

ANNEXURE TO TENDER NO: DPS/MRPU/1/2/3306/OT/2936
TECHNICAL SPECIFICATION FOR MANUFACTURE AND SUPPLY OF
INTEGARED SUBASSEMBLY MODEL TEST SET UP

1. INTRODUCTION

This planned test set up will be used to carry out hydraulic studies on various subassemblies using water as test fluid. The test set up consists of a shell assembly (Grid box) with sleeves and associated piping and components. These parts are assembled by bolted flanged joints. The material of construction for major components is SS 304L and seamless pipe and pipe fittings. The test assembly as per the approved drawing will be fabricated and will be transported to IGCAR stores for safe delivery. The erection and installation of test set up is not in the scope of supplier. The supplier is responsible for safe transfer of the model assembly till the site at IGCAR. The drawings for the model test assembly and its components are attached with this specification documents.

2. PROCESS CONDITIONS

The components of the model during service are subjected to the following process, conditions:

Service Fluid	:	Raw water or de-mineralized water
Temperature	:	Maximum 80° C
Maximum pressure	:	16 bar

3. SCOPE OF WORK

- a) Study of design drawings, preparation of fabrication drawing, assembly procedure, quality assurance plan and stage wise inspection plan.
- b) Preparation of different manufacturing procedures, qualification of manufacturing process and detail assembly procedure.
- c) Procurement of materials, fabrication of parts as per detailed drawings and assembly.
- d) Fabrication of equipment as per approved fabrication drawings and procedures. The outer shell can be fabricated using standard ERW pipe or from plate of required thickness. The entire component shall be fabricated strictly as per approved drawings.
- e) Transportation, delivery of partially assembled parts first at IGCAR stores for verification and then to IGCAR site at Kalpakkam.
- f) Inspection and testing at manufactures shop as well as at purchasers site as per the specification.
- g) Design, procurement of materials and manufacture of jigs and fixtures and tooling required for the manufacturing, handling, inspection and erection at shop.
- h) Design, procurement of materials, manufacture and supply of handling and transportation structure including lifting hooks.
- i) All the material, manpower and tools for manufacturing, testing and inspection charges, component assembly at manufacturer site, safe transportation of items at site mentioned in this document, insurance for the items during transfer etc.is in the scope of manufacturer.

4. APPLICABLE STANDARDS AND DRAWINGS

The latest editions of the following:

ASME Section II Part A&C	:	Materials, welding rod and filler rod specifications.
ASME Section VIII Div1	:	Code for unfired pressure vessel.
ASME Section IX	:	Specifications for welding procedure and performance qualification.
ASME Section V	:	Procedure for Non-destructive examinations.
ASTM A 240	:	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
ASTM A 312	:	Specification for Seamless, Welded, and heavily cold worked austenitic Stainless Steel Pipes.
ASTM A 213	:	Specification for Seamless Ferritic and Austenitic Alloy Steels for Boiler, Super heater, and Heat-Exchanger Tubes.
ASTM E- 165	:	Method for liquid penetrant inspection.
ASTM E-94	:	Recommended practice for radiography testing.
ASTM A-380	:	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
ASTM A 577	:	Standard Specification for Ultrasonic Angle-Beam Examination of Steel Plates.
ASTM A 578	:	Standard Specification for Straight-Beam Ultrasonic Examination of Rolled Steel Plates for Special Applications
ASTM A 262	:	Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASME B 16.5		Standard for Flanges
ASME B 16.9		Standard for pipe fittings
IS 2102: Part 1 : 1993/ISO 2768-1 : 1989	:	General tolerances Part 1 Tolerances for linear and angular dimensions without individual tolerance indications.
IS 2102: Part 2 : 1993/ISO 2768-2 : 1989		<u>General tolerances Part 2 Geometrical tolerances for features without individual tolerance indications</u>

5. MATERIALS

The model shall be fabricated as per the following drawings:

Table 1: Vessel assembly drawings for integrated subassembly model

Sr. No	Drawing No.	Remark
1	ETHD/HES/99240/DD/3125/Rev-A Sheet No. 1 of 2 & Sheet No. 2 of 2.	Integrated Subassembly Test Setup

The manufacturer shall prepare detailed shop drawings based on design drawings indicating all the dimensions with tolerances for all individual items, subassemblies, final assemblies etc. Tighter tolerances shall be apportioned at various intermediate stages of manufacture in order to achieve the final requirements specified in the purchaser's drawings. The

drawings prepared by the manufacturer shall conform to the latest relevant ISO/ Indian Standards with complete dimensions and tolerances for the item / part. The shop drawings shall also include all the welds and their details, including method of inspection / examination, surface finish, bill of materials, allowances for cutting and machining etc., besides other relevant information and details. The drawings prepared by the manufacturer shall be approved by the purchaser prior to start of manufacturing activities. In case of conflict between applicable documents, the technical requirements mentioned in this specification shall govern. In case of any dispute the purchaser's decision shall be final and binding. The purchaser reserves the right to make minor dimensional changes before confirming the drawings for manufacture. Such changes shall be within the scope of the specified work and shall not be considered as extra.

Based on the purchaser's drawings, manufacturer shall prepare detailed operation process sheets (OPS) which includes sketches for the individual parts/subassemblies/assembly, inspection requirements, inspection agency, reference documents, photography etc., for the individual components, subassemblies and final assembly. The same shall be got approved from the purchaser before start of actual manufacture. The manufacturer shall strictly follow the approved OPS. Jigs and fixtures and tooling required for the manufacture, assembly, inspection and testing of the components shall be designed by the manufacturer and drawings for above shall be prepared by the manufacturer.

The details provided in the drawings listed in Table 1 in this specification are comprehensive and provide necessary information for the manufacturer for the preparation of any shop/manufacturing drawings. The manufacturer shall scrutinize the drawings and bring out in writing missing information/discrepancy/mismatch, etc, if any, to the notice of the purchaser at the time of submission of technical part of the tender. If not done so by any successful bidder, then the bidder shall be fully responsible for any difficulties/problems faced during the manufacture, assembly and testing of the component and shall bear the cost of any repair/rework carried out to solve the problems. All the manufacturing and quality assurance documents such as manufacturing process sheets, quality assurance plan, manufacturing procedure, welding procedures, weld data sheets, assembly procedure, erection procedure, packing procedure, inspection and testing procedure etc. shall be prepared by the manufacturer and submitted to the purchaser for approval before taking up the manufacturing and assembly. These documents shall be submitted to the purchaser in digital form in a permanent storage device.

6. MATERIAL SUPPLY AND IDENTIFICATION

There is no free issue material from the purchaser. Manufacture shall furnish the original test certificate to the purchaser for verification of mechanical and chemical properties of the material. Manufacture shall furnish the original test certificate to the purchaser for verification of mechanical and chemical properties of the material. Gaskets are made of elastomers with asbestos fabric insertion (with wire reinforcement) 3-ply, ASME sec VIII Div. 1, Mandatory Appendix 2. All plates, tubes etc., to be used for manufacturing shall be inspected and properly identified by the supplier and approval has to be obtained by the purchaser before commencement of fabrication. Relevant test certificates like chemical composition, tensile strength and heat treatment shall be produced by the supplier to identify the material. IGCAR inspector will collect material sample to conduct the material test in IGCAR laboratory for verifying the material test certificate supplied by the material manufacturer. The supplier has to

facilitate the supply of sample for material test at IGCAR. No conformity of the test certificate will lead to the rejection of that lot of material.

7. MANUFACTURE

Subcontracting of the entire manufacturing activities of equipment is not permitted. Subcontracting of specific work is permitted only with prior approval from the purchaser.

7.1 Material Handling and Assembly

The material has to be chemically cleaned before the assembly if it is not properly cleaned before. The cutting, bending, rolling and welding operations and assembly of components shall be carried out inside a dust free hall. The cutting plan of all material shall be prepared properly to minimize the wastage of the material. The forming tolerances on cylindrical shells, dished ends and pipe/tube bends shall be as indicated in the drawings.

The material has to be chemically cleaned before the assembly. The cutting, bending, rolling and welding operations and assembly of components shall be carried out inside a dust free hall. The cutting plan of all material shall be prepared properly to minimize the wastage of the material. The forming tolerances on cylindrical shells, dished ends and pipe bends shall be as indicated in the drawings. The plastic tank connection with required piping shall be done using suitable gasket and end flange to ensure its leak tightness.

All material shall be cut preferably by mechanical cutting process wherever possible. Any unavoidable thermal cutting shall only be done by plasma cutting process with adequate edge allowance for removal by grinding or machining. After cutting, the edges shall be ground clear of the heat affected zone and edges shall be examined by LPE. Only aluminum oxide grinding wheels shall be used for grinding process. During fabrication, the prepared edges of plates, pipes and other fittings shall be examined by LPE method to detect defects such as lamination, cracks etc. All defects shall be removed / repaired as per procedure approved by the Purchaser and shall be inspected by the Purchaser.

As far as possible, mechanical clamping (without welding) shall be used for making fit ups. Temporary fittings such as tacking strips, cleats etc. shall be carefully removed to prevent damage to the parent plate. Fit up brackets shall be used only on the vessel outside. Any blemishes on the parent material shall be rectified and the area tested/ examined by liquid penetrant method for detection of cracks or any other defects, and if required, radiography shall be carried out as per applicable codes.

8. WELDING

All the welding shall be performed only by TIG process. During welding, care shall be taken to minimize distortion and shrinkage and to obtain final tolerances within limits allowed by ASME Section VIII Division I unless otherwise mentioned and applicable drawings. Proper welding sequence and balanced techniques shall be adopted to minimize weld distortion. Welding filler wires required for TIG welding are in the scope of the contractor. The contractor shall provide relevant test certificate for chemical compositions of filler wire. During the manufacturing process representative of the purchaser will randomly collect weld samples for testing to ensure the quality of the filler wire.

Qualified welder shall carry out the welding of components. Applicable standard shall be ASME Sec. IX. The contractor shall submit a detailed weld data sheet indicating the welding parameters, permissible extent of each weld defects, inspection stages prior to, during and after welding for approval of purchaser. On receipt of approval by the purchaser, welding procedure

and performance qualifications shall be carried out and submitted to purchaser. The same procedure and qualified welders shall be employed while fabricating the components covered by this tender. Contractor shall make the necessary arrangement for welding qualification and testing of weld specimen with relevant reports. LPE shall be done for root as well as final welding. During welding, care shall be taken to minimize distortion and shrinkage and to obtain final tolerances within limits allowed by ASME Section VIII Division I. Proper welding sequence and balanced techniques shall be adopted to minimize weld distortion. No cold forming shall be carried out on any weld in the shell and dished end. Inter pass temperature during welding of austenitic SS shall not exceed 125 °C.

9. EXAMINATION, TESTING AND REPORTS

ASME section-V requirements shall be followed for inspection and testing of all components. NDE personnel employed for examination shall be qualified/certified by either ISNT or an authorized agency in accordance with IS 13805/ISNT-TC-1A of ASNT. Level I/II NDE personnel shall be employed for execution of examination and Level II/III personnel shall evaluate the indications. The supplier's factory/workshop shall be accessible for the purchaser's representative for stage inspection as and when required. All necessary arrangements for inspection and testing is in the scope of the supplier.

9.1 General

Supplier shall prepare inspection procedures for dimensional inspection, LPE, and any other inspection and testing called for in the tender and shall submit the same for Purchaser's approval. These inspections shall be carried out as per approved procedure.

The supplier shall provide for the inspection and testing services and facilities for all the manufacturing works. The supplier shall maintain records of all inspection and tests and these shall be made freely available to the purchaser's authorized representative. All welds shall be ground smooth and shall meet the weld fit up and other tolerances as defined in the drawings. Wherever weld fit up tolerances are not given, the supplier shall prepare the same and get it approved from Purchaser before welding.

9.2 Dimensional Inspection

Dimensional inspection for the individual components and the completed component assembly shall be carried out as per the approved procedures and shall meet the requirements of dimensions and tolerances specified in the drawings.

9.3 Visual Examination

Individual parts, subassembly of parts, and also final assembly shall be visually examined to check the soundness of the part. These shall be free from scratches, dents, tears or any other defects particularly affecting the thickness of the part.

The entire surfaces of formed parts shall be visually examined to check the soundness of the part. These shall be free from scratches, dents, tears or any other defects particularly affecting the thickness of the formed part.

Thorough visual examination of all weld joints shall be carried out after every pass and improper surface finish, weld spatter, surface cracks and surface porosity are not permitted.

9.4 Liquid Penetrant Examination (LPE)

On all weld edge preparations before welding, after carrying out root and final passes of all butt joints shall be subjected to LPE. LPE shall be carried out on each and every pass of butt joints wherever radiography is not possible. Inspection shall be carried out as per ASTM-E-165 and ASME section-V Article-6 and ASME Section VIII Div I shall be followed for acceptance criteria. All necessary arrangements for carrying out LPE and its processing are fully in the scope of the contractor.

8.4.1 Examination of formed parts⁹

Liquid Penetrate Examination on entire formed surfaces, shall be carried out after heat treatment and descaling.

9.4.2 Examination of welds

Liquid Penetrant Examination shall be carried out on root and final pass of all fillet and butt welds.

10. TEST FAILURE

In the event of any failure of the component to meet inspection or test requirements specified, the supplier shall inform to the Purchaser or his authorized representative.

The supplier shall obtain permission from the purchaser before carrying out any repair. All repaired weld joints shall be re-examined and re-tested as per the requirements of the original weld joint and shall meet the requirements of the same. The number of repairs permitted for any weld joint is limited to maximum two.

11. REPORTS

Deviation from the approved drawing, if any, shall be brought to the notice of the IGCAR engineer and approval shall be obtained. The supplier shall submit a detailed quality assurance plan along with the manufacturing drawing for purchaser approval. After completion of manufacture, inspection and testing of Test assembly, the supplier shall submit three copies of the following documents in book form along with as-built drawings.

- All shop drawings along with a soft copy in AutoCAD format.
- All procedures of manufacture and inspection along with a soft copy.
- All qualification, inspection and test reports in digital form.
- Copies all photos taken during different stages of manufacturing with a soft copy.

The supplier shall submit the documents within a period of 2 months from the date of issue of shipping release.

The above documents shall be duly signed by both the authorized representatives of the supplier and purchaser as mutually agreed upon. All the documents (other than drawings) shall be submitted in bound volumes.

12. CHEMICAL CLEANING AND TREATMENT:

All stainless steel materials shall be subjected to chemical treatment as per the procedure given in annexure 1. The equipment and chemical items required for the chemical cleaning is in the scope of the contractor.

13. PACKING AND TRANSPORTATION

On completion of fabrication the supplier shall deliver the fabricated components at IGCAR. Packing shall withstand any sort of shocks during handling, transportation and storing at site. Packing procedure shall be prepared by the supplier and submitted to the purchaser for approval. The packing shall be carried out as per approved procedure. All overhanging parts (nozzles, headers, etc.) shall be suitably stiffened by welding supports etc. to prevent damage due to

vibration. No movement of any parts is permitted during transportation. Transportation of fabricated components from the supplier's shop to IGCAR, Kalpakkam site shall be carried out by the supplier as per approved procedure.

All the surfaces shall be covered with polythene sheet.

Sufficient number of lifting hooks shall be designed and provided by the supplier as approved by the purchaser for lifting the structure when packed with the component, in horizontal condition as well as while making it vertical, and while lifting it in vertical condition. The transportation structure is meant for repeated handling and transportation of each component.

All flanges shall be bolted to their respective position to prevent any movement of component during shipment inside the structure. Component shall be placed on wooden/steel saddles which shall be bolted on to steel bottom frame with straps etc.

14. DELIVERY PERIOD

240 days from the date of receipt of purchase order.

15. GENERAL REQUIREMENTS

Supplier is responsible for any damage during transportation.

Any deviation from the specifications shall not be taken up without the approval of purchaser.

All materials including bolts, gaskets are to be procured by the supplier.

Any tool or fixture required during manufacture of the parts, transportation or during assembly/inspection of the parts shall be designed and fabricated by the supplier at no additional cost.

16. BIDS EVALUATION CRITERIA

- The firm should have necessary machining and fabrication capabilities to manufacture various components of this model. In case the supplier is willing to outsource the manufacturing of some components to third parties, the probable list of sub-vendors to be provided to the purchaser for evaluation along with the quotation. The supplier has the whole responsibility of the total work/supply and quality. Purchaser has right to cancel the sub-contract in the event of sub standard quality of work.
- Only suppliers who have previous experience in mechanical handling, machining/fabrication and assembly to close tolerances of similar machinery/equipments will be considered for award of contract.
- The technicians involved should be capable of reading and understanding engineering drawings. The supplier has to provide proof of experience of work of similar nature that they have successfully executed in the past.
- The manufacturing, assembly and testing of the vessel has to be carried out in weather protected enclosed area. Hence supplier should have separate manufacturing area for SS components with weather protection which can accommodate the final assembled vessel.
- Supplier should have necessary material handling equipments, overhead crane with at least 5 ton capacity, necessary shop floor area for assembly and inspection of the finally assembled vessel and storage area for the components.
- Only supplier who has these facilities will be considered for the award of contract.
- The assembly consists of all the components and shall be evaluated as a whole. Offer with part supply will not be evaluated.
- Any deviation shall be brought out clearly in their offer.

17. GUARANTEE

The supplier shall give a guarantee against any defect in materials and workmanship for a period of 12 months from the date of installation and for over 24 months from the date of receiving the fabricated components at site whichever is earlier.