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PART-I (B)

Tender for Fabrication, assembly, testing and supply of Corrugated bend and Convertor

General description, fabrication and assembly procedure, scope of works, inspection and acceptance criteria

1. General description

The job includes fabrication of one corrugated bend and four Convertors. The components are to be fabricated from Aluminium 6061 T6 grade material. The fabrication of components demands highly precise CNC machines, for machining of jobs and CMM (coordinate measurement machine) or VMM (virtual measurement machine) for profile measurements. Both bend and convertor would be formed using two halves, with bolted assemblies. For ease of assembly and alignment, both the halves of the components are provided with dowels fittings. Components assembly would be made in such a way that it provides leak tightness of up to 4bar gauge pressure and ensures proper metal to metal contact. Inner profile of both the halves must be matched perfectly. Convertor would be provided with cooling arrangement from outer surface. All components would be fabricated and assembled in such way it ensures inner profile geometry within the range of +/- 50 micron accuracy and surface finish 3Delta or better. All components matching surface must have surface finish better than 0.06micron. All the materials used in the fabrication and assembly of above components should be non-magnetic.

Detail of components:

- | | |
|---------------------------------|---------------|
| (1) Assembly of Corrugated Bend | 01No. |
| (2) Assembly of Convertor | 04Nos. |

Spares:

- (1) 02pair of Gaskets sets for each set of converter and bends.
- (2) One set of Hardware including Nut bolts, Heli-coil inserts, washers and dowel pins etc.

2. Fabrication Procedure

(a) Corrugated Bend

The corrugated bend has to be fabricated from solid plate of ASME 6061 T6 grade Aluminium material. The bend outer centre to centre dimension is 1520mmx1520mm.

The corrugated bend forms 90 degree bend having both the terminating ends with small plain circular section of diameter 181.24mm. The corrugated bend have 94nos. of inner rectangular corrugations, having a centre radius of 1400mm. Each corrugation is equally distributed in radial direction and the angular pitch between two corrugations is 0.965°. All the 94nos. of corrugations are equally distributed in total angle of 89.745°.

In each half part of the bend there is three rectangular base provided. This base would be helpful for fixing of bend part while machining and it will also work as base or reference for dimensional and profile measurement of the bend.

A prototype fabrication and testing, before going for actual machining of corrugation in bend halves, is suggested keeping in mind the challenges involved in manufacturing such corrugation in radial direction.

It is proposed to make a prototype from solid aluminium block of the same material from which bend has to be fabricated. A prototype considering 10nos. of corrugation out of actual 94 corrugations has to be made as per drawings. The prototype would be checked for repeatability and accuracy of profile. Only after getting enough confidence, the machining of bends halves corrugation should be carried out. The prototype must be approved by IPR representative. **Maximum two chances would be given to vendor for prototype manufacturing and its approval from IPR.**

(b) Convertor

The convertor assembly has two rectangular ports and one circular port of inner radius 181.24mm. Fig.1 shows inner profile of convertor part. In convertor part, the conversion from circular to rectangular port takes place in following manners:

Step-1: Plain rectangular opening having two ports (34.04mmx 72.14mm) and one open end.

Step-2: Taper Rectangular Wave guide section of length 215mm
(From 34.04mmx117.2mm to 99.6mmx117.2mm)

Step-3: Transition from rectangular to elliptical section (Length 116mm).

Step-4: Straight section of elliptical section (Length 134mm)

Step-5: Transition from elliptical section to circular section (Length 116mm)

Step-6: circular plain section of dia. 181.24mm (Length 50mm)

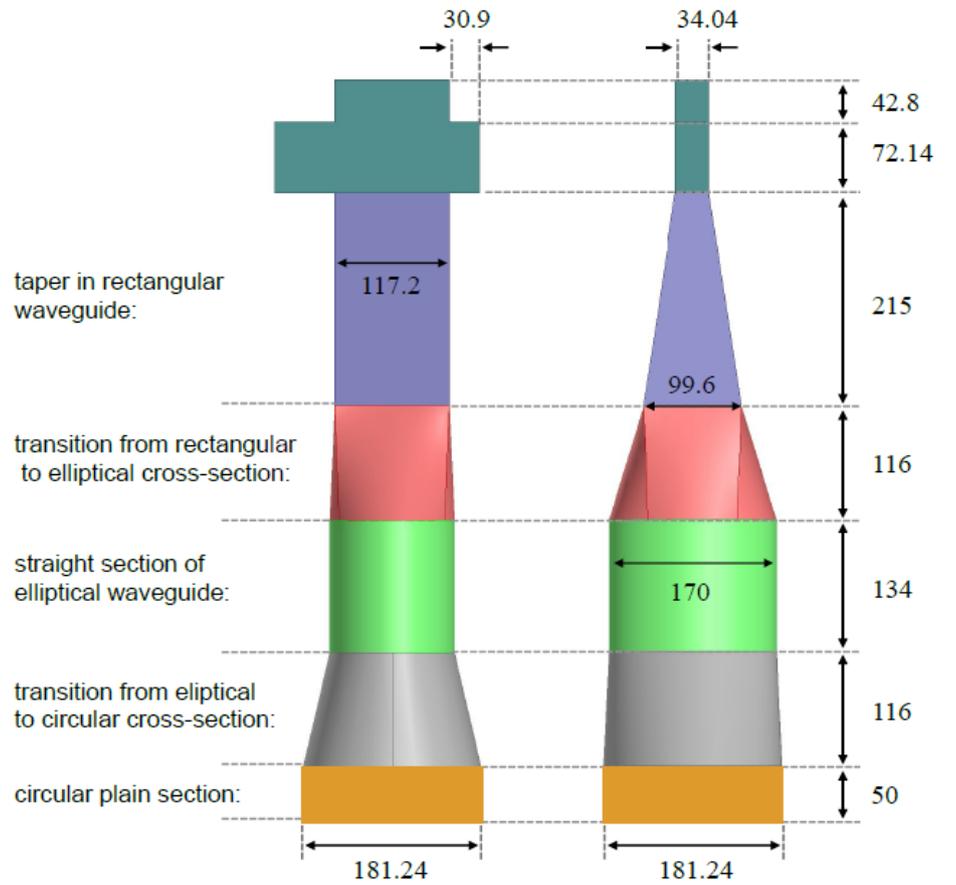


Fig. 1 Inner Profile of Converter

Each part of converter has to be fabricated from solid plate of ASME 6061 T6 grade Aluminium material. Assembly of the converter has to be carried out using SS 304L-M10 hex bolts, dowels pin and VITON gaskets.

Converter assembly rectangular open ends would be covered with Short plate-1 and Short plate-2 as mentioned in converter drawing details.

As this converter has to be water cooled. The conceptual arrangement for water cooling lines is shown in the converter assembly drawing. There has to be one inlet and outlet in each half section of the converter. The copper tube should be fixed in such a way that, it covers maximum surface area and provide good thermal bonding with base. The cooling line must be watertight. The Test pressure for cooling channel hydro test is 13 bar gauge.

Proposed method for cooling lines:

Cooling channel should be formed by fixing of copper tubing on outer surface of the converter part. There should be separate Inlet and outlet in both top and bottom parts of assembly. If possible vendor has to look for possibility of making groove on outer surface of converter part for fixing cooling tubes. It is preferable to have cooling tube properly soldered with outer surface. Cooling channels may be formed

using circular round copper tube or Rectangular tubes. ½"Female NPT or BSP connector has to be provided for input and output end of cooling channels.

Vendor has to take enough care in forming and fixing of cooling channels on convertor parts as no deformation is allowed in inner profile of the component.

Vendor may suggest for better way of providing cooling channel on the convertor part and get its approval from IPR and same has to be incorporated while part fabrications.

(c) Dimensional Tolerance

All components inner profile should be within the range of +/-50 micron accuracy and the inside surface finish should be better than 3 Delta finish. All components matching surface must have surface finish better than 0.06micron.

Wherever required, tolerance is shown in all drawings. Except in the inner profile, all other tolerance for the dimension is not shown in the drawing and should be as per general tolerance limit.

(d) Surface Treatment and Painting

All components outer side (other than inner profile and matching surface) have to be black anodised.

(e) Gaskets

Vendor has to manufacture gasket assembly as suggested in the drawing. The gasket assembly is a combination of VITON seal and metallic casing of material like BeCu. Metallic casing are needed to ensure perfect metal to metal contact between two matching part of components. This gasket would be placed in the groove provided in each half to the components. Also it ensures the air tightness of the component up to 4 bar gauge pressure. VITON material must be genuine VITON which has service temperature up to 150° Centigrade. Vendor has to provide test certificate for genuine Viton gasket material and Outer Metal casing for its verification.

(f) Hardware

All hardware like bolts, nuts, washers should be made of SS 304L non-magnetic materials. The dowels pins have to be procured or fabricated from SS 304L non-magnetic materials. Stainless steel Heli-coil inserts has to be fitted in convertor rectangular opening parts to formed M6 tapping.

(g) Component Assembly and Storage

Before assembly, all components should be cleaned with non-reactive cleaning agent. The assembly of all the components have to be done in dust free environment. The required jigs and fixture has to be used while assembling to ensure proper inside

dimensional tolerances. Sufficient precautions have to be taken to maintain inner surface finish free from any marks and finger prints. After assembly, the component should be properly covered and stored in such a way that there is no weathering effect on it. Components assembly should be carried out in presence of IPR representative.

3. Scope of Works:

- (1) Material Procurement
- (2) Raw Material inspection
- (3) Materials Approval from IPR.
- (4) Generation of Fabrication drawing and its approval from IPR.
- (5) Components and prototype Fabrication
- (6) Component and prototype Assembly and testing
- (7) Inspection at vendor site which includes:
 - a. Visual inspection
 - b. Dimensional test
 - c. Profile Measurement
 - d. Pneumatic test.
 - e. Hydro-test of cooling lines

4. Drawings

The detailed drawing of the job consists of seven sheets (A3 size) having drawing Nos. STC/IPR/CEA/DEV_OWGC_LH_1.A3.

It consists of main components assembly drawings, components drawings and detail components drawings. In drawings, we have shown the prime important dimensions only. After getting the PO, the CAD model will be made available to the vendor for the generation of their own manufacturing drawings. While generating the manufacturing drawing, the vendor must ensure about the component design. The Vendor has to get drawing approval from IPR before commencing manufacturing of the same. Any minor correction if required has to be included at the time of component manufacturing.

The details of drawings are listed below:

Sr. No.	Drawing Nos.	Description
1	STC/IPR/CEA/DEV_OWGC_LH_1.A3. Sheet 01 of 07	Main Component Assembly
2	STC/IPR/CEA/DEV_OWGC_LH_1.A3. Sheet 02 of 07	Corrugated Bend Assembly
3	STC/IPR/CEA/DEV_OWGC_LH_1.A3. Sheet 03 of 07	Component Details
4	STC/IPR/CEA/DEV_OWGC_LH_1.A3. Sheet 04 of 07	Component Details
5	STC/IPR/CEA/DEV_OWGC_LH_1.A3. Sheet 05 of 07	Convertor Assembly
6	STC/IPR/CEA/DEV_OWGC_LH_1.A3. Sheet 06 of 07	Component Details
7	STC/IPR/CEA/DEV_OWGC_LH_1.A3. Sheet 07 of 07	Component Details

5. Deviation if any:

It is necessary for the Vendor to check all drawings and confirm for the tolerance and accuracy, which we have asked for. Deviations in the tolerance and accuracy, if any, should be explicitly mentioned along with the quote.

6. General Terms and Conditions:

- Vendor has to submit the raw material test certificates at IPR before starting fabrication works for its approval
- All the materials to be used should be of good quality and free from any defects.
- Vendor is solely responsible for Material test and component fabrication
- Vendor has to give the inspection call for stage wise inspection of the job by IPR representatives as outlined in time schedule.
- The vendor has to arrange for the entire required test.
- A prototype for bend has to be first checked at vendor site and further sent to IPR for its dimensional, profile measurement and visual check for approval for component fabrication.
- Components assembly with all accessories have to be delivered to IPR only after receiving the pre-dispatch clearance from IPR.
- IPR representative will give final acceptance only after successful completion of all measurements and inspection at IPR site only.
- Final Component assembly has to be suitably tag marked as per the information provided by IPR

7. Acceptance Criteria

(A)Acceptance Test at Vendor Site

- (1) Raw material testing and its approval from IPR.
 - i. Raw material visual inspection by IPR representative at vendor site
 - ii. Raw material Ultrasonic test
 - iii. Mechanical Test- tensile, bending and hardness testing
 - iv. Chemical testing

Note: Mechanical and Chemical testing should be witnessed by IPR representative at government approved laboratory

- (2) Corrugated Bend Prototype Fabrication, testing and its approval from IPR.

Test includes:

- i. Visual test
- ii. Dimensional test
- iii. Inner Profile measurement test
- iv. Pressurisation test

- (3) Test Before Assembly

- a. Component Inner profile testing

Before assembling of the component, inner profile of each section of the component will be checked using of CMM or VMM and the actual profile should be within the acceptable limit.

- b. Dimensional Test
- c. Surface finish
Inner profile surface finish and matching surface finish
- d. Visual Test

(4) Component Test after assembly

- (I) Visual Test
- (II) Dimensional Test
- (III) Pneumatic Test

All component assembly have to be tested at a test pressure of 4Bar gauge using dry air or Nitrogen gas and partially filled with helium gas. Leak will be checked through HLD sniffing technique and measuring pressure drop over a period of 24hours. The allowable leak rate in sniffing mode is 1×10^{-5} mbar litre per second. The pressure drop should not exceed the limit of 0.1bar over a period of 24hour. There should not be any visible leak while testing.

(IV) Hydro-test of cooling lines (For Converter Cooling Channel only)

Cooling lines of convertor parts will be tested for hydro test at 13Bar Gauge pressure. All joints must be water tight; there should not be any visible leak during the test period of around 2hours. After hydro test cooling lines must be dried off and plugged

(B) Acceptance Test at IPR

Final Acceptance Test will be carried out at IPR as mentioned in (A) vendor site test
Sr. No. 4.

8. Time Schedule

Vendor has to provide detailed time schedule (**Maximum 05 Months**) to carry out complete job. Time schedule must include the time scale for drawing generation, material procurement, material testing & approvals, prototype fabrication & approval, component fabrication, assembling and its testing. The job must be finished within prescribed duration of time.

9. Warranty:

Vendor has to give one year warranty for all components and its assemblies from the date of final acceptance from IPR. As per warrantee terms the components assembly and accessories supplied by vendor shall be free from any defects in material or workmanship and in accordance with applicable specification and drawings. In case of any failure, the vendor should replace/correct the same with due course of time free of cost.

10. Packing and Supply at IPR:

The component packing should be as per international standard. The wooden box for packing should be provided with sufficient support including shock absorbing materials to provide full safety to the component assembly while transport. The packing box should be clearly marked for component identification. Box must be tagged with Tilting and shock

indicators. Clear Paint marked as delicate component or fragile components should be made on box to assist while lifting and transport of box. Also the packing box if possible should be provided with lifted hook. The Components Assembly and accessories are to be packed properly while supplying to IPR. Any damage to the parts during transportation to IPR or by any other causes will not be accepted. Damaged part/s will be returned to supplier at their cost for repair or replace works; vendor should repair/replace and deliver it to IPR free of cost.