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प्लाज्मा अनुसंधान संस्थान
INSTITUTE FOR PLASMA RESEARCH
परमाणु ऊर्जा विभाग, भारत सरकार का एक सहायता प्राप्त
संस्थान



An Aided Institute of Department of Atomic Energy,
Government of India

इन्दिरा पुल के पास, भट, गांधीनगर - 382 428 भारत
दूरभाष: (079) 2396 2020/2021/2028
फैक्स: 91-079-23962277
वेब: www.ipr.res.in

NEAR INDIRA BRIDGE, BHAT
DIST. GANDHINAGAR - 382 428 (INDIA)
Phone: (079) 2396 2020/2021/2028
Fax : 91-079-23962277
Web : www.ipr.res.in

ENQUIRY

ENQUIRY NO : IPR/EQL/18-19/237
Date : 08-10-2018

Due on : 01-11-2018 by 1:00 PM IST

Please send your offer in sealed envelope specifying Enquiry No, Date & Due Date, ALONG WITH your credentials for the following items:

Important Note:

Please note that e-mail quotations are not acceptable however you may send your queries (if any) to localpurchase@ipr.res.in

Please ensure your sealed quotation reaches this office not later than above mentioned due date and time.

Kindly go through the following documents properly before quoting which are available on the IPR web portal i.e., http://www.ipr.res.in/documents/tender_terms.html / attached herewith.

- 1) Instructions to the bidders & Terms and conditions (refer Form No: **IPR-LP-01.V4**)
- 2) Bidding format

GST for Goods and Services (IGST/CGST/SGST TAX BENEFITS): Please refer **clause no: 8** of Form No: **IPR-LP-01.V4**

QUOTATION SHOULD BE ADDRESSED TO PURCHASE OFFICER ONLY

Sr No	Description	Quantity
1	Prototype Bellow of SS304L material as per attached specification sheet	2.0 Nos.

Note: Please quote with complete technical details (Technical compliance sheet and product data sheet).

Encl: As per attachment.

Sd/-

Mr. D. Ramesh
Purchase Officer-II

Information to Vendors: We are working towards a single platform for our future requirement. Hence, please refer IPR website i.e, <http://www.ipr.res.in/documents/tenderseng.html> for our future requirement.

Prototype Bellow Specification



(a) Based on the overall dimensions supplied by IPR the scope of work includes design, fabrication, testing, non-destructive examination, cleaning and supply of bellow at IPR.
(b) Quantity of bellow to be fabricated is 01 (one) as per the section 6 and other one (02) bellow out of which one shall be packed as per the section 6 and other one without test.

A

Technical Specification

for

Fabrication, Testing and Supply

of

Prototype Bellow

At

Institute for Plasma Research. Bhat Gandhinagar-382428

Applicable drawings related to fabrication of bellow is given in annexure 1. Preparation of fabrication drawings shall be in scope of vendor.
Applicable Code shall be as per the section 6.

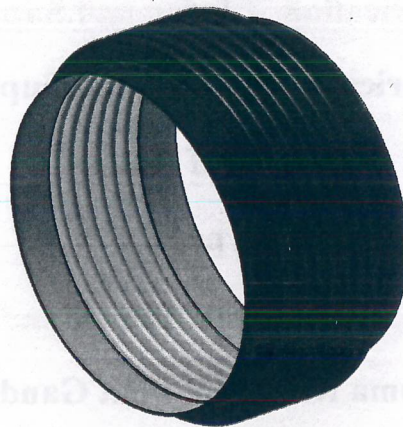
- Following codes and standards shall be used for design, fabrication and testing:
- EIM A, Standards of Bellow Manufacturer's Association
 - ASME Boiler & Pressure Vessel Code, Section II, Part 1
 - ASME Boiler & Pressure Vessel Code, Section V, Non-destructive examination
 - ASME Boiler & Pressure Vessel Code, Section IX, Welding and Brazing
 - ASME Boiler & Pressure Vessel Code, Section VIII, Div 1, Unfired pressure vessels

The bellow shall be manufactured from stainless steel conforming to ASME Specification SA

Prototype Bellow Specification

1. Scope of work:

- (a) Based on the overall dimensions supplied by IPR the scope of work includes design, fabrication, testing, non-destructive examination, cleaning and supply of bellow at IPR, Gandhinagar.
- (b) Quantity of supply
02 (two) Bellow out of which, one shall be baked as per the section 8 and other one without baked.



Prototype Bellow

2. Applicable Drawings

Applicable drawings related to fabrication of bellow is given in annexure 2. Preparation of Fabrication drawings shall be in scope of vendor.

3. Applicable Code

Following codes and standards shall be used for design, fabrication and testing:

- EJMA, Standards of Bellow Manufacturer's Association
- ASME Boiler & Pressure Vessel Code, Section II, "Materials".
- ASME Boiler & Pressure Vessel Code, Section V, Nondestructive examination
- ASME Boiler & Pressure Vessel Code, Section IX, "Welding and Brazing Qualification".

4. Material

Bellow material requirement

The Bellow shall be manufacture from stainless steel conforming to ASME Specification SA -240, Type 304L (HRAP).

Sheet Thickness: 2.5mm (Tolerance as per ASME)

Surface finish: Grinding and polishing of the internal surface finish of the expansion joints is not permitted. The Bellow material is SA240 Type 304L HRAP, hot rolled and annealed with a surface finish of 2.5 micron RMS or better.

Material requirement:

- **Test Certificate:** A test certificate conforming to requirement of material as per ASTM SA 240 shall be produced by vendor.
- Vendor shall provide two coupons of dimension 50 mm x full width of sheet form procured material to IPR for testing purposes. The remaining sheet to be preserved by the vendor (suitable marking to be done on it) so that the bellow can be made from the same sheet.
- Material testing will be done by IPR. On matching (as per ASTM standards) with the test certificate, provided by the vendor, the vendor will be given a go ahead for fabrication.

5. Design Description

Nominal size:

- Inside diameter : 1240 mm
- Maximum outside diameter : 1422 mm
- Length: 635±3 mm
- Thickness: 2.5mm.

Bellow Type: Single ply and Unreinforced

Design Pressure:

- External: 1 Bar (atmospheric pressure)
- Internal: Ultra high vacuum

Temperature:

- Maximum Design temperature: 200 °C
- Ambient temperature: 25 °C

Maximum Movement:

- Operating:
 - Axial: 6.6 mm in Contraction Total Cycle-7500.
: 41 mm in Extension Total Cycle-7500.
 - Lateral: 1mm (Total 5 Cycle)
 - Rotational: 0.20 Additional Degrees (5 Cycle)
- Transient:
 - Axial: 88 mm in Contraction (20 cycle)
 - Rotational: Maximum 0.20 degree (20 Cycle).

Dimensional Limitations:

- Nominal Overall Length: 635±3.0 mm

- N
- Tangents (Straight portion of ends) : 127 ± 3.0 mm

Spring Rate:

- Maximum allowed Axial spring rate: 1400 KN/m
- The designed axial spring rate of Bellows shall be less than maximum allowed axial spring rate.

Based on the above specification vendor shall design the bellow and meet all the requirement mentioned above. Fabrication of bellow shall be started only after final approval of design and drawings by IPR.

6. Fabrication Tolerances

- All the dimension of bellow shall be measured in ambient temperature.
- The outside circumference of the ends of the Bellow shall be within ± 3 mm of the theoretical circumference corresponding to the specified inside diameter.
- Ends of the Bellows shall be perpendicular to the cylindrical axis within ± 2 mm.
- The ends of the Bellow shall be flat within 2mm when the Bellow is in unrestrained state.
- Overall length shall be within ± 3 mm.
- The Ends of Bellow shall be concentric within 3 mm.

7. Welding

Applicable Weld:

- All welding shall be done by gas tungsten arc welding (GTAW). Welding shall be automatic/manual with filler wire specified in filler wire requirement.
- Welding procedure shall be taken prior approval from IPR Gandhinagar before start of production weld. Welder and weld operator qualification shall comply with section IX of the ASME Boiler and pressure vessel code.
- All the required welding shall be done in presence of IPR representative.

Filler Wire Description:

- Applicable filler shall be of ER SS308L
- Vendor shall provide test certificate confirming to requirement of chemical composition.

Weld Qualification:

- Radiography test shall be performed for qualification of all the welding and shall be qualify according to ASME section-IX.

8. Baking

Baking of bellow shall be carried out as per the procedure and requirement given below.

Fabricated bellow shall be Air Baked in furnace at temperature $450 \pm 20^\circ\text{C}$ for 36 Hrs. soaking time. Heating rate and cooling rate shall be 200°C per hour.

9. Cleaning

- The bellow shall be protected to maintain cleanliness throughout the entire fabrication procedure.
- Acetone or isopropyl alcohol shall be used to remove oil, grease, and other contamination at following stage. The vendor may use dampened cloth or immerse in bath as per facilities available. The cleaning should be done;
 - Before bellow forming & after bellow forming and before re-rolling
 - After all the testing (as mentioned in point 10) and before air baking
 - After air baking and before final packaging for shipping
- A clean white cloth dampened with Acetone or isopropyl alcohol shall show no indication of contamination when wiped against the cleaned bellow. This will be done after each bellow cleaning procedure.
- Pickling and passivation after baking.
- Lubricant that effect the ability to obtain ultra-high vacuum levels such as silicon lubricants shall not be used during fabrication. It is also preferred that a hydrocarbon based lubricant is not used.

10. Testing and inspection of Bellow:

Dimension Inspection: Dimensional inspection shall be carried out at the shop floor. Bellow shall meet required thickness; diameter, pitch, convolution height etc. uniformly as mentioned in final approved specification and drawing of bellow.

Dye-Penetrant Test: Full Dye-penetrant test shall be carried out for complete upper and lower part of bellow convolution material and all the welds after fabrication. Bellow shall qualify in above test as per ASME Boiler & Pressure Vessel Code, Section V.

Hydro testing: Hydro test of bellow shall be carried out under internal pressure for minimum of 02 (two) bar for 01(one) Hr. to insure structural compliance.

Axial spring rate test: Vendor shall demonstrate the axial spring rate test by contracting the bellow by 15 % length specified in transient movement condition in section 5.

11. Acceptance Criterion

Acceptance criterion of bellow shall be of meeting following at the vendor shop floor:

- Radiography test as mentioned in section 7.

- Dimensions and tolerances as mentioned in the final approved specification and drawings of bellow by IPR.
- Die-penetrant test of bellow as mentioned in section 10.
- Hydro test as specified in section 10.
- Axial spring test as mentioned in section 10.

IPR representative shall witness all the above test at shop floor before final acceptance.

- All the test shall be carried out before baked condition of bellow.

12. Documentation and approval

Vendor shall submit the inspection & testing plan (ITP) and procedures after receipt of official purchase order from IPR.

Vendor shall keep all the record and submit the relevant documents related to design confirming to Bellow requirement, Material testing certificate, radiography, NDT, dimensional etc. The record shall enable the complete fabrication process details from raw material to delivery.

13. Packaging and transportation

Wrap the bellow securely in plastic and seal to maintain a clean state until installation. Cover the ends of the bellow with a cap to protect the edges and prevent puncture of plastic wrap.

Transport the expansion joint in wooden box (or similar) to protect the bellow and plastic wrap during transportation.

14. Delivery at IPR

Delivery of bellow at IPR, Gandhinagar, Bhat shall be in the scope of vendor. No welding on the shell of bellow for jigs, lifting lug or any arrangement shall be made for handling.

Annexure 1

✓ diagram for bellow fabrication from material procurement to delivery:

