICE

Tender Notice No: RRMD/TN-55/2019

Date:14/10/19

To,
(Company name)

Sub: Tender enquiry for design, fabrication, mounting of components, wiring, supply, inspection, testing, installation and commissioning of Test Console for SOR Test Station at Dhruva

Sealed tenders are invited for and on behalf of the President of India by Head, RRMD BARC, Trombay, Mumbai-400085 from experienced bidders for design, fabrication, mounting of components, wiring, supply, inspection, testing, installation and commissioning of Test Console for SOR Test station at Dhruva, BARC.

1.0 Description of the work:

Design, fabrication, mounting of components, wiring, supply, inspection, testing, installation and commissioning of Test Console for SOR Test Station at Dhruva.

The work mainly involves the following:

- 1.1 Preparation and submission of G.A drawings, electrical schematic drawings & wiring diagrams, bill of material, QA plan and procedure for testing and commissioning for approval.
- 1.2 Mechanical design of the panels and the design for installing supply items as per panel specifications in Annexure I.
- 1.3 Fabrication, pre-treatment and painting as per approved drawings and procedures.
- 1.4 Procurement, assembly and mounting of components as per specification in Annexure I.
- 1.5 Internal wiring of panels.
- 1.6 Programming of PLC & SCADA as per approved documents.
- 1.7 Testing of panels & supply items at bidder's premises.
- 1.8 Transportation & delivery at site.
- 1.9 Dismantling of existing panels and erection of the new panels at site.
- 1.10 Installation of items supplied as a part of this tender at site.
- 1.11 Laying & termination of cables as per approved drawings.
- 1.12 Testing & commissioning, including integrated testing of panels with field instruments.
- 1.13 Submission of commissioning report & 'as commissioned' drawings.
- 1.14 Submission of QA certificates, acceptance test results, warranty certificates and other documents such as maintenance/operating manuals, of the supply items, as applicable.

2.0 Terms and conditions:

- 2.1 The offer should be valid for consideration for **90 days** from due date of the offer.
- 2.2 The work shall be completed within **six months** after issue of the work order.
- 2.3 On completion of the work to purchaser's satisfaction, payment would be released on submission of bills in triplicate along with an advance stamped receipt.
- 2.4 The bidder should also clearly reply in his tender to "whether the contractor / bidder has any relative working in BARC or the contractor himself is an ex-employee of BARC or the contractor has any ex-employee of DAE on his payroll".
- 2.5 Contractor should mention their valid PAN No. and GST Reg. No. in the quotation, failing which the offer shall be rejected.
- 2.6 The workmanship shall be of the highest quality giving an excellent finish to the job. High-class standard shall be maintained throughout.

3.0 Instructions to Bidders:

- 3.1 Bidders should submit documents in support of their technical capabilities.
- 3.2 Price quoted shall be filled up in the same format given in Schedule: B with GST as per applicable rates and no other charges will be payable.
- 3.3 Tender shall be submitted in the sealed cover in the bidder's standard company format quoting our Tender no. on the envelope and addressed to 'Head, RRMD, BARC, Trombay, Mumbai-400085 and submitted in the RRMD office, Dhruva'. The offer should be submitted so as to reach RRMD office, Dhruva **on or before 11/11/2019 up to 1500 hrs. Tender is to be sent only through registered post or speed post, hand delivery or courier of tenders will not be accepted.**
- 3.4 Tenders will be opened on the next (working) day at 1100 Hrs. in RRMD office, DHRUVA, Trombay, BARC. Shri Subhasis Dutta may be contacted on phone no. **25596211/ 25594322/25596210** from 8 AM to 4 PM to arrange entry permit if anyone wants to visit the site before sending their quotation. Alternatively an Email may also be sent at least one day in advance to Email address **sdutta@barc.gov.in/sushilw@barc.gov.in**.
- 3.5 The acceptance of the tenders will rest with Head, RRMD who does not bind himself to accept the lowest offer and reserves with him the authority to reject any or all the tenders received without assigning any reason.
- 3.6 Quotation received after the due date and time shall be summarily rejected.

4.0 Safety Requirements:

- 4.1 Industrial Safety Undertaking will have to be signed after discussion between Contractor/Supervisor of concerned works contract & Safety Officer/Coordinator of Reactor Group.
- 4.2 The contractor or executing agency shall adopt adequate safety measures as per the Job Hazard Analysis (JHA) control measures suggested. The personal protective equipment to contract workers, supervisors & engineers shall be supplied by the contractor at his cost.
- 4.3 General Requirement: All workers, supervisors & engineers of the contractor shall wear necessary protective clothing, safety belts with harness, helmets & canvas/safety shoes properly laced & follow the safety requirements strictly, while working at site.
- 4.4 For working at Heights: All the persons should be physically, mentally fit & to work in heights, medical fitness certificate should be furnished for all workers. The responsibility of all safety precautions related with a particular job at site primarily lies with the Contractor.

- 4.5 The contractor & his persons shall strictly observe all security and safety regulations prevailing at the site. The contractor & his team working at the site shall follow the safety measures as mentioned in "Safety with scaffolding" of GCC & other safety measures at site as per "Construction Safety Manual" available at www.tenderwizard.com/DAE or www.barc.gov.in.
- 4.6 All the workers, supervisors & engineers of the contractor shall have proper medical certificates issued by the competent authorities.
- 4.7 Safe industrial practices for entering & working in confined spaces are to be followed by Contractor & his team, wherever applicable.
- 4.8 Safe industrial practices are to be followed for use of portable ladders & step ladders by Contractor & his team, wherever applicable.
- 4.9 All workers should be insured at the cost of the contractor for risk of working at BARC & no claim will be payable by BARC.

Thanking you,

Yours faithfully,

Head RRMD, BARC
(For and on behalf of the President of India)

SCHEDULE –A

Tender Notice No: RRMD/TN/55/2019

Dated:14/10/2019

Name of Work: Design, fabrication, mounting of components, wiring, supply, inspection, testing, installation and commissioning of Test Console for SOR Test station at Dhruva.

Table for free issue materials

Sr. No.	Description	Qty	Unit	Rate
1	Water	As required	Litre	Free
2	Electricity	As required	KWH	Free

SCHEDULE – B

Tender Notice No: RRMD/TN/55/2019

Dated:14/10/2019

Name of Work: Design, fabrication, mounting of components, wiring, supply, inspection, testing, installation and commissioning of Test Console for SOR Test station at Dhruva.

1	2	3	4	5	6
Sr.No.	Name of items	Qty	Supply rate() (S)	Installation rate() (I)	Total Cost () (S + I)
1	Design, fabrication, mounting of components, wiring, supply, inspection, testing, installation and commissioning of Test Console for SOR Test station at Dhruva.	1 nos.			
Total Basic Cost of Supply					
Total Cost of Installation					
Taxes on Basic Cost of Supply (GST as applicable)					
Taxes on Installation (GST as applicable)					
Total Cost (Including all charges)					

Net supply = Total Basic cost of Supply + taxes on Basic cost of Supply =
Installation charges = Total cost of Installation + taxes on installation cost =

Total cost (including all charges) = Net supply + installation charges

Signature of the contractor with seal

Note: The prices shall be quoted in numerals and words as well. All pages of this form shall be signed with seal. No correction/over writing is acceptable.

GST exemption (@5%) on items supplied shall be applicable against GST exemption certificate approved by competent authority as the materials are to be used for R&D application.

ANNEXURE-I
TECHNICAL SPECIFICATIONS

Scope of the document

This document gives the detailed requirements of design, fabrication, mounting of components, wiring, supply, inspection, testing, installation and commissioning of Test Console for SOR Test station at Dhruva. This includes the panel details, list of instruments/components to be procured by the bidder with their specifications.

Technical Specifications

1. General

This is a requirement for the Research Reactor Dhruva located at BARC, Trombay, Mumbai. The scope includes design, fabrication, testing, supply, site installation & commissioning of an instrumentation test console to be located in Flow Test Station area of the reactor building in Dhruva.

1) Standards:

The equipment covered by this specification shall unless otherwise stated be designed, manufactured and tested in accordance with the requirements of the latest revision of the following codes and standards and in compliance with Indian Electricity Rules wherever applicable. Indian Standards not listed but applicable to various other components should also be followed. Should there be any dispute on design standard, the most stringent one shall be followed after taking approval from purchaser.

IS-513	: Specifications for Cold Rolled Carbon sheet steel
JSS 51034	: Specifications for PTFE insulated wires
IS-228	: Methods of chemical analysis of steel
IS-3618	: Phosphate treatment of iron & steel for protection against corrosion
IS-6005	: Code of practice for phosphating of iron & steel
IS-2062	: Steel for general structure purposes
IEC 61000-4-2	: Electrostatic Discharge testing
IEC 61000-4-3	: RFI Immunity testing
IEC 61000-4-4	: Electrical fast transient/burst immunity testing
IEC 61000-4-5	Surge immunity testing
IEC 61131-3	: Programming Language for PLC
ASTM D1730	: Preparation of Aluminum surfaces for painting
BS EN61326	: Electrical equipment for measurement, control and laboratory use- EMC requirements
IEC 584-2	: Specification of Thermocouples-Tolerances

2) Materials of construction, dimensions & mounting:

The materials of construction, dimensions and mounting arrangements etc are mentioned in detailed specifications attached with this section.

The detailed structural design shall be the responsibility of the contractor. The purchaser's drawings shall be used only as a guide. It must be ensured that the overall dimensions given in the purchaser's specifications are not to be exceeded without the prior approval of the purchaser.

3) Fabrication methods

- i) Bolted construction is preferred and welding should be kept to the minimum possible.
- ii) Bolts shall not be visible from outside.
- ii) Gasket shall be used at the respective bolted joints.
- iii) The plate wherever required shall be bolted/welded or bent to give sufficient rigidity.

- iv) The finished panel shall be free from warpage or distortion. Angle iron framework shall not be used at the junction of the slopping and vertical portions of the panel. The plate wherever required shall be bolted/welded or bent to give sufficient rigidity.
- v) The inside of panel shall be as open as possible to give complete access to the instruments. The panel shall be enclosed with the gasketed hinged doors. Louvers shall be provided on the doors.
- vi) The panels shall be covered at top and bottom with steel plates having suitable thickness.
- vii) The contractor shall be responsible for complete design of the panels for accommodating the listed components & should submit the GA drawings for the panels for approval of purchase before starting the fabrication.

4) Pre-treatment & painting

Painting procedure:

On completion of fabrication, all steel work shall undergo following processes

- a) Pre-treatment by seven tank process
- b) Painting.

Pre-treatment by seven-tank process

1 Degreasing:

Surface cleaning to remove oil, grease, dirt and swerve from assemblies shall be done by either of following methods.

- i. Tri Chloro Ethylene cleaning as per clause 7.1.2 of IS-6005-1970 or
- ii. Alkaline cleaning as per clause 7.1.3 of IS-6005-1970.

2 De-rusting:

Rust may be present after degreasing owing to exposure to corrosive conditions during manufacture. Scale may be present from operations during manufacture. It is therefore, necessary that rust be removed before application of phosphate treatment.

De-rusting shall be done by chemical treatment method as per clause no.8.1.2 of IS-6005-1970. Supplier may adopt either of the following methods.

- i. Pickling with Sulphuric, hydrochloric or Phosphoric acid as per clause no.8.1.2.1 of IS-6005-1970.
- ii. Duplex sulphuric and phosphoric acid process as per clause no.8.1.2.3 of IS-6005-1970.

3 Phosphate treatment

The phosphate treatment shall be carried out in such a manner that coating formation is proper as per class C vide clause 3.1.4 of IS-6005-1970. Proper attention shall be given to time of phosphating, solution temperature and composition for required coating formation. The coating weight shall be in accordance with IS-3618-1966.

4 Rinsing and Chromate Passivation

After phosphating, thorough rinsing with water is necessary in order to remove soluble salts, which would otherwise tend to promote blistering under a paint film. Care should also be taken to ensure that the water supply itself is sufficiently free from harmful salts. Then the components shall be used in hot dilute chromate solution as per clause no.4.4.1 of IS-3618-1966 under a temperature not below 600 C.

Painting

Supplier shall adopt epoxy based powder coating. Bidder should get the paint shade and texture approved. Supplier shall submit detailed procedure before starting the job.

5) Mounting of instruments

The total set of instruments is as mentioned in the technical specification of the panels.

For the bigger instruments like Power supplies etc support brackets may have to be added wherever necessary to ensure rigid mounting of the same. The contractor shall be responsible for the detailed design and providing of such supports.

6) Internal wiring

Panel internal wirings include terminations from the mounted instruments to the panel termination strips, necessary looping on the termination strips and inter-connections between relevant instruments.

- a) As currents are low and voltage is not higher than 240 VAC, 1 sq mm standard conductor with Poly Tetra Fluro-Ethylene (PTFE) insulation, 600V grade, suitable for maximum conductor temperature of 150° C may be used.
- b) When a single wire at the panel terminal strips is to be multiplied for connections to various equipments the same shall be done by a jumper at terminal strips and not by looping the wire from equipment to equipment.
- c) All connections to instruments where screw posts are provided shall have crimped AMP or equivalent connector fixed on the wires.
- d) Wherever space permits, plastic raceways may be supplied. Otherwise neat assembly of wires bunched together with nylon / PVC straps shall be provided. The maximum distance between such anchoring points shall not be more than 100mm. Unused areas of panel shall be kept free of wiring to facilitate the installation of future equipment. Wiring between points shall be point to point with no splicing or T connections.
- e) All instruments/components should be connected with sufficient loop slack to permit the withdrawal of the instrument/ component from behind or beneath the panel for maintenance, test or alteration. The wires to any one component/instrument shall be neatly bunched together.
- f) Wires shall be identified with double termination identity sleeves showing the two terminations of the wire. Such sleeves should be provided at both ends of the wire. Identification shall be marked in such a manner that it may be read easily from positions normally used when the equipment is being serviced.
- g) Suitable and uniform colour code for these sleeves shall be used for ease of identification of the wires.

7) Earthing/Grounding:

Each instrument or device having an electrical grounding terminal, shall be connected through insulated wire to a common ground bus provided in the panel for connection to station ground as described below:

All the panels shall be provided with two ground buses of bare copper strip of size not less than 25 mm X 3 mm. The ground buses shall be mounted horizontally in the panels. It shall be connected to sheet steel metal framework by means of mild steel and parts of 50mm height provided at regular intervals. These parts shall be connected to panel framework by welding before the panels are painted. The bus bars shall have tapped holes at regular intervals along its length to enable termination of safety ground connections from different equipments in panel through green colour PVC insulated stranded copper of 4 mm² by crimped lugs. A single connection of 16 mm² bare copper wire through crimped lug shall be made between panel ground bus to nearest plant grounding bus.

8) Support structure:

- Base frame of the console: It shall be made up of ISMC channel of suitable thickness and height to meet the load requirements. The channel should be properly grouted to the floor.
- Structure of the Panel: It shall be made of angles of suitable thickness and size to meet the load requirements.

9) Cable entry, termination and wiring:

All signal and control cables from the field are to be terminated on the panels on the panel termination strips. Teflon coated Multi-colour Wire of 1 mm² size shall be used for Panel internal wiring. Every termination should have a specified numbering schedule by use of ferrules. The total number of terminals to be provided in each panel is as per the tender document and the number of terminals, which are to be wired, will be provided later in the relevant drawings.

All cables will enter and leave from the side of the Console, unless otherwise specified. The cables shall enter the side of the Console through proper cable glands or grommets and routed suitably inside to the termination points.

Terminals to be used for signal and power supply connections to the instruments/components shall be screw type, suitable for taking conductor up to 2.5 mm². The terminals carrying voltage of 230 V_{AC} & 110 V_{AC} and above shall be provided with suitable protective covers so as to prevent any danger to personnel due to inadvertent contact with the same. Also physical separation shall be provided between DC and AC supply terminals.

Wires terminated by the Contractor shall be connected with care. The correct torque as recommended by the terminal block manufactures shall be applied by torque limiting screwdrivers, which shall be checked by a suitable standard at frequent intervals.

10) Labels

All instruments on the panel face are to be labeled. These labels should be screen-printed plastic materials and fixed by an adhesive to the panel.

Abbreviations wherever necessary in order to accommodate within the space available are to be used with prior approval from the purchaser.

The material for the nameplate on the panel shall be 1.6 mm thick, 3 ply black white black hylam (laminated) or 1.6mm thick black anodized aluminum with matter engraved. The front edges shall be chamfered to 0.5 x 45° to get a uniform border. Nameplates shall be black with white characters. Basic material either hylam or aluminum, type of characters, size of characters and depth of engraving shall be subject to purchaser's approval.

The nameplate shall be fixed with blackened pan head screws or with the use of suitable adhesive depending on the size of the nameplates. In case of adhesive fixing, it shall be ensured that the adhesive will have sufficient bonding strength and also it is possible to remove the fixed nameplate for replacement or deletion by applying white petrol at the joint without causing damage to painting on the panel.

Care shall be taken to ensure that nameplates are located in an orderly manner with proper spacing from the equipment to maintain the aesthetic look.

11) Approved / Preferred makes of components:

All supply instruments/components should be as per specifications and should be procured only from the specified manufacturers wherever mentioned, in order to ensure desired quality and target reliability. The bidders shall ensure the pre-dispatch inspection/testing of the items by the Purchaser or his representative, at the respective manufacturer's premises for items as specified in the technical specifications. The bidders shall ensure that the manufacturer/component supplier has all provisions to conduct such tests. In case of any deviation, the vendor shall be inform the purchaser and take consent in writing for modifications. The equipment offered by the supplier shall be complete in all respects and any equipment or auxiliary components that are not covered by this specification but essential for proper design, operation and maintenance shall be included in the tender.

12) Inspection, Tests & Reports:

Quality surveillance relating to all aspects of manufacture shall be carried out by RRMD, BARC. The supplier shall provide all the testing and inspection services and facilities satisfactorily as required. Inspection shall be carried out in a satisfactory manner and shall be subject to approval by the purchaser. Supplier shall carry out all the tests as per quality assurance plan (QAP), which will be supplied to the qualifying bidders.

Purchaser or his authorised representative shall have access to contractor's premises at all reasonable times to the extent necessary to assess compliance with the provision of this specification. Purchaser shall also have the right to conduct at Purchaser's expenses any additional inspection & testing.

13) Inspection:

In the event of failure of the product or any part to fully meet any inspection or test requirement specified herein, the contractor shall notify the purchaser or his authorized representative his intention to repair and/or use such product or part, and such repair or use shall be subject to approval by the purchaser. If the repairs, including redesign are likely to affect the results of tests or work previously completed, appropriate re-inspection and retesting shall be conducted.

The panels shall be carefully examined to determine conformance with this specification with respect to material and workmanship, finish, marking, dimensions and to assess its conformance with other requirements stated or reasonably implied and not covered by specific tests.

14) Tests:

The contractor shall notify the purchaser of his intention to carry out tests, giving sufficient notice to enable purchaser's representative to be present. Tests shall be carried out as per requirement detailed below:

a. Process Check

Visual Checking

Visual checking shall be done on sheet steel; fabrication process and painting as per QA plan referred above.

Dimensional Checking

Dimensional checking shall be done on sheet steel and panel as per QA plan referred above.

Weld Check

i. Visual

ii. Liquid penetrate test shall be done as per relevant standard.

Pretreatment Check

Pretreatment shall be done as per clause no 4 of this specification.

b. Type test

Painting Thickness Check

Painting thickness shall be checked as per IS-101. The paint thickness should be between 50 to 120 μm .

Scratch Hardness test

Scratch hardness test shall be conducted as per clause no. 3.0 of IS-101-1988 on test coupon.

Bend (Flexibility) test

Bend test shall be conducted as clause no 2 of IS-101-1988 on test coupon.

Pull off (Adhesion) test

Pull off test shall be conducted on test coupon as per clause no.5 of IS-101-1988.

c. Acceptance test

Voltage Proof test

Voltage proof tests between conductors and ground for one minute as follows:

- i. 240 V AC circuits - 1500V, 50 Hz.
- ii. 24 V DC circuits - 500V, 50 Hz.

Insulation Resistance test

Insulation resistance test shall be carried out on panel by applying 500 V DC between the terminals and the panel. The insulation resistance shall be more than 10 MΩ.

Continuity Check

Continuity checks for wiring errors shall be carried out.

Material and Component test

Material test certificates shall be furnished.

All the components/Instruments used on the panels shall be subjected to visual, mechanical, Electrical & functional tests. The test results shall be documented and submitted to the purchaser's QA engineer for review. Details of the tests to be conducted shall be mentioned in QAP prepared by the supplier after award of contract.

Supply of the material shall be strictly as per the mutually agreed QA plan between the supplier and the purchaser.

Copies of test reports, signed by a responsible representative of the Contractor shall be submitted to the Purchaser, as per the general contract.

15) Drawings

The bidder shall supply all relevant drawings, pertaining to panel layout GA, exact GA with dimensions, details of instrument/component mounting & fixtures, mounting details of panels on floor, internal wiring including ferrule numbers, termination numbering, etc.

The detailed structural design shall be the complete responsibility of the contractor. It must be ensured that the overall dimensions given by purchaser are not changed without the permission of the purchaser. Contractor should submit GA drawings as well as fabrication drawings for purchaser's approval before starting fabrication.

16) Instruction manuals

The bidder shall supply all relevant instruction manuals pertaining to the supply items. Complete documentation for assembling, configuration and programming of items shall be provided.

17) Packing & forwarding

The contractor shall make adequate provisions to protect the panels supplied to this specification to ensure that on arrival, they shall not have suffered corrosion or damage of any kind. All mounted instruments shall be adequately blocked where necessary to prevent damage during shipment. The panel shall be shipped by truck directly from contractor's works to BARC, Mumbai.

18) Identification during shipment

The package(s) shall be clearly and legibly marked with the following information:

Purchaser's reference No. (Works Order No.)

Description and quantity of item:

19) Information required with the bid

The bidders shall quote for the components of makes and models as specified in the tender document. Any deviations in terms of make, model and specification shall be brought out explicitly in the offer along with full technical details of the alternate/equivalent products offered. The purchaser reserves the right to accept or reject such alternate or equivalent products.

2. Technical Specifications for SOR Test Console

- 1) Material of Construction of Console: 2 mm CRCA.
- 2) Dimensions of Console: Dimensions of the Console shall be as shown in Figure1. Door shall at the back side and cable entry shall be from the side of the console.
- 3) Painting of Console: Console shall be pre-treated by seven tank process and powder coated with an uniform paint thickness of 60 microns. Colour shade shall be RAL7035.
- 4) Instruments like volt meters, current meters, Canon connector and digital timers shall be mounted on front face of Console. Power supply unit & other items like PLC, heater controller etc shall be mounted inside the panel.
- 5) HMI shall include a Personal Computer. Monitor shall be mounted on SOR Test console as shown in Figure 1. SCADA software shall be executed in the HMI.
- 6) Bidder shall carry out wiring and terminations in the panel as per approved drawings, as mentioned in general specification.
- 7) Interfacing of components with PLC and SCADA and programming of the PLC and SCADA as per interlock drawings and checklist shall be carried out by the bidder.
- 8) Pre treatment and painting of Console: As per clause mentioned in general specifications.
- 9) Earthing bus bars: As mentioned in general specification.
- 10) Support structure: As mentioned in general specification.
- 11) List of Components for SOR test console are as follows:

Sr. No.	Item Description	Specifications	Qty (Nos.)
1	SOR Test Console	MOC: 2 mm CRCA, Dimensions: As specified in Figure 1	1
2	HMI	HMI: Personal Computer with MS-Windows as OS, Monitor size: minimum 15 inch, Processor : Intel core i3 or better, RAM: 8GB or better, Operating System: Suitable for running SCADA and PLC software	1
3	Panel Cooling fan	Supply: 230 VAC, 20 Watt	1
4	Clutch voltage and current meter	Voltage Range: 0-60 V DC, Current Range: 0-2 Amp DC, 8-digit LED Display, With Modbus RTU communication, Make: Rishabh Model: RISH-EM-DC	1
5	Voltmeter for measuring potentiometer voltage	Voltage Range: 0-10 VDC, 8-digit LED Display, With Modbus RTU communication, Make: Rishabh Model: RISH-EM-DC	1
6	Motor supply voltage and current meter	Voltage Range: 0-150 VAC, Current Range: 0-2 Amp AC, 3 phase, LED 7 segment 4 Digit display, With Modbus RTU communication, Make: Schneider, Model: ION6200	1
7	Digital Timer	Programmable 5 I/P, 2 Relay Out with 4 Digit Display (Preferably Make: Red Lion, Model: PAXTM000), With Modbus RTU communication	2

Sr. No.	Item Description	Specifications	Qty (Nos.)
8	Power relays	4 NO/NC, 48 VDC, 5 A for supply of HG motor raise lower and switching heater, Make: Finder, Model: 55.34.9.048.5080	6
9	Relay Socket	Make: Finder, Model: 94-54-SPA	6
10	Emergency stop Button	Make: Teknic, 48 VDC, Red, size: 40mm diameter, Model: 2AM4	1
11	Tip Jack	Female	4
12	Toggle Switch for Clutch slip test circuit	1 SPDT	1
13	48 VDC Power supply	5 Amps, SMPS, Make: Phoenix or equivalent	1
14	5 VDC Power supply	1 Amps, Make: Phoenix or equivalent	1
15	MCB for HG motor	5 A, 3 Phase, 110 VAC Make: Schneider or equivalent	1
16	MCB for DC power supply unit and Digital Timer power supply	5 A, 1 Phase, 230 VAC Make: Schneider or equivalent	5
17	MCB for heater	10 Amps, 1 Phase, 230 VAC Make: Schneider or equivalent	2
18	Terminal Blocks	For 2.5 mm ² wire, DIN rail mounted, Push fit type, Model: WAGO 280	50
19	Cannon Connector Plug	Make: ITT Cannon, Model: MS 3106 B28/21-P	1
20	Cannon Connector Receptacle	Make: ITT Cannon, Model: MS 3102 B28/21-S	1
21	Canon Connector Plug HG end	Make: ITT Cannon Model: KPT-06-E-20-39-P	1
22	Canon Connector Receptacle HG end	Make: ITT Cannon, Model: KPT-02-E-20-39-S	1
23	Potentiometer for power supply to HG POT circuit	Reputed Make, 5000 Ω , 2 Watt, Tolerance $\pm 10\%$	1
24	Potentiometer for Clutch slip test circuit	Reputed Make, 50 Watt, 100 Ω (Torroidal Power Rheostat)	1
25	Transformer	Make: Marathon or other reputed make, 3 phase; 415 to 110 VAC, 2.5 Amps.	1
26	Heater Temperature Controller	PID+SCR control for 230 VAC 1 phase 1KW heater, facility for remote and local set point input, Input: 4-20 mA, RTD, Make: Marathon or other reputed make	1
27	Heater	Blanket type Silicon Rubber heater with sponge insulation (5 mm thick) and cylindrical casing (For 120 mm dia. and 377 mm height) in two halves with hinge at center and clamp for fixing, material of construction: SS with 1 mm thickness, 0.5 m long teflon lead wires, 1 KW, 230 VAC 1 phase, Make: Marathon or other reputed make. Drawing of heater wrapped on head gear is provided in figure 2 for reference	1

Sr. No.	Item Description	Specifications	Qty (Nos.)
28	Temperature element for heater temperature	3 wire RTD, PT-100, mounted on the heater, Accuracy: +/- 0.15°C	1
29	PLC	As per Annexure II	1
30	SCADA	As per Annexure II	1
31	Arduino Uno kit with SD card reader and card	-	1
32	Digital Video graphic (Paperless) Recorders	As per Annexure III	2

12) Description of SCADA screens

SCADA shall have the following screen on display.

- SOR Testing.
- Adjustor Rod Testing.
- SOR clutch slipping test.
- Drop Profile of SOR.
- Heater Control Screen.
- History.

Functionality of each screens are described below:

i. SOR drop testing

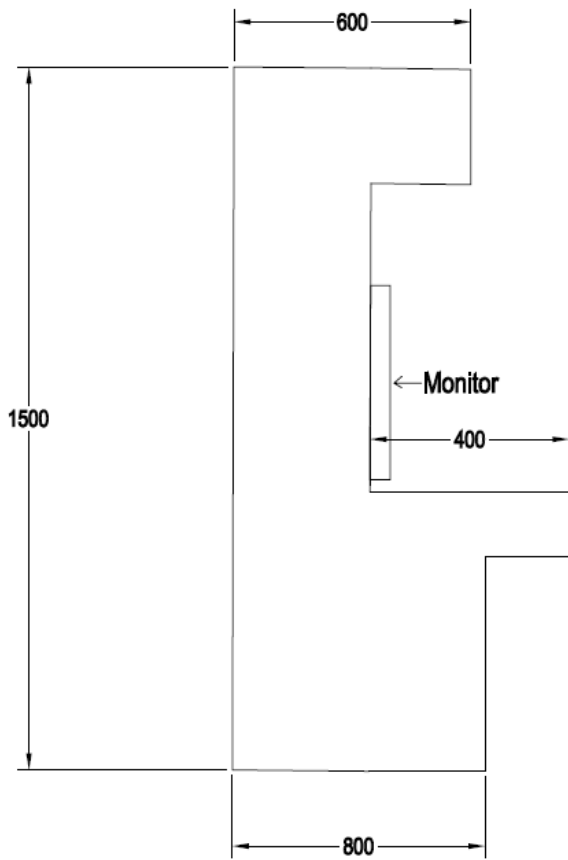
- a) Select option for Short servicing or Full Servicing: Opens up a checklist as per selection.
- b) Provision for user to enter HG No.
- c) Provision for user to fill up Checklist as per above selection.
- d) Provision for user to set temperature of head gear in Heater Control Screen. For this purpose a link to Heater screen shall be provided & temperature of the head gear (through RTD Pt-100 installed on the heater) shall be shown in this screen (Analog input). PLC shall provide set-point for the heater controller (Analog output).
- e) Provision for user to enter the no. of drops to be taken and the delay between the drops during the drop test.
- f) Select option for Auto/ Manual drop tests.
- g) Drop Tests shall be carried out as per logic implemented through PLC in auto mode. Time for SOR to drop 100% & 80% of full travel shall be measured by PLC & digital timers separately, time measured by digital timers shall be communicated to PLC and displayed in SCADA.
- h) In manual mode, there should be provision for manual raising and lowering and dropping the shut off rod, energizing/ de- energizing of clutch.
- i) Voltages and current measured through Voltmeter and Ammeter shall be displayed on the SCADA screen.
- j) Provision for user to enter remarks and saving the data for printing shall be provided.

ii. Adjustor rod testing

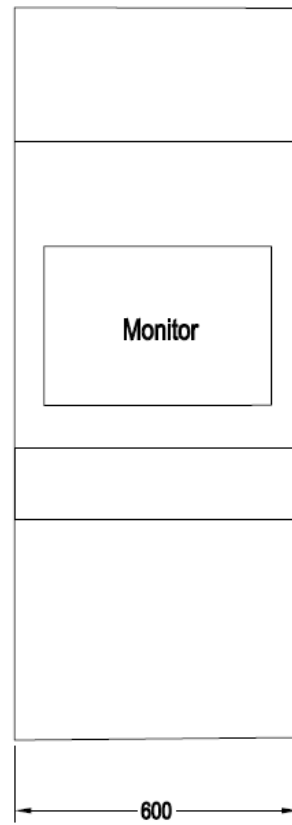
- a) Select option for Short servicing or Full Servicing: Opens up a checklist as per selection.
- b) Provision for user to enter HG No.
- c) Provision for user to fill up Checklist as per above selection.
- d) Provision for user to set Temperature in Heater Control Screen, for this purpose a

link to Heater screen should be there & temperature of the head gear (from RTD installed) should be shown in this screen.

- e) Provision for the user to select the no. of raise lower operation in Auto or Manual mode.
 - f) Auto Raise and lower operation shall be carried out as per logic implemented in PLC.
 - g) Provision for user to enter remarks and saving the data for printing shall be provided.
- iii. SOR clutch slip test**
- a) Provision for user to enter HG No.
 - b) Provision for user to apply clutch voltage manually
 - c) Clutch current & voltage shall be displayed on SCADA screen.
 - d) Provision for user to enter remarks and saving the data for printing shall be provided.
- iv. Drop Profile test of SOR**
- a) Provision for user to enter HG No.
 - b) Provision for user to start drop profiling by sending start command to Arduino Uno & carry out a drop test by dropping the SOR. Stop command shall be send to Arduino Uno when test is completed.
 - c) Data shall be stored in SD-card (connected to Arduino Uno kit) in CSV format.
 - d) HMI should read the SD-card connected through a card reader and plot the drop profile in SCADA.
 - e) Provision for user to enter remarks and saving the data for printing shall be provided.
- v. Heater Screen**
- a) Provision for user to enter HG No.
 - b) Provision for user to set temperature of the heater.
 - c) Actual Temperature shall be displayed on the SCADA.
 - d) Provision for user to enter remarks and saving the data for printing shall be provided.
- vi. History**
- a) History in the form of PDF prints of Screens after completion of test shall be provided.
 - b) All PDF files shall be stored in PC for printing and reference.
 - c) Provision for searching, opening and viewing of these old files should be provided on this screen.



Side view of SOR test console



Front view of SOR test console

Figure 1: Front and side view of SOR test console

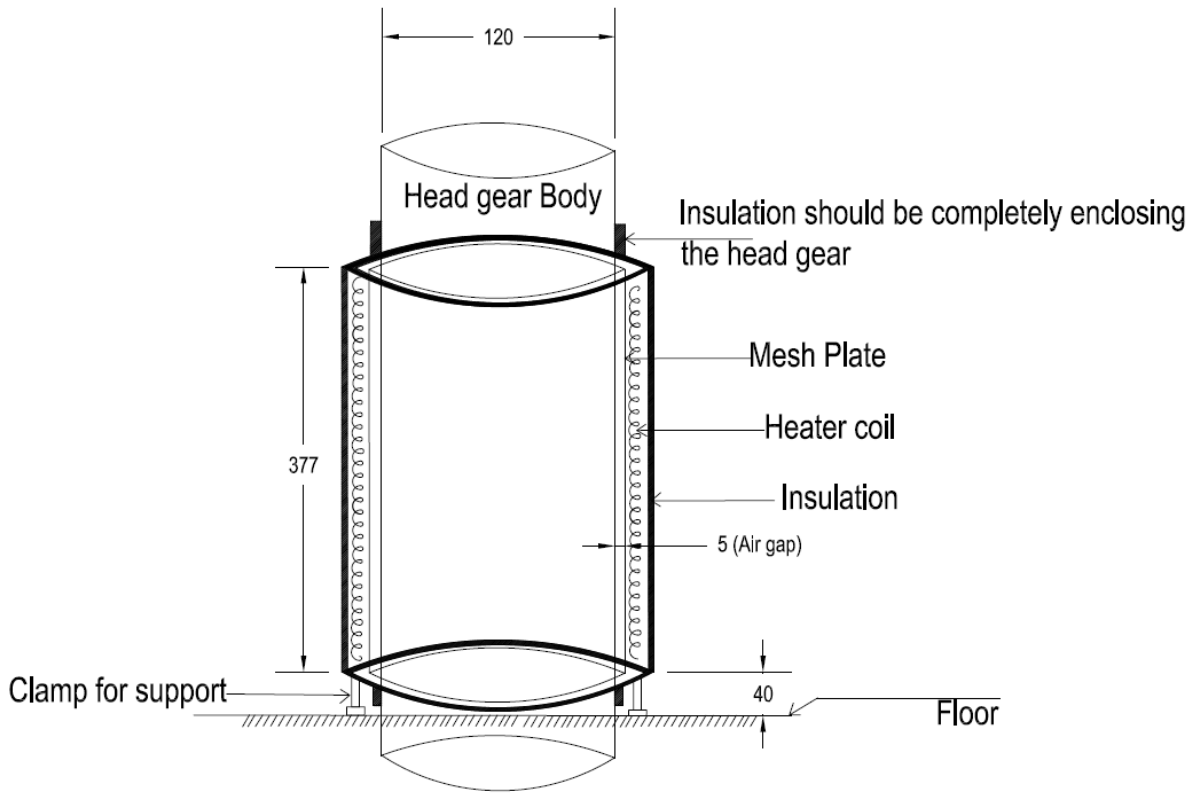


Figure 2: Details of heater wrapped on head gear

Annexure-II

Technical Specifications for PLC and SCADA

1. Technical specification of PLC

- 1) **Make:** Seimens, Schneider, Allen Bradley or equivalent.
- 2) **Power Supply:** 230VAC.
- 3) **Work memory:** 350 KB or more.
- 4) **Internal storage:** 8 MB or more.
- 5) **Micro memory card storage:** 512 KB.
- 6) **Integrated communication services:** Modbus, TCP/IP, UDP, SNMP, NTP.
- 7) **Interfaces:** RS-485, RJ45, USB.
- 8) **Integrated functionality:** Real Time clock, password protection.
- 9) **Execution Speed**
The CPU shall perform operations with the following speed:
 - a) Execution for 1K instruction: Better than 20 μ s for 100 % Boolean instructions
 - b) Execution time for instructions shall be as follows:
 - 1 μ s floating points
 - 0.08 μ s Boolean or better
 - 0.075 μ s on word or better
 - 0.075 μ s on fixed-point arithmetic
 - c) System overhead: Shall not be > 1 ms

10) Electrical Specifications

PLC shall comply with the following standards:

- a) Electrostatic Discharge test as per standard IEC 61000-4-2
- b) RFI Immunity test as per standard IEC 61000-4-3
- c) Electrical fast transient/burst immunity testing IEC 61000-4-4
- d) Surge immunity testing IEC 61000-4-5

11) PLC programming software

The PLC programming method shall conform to IEC 61131- Part 3 programming languages standard. The software shall support Ladder Diagram (LD), Functional Block Diagram (FBD), Instruction List (IL), Structure Text (ST) and Sequential Flow Chart(SFC).

Vendor shall provide 2 licenses for the PLC programming software.

The PLC programming software shall allow the following

- a) Programs to be written, edited in all IEC 61131-3 programming languages.
- b) Upload and download of programs to/from PLC.
- c) Designing of PLC architecture and I/O mapping.
- d) Evaluation of inputs from field through I/O modules.
- e) Execute the logic based on inputs and generate the output.
- f) Monitoring the program status online.

12) Digital Input Module:

- a) Make: Siemens, Allen Bradley or equivalent
- b) Number of Channels:16
- c) Input Voltage: 48VDC
- d) Isolation: Galvanic isolation
- e) Field connection: screw terminals
- f) Protection: Reverse polarity protection
- g) Response time: 10 ms or better

13) Digital Output Module:

- a) Make: Siemens, Allen Bradley or equivalent
- b) Number of Channels:16

- c) Input Voltage: 48VDC
 - d) Isolation: Galvanic isolation;
 - e) Field connection: screw terminals
 - f) Response time: 5 ms or better
- 14) **Analog Input Module:**
- a) Make: Siemens, Allen Bradley or equivalent
 - b) Number of Channels: 04
 - c) Input Range: 4-20 mA/ 1-5 VDC
 - d) Resolution: 16 bits
 - e) Maximum Input Voltage: 50 VDC
 - f) Maximum current input: 40 mA
 - g) Isolation: Galvanic isolation
 - h) Field connection: screw terminals
 - i) Accuracy: +/- 0.5 % of span
 - j) Broken Wire (Burn out) detection
 - k) Protection: Reverse polarity protection
 - l) Response time: 20ms or better
- 15) **Analog Output Module:**
- a) Make: Siemens, Allen Bradley or equivalent
 - b) Number of Channels: 04
 - c) Output Range: 4-20 mA/1-5 VDC
 - d) Resolution: 12 bits
 - e) Maximum Input Voltage: 50 VDC
 - f) Maximum current input: 40 mA
 - g) Isolation: Galvanic isolation
 - h) Field connection: screw terminals
 - i) Accuracy: +/- 0.5 % of span
 - j) Response time: 10ms or better

2. Technical specification of SCADA

The SCADA system is a centralized facility for data-acquisition and control functions. SCADA software shall be executed on the HMI counted on the Console. Vendor shall offer software and licenses for following requirements:

- a. SCADA Server (Server license): 2 nos.
- b. Engineering station (Full development license): 2 nos.

General requirements of SCADA are as follows:

- 1) Make: Simatic WinCC, Eclipse or equivalent.
- 2) The SCADA should be 64 bit software capable of running in Windows 10 or latest for client machines.
- 3) SCADA shall have minimum of 1000 tags.
- 4) It shall be commercially available software package combined with various modules like IO server, HMI designer, Trend viewer, alarm management, report generation etc.
- 5) Software modules should be available for Dynamic Graphic Displays, Historical Data logging, Real Time Trending, Project level scripting, Alarm Management, Security, OPC compliance, Process control, Project management, Report generation etc.
- 6) Software shall read and write variables or tags.
- 7) Hardware dongle based licensing shall be used. The dongle shall be portable, any system having the software and dongle can be used for SCADA operation.
- 8) Detailed diagnostics shall be provided by the software.
- 9) All device drivers for various communications protocols shall be provided.

Annexure-III

Technical Specifications for Digital Video graphic (Paperless) Recorders

General:

This specification covers the technical requirement for manufacture, testing, packaging, supply & warranty of “Digital Video graphic (Paperless) Recorders” with 12.1" TFT screen, Universal Analog inputs, math functionality, related software and built in memory.

Functional Specifications:

- 1) **Make** Eurotherm or equivalent
- 2) **Model No** 6180A
- 3) **Display**
 - a) **Type** Colour TFT LCD with cold cathode, backlight, fitted with resistive, analogue, Touch-Panel
 - b) **Size** 12.1”
 - c) **Resolution** XGA (1024 x 768 pixels)
- 4) **Data Storage**
 - a) **Internal Memory** Recorder shall have 96 MB or higher internal EEPROM memory for storing the set up/configuration data & recorder data. The memory shall be with Lithium battery backup. (Battery life shall be minimum 5 years in normal operation of the Recorder.)
 - b) **Removable Media** Recorder should support use of SD Card with 8 GB capacity. It should also be provided with a USB port supporting at least 8 GB drive. Supply of SD card is not in the scope of the supplier. Recorder should provide indication of how long Disk storage (internal and external) will last.
- 5) **Sampling Rate** Recorder should have a configurable sampling rate. Minimum sampling rate should be 125 mS or lesser.
- 6) **Input**
 - a) **Input channels** 24
 - b) **Type of Input** Universal analog input consisting of Thermocouple (J, K & T types), PT-100 RTD (2/3 wire), mA (0 to 20 / 4 to 20), Voltage (0 to 10V/ -10 to 10V), milli volts, resistance in Ohms, Potential Free Contact etc. with burn out indication (both upscale and downscale-user selectable) for Thermocouple and RTDs.
 - c) **Noise rejection (48 to 62 Hz)** Common Mode > 140 dB (Channel to channel & channel to ground)
Series Mode > 60 dB
 - d) **Max. common mode voltage** 250 Volts continuous
 - e) **Max. series mode voltage** 45mV or more for mV/TC input
20 Volts peak for DC voltage/current input
 - f) **Isolation**

Channel to channel	} 300 V RMS
Channel to signal ground	
Channel to Earth	
 - g) **Dielectric strength** Channel to channel 2500Vac or higher
Channel to Earth 1500 Vac or higher
 - h) **Insulation resistance** Should be 10 MΩ or higher at 500 VDC
 - i) **Input impedance** 10 MΩ or higher for mV / thermocouple input (Up to 1 V)

65 k Ω or higher for voltage input (Up to 20 V)

7) Data Display

- a) Display Modes The recorder should have Trend (Vertical & Horizontal), Bargraph (Vertical & Horizontal) and Digital indication.
- b) Groups It should be possible to arrange the input parameters in 6 or more groups for display.
- c) Colour It should be possible to configure different colours for different inputs
- d) Tags It should be possible to configure chart divisions, chart traces (thick or thin), Pen names, Engineering units, tag descriptions for each input

8) Math functionality

- a) Math Operations Mathematical functions like addition, subtraction, multiplication, division, square rooting, logarithmic function (\log_{10} , ln), rounding, modulus, square, average, reciprocal, totalisation etc shall be user programmable.
- b) Math Channels It shall be possible to form a mathematical expression using the math operator and taking the inputs from other channels/pens and assign the result to the other pen.
- c) Totaliser It shall be possible to configure fully independent 10 digits Totalisation channels and assign it to a particular pen of the recorder.

9) Alarm Function

- a) Alarms set points There should be a provision of 4 independent alarm points for each input
- b) Alarm Action It should be possible independently configure each set point to high or low value of input
- c) Hysteresis It should be possible to independently configure hysteresis for each set point
- d) Alarm Relays Each recorder should be provided with at least 3 programmable alarm relays. It should be possible to independently configure each relay to energise or de-energise on alarm condition

10) Historical Data/Data Replay

It shall be possible to review the Recorded Data stored in the internal memory / SD card / USB memory stick on the Recorder. On line recording (data acquisition) shall not be affected during this operation.

11) Chart speed and Logging Rate

It shall be possible to configure the chart speed/logging rate from seconds per division to hours per division.

12) Recorder Setup

It shall be possible to set up, program and configure the Recorder, both locally, through an Integral Keypad via user friendly- user selectable pull down menu, and remotely from PC. It shall be possible to transfer the configuration from the PC to the recorder by direct interfacing and/or through the USB memory stick

13) Power Supply

- a) Supply Voltage 100 to 230V_{AC} \pm 15%; 47 to 63Hz
- b) Power Consumption 60 VA or lesser

14) PC based Software

The Software shall be supplied along with the Recorder. The software shall be multitasking software

and shall operate in the Windows environment. The software shall have the following features:

- a) Features for Recorder configuration,
- b) Recorder Simulation on PC: Ability to fully simulate the recorder configuration on the PC without connection to any recorder hardware.
- c) Import Data: Ability to import data from the recorder through the USB memory stick or using real-time communication through communication protocol/network.
- d) Data storage
- e) Preparing charts for selected period from stored data and printing the same if required
- f) Export Data: Ability to export the data to other windows based applications like Microsoft Excel.
- g) Customise displays and screen designing provision for making nonlinear scales, bargraphs, etc.
- h) Viewing historical data, trends etc.
- i) LAN Connectivity/ Interface Port: Ethernet Interface port of (10BASE-T/100BASE-TX) (RJ45) type. The recorder should support TCP/IP and FTP protocols.

Performance Specifications

- 1) **Accuracy**
 - a) Voltage/Current Input $\pm 0.30\%$ of Calibrated Span (Inclusive of Repeatability, Linearity & Hysteresis)
 - b) T/C Input As per IEC 584-2
 - c) CJC Accuracy $\pm 1^{\circ}\text{C}$
 - d) Resistance/RTD Input 0.1 % of calibrated span
- 2) **Stability** 0.1%/year or better
- 3) **Ambient temperature Effect** Less than or equal to 0.01 % of full scale/ $^{\circ}\text{C}$
- 4) **EMI susceptibility** As per BS EN61326

Environmental Conditions

- 1) Operating Temperature 10 to 50 $^{\circ}\text{C}$
- 2) Humidity 5 to 80% RH (Operation)
5 to 90 % RH (Storage)

Physical Specifications

- 1) Mounting Panel Mounting
- 2) Bazel Size 292 x 292mm
- 3) Bazel Colour Black*
- 4) Cut out Size 281 x 281mm (both $\pm 1\text{mm}$)
- 5) Depth behind panel Should not exceed 280 mm
- 6) Weight Should not exceed 7 Kg

*The recorders are to be mounted in Main Control Room. From aesthetic point of view it is important to have black bazel.

Inspection & Testing

Pre-dispatch inspection & testing will be carried out in presence of purchaser or his authorized representative at the suppliers end. The supplier shall be responsible to make suitable arrangements for the same. The purchaser shall also have the right to conduct at their own expense any additional inspection or testing, they deem necessary apart from the ones mentioned in specification. Supplier shall intimate at least 15 days in advance about the date and location of

inspection. Operation, service and Maintenance manual shall be supplied for each of the recorder.

Complete details of inspection and testing facilities available with the bidder and the QAP may please be submitted along with quotation. Following acceptance tests shall be carried on all the recorders.

- a) Visual examination & Dimensional checks.
- b) Functional Checks, verification and familiarization of all the features of the recorders.
- c) Calibration checks
- d) Performance check.
- e) Performance & functional check of alarm unit.
- f) Check for chart speed / logging rate accuracy.
- g) Check for CMRR and NMRR (Detailed procedure mentioning the codes and standards followed for carrying out these tests should be submitted.)
- h) Check for the effect of change of supply voltage.
- i) Insulation resistance & high voltage test.
- j) Check for the PC connectivity and familiarization with the software supplied.

Material & workmanship

Material chosen and workmanship shall be of good quality and acceptable standards and in accordance with good practices pertinent to the manufacture of high quality Paperless Recorders suitable for the service conditions and other provisions of this specification.

Guarantee

Material shall be guaranteed for performance and workmanship and against any manufacturing defects for a period of 12 months from the date of commissioning or 18 months from the date of receipt of material whichever is earlier.

Certificate of Compliance

The manufacturer shall supply in triplicate, certificate of compliance stating that the material supplied is in accordance with all the provisions of this specification.