An ISO 9001 Company

Bharat Heavy Electricals Limited

(High Pressure Boiler Plant**)**
Tiruchirappalli – 620014, TAMIL NADU, INDIA
CAPITAL EQUIPMENT / MATERIALS MANAGEMENT

ENQUIRY **NOTICE INVITING TENDER**	Phone: +91 431 257 79 38 Fax : +91 431 252 00 31 Email : tvenkat@bheltry.co.in Web : www.bhel.com

TWO PART BID Tender to be submitted in two Parts	**Enquiry Number:** **2851300035**	**Enquiry Date:** **28.11.2013**	**Due date for submission of quotation:** **07.01.2014**

You are requested to quote the Enquiry number date and due date in all your correspondence. This is only a request for quotation and not an order.

Please note that under any circumstances both delayed offer and late offers will not be considered. Hence vendors are requested to ensure that the offer is reaching physically our office before 14.00 hrs on the Date of tender opening.

Item	Description	Quantity
10	Hydraulic Tube End Swaging Machine as per the technical specification & commercial conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in)	**1.00 No.**

Important points to be taken care during submission of offer

1. **Material shall be delivered to**
   Indigenous Vendors:
   FOR, BHEL, Stores
   Power Equipment Fabrication Plant
   Bharat Heavy Electricals Limited
   Mundipar – 441 804, Taluka: Sakoli, District: Bhandara, Maharashtra State
2. **Delivery required 10 months from the date of purchase order.**
3. **Erection and Commissioning period required 1.5 Months from the date of intimation by BHEL.**
4. **EMD for this Tender will be (INR) : 2,00,000.00**
5. **Compliance Form No: BND/IMP/02, BND/IND/02A to be filled and enclosed along with the offer failing which, the offer will not be considered for evaluation.**
6. **All updates, amendments, corrigenda, etc., (if any), for each tender will be posted only on the above websites from time to time, as and when required, until each tender is opened. There will be no publication of such updates, amendments, corrigenda, etc., through newspapers or any other media.**

BHEL's General guidelines / instructions (refer MM / CE / GENL / 001 – EMD) including bank guarantee formats and list of consortium banks, commercial terms check-list can be downloaded from BHEL web site http://www.bhel.com or from the Government tender website http://tenders.gov.in (public sector units > Bharat Heavy Electricals Limited page) under Enquiry reference "2851300035".

Tenders should reach us before 14:00 hours on the due date Tenders will be opened at 14:30 hours on the due date Tenders would be opened in presence of the tenderers who have submitted their offers and who may like to be present	Yours faithfully, For **BHARAT HEAVY ELECTRICALS LIMITED** Sr. Manager / Capital Equipment / MM

Hydraulic Tube End Swaging Machine
Part A

SECTION – 1: Qualifying Criteria

The BIDDER has to compulsorily meet the Qualifying Criteria indicated in Section 1 to get qualified. Otherwise the technical offer will not be considered.

S. No	REQUIREMENTS	VENDOR's COMMENTS
1.1	The BIDDER / VENDOR (OEM) shall have a minimum of TEN Years of Continuous Experience in the Design, Manufacture & Supply of "**Hydraulic Presses / Hydraulic Tube End Swaging Machine**". Vendor shall indicate the actual no. of years of experience in the field	
1.2	Only those vendors (OEMs) should quote, who have commissioned in the past (10) years (on the original date of opening of Tender) at least ONE "**Hydraulic Tube End Swaging Machine**" for Cold Swaging of steel tubes of OD 38.1 mm to 76.1 mm with OD reduction after swaging of 12.5 mm or above. **EITHER** (i) in at least one country other than the country of origin to establish vendor's (OEM's) global business activity **OR** (ii) in India; and the referred machine is presently working satisfactorily for more than one year after commissioning (on the original date of opening of Tender). The name and contact addresses of the customers to whom the machine has been supplied has to be furnished with details. BHEL reserves the right to accept or reject the OEMs based on the assessment of their technical and financial capability.	
1.3	Vendor has to submit at least ONE PERFORMANCE CERTIFICATE from their customers in India or from the customers to whom the machine was supplied outside the country of origin, for satisfactory performance of the machine as given under Clause 1.2 above, for a minimum period of one year (as on the original date of opening of Tender). (Original Certificate or through E-mail directly from the customer). The original performance certificate may be returned after verification by BHEL, if required. For obtaining the Performance certificate, a suggestive format is provided.	

S. No	REQUIREMENTS	VENDOR's COMMENTS
1.4	BHEL reserves the right to verify the information provided by the Vendor for the referred machine at their referred customer's works. It shall be the responsibility of the vendor to facilitate the visit of BHEL's team at their referred customer works .The Travel and Boarding expenses for BHEL Personnel shall be borne by BHEL. In case the information provided by vendor is found to be false/ incorrect, the offer shall be rejected.	

SECTION – 2:

The Bidder / Vendors are requested to provide the following details

S. No	PARTICULARS	VENDOR's RESPONSE
2.1	The BIDDER / VENDOR to furnish reference list of Customers, with complete address, details of contact person, where **Hydraulic Tube End Swaging Machine** have been supplied in the past.	
2.2	Specify details of **Hydraulic Tube End Swaging Machine** supplied to other units of BHEL, if any (Year of commissioning with all parameters etc.)	
2.3	Details on SERVICE-AFTER-SALES Set-Up in India including the Addresses of Agents / Service Centers in India.	
2.4	Any Additional Data to supplement the manufacturing capability of the BIDDER for the subject equipment.	

SECTION – 3

Bidder / Vendor to note the following

S. No	REQUIREMENTS	VENDOR's RESPONSE
3.1	The BIDDER / VENDOR shall submit the offer in TWO parts. 1. Technical Offer [**with PART A & PART B**] 2. Commercial Offer and Price bid.	
3.2	The Technical Offer shall contain complete details against all clauses of Technical Specifications given by BHEL.	
3.3	The Technical Offer shall be supported by copies of Product Catalogues and Data Sheets and technical details of 'Bought-Out-Items'.	
3.4	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	

Suggestive Format of Performance Certificate:

The Performance certificate should be produced on **Customer's Letter Head** and submitted along with the offer.

(*On Customer's Letter Head*)

PERFORMANCE CERTIFICATE

1. Supplier of the machine :

2. Make & Model of the machine :

3. Month & Year of Commissioning :

4. Application :

5. Sizes of Jobs Performed in the machine
   a. Tube diameter :
   b. Tube thickness :
   c. Reduction in tube dia after swaging :
   d. Swaged Length (maximum) :

6. Performance of the Machine : Satisfactory / Good / Average / Not Satisfactory
   (Strike off whichever is not applicable)

7. After sales service : Satisfactory / Good / Average / Not Satisfactory
   (Strike off whichever is not applicable)

8. Any other remarks :

Date:

Signature & Seal of the Authority
Issuing the Performance Certificate

Hydraulic Tube End Swaging Machine

Part B: Technical Specification

Note:-

1.0 The Column **"Vendor's offer with Technical details & Remarks"** of this format shall be filled in by the Vendor and submitted along with the offer. Inadequate / incomplete, ambiguous or unsustainable information against any of the clauses of the specifications / requirements shall be treated as non-compliance.

2.0 The offer and all documents enclosed with the offer should be in **English language** only.

Name & Address of the Vendor:	Name & Address of the Indian agent:
Telephone no.:	Telephone no.:
Fax no.:	Fax no.:
e-mail:	e-mail:

3.0 **Scope**: - Design, Manufacture, Supply, Erection & Commissioning of **Hydraulic Tube End Swaging Machine** for BHEL complying with the specification as below.

<table>
<tr><th>S. No.</th><th>PARTICULARS & BHEL SPECIFICATION</th><th>VENDOR'S OFFER with Technical details & Remarks</th></tr>
<tr><td>1.0</td><td>APPLICATION:
a) The machine is meant for Cold Swaging (without mandrel) of Tube ends of seamless steel tubes in (axial) Horizontal Direction by means of Hydraulic action.
b) Swaging is a process of reducing the Tube Outer diameter at the tube ends up to a max. Tube length of 400 mm.</td><td></td></tr>
<tr><td>2.0</td><td colspan="2">TUBE SPECIFICATIONS FOR SWAGING:</td></tr>
<tr><td>2.1</td><td>Tube Outer Diameter and Thickness:
All are OD (Outer Diameter) Controlled tubes with thickness tolerance of Max.+18 %
<table>
<tr><th rowspan="2">S. No</th><th rowspan="2">Tube OD (mm)</th><th colspan="2">Tube Thickness (mm)</th><th rowspan="2">Swaged tube OD (mm)</th><th rowspan="2">Reduction in OD (mm) after swaging</th></tr>
<tr><th>Min.</th><th>Max.</th></tr>
<tr><td>1</td><td>38.1</td><td>4</td><td>6.3</td><td>28.6/31.8</td><td>9.5/6.3</td></tr>
<tr><td>2</td><td>44.5</td><td>4</td><td>10</td><td>31.8</td><td>12.7</td></tr>
<tr><td>3</td><td>47.63</td><td>5</td><td>10</td><td>44.5</td><td>3.13</td></tr>
<tr><td>4</td><td>48.3</td><td>8.1</td><td>-</td><td>38.1</td><td>10.2</td></tr>
<tr><td>5</td><td>51.0</td><td>2.9</td><td>12</td><td>44.5</td><td>6.5</td></tr>
<tr><td>6</td><td>54.0</td><td>3.6</td><td>12</td><td>44.5</td><td>9.5</td></tr>
<tr><td>7</td><td>57.0</td><td>4</td><td>10</td><td>44.5</td><td>12.5</td></tr>
<tr><td>8</td><td>60.3</td><td>4</td><td>-</td><td>54.0</td><td>6.3</td></tr>
<tr><td>9</td><td>63.5</td><td>3.2</td><td>12.5</td><td>51.0</td><td>12.5</td></tr>
<tr><td>10</td><td>69.85</td><td>4.57</td><td>-</td><td>63.5</td><td>6.35</td></tr>
<tr><td>11</td><td>76.1</td><td>3.2</td><td>12.5</td><td>63.5</td><td>12.6</td></tr>
</table></td><td></td></tr>
</table>

S. No.	PARTICULARS & BHEL SPECIFICATION		VENDOR'S OFFER with Technical details & Remarks
2.2	**Tube Material :** a. Carbon Steel: SA192, SA210A1, SA210C b. Alloy Steel: SA209 T1, SA213 T11/T12/T22/T91/T23/ T92 c. Stainless Steel: SA 213 TP304H/TP321H/TP347H/SUPER304H		
2.3	**Job Details:** Refer Annexure 1 (Typical Drawing)		
3.0	**OPERATING PARAMETERS:**		
3.1	**Tube Diameter** Minimum OD before swaging: 38.1 mm Maximum OD before swaging: 76.1 mm Minimum OD after swaging: 28.6 mm Maximum OD after swaging: 63.5 mm		
3.2	Tube Wall Thickness: 2.9 mm to 12.5 mm		
3.3	Swaging length**:** 400 mm (maximum)		
3.4	Stages of Swaging (Single stage or Multi stage): Vendor to specify		
3.5	Included angle for Swaging (Refer Annexure - 1)  15 degree	15 degrees	
3.6	Reduction of Tube OD per stage for swaging: 12.5 mm reduction on tube OD 63.5 mm.		
3.7	**Tube length handled:** Minimum: 2000mm (Special Case – 950mm with supporting tube for extra length) Maximum: 15000mm.		
3.8	Tube batch quantity: 100 tubes		
3.9	**Reference tube size for establishing the machine capacity:** Tube OD from 63.5 mm to 51 mm		
3.10	**PRODUCTIVITY: 100** Nos. of Swaging operation per shift (8 hours) in **OD 63.5 mm to 51 mm** Tubes for batch production jobs.		

S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
4.0	**QUALITY REQUIREMENTS FOR SWAGING:**	
4.1	**Visual Defects:** On visual inspection the Outside and Inside surfaces of the tube shall be free from harmful surface defects such as Wrinkles, Scouring marks, Lines, Scratches, Tapering, Tool marks, Chatter marks, Tears, Drags and Depressions etc.	
4.2	Ovality % = {(Max. OD - Min. OD)/ Original OD} x100 Ovality % at any particular cross-section of tube to be Less than 1% of Nominal OD.	
4.3	MPI / LPI of the swaged tube surface: No significant indications	
4.4	Diameter tolerance on ID: + 0.0 / -0.3 mm	
4.5	**Axis Offset between smaller tube end and bigger tube end to be as follows:** For tubes of Swaged length < 100 mm : 0.15 mm For tubes of Swaged length between 101 – 200 mm : 0.25 mm For tubes of Swaged length between 201 – 300 mm : 0.35 mm For tubes of Swaged length between 301 – 400 mm : 0.50 mm	
5.0	**SWAGING CYCLE** (Preferred sequence) – a) Tube storage in rack b) Tube feeding by pinch roller c) Sensing of tube positioning ready for swaging. d) Clamping of tube e) Lubrication of tube surface f) Swaging die movement for swaging operation g) Clamping die open h) Relieving the tube from the swaging die i) Retraction by pinch roller j) Sensing of tube end before kick off from the tube stand Vendor to provide details of any other sequence, which will enhance the productivity.	

S. No.	PARTICULARS & BHEL SPECIFICATION		VENDOR'S OFFER with Technical details & Remarks
6.0	**MACHINE PARAMETERS**		
6.1	Machine capacity in metric ton (Not less than 150 metric ton)	Vendor to specify	
6.2	Maximum Swaging Force in Tons	Vendor to specify	
6.3	Maximum Swaging Pressure	Vendor to specify	
6.4	Maximum Swaging Speed	Vendor to specify	
6.5	Tube working Height (Tube axis): around 1050 mm from ground level		
6.6	Main Pump Motor power in kW	Vendor to specify	
6.7	Main Pump Motor flow in LPM	Vendor to specify	
6.8	Total Power Requirement in kVA	Vendor to specify	
7.0	**MACHINE CONFIGURATION:** The entire Machine shall be designed to have rugged construction to withstand the forces applied during swaging process. The machine has to be configured with the following sub-systems, integrated to give the desired results :		
7.1	**Tube Storage system**		
7.1.1	Tubes will be loaded to the storage rack in the form of bundles. At a time, TWO bundles may be loaded (max wt. 8 metric ton) on the storage rack. Each tube bundle size will be equivalent to that formed by 20 tubes of OD 63.5 mm or 40 tubes of 38.1mm.		
7.1.2	Storage rack shall have a flat portion of minimum width: 1000mm, length: 15m and at suitable height (vendor to specify) from the ground to load the bundles. Storage Rack shall have suitable Bundle Stopper arrangement pneumatically operated to hold the tubes in bundle form. Vendor to specify supports for minimum tube length of 950mm.		
7.1.3	A Sloping rack of width: 2000mm and length: 15m shall be provided after the storage rack. The angle of slope shall be 4-5 degrees. Vendor to specify the angle. Also the in feed stand shall be lined with Teflon / nylon so that the noise generated during tubes roll over is minimum.		
7.1.4	Release of Bundle Stop shall spread the bundled tubes (as single layer of tubes) on the sloping stand, without causing damage to the tubes and the storage rack system.		

S. No.	PARTICULARS & BHEL SPECIFICATION		VENDOR'S OFFER with Technical details & Remarks
7.1.5	A tube stopper mechanism should be provided before tube kick-off facility. Vendor to specify		
7.1.6	A Pneumatically operated 'Lift and tube roll type' tube kick-off system to be provided to lift one tube at a time from storage rack and deliver to the pinch roller conveyor for in-feed to the machine. Vendor to furnish details.		
7.1.7	**Constructional Details** a) Storage rack shall be made of stands & supports and the storage rack including bundle stops should be designed such that no damage occurs due to the impact loading and rough handling of tubes. b) The minimum thickness of sections and plates used for the structure construction should not be less than 7.5 mm. c) Vendor to specify the Speed and Rating of Electric Motors and details of the Drives selected.		
7.2	**Tube conveying system**		
7.2.1	Pinch roller conveyor of Heavy Duty type provided with a tension adjuster, so as to maintain a constant roller & tube contact to achieve the feed rate should be provided.		
7.2.2	The pinch roller conveyor should have a two way drive i.e. forward drive for feeding the tubes into the machine for swaging and reverse drive for retraction of the swaged tubes out of the machine. Type of drive for the conveyor – vendor to provide details.		
7.2.3	Suitable height adjustment feature in the pinch roller system/tube conveyor for accommodating various tubes of diameter ranging from 38.1 mm to 76.1 mm. Vendor to specify.		
7.2.4	Vendor to specify details such as dia. of roller, pitch between rollers, Width of the roller etc.		
7.2.5	Suitable Guide roller arrangement on in-feed conveyor system. Vendor to specify and furnish details.		
7.2.6	Conveyor Line Speed (Tube Feed Rate)	To match the expected productivity level. Vendor to specify	

S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
7.2.7	The vendor shall furnish a schematic diagram for the tube conveying System & Roller and Drive Arrangements.	
7.3	**Tube clamping (gripper) system**	
7.3.1	The tube should be clamped before swaging operation. The clamping length shall be minimum – **1500mm**. Vendor to specify	
7.3.2	Clamping mechanism: Vendor to give details supported with suitable sketches. Clamping to be preferably from the bottom.	
7.3.3	Clamping die shall be in two halves (Top & Bottom) - Vendor to provide details.	
7.3.4	The clamping (gripper) die surface should not have any serrations. Vendor to confirm.	
7.4	**Tube surface Lubrication for swaging operation** Vendor to specify the type of lubrication of tube during swaging (semi-automatic) - Details to be furnished. T91 tubes require application of solid lubrication for swaging. Optional: Semi-Automatic / Automatic tube lubrication system.	
7.5	**Tube swaging system**	
7.5.1	After lubrication of tubes, the Swaging process shall be done in the axial direction of the tube for various tube sizes as mentioned in Clause 2.1 with the help of suitable Swaging Dies.	
7.5.2	Changing of Dies shall be simple and easy – Vendor to ensure that the Dies shall not be mounted directly on to the piston rod side of the swaging cylinder instead a suitable intermediate replaceable Sleeve arrangement to be provided. Sufficient clearance to be provided for assembling and dismantling of dies. Vendor to confirm.	
7.5.3	Stroke length of Swaging shall be adjustable	
7.5.4	Relieving the tube from the die after swaging is completed – Pneumatic jolting arrangement mounted on the rear portion preferable. Vendor to explain the method adopted	
7.6	**Retraction of swaged tubes**	
7.6.1	The swaged tube has to be retrieved back by the pinch roller conveyor.	

S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
7.6.2	A Pneumatically operated 'Lift and tube roll type' tube kick-off system to be provided to lift one tube at a time from pinch roller conveyor and deliver to the Tube sloping rack of Tube conveyor system for further Heat Treatment of the job (Only Underlined portion is under BHEL scope). Vendor to furnish details.	
7.6.3	Sensing of tube end during retraction of tube after swaging for giving feedback to the kick off system – vendor to provide details.	
8.0	**TOOLINGS:** Set of tooling for the following sizes to be quoted: 1. OD 63.5 mm swaged to 51 mm 2. OD 76.1 mm swaged to 63.5 mm a) Clamping / Gripper Dies (2 piece construction) b) Swaging Die c) Straightening Die Any optional tooling should be listed and quoted item wise separately.	
9.0	**HYDRAULICS**	
9.1	The System should be centralized, modular / stacked valve construction having minimum number of pipes / pipe joints and all elements should be located at suitable location with easy accessibility of components for maintenance. It should be possible to replace hydraulic elements like valves, manifolds etc. without disturbing the associated pipelines. Vendor to Furnish Details	
9.2	All hydraulic elements shall be of EATON VICKERS / BOSCH REXROTH / PARKER DENISONS make.	
9.3	Pumps, valves, accessories etc shall be of BOSCH-REXROTH /EATON VICKERS/ PARKER DENISONS only (Details to be submitted). The seals used in cylinders shall be of MERKEL / PARKER / BUSHAK + SHAMBAN / HUNGER / SIMRIT make. Vendor to confirm & furnish details	
9.4	Suitable filtration system should be provided with Duplex / standby filter units. It is preferable to use re-usable type of filter elements in the system. The filter unit shall be of HYDAC / PARKER / BOSCH REXROTH only. Vendor to confirm & furnish details	

S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
9.5	The flexible hoses used in the system shall be of GATES / AEROQUIP / PARKER only. Vendor to specify	
9.6	All the pipe / hose end fittings shall be of standard weld nipple with O-ring seating type (DIN 3865 or equivalent) of suitable material. No ferrule joints are to be used in the hydraulic system. All threaded connections shall be of metric sizes. Vendor to confirm and specify. Make: PARKER / STUCCHI / BOSCH REXROTH / EATON VICKERS	
9.7	The maximum pressure of the system should preferably not to exceed 310 bar. Vendor to specify	
9.8	Each pump should have an independent motor. Tandem pumps shall be avoided. Main pump shall have standby pump provision. Vendor to confirm.	
9.9	Failure indication for oil level, temperature, pressure, filter clogging should be provided. Vendor to confirm & furnish details	
9.10	Automatic shut off provision during hose failures, chiller failure, low oil level etc. Pump unloading feature during idle running to be provided for energy conservation. Details should be submitted. Vendor to specify	
9.11	Vendor to provide hydraulic Oil chiller unit - Refrigeration type for required tank capacity to maintain oil temperature not exceeding 50°C. – Vendor to provide details of Oil Chiller. Make: WERNER FINLEY/DAIKIN/RITTAL/RITE TEMP	
9.12	All oil pipelines shall be of seamless steel and should undergo pickling process. Vendor to confirm	
9.13	The hydraulic oil to be used shall be of standard ISO Viscosity Grades – 46 / 68 only. Vendor to confirm. Hydraulic circuits shall be designed with minimum number of control valves and to suit the hydraulic oil.	
9.14	Hydraulic power pack and Oil tank shall be separate from the Machine and positioned behind the machine conveniently to attend to any maintenance problems	
9.15	Vendor to specify the size of Hydraulic oil tank, capacity in litres	
9.16	Hydraulic oil will be supplied by vendor during pre-dispatch inspection at supplier's works and commissioning at BHEL works. Vendor to confirm	

S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
9.17	Sufficient number of check-points to be provided wherever pressure is required to be read for setting and trouble shooting. Minimess Pressure Gauge - 1 No with Connecting Hose to be provided.	
9.18	All cylinders used in the machine should have standard bore and rod sizes. The piston rod shall be hard chrome plated. Vendor to furnish details	
9.19	The control voltages for all the Solenoids of the valves shall be of 24 V DC and all solenoid operated DC valves should have manual over-ride provision and light indicating solenoids. Vendor to specify	
9.20	The pipelines to be painted with standard colours as per the colour coding accepted internationally for hydraulic systems. Vendor to furnish details	
9.21	All hydraulic pipelines, hoses and electrical control cables to be neatly laid out with proper clamps and flexible hose conveyors wherever required. Vendor to confirm	
9.22	Suitable leakage oil collection metallic tray to be provided wherever required. Vendor to confirm	
9.23	The Power pack should be designed taking into account the energy efficiency (Hi-low pump system, proper unloading during idling, etc.). The motor used for pumps shall be LATEST energy efficient ones. Vendor to furnish details	
9.24	All the components in the hydraulic power pack shall be provided with identification numbers, as per the hydraulic circuit and should be pasted with metallic identification number plates. Anodized hydraulic circuit- 1 No shall be mounted in suitable area for ready reference/trouble shooting. Vendor to confirm	
10.0	**PNEUMATIC SYSTEM:**	
10.1	The pneumatic operated elements of the machine shall work efficiently by a centralised pneumatically actuating system with BHEL compressed air supply at a pressure of minimum 5 kg/cm^2 through 1" line.	

S. No.	PARTICULARS & BHEL SPECIFICATION		VENDOR'S OFFER with Technical details & Remarks
10.2	BHEL will provide compressed air at only one point near / on the machine. Vendor shall provide suitable filter-regulator-lubrication (FRL) unit at this point. Vendor to confirm		
10.3	Hydraulic, Pneumatic & Lubricating oil piping should be preferably metallic except places where flexible piping is essential. All the pipes required for the same shall be included in the standard scope of the machine. Vendor to confirm		
10.4	Pneumatic components shall be of FESTO / SMC / NORGREN make only. Vendor to Specify		
11.0	**LUBRICATION:**		
11.1	Machine lubrication: Automatic centralized lubrication system with timer control and suitable metering cartridges to be supplied. Vendor to confirm		
11.2	First filling of Lubrication Oil and grease to be supplied by the supplier. Indian equivalent shall be mentioned.		
11.3	The lubrication lines shall be mounted on the machine such that they are not projecting out and prone for damage.		
12.0	**CONTROLS:**		
12.1	Type of controls provided – PLC based (Make shall be of ABB / Allen Bradley/ MITSUBISHI / SIEMENS)	Vendor to specify	
12.2	Machine shall be operated in three modes viz., Manual, Semi-Automatic and Automatic Under Automatic option the complete Swaging cycle shall be automatic from tube feeding to tube kick off.	Vendor to specify	
12.3	Swaging Stroke Control to be provided	Vendor to specify	
12.4	Tube feeding to the machine by pinch roller Control to be provided on operator control panel	Vendor to confirm	
12.5	Tube Relieving from the Swaging Die control to be provided	Vendor to specify	

S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
13.0	**ELECTRICAL SYSTEM:**	
13.1	415V with a voltage fluctuation of +/- 10%, 50HZ with a fluctuation of +/-3%, 3 Phase AC (3 wire system without neutral) power supply will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All cables, connections, circuit breakers etc. required for connecting BHEL's power supply to the machine shall be in the scope of vendor. Vendor to confirm	
13.2	Wiring: 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. External wiring from / to control panel, control desk, external motors etc shall be by means of screened multi-core cables.	
13.3	Encoders, limit switch, feedback devices shall be suitably placed for easier accessibility rigidly.	
13.4	All alarm tripping logics and control logics incorporated in the machine to be listed out by the vendor.	
13.5	Control circuit voltage should be 24 V DC.	
13.6	Control panel shall have built in 230V, 5 amps, 3 pin plug.	
13.7	All electrical panels including operator's panel should be provided with fluorescent lamps for sufficient illumination and power receptacles of 220 Volts, 5/15 Amp AC. All adapters /receptacles should have compatibility with Indian equivalents.	
13.8	Type of drives used for motors to be indicated.	
13.9	All electrical control cabinets & panels should be vermin and dust proof. All Electric enclosures shall have IP 54 protection. Vendor to confirm	
13.10	Motors and drives shall be of ABB/ SIEMENS / MITSUBISHI / HINDUSTAN / KIRLOSKAR / GE / INDRAMAT / SEW or any other reputed makes conforming to IS / IEC Standards and acceptable to BHEL. Vendor to confirm and indicate make and type in the offer	

S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
13.11	All electrics shall be of reputed make like SIEMENS / SEW / ROCKWELL ALLEN BRADLEY/ TELEMECHANIQUE/ DELTA conforming to IEC or Indian standards.	
13.11	All components/devices/terminals are to be incorporated with ferrules.	
14.0	**MACHINE FOUNDATION:**	
14.1	Vendor shall submit the m/c foundation drawing for getting BHEL's approval within one month from the date of Purchase Order. Complete details like static and dynamic loads etc required for foundation design shall be submitted by the Vendor within three months after getting BHEL's approval. Vendor to confirm	
14.2	BHEL shall design and construct complete foundation for the machine as per the Vendor's recommendation	
14.3	**Machine Levelling & Anchoring System:** Complete anchoring system including foundation bolts, anchoring materials, fixators, levelling shoes etc. should be supplied with the machine	
15.0	**AMBIENT CONDITIONS**	
15.1	The Swaging machine with all Sub-Systems shall be suitable for operation in an ambient temperature varying from 25 to 50°C and with a relative humidity varying from 45% to 90% at the factory location.	
15.2	The entire equipment shall be Tropicalized in Design and Construction	
15.3	The vendor should ensure trouble free operation of the machine, Thermal Stability of the complete machine and accuracy requirements of BHEL components, keeping in view of ambient conditions as mentioned above.	
16.0	**INBUILT SAFETY ARRANGEMENTS:** Following safety features in addition to other standard safety features should be provided on the machine:	
16.1	A detailed list of all alarms / indications provided on machine should be submitted by the Vendor.	
16.2	All the pipes, cables etc. on the machine should be well supported and protected. These should not create any hindrance to machine operator's movement for effective use of machine. Vendor to Confirm	

S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
16.3	Machine should have adequate and reliable safety interlocks / devices to avoid damage to the machine, work piece and the operator due to the malfunctioning or mistakes. Vendor to specify	
16.4	Machine functions should be continuously monitored and alarm / warning indications through lights/ alarm number with messages (on the display and operator panels) should be available. Vendor to Confirm	
16.5	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations and suitably guarded. Vendor to Confirm	
16.6	Emergency Switches should be provided at suitable locations as per International Norms. Vendor to Confirm	
16.7	All lubricated parts like Bed, guide ways shall have provision for collecting the used Lubrication oil from machine guide ways and preventing them from spilling over on to the ground. Vendor to Confirm	
17.0	**PAINTING:**	
17.1	The heavier machine parts are to be heat-treated after fabrication (including castings and forgings) and shot blasted for surface preparation prior to painting.	
17.2	One coat of Primer with 25 microns of DFT (Dry Film Thickness)	
17.3	Finish coat by Polyurethane Paint - Colour shade: RAL 6011 (Reseda Green)	
18.0	**MACHINE SPARES**	
18.1	Item wise breakup of mechanical, hydraulic, electrical and electronic spares used on the machine in sufficient quantity as per recommendation of Vendor for 2 years of trouble free operation on three shifts continuous running basis shall be offered by vendor. Vendor to confirm that the availability and timely supply of all listed spares for the equipment shall be ensured for a minimum period of ten years from the supply of machine. The list to include following, in addition to BHEL recommended spares: **(Unit Price of each item of spare should be offered)**	

S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
18.2	**Mechanical & Hydraulic Spares:** All types of Pumps, Valves, Pressure Switches, Transducers, Flow Switches, Filters, Seals, O-rings, Hydraulic Hoses etc. Each Item 1 number as spare. Vendor to confirm.	
18.3	**Electrical /Electronic:** All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Main Power Switch, Encoders, Power Module & Control cards etc.	
18.4	All types of spares for total machine and accessories should be available for at least ten years after supply of the machine. If machine or control is likely to become obsolete in this period, the vendor should inform BHEL sufficiently in advance and provide drawings of parts / details of spares & suppliers to enable BHEL to procure these in advance, if required	
18.5	Vendor to confirm that complete list of spares for machine and accessories, along with item part no / specification / type / model, and name & address of the spare supplier shall be furnished along with documentation to be supplied with the machine	
19.0	**DOCUMENTATION:**	
19.1	**Three** sets (hard copies in bound form) of following documents, in English language should be supplied along with the machine:	
19.2	Operating manuals of Machine	
19.3	Detailed Maintenance manual of machine with all drawings of machine assemblies/sub-assemblies/parts including Electrical / Pneumatic/ Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list.	
19.4	Machine data/ Commissioning data to be provided.	
19.5	Complete list of spares for machine and accessories, along with item part no / specification / type / model and name & address of the bought out item supplier shall be furnished along with documentation to be supplied with the machine	
19.6	Manufacturing drawings for all supplied tooling as mentioned under Clause 8.0	
19.7	Catalogues, O&M Manuals of all bought out items including drawings, wherever applicable.	

S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
19.8	Detailed specification of all rubber items and hydraulic/lube fittings	
19.9	PLC program print-outs with comments in English.	
19.10	PLC program and data on CD, Flash memory card.	
19.11	Complete back up of hard disk on GHOST CD and clear written Instructions (3 copies) to take back up and reloading of a new hard disk.	
19.12	One additional set of all the above documentation on CD/DVD.	
19.13	Complete Master List of parts used in the machine shall be submitted by the vendor.	
19.13	Complete list of Alarm log, Error code, error messages & remedies to be provided by the vendor.	
19.14	One additional set of all the above documentation on CD.	
20.0	**MACHINE INSPECTION & ACCEPTANCE:**	
20.1	**At Supplier's Works**	
20.1.1	The Machine shall be offered for inspection and performance trials to test the design capabilities of the machine, by BHEL Engineers at Supplier's works before Dispatch. The tube materials shall be supplied by BHEL.	
20.1.2	All the features of the machines shall be operated and shown and to work as given in the specification, at supplier's works during inspection. The performance trials shall be conducted at Supplier's works on the tube materials supplied by BHEL. A minimum of 10 swagings have to be done with consistent quality meeting the quality requirements specified under clause 4.0.	
20.2	**At BHEL Works**	
20.2.1	The prove-out trials for swaging shall be carried out at BHEL works for the tooling ordered by BHEL. Performance trials tests will be conducted on alloy steel & stainless steel tubes supplied by BHEL. The finished jobs have to pass all the quality tests as specified under Clause: 4.0	
20.2.2	The production output of the machine shall be proved out by the commissioning Engineer at BHEL works for the Production rate mentioned under Clause: 3.0	

S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
21.0	**ERECTION AND COMMISSIONING:**	
21.1	Supplier to take full responsibility for the erection and for start-up, testing and commissioning of machine, its controls and accessories. Supplier shall send suitable qualified Engineers along with erection crew for Erection and Commissioning of the machine at BHEL works. Vendor to Confirm	
21.2	Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by Vendor in their foundation/layout drawings. Arranging requirements like material handling and helpers shall in the supplier's scope. Vendor to Confirm	
21.3	Successful proving of BHEL components by the Vendor shall be considered as part of commissioning. All tests, as mentioned (Machine Acceptance) shall form part of the commissioning activity. Vendor to Confirm	
21.4	Commissioning spares, required for commissioning of the machine shall be supplied free of cost Vendor to Confirm	
21.5	Test Mandrels, Instruments and other necessary equipment including Laser equipment, if required, to carry out all above activities should be brought by the Vendor. Vendor to Confirm	
21.6	Portion, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection should be repainted and merged with the original surrounding paint by the vendor. For this purpose, the Vendor should supply sufficient quantity of touch-up paint of various colours of paint used. Vendor to Confirm	
21.7	The Vendor shall bring special tools and equipment required for erection of the machine. Necessary tools like Torque Wrench, Spanners, Keys, grease guns etc. for operation and maintenance of the machine should be supplied. List of such tools should be submitted with offer. Vendor to Confirm	
22.0	**TRAINING:**	
22.1	The supplier shall train TWO BHEL Engineers in Operation and Maintenance (Mechanical, Electrical/ Electronics and Programming) of the Machine at supplier's works after the pre-dispatch inspection.	

S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
22.2	The Supplier shall impart training to BHEL's Machine Operators and Maintenance crew in Operation and Maintenance (Mechanical, Electrical/ Electronics and PC based control System) during commissioning of the Machine at BHEL works for five working days.	
22.3	Airfare, board & lodging for the BHEL Engineers who will be visiting supplier's works for pre-dispatch inspection and training, shall be borne by BHEL.	
22.4	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel	
22.5	The training shall include the following: a. Safety b. Operation of the machine c. Trouble-Shooting, d. All special features of the machine e. Electrical / Mechanical / Electronics systems	
22.6	Vendor to clearly mention whether the training is offered free of cost or chargeable. If chargeable, the vendor has to quote on man-day basis.	
22.7	Co-ordination for a visit of BHEL Personnel to an industry having similar / identical machine & system, in case of order realization, for system acquaintance & performance feedback	
23.0	**GENERAL POINTS**	
23.1	Make and Model of the machine. Vendor to specify	
23.2	Floor area required (Length, Width, Height) for complete machine & accessories : Vendor to specify	
23.3	Total weight of the machine : Vendor to specify	
23.4	Weight of heaviest part of the machine: Vendor to specify	
23.5	Dimensions of largest part/ sub-assembly/ assembly of the machine: Vendor to specify	

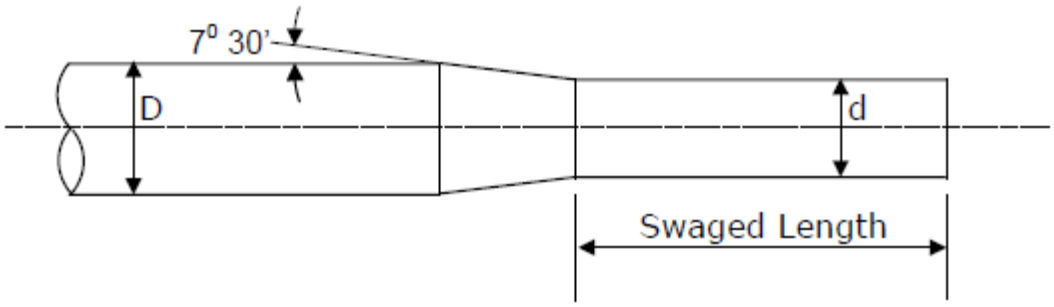
S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
23.6	Complete description of all systems & sub-systems shall form part of the technical bid.	
23.7	A schematic diagram showing the layout of the machine & associated systems with salient dimensions shall be submitted along with the offer.	
23.8	Vendor to submit General Arrangement drawing with the offer and explain the sequence of operation of the Swaging Process to be performed.	
23.9	The operating sequence of the machine with broad outline of various operations involved should be furnished with the offer.	
23.10	Standards for Design, Manufacture and testing of the machine shall be in accordance with internationally accepted standards.	
24.0	**SCOPE OF SUPPLY**	
24.1	**Supplier Scope**	
24.2.1	Design, Manufacture, Supply, Erection of Swaging machine	
24.2.2	Design drawings with complete bill of materials to be submitted for BHEL approval before manufacturing within 45 days of placement of order.	
24.2.3	Foundation drawing to be submitted for BHEL approval.	
24.2.4	Hydraulically operated Horizontal Tube Swaging machine – 1 No.	
24.2.5	Hydraulic power pack unit – 1 No.	
24.2.6	Electrical Control Panel – 1 No.	
24.2.7	Operator Control Unit – 1 No.	
24.2.8	Hydraulic oil Chiller unit – 1 No.	
24.2.9	Tube storage and feeding system – 1 No.	
24.2.10	Dies for swaging sizes of tubes corresponding to the tooling ordered by BHEL.	
24.2.11	First fill of oil, lubricant and grease	
24.2.12	All anchoring & foundation bolts, levelling plates for the complete machine	
24.2.13	Levelling Instruments, Power Tools / Hand Tools for erection.	

S. No.	PARTICULARS & BHEL SPECIFICATION	VENDOR'S OFFER with Technical details & Remarks
24.2.14	Welding machines and consumables required for erection	
24.2.15	Commissioning Engineer with erection crew for commissioning of m/c at BHEL works	
24.2.16	Job Quality and Productivity Prove-out at BHEL works	
24.2.17	Training to BHEL employees	
24.2.18	O&M manuals/ Documents	
24.3	**BHEL Scope**	
24.3.1	Drawings approval	
24.3.2	Civil foundation work as per manufacturer's drawing	
24.3.3	Tube materials for trials and prove out at supplier's works	
24.3.4	Tube materials for production trial at BHEL works	
24.3.5	EOT Crane inside shop	
24.3.6	Single Compressed air point at the location indicated in the drawing	
24.3.7	Single Electrical Supply point at the location indicated in the drawing	
25.0	**GUARANTEE:** Performance Guarantee to be given for 12 months from the date of commissioning OR 18 months from the date of dispatch whichever is earlier.	
26.0	The supplier shall give point by point confirmation with reference to the above specification.	

Enclosure: Annexure - 1 SWAGING – Sketch

ANNEXURE 1

Swaged Tube end sketch



S. No	Before Swaging Tube OD - 'D' (in mm)	After Swaging Tube OD – 'd' (in mm)	Reduction in Tube OD (in mm)
1	38.1	28.6 / 31.8	9.5 / 6.3
2	44.5	31.8	12.7
3	47.63	44.5	3.13
4	48.3	38.1	10.2
5	51.0	44.5	6.5
6	54.0	44.5	9.5
7	57.0	44.5	12.5
8	60.3	54.0	6.3
9	63.5	51.0	12.5
10	69.85	63.5	6.35
11	76.1	63.5	12.6

BHEL, Tiruchirappalli