Sub: Design, Manufacturing, Testing, Supply, installation and commissioning of Special Purpose Tube Forming Machine (one no.) as per attached technical specification.

Dear Sir,

Your sealed offer is invited for & on behalf of President of India for Design, Manufacturing, Testing, Supply, installation and commissioning of Special Purpose Tube Forming Machine (1 no.) as per attached technical specification.

The scope of work, technical specifications, terms and conditions are enclosed in Annexure I,

Your offer in sealed envelope should be addressed to

Head,
Integrated Fuel Fabrication Facility
BARC, Trombay, Mumbai - 400 085.
Attn.: Lalit Kumar

and duly marked with above reference no. and due date on the sealed envelope, should reach us on or before 31/08/2020, 16:00 hrs by Speed Post/Registered Post only.

Yours faithfully

(Lalit Kumar)
SO/F, IF3
For & on behalf of President of India

Encl: 1. Annexure I
Technical specification for Special Purpose Machine for tube forming

1. **Scope of the job:** Design, Manufacturing, Testing, Supply, installation and commissioning of Special Purpose Tube Forming Machine (1 no.) to achieve following objective.

2. **Objective:**
   
a) Figure 2 shows assembly of Zirconium alloy tube with Stainless Steel components. The Hydraulic Tube Forming SPM is required to carry out the forming of tube on 1st and 2nd end by spinning/flow turning process to fit stainless components as given in figure 2.

b) Forming of 1st end of tube when tube is empty and no structural components are assembled with tube.

c) Forming of 2nd end of tube when tube is filled with structural components and cassette head.

Mechanical properties of Zirconium alloy at room temperature:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultimate tensile strength</td>
<td>450MPa (45.9 Kg/mm²)</td>
</tr>
<tr>
<td>Yield strength (minimum)</td>
<td>200MPa (20.4 Kg/mm²)</td>
</tr>
<tr>
<td>Percentage elongation (typical)</td>
<td>40%</td>
</tr>
</tbody>
</table>

![Figure-1](attachment:image.png)
3. **Sequence of Operation for forming 1st end of tube:** Forming of the 1st end of tube to fit sleeve inside the tube and bottom ring & inlet nozzle outside the tube by following steps:-

a) Before start of 1st end forming, tube is empty and no components is attached with tube.

b) Insert the forming mandrel (refer figure -1) from one end of the tube before forming upto the desired depth.

c) Pass the tube through the bore of machine spindle and hold the same along with the mandrel in the machine collet.

d) Provide Tailstock support to the mandrel near 1st end.

e) Also, provide support to tube near 2nd (other) end. This support should not damage tube during 1st end forming operation.

f) Form the tube onto the mandrel by means of a Forming Tool mounted on the carriage of the machine. The forming operation will be done by moving the forming tool manually in number of cycles with increasing depth of forming. Check the forming using a components sleeve and bottom ring, which will be supplied by the purchaser. **There should not be crack on forming surface.**

g) Face the formed end of the tube if required by means of facing/parting tool mounted on the tool post.

h) Remove the tube from the machine and remove the mandrel from the tube.

i) **Check dimensions as per Figure – 1 of formed end.**

j) For checking of formed end assembly requirement, assemble sleeve, bottom ring and inlet nozzle with tube 1st end.

k) Close open end of nozzle by required fixture and fill water in tube. Carry out required leak test at 1.01 bar differential pressure, leak should not be more than 10 ltr per hour from rolled joint of 1st end.

l) If leak test is satisfactory, then for parting excess length, Pass the unformed end of the tube through the bore of machine spindle and hold the same in the machine collet.

m) Part off excess length from the tube with the help of a parting tool mounted on the tool post as per detail given in figure 2.

n) If leak test fails, then cut the formed end (1st end) and repeat the forming operation of 1st end.

o) Three set of forming tools, cutting tools and clamping fixture is in the supply of scope. Trial with all the forming tools shall be taken before acceptance of formed tools.

p) Party may have to make multiple forming tools set before finalization of forming tools dimension to achieve dimension as per drawing given in this specification.

q) Loading and unloading of tube will be carried out manually.
r) Hydraulics Power Pack make should be Yuken/Rexroth or other equivalent.

s) VFD to be used for rotation of job shall be of Siemens or other equivalent.
4. **Sequence of Operation for forming 2nd end of tube:** Forming of the 2nd end of tube after fitting structural components (Sleeve, bottom ring & inlet nozzle) at 1st end of formed tube and other components inside tube (refer figure -2) (weight of tube assembly – 15 kg) by using following steps:-

- a) Before start of 2nd end tube forming on actual tube assembly, use only cassette head in place of mandrel and qualify for 2nd end forming after visual and dimensional inspection of tube from inside and out side surface after forming. Proper support shall be made for holding during forming. Fabrication of forming wheel and support (3 sets) is in the scope of supplier. Purchaser will supply 2 sets of components (tube, sleeve, bottom ring, inlet nozzle, top nut, cassette head & top ring) on returnable basis for forming 1st & 2nd end qualification.

- b) After qualification of 2nd end tube forming by using cassette head, Assemble 1st end formed tube along with structural components for doing 2nd end forming.

- c) Pass the 2nd end of tube fitted with structural components (refer figure – 2) through the bore of machine spindle and hold the same in the machine collet.

- d) Insert fixture in cassette head for tail stock tailstock support to the tube assembly.

- e) Also, provide support near 1st end of tube during 2nd end forming of tube.

- f) Form the tube onto the cassette head fitted inside 2nd end of tube by means of a Forming Tool mounted on the carriage of the machine. The forming operation will be done by moving the forming tool in number of cycles with increasing depth of forming.

- g) Check the forming by visual check for crack or dent & using top Ring and top nut.

- h) Face or cut extra length from the formed end of the tube if required by means of facing/parting tool mounted on the tool post.

- i) Loading and unloading of tube will be carried out manually.

5. **Salient features of the machine:** The machine shall consist of following.

- a) Headstock for holding and rotating the tubes.

- b) Machine Bed for carrying longitudinal carriage, Cross-slide and Tailstock.

- c) Hydraulic Power Pack and Cylinders for providing movement/feed/forming pressure for Tailstock, Carriage and Cross-slide.

- d) Support for free end of tube and 2nd end of tube during forming.

- e) Cutting tool post on machine bed. 3 nos. of cutting tools shall be provide with machine.

6. **Parts of SPM:**

- a) **Headstock:** The Headstock shall have the drive mechanism for the tubes being formed. Hollow Spindle of the mechanism shall allow tube with O.D upto 70mm to pass through it. The
Spindle shall rotate at continuously variable RPM from 0 to 20. Suitable manual clamping collet shall be mounted on the Spindle for holding the tubes. Maximum Spindle run out shall be 0.01mm or less.

b) **Machine Bed:** The bed shall be a rigid cast/fabricated structure. The bed shall be fitted with hardened and ground Guide-ways with auto lubrication points for allowing smooth and accurate movement of carriage. The accuracy should be 0.02/300mm or better.

c) **Carriage:** The Carriage shall travel longitudinally on the Guide-ways of machine bed. The movement shall be provided by Hydraulic Power Pack and Cylinder at infinitely variable feed rate ranging from 0-100mm/min and a stroke length of 100mm. It should also have rapid feed upto 6m/min.

d) **Cross-slides:** Two Cross-slides shall be mounted on either side of the carriage. The Cross-slide shall carry a Tool Post on which a Forming Tool and Parting/Facing Tool can be mounted. The Cross-feeds shall be provided by the Hydraulic Power Pack and Cylinders. The Cross-feed shall be infinitely variable with feed rates ranging from 0-100mm/min and a stroke length of 50mm. It should also have rapid feed upto 6m/min. The necessary forming pressure shall be provided by the movement of the Cross-slide.

e) **Tailstock:** The tailstocks shall have revolving center supporting mandrel and tube to give more accuracy in forming. The Tailstock shall have stroke of 50mm. It shall be fitted with a revolving centre and shall be hydraulically actuated. It should also have manual stroke of 100mm for easy loading/unloading of tubes, tools, collet etc.

f) **Control and Display Console:** The Control and Display Console shall be mounted at suitable places on the machine. It shall have all essential controls of the machine grouped together in the order of operating sequence. Digital Indicators shall be provided for Spindle RPM and feed rates of Carriage and Cross-slides.

g) **Motors:** The power of main motor shall be 15 H.P. or more.

h) **Hydraulic controls:** All hydraulic controls of the machine shall be done by using suitable control system.

i) **Stoppers:** Adjustable mechanical stoppers shall be provided for quick and easy setting of tube on the machine.

j) **Make of Major Items:**
   - Hydraulics Power Pack: Yuken/Rexroth or other standard supplier
   - Electric Motor: Siemens/CG or other standard supplier
   - PLC & HMI: Siemens or other standard supplier
   - VFD: Siemens or other standard supplier

7. **Drawings and Documents:** The supplier shall furnish following details in their offer:

   a) General arrangement drawing, layout plan and space requirement.
Ref: BARC/IF3/06/2020/71307 dt. 04 Aug 2020

b) Control system.

c) Description about the machine and its working.

In the event of an order, the supplier shall submit, within two months of placing order, detailed manufacturing drawings of the machine, foundation drawings, and electrical/pneumatic/hydraulic circuit drawings for approval by purchaser. The manufacture of machine shall be taken up only after approval of drawings. Foundation drawings shall indicate static and dynamic loading. Two sets of manuals shall be supplied with the machine for erection, commissioning, operation and maintenance of the machine.

8. **Inspection and Performance Test**: the supplier shall allow the purchaser to inspect various units of equipment for stage inspection and shall demonstrate the performance of the machine at the supplier's premises before dispatch.

9. **Guarantee**: The supplier shall guarantee trouble free operation of the machine for a period of 12 months after commissioning. Defective parts, if any, shall be replaced free of cost by the supplier during the guarantee period.

10. **Installation/Commissioning**: The supplier shall install and commission the machine along with the control at B.A.R.C., Trombay Mumbai and demonstrate the performance. Reasonable facilities like power supply, pneumatic line, forklift and welding facility will be provided by the purchaser. All other tools and consumables shall be arranged by the supplier.

11. The bought out items used in the machine shall be from reputed manufacturers. The supplier shall indicate the list of bought out items and their make in the quotation.

12. **List of Components**: All components to be used in the machine should be as per the annexure enclosed.

13. **Spares**: A separate quotation shall be submitted for spares required for 5 years of trouble free operation.

14. **General terms and condition:-**

14.1 Material delivered to IF3, South Site Zonal Stores, BARC, Trombay, Mumbai – 400 085 under advance intimation to Shri Lalit Kumar, Ph: 2559 4534/4526.

14.2 For entering inside BARC premises vendor shall arrange Police Verification Certificate (PVC) for their personnel and obtain required BARC security clearance in advance for entire duration of contract

14.3 Payment Clause: 100% payment including taxes & duties applicable will be paid only after satisfactory completion of work and submission of the following documents:

14.4 Advance Stamped Receipt, Original Bill in Triplicate and Guarantee/Warrantee Certificate, installation & commissioning report etc. Payment will be made through ECS/RTGS after filling option form. Option form will be provided along with work order.

14.5 Payment will not be made on prorate basis. Part payment & advance payment is not possible.
14.6 Income Tax:- Income Tax @ 2% and GST TDS @ 2% will be deducted from vendor bill.

14.7 Delivery Period:- Work completion time is twelve months from date of issue of Work Order.

14.8 GSTN Invoice: GSTN invoice should have details of a) GSTN b) PAN & c) Location of supply d) tax component to be separately indicated.

14.9 GST @ 5% shall be paid Since theses goods are to be supplied against the work order meant for research purpose of a research organization under DAE, the necessary GST will be exempted to the party.

14.10 Supplier will have to submit undertaking stating that GST has been promptly deposited with the authority (copy of blank under taking will be provided with work order).

14.11 Guarantee for system, material quality & workmanship shall be provided for period of one year from date of supply of material to BARC.

14.12 If required, party required to send request letter for extension of delivery period before expiry of work order.

14.13 Penalty:- Any delay in supplying the finished components, which is attributable to the contractor, is liable for penalty @1/2 % per week (max 5 %) to be imposed on the contractor.


Confidentiality:

15.1 No party shall disclose any information to any third party concerning the matters under this contract generally. In particular, any information identified as “Proprietary” in nature by the disclosing party shall be kept strictly confidential by the receiving party shall not be disclosed to any third party without the prior written consent of the original disclosing party.

15.2 This clause shall apply to the sub-contractor, consultants, advisers or employees engaged by a party with equal force.

15.3 “Restricted information” categories under Section 18 of the Atomic Energy Act, 1962 and “Official Secrets” under Section 5 of the Official Secrets Act, 1923:

15.4 Any contravention of the above-mentioned provisions by any contractor, sub-contractor, consultant, adviser or the employees of a contractor will invite penal consequences under the aforesaid legislation.

15.5 Prohibition against use of BARC’s name without permission for publicity purposes:

15.6 The contractor or sub-contractor, consultant, advisor or the employees engaged by the contractor shall not use BARC’s name for any publicity purpose through any public media like Press, Radio, T.V. or Internet without the prior written approval of BARC.

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16. **Requirements in offer document:-**

16.1 Your sealed offer (not stapled) super scribed with enquiry letter reference number & date, due date & subject to be addressed to as mentioned and must reach us on or before due date & time as mentioned.

16.2 Quotations are to be in printed letter head (not computer generated format) and must be neatly type written/printed. Quotation format should consists of GST number, PAN of the firm, etc. Quotations that are received in computer generated form are to be considered as invalid & rejected.

16.3 **Experience:** - Vendor shall mention in offer document regarding their past experience in working with any BARC/DAE unit and carrying out of similar jobs. A declaration is expected in offer document in this regard.

16.4 **Facility:** - Vendor must have required fabrication facility and inspection tools, qualified & experienced staff, clean & ample workshop premises & other infrastructure for execution of the work. A declaration regarding facilitates shall be mentioned in offer document. Customer's representative may physically assess vendor's facility for vendor evaluation.

16.5 **Pricing:** - Offer pricing shall be for complete system and must be valid for entire duration of contract.

16.6 **Taxes & Duties:** - Any taxes and duties to be levied over and above offered price must be mentioned clearly in offer document.

16.7 **Offer validity:** - Offer must be valid at least for a period of 210 days from date of submission of offer document.

16.8 There may be minor changes in some dimensions in the drawing and these changes shall be informed by purchaser well in advance of fabrication as and when required. Vendor shall agree to accept those changes in drawings.

16.9 Any terms & conditions could not be met by vendor shall be clearly mentioned in the offer document.