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Title	Design, Fabrication and Supply of Torus Cryo Pump Housing (TCPH) with Bellows and Other Loose items
Sub-title	MANDATORY APPENDIX : II-TCPH-APB3_05_DIMENSIONAL INSPECTION

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1. SCOPE

This mandatory appendix covers the dimensional inspection requirements for TCPH.

2. REFERENCES

- ISO 5458:1998: Geometrical Product Specifications (GPS) – Geometrical Tolerancing - Positional Tolerancing
- ISO 2768:1989:Tolerance for Linear and angular dimensions without individual tolerance indication
- ISO 13920:1996: General tolerance for welded construction
- ASME Section VIII Division 2, Edition 2013

3. REQUIREMENTS

3.1. Pre-requisites:

Bidder shall establish shop floor documentation for dimensional inspection for each stage. Elements relating to dimensional control shall include:

- Reference standards
- Manufacturing drawings and CAD models
- Design change procedures
- Document control
- Measurement procedure
- Instrument calibrations and test procedures
- Non-conformity procedure

3.2. Frequency and stages of Inspection

Dimensional Inspection shall be carried out at all required stages starting from part, sub-assembly and final assembly stage to satisfy the tolerance requirements specified in ASME Sec-VIII, Div.2 and Mandatory Appendix-II-TCPH-APB 3_02 Drawing


I-I and IO shall witness the dimensional inspections in accordance with relevant MIP/IP.

3.3. Measuring Instruments and calibration:

All equipment used for dimensional measurement shall be in accordance with Annex 2.E.12 from ASME section VIII, Div.2. Each instrument shall have calibration certificates (released by independent accredited laboratory) at the time of use with a required validity.

3.4. Dimensional measurement:

The equipment selected by the Bidder shall fit for the requirements of the measurement process. The selection process shall consider areas such as measurement uncertainty, speed of data acquisition, measurement geometry, local environmental conditions etc.

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Measurement uncertainty shall be calculated for all reported measurements, at a confidence level of $\pm 2\sigma$. As a general rule, the uncertainty value shall not exceed 10% of the tolerance applicable to the feature being measured.

Dimensional measurements shall be taken with respect to co-ordinate system define in tolerance drawings. These dimensions shall also include key dimensions to be measured at room temperature (20⁰ C) or corrected to this temperature. The correction factor at that temperature may be mutually agreed upon.

During measurement bidder shall ensure that components are in free condition without any restraints. If supports are taken, it shall be ensured that it does not impact final dimensions.

The Bidder shall prepare dimensional measurement procedure which includes details of measurement process (i.e. measurement instruments, methodology and software etc.) for individual parts and assemblies.

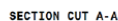
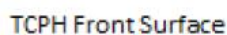
In order to monitor deformation (if required) during the manufacturing process, reference points on the component shall be periodically measured. The location and frequency of measurements shall be mutually agreed

Following key dimensions shall be considered during dimensional Inspection:

- Overall assembly dimensions of TCPH shall be measured at interval of max 300mm for straight portion. Curvature portion shall be check using appropriate templates.
- Cryopump flange flatness and Perpendicularity shall be measured at the interval not more than 50mm.
- Dimensions of Main flange (To ensure sufficient extra material) connecting Cryostat shall be check at interval not more than 300mm for straight portion. While, curvature portion shall be verified using appropriate template.


Bidder may propose other equivalent method suitable for measurement of above criteria.

Bidder has to affix fiducials on each TCPH as per below proposed locations. However, details may be changed based on further assessment from IO.



FiduciaSupport (**25mm X 25mm X 25 thk**

During final dimensional inspection, environmental conditions having vibration, unstable ground, noise and dust, direct sunlight on component/measuring instrument and fast variation in temperature etc. shall be avoided.

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3.5. Acceptance:

The dimensions of TCPH shall be within the tolerance specified in ASME sec-VIII, Div.2, and Mandatory Appendix-II-TCPH-APB 3_02 Engineering Drawings. The Bidder shall produce “as-built” drawings to demonstrate the compliance with the design. Additionally, Interface dimensions if any identified by IO shall also be recorded. Any discrepancies shall be subjected to non-conformance report and its corrective actions.

3.6. Dimensional Measurement Report:

All inspection reports shall include following information as minimum and shall be in format acceptable to I-I.

- Identification of the company responsible for dimensional control when subcontracted.
- Identification of measuring instruments with date of calibration and validity.
- Identification of components/parts examined including fabrication process (forging, rolling, welding etc.)
- Dimensional inspection procedure along with revision details
- Sketches and drawings if required to represent dimensional measurement
- Surface preparation (method, cleaning, grinding, machining etc.)
- Material grade and thickness of part
- Drawing no. along with revision details
- Date of examination
- Name of operator along with signed and date
- Non-Conformity Report if any
- Meteorological data (temperature, etc.)
- Interpretation of result (Acceptance/Non Acceptance)

I-I does not prescribe to use any software for measurement. However, it is critical that measurement data can be easily transferred between parties. This data may be required to verify the measurement processes, address non-conformance/deviations issues. In addition, these data shall be used to construct a configuration model representing the true geometry of the as-built TCPH.

4. DOCUMENTATION

The Bidder shall submit dimensional Inspection procedure to I-I for approval before start of any dimension inspection activity.

The Bidder shall submit dimensional Inspection report to I-I for approval during manufacturing.

In case of corrective measures (such as machining, welding or plastic deformation etc.) required to comply with the drawing requirements, proposal of such shall be covered in NCR report and shall be submitted to I-I and IO for approval.