# Bharat Heavy Electricals Limited

**(**High Pressure Boiler Plant**)**
Tiruchirappalli – 620014, TAMIL NADU, INDIA
An ISO 9001 Company
CAPITAL PURCHASE / MATERIALS MANAGEMENT / MANUFACTURING


| **ENQUIRY** | Phone: +91 431 257 75 75<br>Fax : +91 431 252 07 19<br>Email : rrmanohar@bheltry.co.in<br>Web : www.bhel.com |
|---|---|

| | **Enquiry Number:** | **Enquiry Date:** | **Due date for submission of quotation:** |
|---|---|---|---|
| | **2620600031** | **01.06.2006** | **07.08.2006** |
| Your are requested to quote the Enquiry number date and due date in all your correspondences. This is only a request for quotation and not an order | | | |

| **Item** | **Description** | **Quantity** | **Delivery Schedule** |
|---|---|---|---|
| 10 | Panel Processing Machine 20 Torch MIG / MAG welding with accessorises as per the technical specification & commercial conditions applicable (to be downloaded from web site **www.bhel.com**) | 1 No. | 30.05.2007 |

**Note:**

**(1) The detailed Technical Specification along with technical point-by-point confirmation, Commercial Terms & Conditions applicable for this Enquiry, Confirmation of acceptance for BHEL commercial terms & conditions and Price Bid formats have been posted in BHEL Corporate web site www.bhel.com under Enquiry reference "2620600031". Your offer should be based on all the above documents.**

**(2) Also, you are requested to fill in the Supplier Registration formats available in www.bhel.com (under Advancement – Supplier Registration) and send it along with your offer.**

| | |
|---|---|
| Tenders should reach us before 14:00 hours on the due date<br>Tenders will be opened at 14:30 hours on the due date<br>Tenders would be opened in presence of the tenderers who have submitted their offers and who may like to be present | Yours faithfully,<br>For BHARAT HEAVY ELECTRICALS LIMITED<br><br>Dy. Genl. Manager / Capital Purchase / MM / Manufacturing |

# PART A

## QUALIFYING CRITERIA FOR THE SUPPLY OF *BOILER FURNACE WALL PANEL WELDING STATION*

## SECTION – I

The BIDDER / VENDOR has to necessarily provide the following details, for making an assessment of the firm's capability and competency:

[The BIDDER is expected to give complete details against each clause in the table given below and wherever necessary an additional sheet may be attached (giving clear reference number) to cover the required details]

| S. No. | PARTICULARS | VENDOR's RESPONSE |
|---|---|---|
| **1.0** | Number of Years of Experience of the BIDDER/ VENDOR in the field of design, manufacture and supply of 'Boiler Furnace Wall Panel Welding Machines' | |
| **2.0** | Number of Tubular Panel Welding Machines supplied, installed and commissioned till date, for Ultra High Pressure Boiler Industries [Manufacturers]. | |
| **3.0** | Technical Details like Number of Welding Torches, Type of Welding Process, Size of Finished Panel, Dimensions of Tubes and Fins Used (for Panel Building), Supporting Systems (like Facilities for Tube Stacking & Feeding, Fin-Decoiling, Fin Blasting & Calibration, Sub-Panel Fit-Up & Tacking, Panel Flipping, Panel/Sub-Panel Transportation, Panel Inspection) of the already supplied Panel Welding Machines to be given | |
| **4.0** | Details of Design Set-Up and Technology Back-Up assured for the PRINCIPAL Equipment Maker | |
| **5.0** | Details on International Standards / Process Codes followed (if any) in the Design of the Equipment. [Copy of the English Version of relevant portion of the Standards / Codes followed, to be furnished with the Technical Offer] | |

| S. No. | PARTICULARS | VENDOR's RESPONSE |
|---|---|---|
| **6.0** | Details of Quality System followed [Furnish the salient aspects of the Quality Assurance System followed] for the machine building / manufacture | |
| **7.0** | Details on the Facilities available for Machine Building / Fabrication and Performance Testing at the BIDDER's Works and Sources of OUTSOURCING / SUB-CONTRACTING | |
| **8.0** | BIDDER to list down the Sub-Vendors from whom Bought-Out Items, Accessories, Attachments, Infeed / Outfeed or such Material Handling Units are likely to be sourced for the subject machine. | |
| **9.0** | Comprehensive Details on Performance Testing - of the Equipment quoted, to be given with the Technical Offer | |
| **10.0** | Details on SERVICE-AFTER-SALES Set-Up in India including the Addresses of Agents / Service Centre in India and Asia | |
| **11.0** | Any Additional Data to supplement the manufacturing capability of the BIDDER for the subject equipment. | |

## SECTION – II

The BIDDER / VENDOR has to compulsorily meet the following requirements to get qualified for submitting an offer for the PANEL PROCESSING MACHINE.

| S. No. | REQUIREMENTS | VENDOR's COMMENTS |
|---|---|---|
| **12.0** | The BIDDER / VENDOR shall have a minimum of TEN Years of Continuous Experience in the Design, Manufacture & Supply of Tubular Panel Welding Station. | |
| **13.0** | The BIDDER / VENDOR shall have supplied at least two numbers of Tubular Panel Welding Machine of the CAPACITY and CONFIGURATION specified [minimum configuration as given under PART B] in the recent past, say in the last five years. | |
| **14.0** | Reference List of Customers and Performance Certificate from CUSTOMERS (minimum one Customer) with full contact details of CONTACT PERSON, for the proof of capability for machine building and servicing . | |

| S. No. | PARTICULARS | VENDOR's RESPONSE |
|---|---|---|
| **15.0** | BIDDER has to co-ordinate for the visit of BHEL Team (at BHEL Cost) to the BIDDER's Customer Works, to witness the capability of an existing Tubular Panel Building Machine, if warranted. | |

## SECTION – III

The BIDDER / VENDOR has to comply with the following, for accepting the Technical Offer for scrutiny by the Purchaser :

| S.No. | REQUIREMENTS | VENDOR's COMPLIANCE |
|---|---|---|
| **16.0** | The BIDDER shall submit the offer in TWO PARTS - Technical **[with PART A & PART B]** & Commercial and Price Bid | |
| **17.0** | The Offer shall contain a comparative statement of Technical Specifications given by BHEL and the Offer Details submitted by the Bidder, against each clause. A just 'CONFIRMED' or 'YES' or 'COMPLIES' or 'NO-DEVIATION' or similar words in the technical comparative statement may lead to disqualification of the Technical Offer. | |
| **18.0** | The BIDDER / VENDOR shall assure a continuous support for SPARES and SERVICE for TEN Years, from the date of commissioning of the equipment . | |
| **19.0** | The Technical Offer shall be supported by Product Catalogue and Data Sheets in ORIGINAL and complete technical details of 'Bought-Out-Items' with copies of Product Catalogue and Selection Criteria | |
| **20.0** | The Commercial Offer (given with the Technical Offer) shall contain the Scope of Supply and the Un-Priced Part of the Price-Bid, for confirmation | |
| **21.0** | BIDDER has to indicate the Country of Origin for the supply of MAIN EQUIPMENT. | |
| **22.0** | The reference List of Customers shall be accompanied with the details (Phone Number /E-Mail ID) of the CONTACT PERSON for cross reference by BHEL | |

# PART B

## TECHNICAL SPECIFICATIONS for BOILER FURNACE WALL PANEL WELDING STATION

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| **1.0.0** | **PURPOSE** | For continuous welding of Ultra-High Pressure Boiler Membrane Wall Panels and other Panels formed by welding of seamless tubes with intermediate flats (fins) in the fashions :<br><br>a. Sub-panels (5 Tubes and 6 Fins Or 6 Tubes & 5 Fins)<br>b. 2 Nos. of Boiler Economiser Tubes (1 Tube & 2 Fins)<br>c. Welding Together Sub-Panels to form finished panels upto a width of 2500 mm. | |
| | | | |
| **2.0.0** | **JOB SPECIFICATION** | | |
| 2.1.0 | Tube Outside Diameter | 25.4mm to 76.1mm | |
| 2.2.0 | Tube Wall Thickness | 2.3mm to 10mm | |
| 2.3.0 | Tube Material | | |
| | a) Carbon Steel | SA192, SA210A1, SA210C | |
| | b) Alloy Steel | SA209T1, SA213T11, SA213T22, SA213T91 | |
| 2.4.0 | Fin Material | Carbon Steel & Alloy Steel | |
| 2.5.0 | Fin Width | 10mm to 110mm | |
| 2.6.0 | Fin Thickness | 5mm to 12mm | |
| 2.7.0 | Fin Coil Weight | 1000 to 2000 kgs. | |
| 2.8.0 | Fin Coil Diameter | 1000 to 1200 mm | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 2.9.0 | Panel Length (Welded Portion) | Minimum : 4000 mm<br>Maximum : 25000 mm | |
| 2.10.0 | Panel Width | Upto 2500 mm | |
| | | | |
| **3.0.0** | **WELDING LINE** | | |
| 3.1.0 | WELDING STATION | | |
| 3.1.1 | Type | PLC Controlled Push-Through (moving tube) Stationary Welding Machine | |
| 3.1.2 | Weld Process | MIG/ MAG / CO2 (Interchangeable) | |
| 3.1.3 | Welding Wire Diameter | 1.2 mm, 1.6 mm for MIG / MAG / FCAW | |
| 3.1.4 | Construction | Rigid Closed Frame | |
| 3.1.5 | Number of Torches | 20 [Twenty in Total] suitable for MIG / MAG / FCAW Welding | |
| 3.1.6 | Torch Arrangement | a. Preferred to have 10 Torches each for top & bottom side welding.<br>b. BIDDER to give details on torch selection and arrangement so that optimum usage of torches and effective panel building operation are ensured, at any time.<br>c. BIDDER to ensure to eliminate machine operation limitations, maintenance hurdles, high amount of heat generation due to welding, ineffective weld-fume extraction, problem in viewing & monitoring all operating torches during the welding operation, etc.<br>d. Design to ensure no formation of kink, bow and twist in the panel building, in addition to a perfect defect-free welding. | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 3.1.7 | Welding | Both Topside & Bottom side of the panel simultaneously | |
| 3.1.8 | Selection of Torches for welding in a group | Welding with Any or All 20 Torches at a time | |
| 3.1.9 | Welding Speed (Variable Range) | 150 to 3000 mm / min in single mode (Expected Average Welding Speed around 1000 mm / min) | |
| 3.1.10 | Drive | Inverter Controlled AC Drive | |
| 3.1.11 | Upper Form Roller Shafts | Screw Rod and Locking Arrangement with Gear-Box and Motor [in case of hydraulic arrangement]. Proper arrangement of Valves (with control valve for adjusting Pressure) and with Mechanical Limits to Prevent Over-Pressing. Total System shall be without any oil leak and maintenance free concept. | |
| 3.1.12 | Lower Form Roller Shafts | 1. Provided with arrangement to vary the effective height, so that adjustment for different diameter of the tubes (coming in the panel) is possible.<br>2. Centre-line correction and alignment with the machine center is to be simple and maintenance free, with easy accessibility. | |
| 3.1.13 | Form Rollers and Distance Rings | Shall be suitable for both tube-end and fin-end panels. | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 3.1.14 | Fin Bar Support (vertically adjustable) to position fins at tube center | Hydraulically Operated having automatic control with mechanically pre-settable system to suit various tube diameters | |
| 3.1.15 | Fin Bar Pressing Rolls | Hydraulically Operated having automatic control with mechanically pre-settable system to suit various tube diameters | |
| 3.1.16 | Fin & Tube Clamping Device | Side Pressing Unit with hydraulically operated pressing rollers for fins or tubes with automatic control and mechanically pre-settable provisions [Rigidity and Alignment to be ensured in line with horizontal positioning of the panel]. | |
| 3.1.17 | Control of Hydraulically Operated Pressing Units | Individual Hydraulic Valve & Display on Control Panel of Hydraulics | |
| 3.1.18 | Arc Blow Prevention & Return Current Collecting Arrangement | a. Welding return current collectors (for grounding) are to be provided at suitable locations and machine frame is to be constructed with separate high capacity collectors to withstand high current flow.<br>b. Design to avoid over heating of collectors and to avoid current flow through rollers & other machine supporting systems. | |
| 3.1.19 | Service Platform over the Machine | To locate the welding power sources, fume and slag recovery vacuum units, welding coil holders (300 kg. Jumbo/ marathon packs), hydraulic power pack, etc. | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 3.1.21 | Roller construction for feeding the tube and pressurizing the tubes | Sufficient number of rows of rollers across the width & length of the panel are to be arranged, in order to avoid welding heat related problems of like bow / twist generation during welding and insufficient pressure related problems in the horizontal or vertical directions. | |
| 3.1.22 | Weld Quality | Machine Design to ensure perfect weld quality (in single stroke) without any defects like Weld Skip-Off, Off-Line, Burn- Through, Under-Cuts, Lack of Fusion or Penetration, Weld Porosity. | |
| 3.1.23 | Machine Elements | Welding components / equipments arrangement are to be of rigid and solid design, self guiding/holding type and user friendly to avoid welding related problems (due to fragile arrangement of wire feeders, guides & controllers, torch assembly & positioning, devices with respect to feeding rollers, etc.) The torch vertical up and down adjustment can be by through a rack and pinion or ball screw drives, for an improved design. | |
| | | | |
| **3.2.0** | **WELDING EQUIPMENT** | | |
| 3.2.1 | Welding Power Source | 20 Nos. Inverter Controlled (IGBT based) DC Welding Powersource | |
| 3.2.2. | Powersource Current Rating | 50 to 500 Amps. @ 100 % Duty Cycle | |
| 3.2.3 | Welding Process | Suitable for MIG / MAG / FCAW with $CO_2$ Gas Shielding | |
| 3.2.4 | Powersource Make | Should be of proven make | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 3.2.5 | Other Features of Powersource | Capable to produce Perfect Weld in the Panel Building Process [with Spatter Free Welding, Smooth Arc Initiation, Crater Filling, Good Penetration, Uniform Weld Bead Formation, etc.] | |
| 3.2.6 | Welding Torch Mounting Arrangement | a. Torch Mounting Guide to be around 2100 mm in length.<br>b. Manual Movement with Pneumatic Locking.<br>c. It should be possible to move and locate the Welding Torch Carriages at any desired position on the horizontal Guide Beam | |
| 3.2.7 | Stroke for Up/Down adjustment for Welding Torch by pneumatic mode | Shall be a minimum of 100 mm. Otherwise BIDDER to specify the stroke. | |
| 3.2.8 | Welding Wire Coil Holders | Capacity to hold and feed 25 kg. Spools | |
| 3.2.9 | Welding Wire Drum Holders | Capacity to hold 300 kg. Jumbo spools | |
| 3.2.10 | Weld Arc Shielding Glass | Machine mounted arc shield for MIG / MAG / FCAW Welding | |
| 3.2.11 | Gas Mixing Unit | 2 Nos. | |
| 3.2.12 | Gases to be mixed | Argon & $CO_2$ Gases | |
| 3.2.13 | Mixing Ratio | Argon 80 to 100%<br>$CO_2$ 0 to 20 % | |
| 3.2.14 | Mixed Gas Flow Rate | 20 - 100 litres / min. | |
| 3.2.15 | Inlet Pressure | 3.5 to 10 Bar | |
| 3.2.16 | Outlet Pressure | 2.8 Bar or equivalent to maintain free gas flow across the torch | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 3.2.17 | Gas Manifold - Accessories | 1. Gas Manifold, Gas Solenoid Valves, $CO_2$ Gas Heater, Gas Flow-Meters and Regulators with hoses and end connections, are to be provided with machine tripping logics arrangement.<br>2. Cylinder Rack for holding gas cylinders and Gas Mixing Unit<br>3. Mechanism for cleaning of spatter from nozzle in MIG / MAG / FCAW Welding | |
| 3.2.18 | Fume Extraction Unit | a. 1 Set of separate electrically driven multi-stage turbine type vacuum system for welding [CO2 gas dominated] fumes extraction and fine filtering before let-out to shop floor.<br>b. Turbine vacuum generation around 5000 mm of water column with a flow rate of 1500 normal meter cube per hour and with filter cartridge to separate the fumes and CO2 , and open let-out gases within environmentally acceptable limits.<br>c. The fumes extraction should be aimed from each individual torch with nozzle arrangement and isolation valves with proper control & instrumentation. | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 3.2.19 | Slag Recovery Unit | a. 1 set of slag breaking device for $CO_2$ weld slags generated during welding, using Toothed Wheels actuated pneumatically.<br>b. Turbine type vacuum generation around 5000 mm of water column with a flow rate of 1500 normal meter cube per hour, with blower/cyclone type dust & slag separator [for $CO_2$ weld slag removal] .<br>c. The slag suction nozzles are to be positioned against each torch for effective collection of slag collected on the panel with isolation valves and instrumentation. | |
| | | | |
| **3.3.0** | **MACHINE OPERATIONAL CONTROLS** | | |
| 3.3.1 | Welding Process Control | Independent Process Controllers | |
| 3.3.2 | Machine Control | Industrial PC based PLC Control | |
| 3.3.3 | The Controls shall be Hinged with swiveling arrangement | Located in a convenient position for the operator (180 deg Swivel) | |
| 3.3.4 | Remote Control on Both Sides of Welding Machine | For Welding Torches' Operations : -<br>Torch Left / Right<br>Torch Up / Down<br>Wire Feed | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 3.3.5 | Control Features | 1. Auto / Semi auto / Manual Start / Stop of welding according to panel movement.<br>2. If panel movement stops or slows down, welding should be stopped. Similarly panel movement should STOP if welding is interrupted.<br>3. All necessary interlocks such as burn through, weld seam tracking and protection, welding wire feed indication and alarm for change over, etc., to produce quality weld and safe operation.<br>4. Data logger and data acquisition on line record and control<br>5. Tube Blast Unit Control /Wire Feed Control / Panel Movement Control / Tube Pre-Heat Heater Control<br>6. Operation of Torches / Upper Rolls / Fin Pressing Rolls / Slag Breaker / In-Feed, Out-Feed and Return Conveyor Control / Emergency Stop , etc.<br>7. Controller shall be provided with Digital Ammeters & Voltmeters for display of welding parameters.<br>8. Digital Meters for Welding Speed, Pre-Heat Temperature, Gas Flow<br>9. Provision for setting & locking of welding parameters<br>10. Display of Hydraulic Pressing units | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| **3.4.0** | **IN-FEED and OUT-FEED CONVEYORS** | | |
| 3.4.1 | a) Conveyor Design | 1. Made of Wear Resistant but Smooth (not to make impressions on the tubes of the panels) Steel Rollers.<br>2. Position of Idler & Motorized Rollers are to be so designed that the Panels of All Dimensions (within the range specified) are handled smoothly.<br>3. BIDDER to specify the details on the arrangement of Drive and Idler Rollers. | |
| 3.4.2 | b) Conveyor Width | Suitable for making Panels upto a width of 2500 mm | |
| 3.4.3 | c) Conveyor Speed | 600 to 6000 mm / min. (synchronized to the Welding Speed in Automatic Mode) – Otherwise selectable for Manual Operations, without the welding operation also. | |
| 3.4.4 | d) Conveyor Length | Effective Length of 25000 mm on ONE SIDE | |
| 3.4.5 | e) Pass-On Stand | Provided with all motorized Steel Rollers Stand, suitable for pushing Panels (with width upto 2500 mm) through the full traverse length of the In-Feed Conveyor, Out-Feed Conveyor and the Machine Frame Width. | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 3.4.6 | f) Cross Conveyors | 1. Cross Conveyor is to transport sub-panel / mini-panels coming to the Out-Feed Conveyor after welding, back to the In-Feed Conveyor (for further welding), though the pass-On Stand.<br>2. Cross Conveyor has to be provided for both the In-Feed and Out-Feed Segments (may be with an overlap in the Pass-On Segment also) and to be located at equal distance on the In-Feed and Out -Feed Segments for evenly loading the 24 meter long panel and to transfer the panel from one end to other end across the width of the In-Feed and Out-Feed Conveyors.<br>3. Each Cross Conveyor Unit shall be made of an assembly of minimum six numbers of cross-transferring mechanism. | |
| | | | |
| **3.5.0** | **INTEGRATED TUBE & FIN FEEDING ARRANGEMENT** | | |
| 3.5.1 | Tube Feeding System | a. One Tube at a time from the Sloping Storage Rack.<br>b. Tube Lowering onto Scallop Bar on Cross Transport Conveyor by moving Up / Down mechanism operated pneumatically<br>c. Tube feeding system shall be integrated with the Fin Feeding Chain Conveyor for convenience | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 3.5.2 | Fin Storage and Feeding System | 1. Automatic fin bar drawing device for pulling the calibrated fin from the Decoiler Unit and through the fin-blasting and fin- calibration machine, to the fin in-feed chain conveyor.<br>2. The fin pulling mechanism shall be through a rack and pinion drive unit for better & positive grip [and to be installed under the Sloping Tube Rack, for compactness].<br>3. The fin in-feed conveyor [to carry the calibrated fins and to store] has to be wide and rigid by design.<br>4. The conveyor has to be driven by a single drive & gear box assembly unit, to avoid dislocation, misalignment and failure of fin feeding due to the provision of multiple drives and numerous gear boxes.<br>5. The fin bar storage should be up to 24 Fin Bars | |
| 3.5.3 | Staging table | With fixture for arranging the tubes & fins including automatic feeding of tubes & fins to the staging table | |
| 3.5.4 | Transport of Tack Welded Panel to Machine In-Feed Table | By means of Cross Transport Conveyor | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 3.5.5 | Tack Welding Fixture | Initially tack welding of Panel Assembly at the tack welding fixture in front of Staging Table - 5 to 10mm tack welding in the beginning (up to 250mm length) of Panel for firm grip of the fins with respect to tubes to cover 6 tubes fin positioning initially. Pneumatic tube & fin alignment & pneumatic clamp for initial tag welding of tube for sub-assembly of welded mini panels. | |
| 3.5.6 | Flipping Arm Facility | For handling the welded panel to tilt / fillip 180 deg., along the length of the in feed conveyor for 25 meter panel of 3 meter width in case of defect elimination of both sides welded panel or single side welded panel at times | |
| 3.5.7 | Control Unit for the above | For Automatic, programmable feeding of tubes & fins in sequence and in required quantity based on panel configuration selected | |
| | | | |
| **3.6.0** | **FIN CALIBRATING LINE** | | |
| 3.6.1 | DE-COILING UNIT | Rigidly designed and smooth working | |
| a) | Loading | Manual | |
| b) | Uncoiling | By pinch rolls in the fin calibrating m/c. | |
| c) | Fin Coil OD / ID / Width | 1500mm / 500mm / 200mm | |
| d) | Coil Weight | 2000 kgs. (maximum) | |
| e) | Device to prevent free uncoiling | Friction Brake (with adjuster) | |
| f) | Length Measuring Devices | Auto & manual Length measurement & shearing units to be provided in the machine | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 3.6.2 | BUTT WELDING BENCH | To be of simple and compact design | |
| a) | Clamping | Manually operated clamps | |
| b) | Welding Process | BIDDER to specify for quality weld | |
| c) | Sensor for indicating finishing of fin | To stop the Calibrating Machine automatically, once the fin comes to an end in the de-coiling unit. | |
| 3.6.3 | FIN GRIT BLASTING M/c. | Integrated to the Fin Bar Calibrating line | |
| a) | Type | Push-Through Type | |
| b) | Location | Between Fin Butt-Welding Bench & Calibration Machine | |
| c) | Cleaning Standards | SA2½ (Sweden) | |
| d) | Number of Nozzles | Bidder to specify | |
| e) | Nozzle Diameter | Bidder to specify | |
| f) | Blasting speed | Bidder to specify | |
| g) | Shots / Grit – Quantity, Mix, Selection & Specification | Around 500 kgs./filling, Metagrit 65 / Steel Grit, Particle Size - 0.2 to 0.65 mm | |
| h) | Filter Cleaning | Automatic and Pulse Jet Cleaning | |
| i) | Dust Collection | In designated Dust Collecting Bins | |
| j) | Dust Extraction - Outlet Air Quality | Dust Emission Maximum @ 5mg/$Nm^3$ [for particle size 10 micron & above] | |
| k) | Integral Abrasive (GRIT) Recovery & Recycling System | | |
| l) | Location | Normal Shop-Floor Area | |
| m) | Dust Separation | Through a system containing cyclonic separators, ducts connecting blasting chamber & dust extraction unit, dust collectors and exhaust fan | |
| n) | Shots / Grit Leakage | Fool proof arrangement for NO leakage. | |
| o) | Control | Manual & Automatic Start / Stop with indicating alarm for grit/shots level low | |
| p) | Noise Level | Not exceeding 80 dB (A) | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|---|
| 3.6.4 | CALIBRATING MACHINE | Elegant Design with Rugged Operation | | |
| a) | Purpose | Calibration of Width of Fin Bar & Edge Beveling by Forming & Machining processes | | |
| b) | Calibration Capacity | Suitable for the Material Class St42 (maximum - 420 $N/mm^2$) | | |
| c) | Width of Fins used | 10 mm to 110 mm (in steps) | | |
| d) | Fin thickness | 4 mm to 12 mm | | |
| e) | Width Calibration By Forming | Fin Thickness (mm) | Forming Width | |
| | | 4 to 6 | 3.0 mm | |
| | | 6 to 8 | 2.0 mm | |
| | | 8 to 12 | 1.5 mm | |
| f) | Calibration Speed | Desired Range : 0.5 to 6.0 M / min. | | |
| g) | a. Width Calibration & Beveling by Machining<br>b. Beveling by Machining (all four edges) | 5.0 mm<br>[Max. Cut-Off from the Width]<br><br>3 mm x 3 mm | | |
| h) | Calibration / Beveling Speed | Desired Range : 0.2 to 2.0 M / min | | |
| i) | Width Calibration by Forming & Edge Beveling by Machining | Around 3.0 M / min. | | |
| 3.6.5 | FIN BAR MACHINING UNIT | To have Smooth Machining Operation | | |
| a) | Position | Between Two Forming Calibration Units | | |
| b) | Process | Milling without Cutting Fluid | | |
| c) | Width Adjustment (Also possible on-line) | Manual, with Digital Display of Milling Head Position | | |
| d) | Vertical Adjustment of Milling Cutters | Manual by Removable Washers | | |
| e) | Chip Handling | Chip Guards & Channels for Collecting Chips to a Disposable Box | | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 3.6.6 | Fin Bar Straightening & Calibrating Unit by Forming | a. 1 Set Supporting & Guiding Rollers<br>b. Vertical & Horizontal Rollers, Mechanically Adjustable<br>c. Hydraulic Opening of Upper Straightening Rollers<br>d. 1 Set Horizontal Rollers for Straightening before Calibrating<br>e. 2 Nos. Forming Calibrating Units & Support Rollers<br>f. Motorized, Hardened, Calibrating Rollers, Mechanic-ally adjustable to the needed Fin-Width, with Mechanical Width Indicators. | |
| 3.6.7 | HYDRAULIC CUT OFF UNIT | For the Calibrated Fin after Calibration | |
| a) | Cutting | Hydraulic Shear | |
| b) | Length & No. of Cut Fin Bars | Pre-Settable | |
| c) | Accuracy of Length of Fin Bar | ±12.7mm in 30m Long Fin Bar | |
| d) | Interlock | Calibration is Stopped for Cutting Process & Re-Started Automatically after Cutting | |
| e) | Hydraulic Unit | Independent Hydraulic Unit for Calibration Machine including for Cutting | |
| 3.6.8 | CONTROL PANEL | Touch Screen Type Design preferred | |
| a) | Mounting | Hinged | |
| b) | PLC Control | Start / Stop of Calibration<br>Length & Width Measurement<br>Cutting of Fin Bar<br>Counting of Calibrated Fins<br>Safety & Limit Switch Operation | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 3.6.8. c) | Digital Indications | Width of Fin Bar<br>Length & Pre-Set Length of Fin Bar<br>Quantity & Pre-Set Quantity (Nos.)<br>Milling Speed | |
| d) | Protection | Enclosure IP54<br>RF Shielding<br>Ambient 45 deg Celsius & RH 95% | |
| e) | Safety | EN Safety Norms<br>Safety & Limit Switches<br>Windows & Inside Light for Good Visibility During operation | |
| | | | |
| **4.0.0** | **BUFFER STORE FOR SUB-PANELS** | | |
| 4.1.0 | Purpose | Storage of Welded & Finished Sub-Panels | |
| 4.2.0 | Type | Paternoster Type | |
| 4.3.0 | Storage Magazine | Up / Down Movable | |
| 4.4.0 | Number of Storage Planes | 4 | |
| 4.5.0 | Loading Capacity per Storage Plane | 5 Tons | |
| 4.6.0 | Operation | Motorized Up / Down | |
| 4.7.0 | Loading / Unloading | By Conveyor. Order of Loading / Unloading can be freely chosen | |
| 4.8.0 | Elevating Mechanism & Lifting Forks | 6 Sets (Modular Construction) | |
| | | | |
| **5.0.0** | **INSPECTION TABLE** | | |
| 5.1.0 | Purpose | For Panel Inspection | |
| 5.2.0 | Size | 2.5m x 25m | |
| 5.3.0 | Transportation of Panels to & from Inspection Table | Cross Transport Conveyor Extension from Roller Conveyors on Out-feed Side | |
| | | | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| **6.0.0** | **AIR COMPRESSOR** | 1. With required pressure and flow for grit blasting and all other pneumatic operations coming in the entire welding station.<br>2. BIDDER to specify the technical details of the offered Air Compressor | |
| **7.0.0** | **REFRIGERATED AIR DRIER** | To eliminate moisture content from compressed air at the designed flow and pressure rate. | |
| | | | |
| **8.0.0** | **GENERAL POINTS** | | |
| 8.1.0 | Industrial PC based PLC Unit | a. Make – FANUC / Siemens / Mitsubishi<br>b. PC & PLC must built with flash memory card with back up of machine operation programme, Display should be of 14 inches of color monitor, PC should provide serial, parallel & USB port with CD writer with UPS of 2 hours back up time.<br>c. Programming Tool for PLC with accessories & cables for uploading and downloading of program | |
| 8.2.0 | Hydraulic System **[REFER ANNEXURE – 1 for DETAILS]** | Make : Vickers, Rexroth or Denisons Hydraulic Power Pack / Standard Hydraulic valves with separate oil chiller to keep oil operating temperature in all seasons at 40 degree. | |
| 8.3.0 | Set of Service Tools | All service related tools for dismantling and assembling of machine components | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 8.4.0 | Machine Lighting | Suitable Fluorescent Light or Metal Halide Lamp wherever required in the Machine | |
| 8.5.0 | Noise Level Control | By providing non-metallic linings in the various tube conveyors in the system | |
| 8.6.0 | Electrical Wiring | a. All electrical motors, limit switches etc, on the machine shall be wired using PVC sheathed cable running in conduits to cable ducts to common terminal block.<br>b. External wiring from / to control panel, control desk, external motors etc shall be by means of screened multi-core cables<br>c. External wiring from / to control panel, control desk, external motors etc shall be by means of multi-core shielded cables with metal cable ducts with proper support | |
| 8.7.0 | Utility Supply by BHEL | a. BHEL will terminate the shop supplied compressed air supply at the hand wheel valve (to be provided by the supplier).<br>b. The compressed air will be at a pressure of 60 PSI to 70 PSI. All pneumatic systems on the machine, dust collector etc shall be designed to operate efficiently at this air pressure<br>c. Separate air compressor (Supplier Scope) for Fin Grit Blasting Machine. | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 8.8.0 | Pneumatic System | Pneumatics on machine, and associated equipment shall be connected by nylon and/or steel tube to common point on machine. Fitted at the common point would be a lubricator, regulator, filter and hand wheel valve | |
| 8.9.0 | Fasteners Standards | All fasteners involved in the machine and the auxiliaries has to be metric (SI units) | |
| 8.10.0 | Electrical Mains Supply (For Machine & Sub-Systems) | a. BHEL will provide electric power supply through a 415V±10%, 50Hz±3%, 3 Phase AC, 3 Wire System (no neutral conductor) at one point.<br>b. Supplier to plan for all further distribution network with suitable step-down transformers. | |
| 8.11.0 | Electric Motors | All motors shall be of any one of the makes (ABB, SIEMENS,) or Reputed European makes conforming to IEC Standards. | |
| 8.12.0 | Electric Devices | a. All the motor control variable frequency drives should have input and out put chokes with brake resistor.<br>b. All indication lamps should be provided with LED Indication Lamp. | |
| 8.13.0 | Control Circuit Voltage | Shall not exceed 24 V DC. | |
| 8.14.0 | Foundation & Base Plates | By BHEL as per Supplier Drawings | |
| 8.15.0 | Safety | EN Safety Norms | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 8.16.0 | Ambient Atmospheric Conditions | a. The Panel Welding Machine with all Sub-Systems shall be suitable for operation in an ambient temp. 25 to 50°C and with a Relative Humidity of 90% (both high values do not occur simultaneously).<br>b. The ENTIRE EQUIPMENT shall be TROPICALISED in Design and CONSTRUCTION. | |
| | | | |
| **9.0.0** | **MACHINE CONSTRUCTION** | | |
| 9.1.0 | Machine Operation | The Basic Machine with all the Sub-Systems, Accessories and Attachments are to be designed for working in three shifts (8 hour shift) a day and all the 365 Days in a year, with the recommended PREVENTIVE MAINTENANCNE MEASURES | |
| 9.2.0 | Machine Maintenance | The machine configuration and element arrangement should have easy accessibility, higher rigidity, self-aligning /fitting, locking & piloting arrangement of machine components and modules, to ensure a 'maintenance free' concept. | |
| 9.3.0 | Electrical Wiring | a. All electrical motors, limit switches etc, on the machine shall be wired using PVC sheathed cable running in conduits and converging to common terminal block<br>b. External wiring from / to control panel, control desk, external motors etc shall be by means of screened multi-core cables | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 9.4.0 | Pneumatic Circuits | a. Pneumatics forming part of the machine and associated equipment shall be connected by nylon reinforced synthetic rubber and / or steel tubes.<br>b. Pneumatic Circuit to originate from a common point on the Machine and provided with a suitable Filter / Regulator /Lubricator Unit and in addition a hand wheel valve.<br>c. Bidder to give details on the Air Compressor, Refrigerant Air Dryer and Elements forming part of the pneumatic circuitry. | |
| 9.5.0 | Hydraulic Circuits | a. Hydraulics forming part of the machine and associated equipment shall be connected by reinforced synthetic rubber hoses of reputed makes and / or steel tubes of sufficient capacity.<br>b. Hydraulic Circuit to originate from a common point on the Machine and provided with suitable oil filters, control valves and elements of reputed makes.<br>c. All the hydraulic elements in the circuitry shall have easy access during the maintenance of the M/c. | |
| 9.6.0 | Hydraulic Power Pack - Protection Controls | To have suitable means and measures for Temperature Control, High & Low Pressure Control, Oil Level Sensing, etc. | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| 9.7.0 | Chiller Unit for Cooling of Sub-Systems | Suitable Capacity Refrigerant / Radiator type Chilling Units are to be provided for the cooling of Power Transformers, Tube Clamping Rollers, Hydraulic Power Pack Oil, etc. Bidder to give Complete Technical Details on these Chilling Units | |
| 9.8.0 | Interlock System for Chilling Units – Coolant Flow | Suitable flow censors are to be provided to have an interlock with welding circuit, to avoid failure of flow of cooling medium | |
| 9.9.0 | Painting | a. The heavier machine parts are to be heat-treated after fabrication (including castings and forgings) and shot blasted for surface preparation prior to painting.<br>b. One coat of Primer with 25 μ of DFT (Dry Film Thickness) and 48 hours of compulsory curing after painting.<br>c. Two coats of Enamel Paint (Colour – Apple Green) each with 25 μ of DFT and intermittent curing of minimum 16 hours.<br>d. All unpainted surfaces shall be protected from rust during transit | |
| 9.10.0 | Safety Guards | Panel Welding Machine shall have Safety Guards / Sliding Doors for protection against the welding arc / splash / flashing for the Machine Operators. Safety Doors to have visible glasses for clear vision also. Bidder to submit details on this arrangement offered. | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| **10.0.0** | **MACHINE SPARES** | | |
| **10.1.0** | **OPERATING SPARE PARTS** | a. The Supplier shall LIST DOWN with the OFFER, the complete set of replaceable parts / components items / coming in the Panel Welding Machine and other Sub-Systems / Accessories / Attachments and shall QUOTE the Unit Price for each item.<br>b. BHEL will procure almost all parts listed under the above category with the Panel Welding Machine. | |
| **10.2.0** | **COMMISSIONING SPARES** | Bidder has to COMPULSORILY quote for the following items with the OFFER :<br>a. Mechanical wearing components due to linear movement and rotation, etc. [ Each 4 Nos.]<br>b. Spares for Hydraulics Power-Pack viz., 'O' rings, Sealing Rings, Hydraulic Valve 'O' rings, etc.. [Each 4 Nos.]<br>c. Electrical & Electronic Items:- PCB & PLC I/O Card, Digital to Analogue Card, CPU Card, HMI, Field Sensors (such as Encoders, Optical Sensors, Proximity Switch, Limit Switch), Display Unit, etc. [Each 4 Nos.] | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | BIDDER's OFFER WITH COMPLETE TECHNICAL DETAILS |
|---|---|---|---|
| **11.0.0** | **MACHINE INSPECTION & ACCEPTANCE** | | |
| **11.1.0** | Machine Performance Testing and Acceptance | The Panel Welding Machine and the Accessories shall be tested for its performance prove-out as per BHEL Specifications, at the Supplier's Works prior to despatch.<br><br>a) Welding trials have to be done with a minimum of 30 tubes and fins, to form sub-panels & finished panels – tube & fin sizes selected will be based on a mutually agreeable criterion.<br><br>b) The tube and fin materials are to be arranged by the SUPPLIER for welding trials or BHEL will make arrangements for the material supply for which the BIDDER has to indicate the cost of welding trials at the Supplier's Works.<br><br>c) The sample welded panels should pass through the prescribed tests and satisfy the requirements of BHEL QUALITY ASSURANCE PLAN. [Details will be elaborated during the Technical Discussions at BHEL]<br><br>d) BIDDER to give complete machine performance testing programme with the TECHNCIAL OFFER | |

| S.No. | PARTICULARS | BHEL SPECIFICATIONS | VENDOR's OFFER |
|---|---|---|---|
| **12.0.0** | **ERECTION & COMMISSIONING** | | |
| **12.1.0** | Mechanical Erection | Erection of the Equipment will be done by BHEL under the supervision of SUPPLIER's SERVICE ENGINEERS and as per the guidelines furnished in the Erection Manual given by the Supplier | |
| **12.2.0** | Commissioning | Commissioning of the Equipment and Smooth Functioning of all the Sub-Systems (at BHEL Works) shall be the RESPONSIBILITY of the Supplier. | |
| **12.3.0** | Performance Prove-Out | After the successful commissioning of the machine and sub-systems, the COMMISSIONING ENGINEER and the APPLICATION ENGINEER of the Supplier have to establish the Performance Prove –Out for the Machine's Capability and the Production Rate from the Machine, as given in the TECHNCIAL OFFER | |
| | | | |
| **13.0.0** | **MACHINE DOCUMENTATION** | | |
| **13.1.0** | O & M Manuals | a. Six Copies of the Operation & Maintenance Manual to be given in Hard Bound Paper Copies with three copies in CD form (SOFT COPY)<br>b. One Hard Copy of O & M Manual shall be submitted at the time of INSPECTION of the Panel Welding Machine by BHEL Officials, at the Supplier's Works .<br>c. The following documents and details [given under the **Clause Sl. No. 13.2.0**] shall form part of the Operation & Maintenance Manual | |

| S.No. | PARTICULARS | BHEL SPECIFICATIONS | VENDOR's OFFER |
|---|---|---|---|
| **13.2.0** | Documents and Technical Details | a. GA Drawing of the Panel Welding Station.<br>b. GA Drawing of Individual Mechanisms.<br>c. Sub-Assembly Drawings (without dimensions) for sub-systems for maintenance purpose..<br>d. Electrical Wiring Drawings – Power & Control Circuits<br>e. Pneumatic/Hydraulic Circuit Diagram / PLC Ladder Diagrams (Soft Copy) with Flash Memory Card.<br>f. PLC Ladder Diagrams (Hard Copy)<br>g. Complete Printed Circuit Board Schematics indicating check points (Test Points) for Electronic Controls<br>h. Alarm Log, Error Code, Error Messages & Remedies and On-Line Fault Diagnostics to be provided.<br>i. PLC Programming Tool : On-Line Troubleshooting, Software Modification, Upload and Down-load of Programs.<br>j. Specifications/Ratings of All Bought-Out-Items<br>k. Warranty / Guarantee Card for all Bought-Out-Items<br>l. Trouble Shooting Chart for Main and all Sub-Systems<br>m. Machine related PC Details – Machine Operating Softwares, Parameters Selection Software, File Handling, Display Recording. CD Read and Write unit, Serial and USB Ports to be ensured.<br>n. UPS is required for 1 hour back up time for PC data.<br>o. Total weight of the Machine & Sub-Systems | |

| S.No. | PARTICULARS | BHEL SPECIFICATIONS | VENDOR's OFFER |
|---|---|---|---|
| **14.0.0** | **TECHNCIAL OFFER** | The Technical Offer shall contain the following :<br>a. Complete Scope of Supply, including Main Equipment, Job Handling Unit, All Accessories and Attachments, etc.<br>b. List of Operating Spares, Commissioning Spares, Foundation / Anchoring Materials<br>c. Erection, Commissioning and Performance Prove-Out Details.<br>d. Complete description of all systems & sub-systems forming part of the Panel Welding Station<br>e. A schematic diagram showing the layout of the machine & associated systems with salient dimensions shall be submitted<br>f. The operating sequence of the machine with broad outline of various operations involved<br>g. The selection criteria of structural and machined components including material details for the rigidity of the machine and standards. | |
| **15.0.0** | **TRAINING** | a. The Supplier shall train four of BHEL Engineers in the Operation & Maintenance of the Machine at the Supplier's Works for a minimum period of 15 Working Days, after the INSPECTION of the Equipment.<br>b. The Supplier's Service Engineer/Application Engineer shall train of BHEL Engineers in the Operation, Trouble Shooting and Maintenance of the Machine at BHEL Works for a minimum period of Four Weeks , after the SUCCESSFUL COMMISSIONING of the Equipment, at BHEL Works. | |

| S.No. | PARTICULARS | BHEL SPECIFICATIONS | VENDOR's OFFER |
|---|---|---|---|
| **16.0.0** | **PERFORMANCE GUARANTEE** | The Performance of the Total Equipment and/or the Components / Sub-Assemblies / Bought-Out-Items shall be guaranteed for a minimum period of twenty- four months from the date of performance acceptance at BHEL Works. | |
| | | | |
| **17.0.0** | **OPTIONAL ACCESSORIES or SUPPORTING SYSTEMS** | | |
| **17.1.0** | Preheating Arrangement | 1. An in-built tube & fin preheating system for panel welding, when alloy-steel tubes / fins are to be welded, with option for selection of pre-heating requirement.<br>2. The pre-heating temperature shall be around 250 ° C (maximum) for a period of 15 minutes prior to welding operation.<br>3. An indicator for the attained temperature, preferable in the operator control panel . | |
| **17.2.0** | Weld Quality Scanner | 1. A suitable hand held or machine mounted instrument with recording / live indicating facility to check the quality of weldment in the panel, after the welding operation.<br>2. A mechanised in-built system is preferred<br>3. BIDDER to give complete technical details on the offered quality check instrument. | |
| **17.3.0** | Integral Tube Grit Blasting Machine [Machine through-put to match the tube feeding rate for the proposed Panel Welding Machine] | 1. It is desired to install an integrated or stand –alone tube grit blasting system for the surface cleaning of tubes, to be welded in the proposed panel machine.<br>2. BIDDER to give complete technical details on the offered Tube Grit Blasting Equipment. | Tube OD : 25 mm to 76 mm<br>Length (max.): 15000 mm<br>Length (min.): 4000mm<br><br>Built-Up Panel Length NOT to EXCEED 12 Mtrs. for this intended application. |

**ENCLOSURE : ANNEXURE – 1 : HYDRAULICS DESIGN & CONSTRUCTION**

# ANNEXURE - 1

## HYDRAULICS DESIGN and CONSTRUCTION *: -*

1. The hydraulic power pack for the machine operations like holding and moving of the tubes shall be different for that used for the flipping arm mechanism [that is, both are to be independent for maintenance simplicity].

2. All the power packs, manifold / valve cartridges, pressure and flow regulation stations are to be separately kept away from the machine. The cylinders, hydraulic heavy pressure joints are to be ensured with welded nipple joints.

3. Provisions and suitable clamping are to be made properly for dampening and arresting the vibrations induced (in the machine) and transmitted to the hydraulic joints.

4. The proposed hydraulic hoses and the joints are to be of metric size with male swivel nut and female adaptor on the cylinder ends with leak proof fittings. No ferrule joints are to be proposed in the hydraulic system.

5. All hydraulic pumps for the power packs should be loaded only during the times of machine operational requirement and to be in the unloaded condition, during ideal running conditions. All hydraulic pumps should have 100% standby provisions.

6. All hydraulic power pack return oil from cylinders, relief valves, hydro motors and other hydraulic valves are to be routed through a common return line to the oil tank. For oil cooling arrangement, the return oil to the tank can be routed through a suitable size of shell and water tube type cooler unit, to maintain the oil temperature below 40/45 °C, as the machine has to work in a TROPICALISED CONDITION throughout the year.

7. A parallel refrigerated type oil chiller for the total oil cooling may also be offered as a part of power pack, for stand by / safety measures.

8. The hydraulic valves input oil viscosity and micron level cleanliness has to be clearly mentioned in the offer.

9. As an option, a centrifuge unit for oil, dust and moisture separation has to be offered.

10. All hydraulic components of the power pack such as pump, cylinders, valves, pressure regulators, flow regulators, hydro motors, etc. are to be only of Rexroth, Vickers or Denesion.

# ANNEXURE - 1

**HYDRAULICS DESIGN and CONSTRUCTION *: - [continued]……..***

11. The details of bought-out items, coming as the internal components of hydraulic unit, have to be given item wise for the procurement of spares [such as oil seals, 'O' rings, all rubber items, cylinders, piston and piston rings, bearings, bushes, etc.] with the main equipment.

12. The hydraulic power pack and other associated elements are to be adequately designed and selected, to enable a smoother operation of the hydraulic cylinders during linear movements and to ensure leak proof working arrangements for a nil failure or a safe sealing, during the machine operation.

13. Since the machine is intended to work in three shifts a day and for all the 365 days in an year, the BIDDER shall give complete details [including detailed schematics] on the hydraulics, with the TECHNICAL OFFER.

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