SECTION ‘C’
TECHNICAL SPECIFICATIONS
OF
STORES AND DRAWINGS

Institute for Plasma Research

(An Aided Institute of Dept. of Atomic Energy)
Bhat, Gandhinagar

Eligibility Criteria (Annexure-A)

ITEM DESCRIPTION	**Preparation of fabrication drawings, supply, installation and testing of Secondary chamber assembly at FCIPT, Gandhinagar as per the detailed specifications mentioned in the tender document.**

Sr. No.	**Criteria**	**Documents required to submit / upload**
1	Bidder must have fabricated, supplied, installed & commissioned metallic chamber either of a) Min. 1 meter x 1meter x 1meter or b) Min 1.0 m3 clear volume. In last five years from the date of tender.	Bidder should upload copy of the purchase order/ contract with technical details along with installation/acceptance reports.
2	The Bidder must have ISO-9001:2015 certification	Bidder should upload copy of the valid certificate.
3	Bidder must have or access facility for design, fabrication, inspection and testing of metallic chamber.	Bidder should submit the a) Self-certificate certifying the details of in house facilities: and /or b) Copy of PO or invoice or the agreement with the vendors/sub-vendors for out sourced items.
4	Bidder must have an experience of refractory and/or thermal insulation lining application (refractory / insulation brick lining/castable lining etc.)	Bidder should upload: a) The copy of the purchase order/ contract along with the acceptance completion certificate; and/or b) The copy of agreement with the vendors/sub-vendors who involved in refractory and/or insulation lining application (refractory/ insulation brick lining/castable lining etc.)
	Note:	
a	The response to tender without submission of proof of above points will summarily be rejected without further communication	
b	The bidder shall not be under a declaration of ineligibility for corrupt or fraudulent practices or blacklisted with any of the Government agencies	
c	Original documents shall be produced for verifications, if required	

Tender document
For preparation of fabrication drawings, supply, installation and testing of Secondary Chamber assembly

Contents

1. Introduction

Pyrolysis system comprises of various subsystems such as feeder chamber, primary chamber, secondary chamber, gas cleaning system, induce draft fan, chimney, etc. There will be high temperature (1050 ±50 °C) inside the secondary chamber. The schematic of pyrolysis system is shown in figure 1 below. The schematic of secondary chamber is shown in figure 2 below. The operation and functional details of secondary chamber is briefed in section 1.1

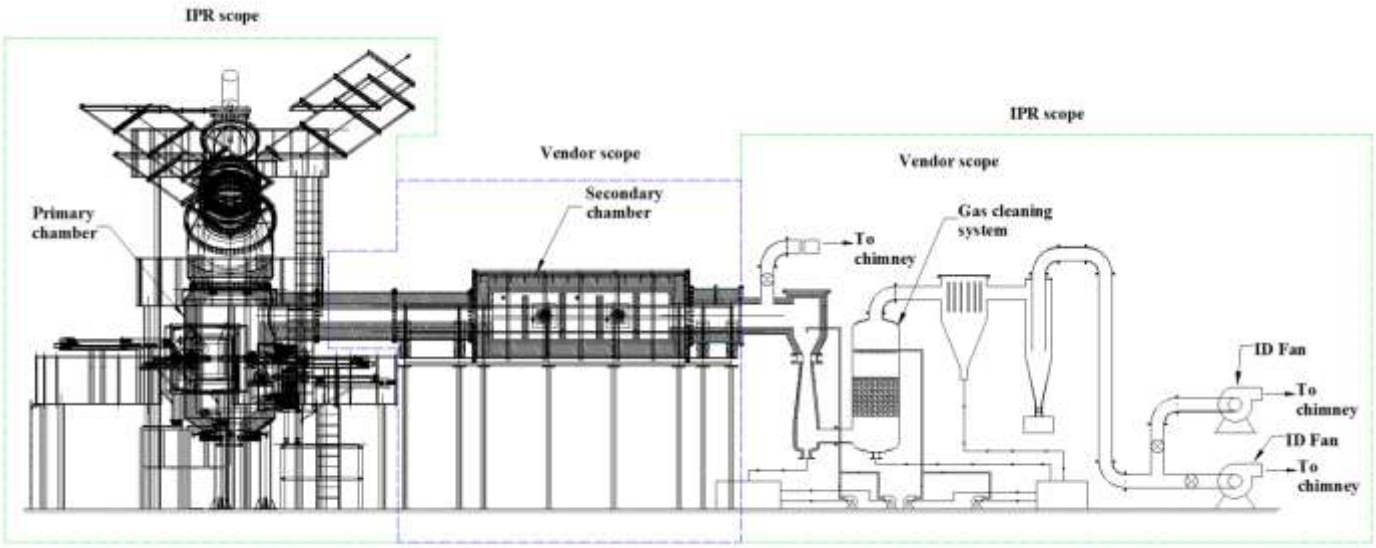

Figure 1: Schematic of 200 kg/hr plasma pyrolysis system

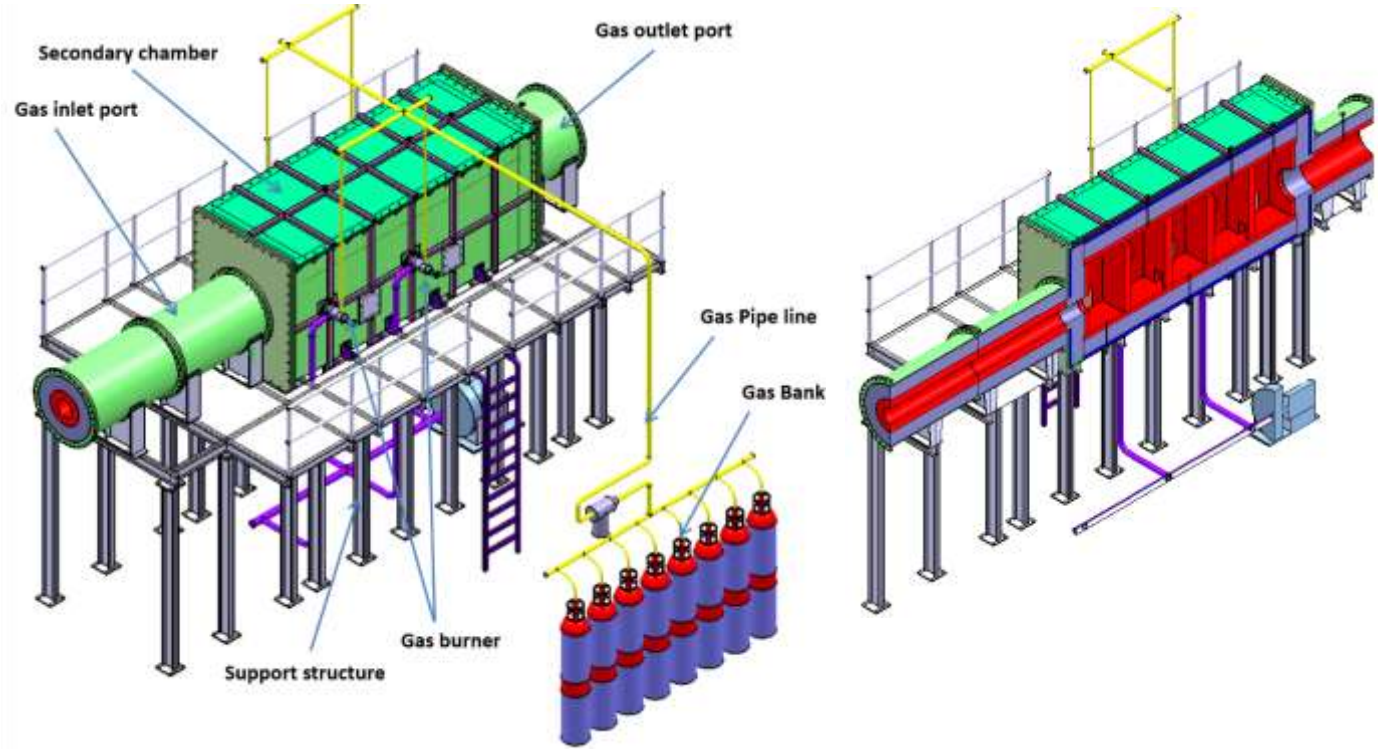

Figure 2: Secondary chamber assembly

1.1. Secondary chamber assembly

The product gas from the primary chamber will be piped to secondary chamber (combustion chamber) for combustion. In this chamber the product gas has to combustion and exhaust gas has to be sent to the gas cleaning system. Before waste will be charged into the plasma reactor, interlocks ensure that the ~~bulk~~ temperature of the secondary chamber will be at a temperature of 1050 ±50 °C prior to feeding waste. The gases coming from the primary chamber will have to reside a minimum 2.0 seconds in secondary chamber. Before feeding the waste in the plasma reactor the secondary chamber has to be preheated at a temperature of 1050 ±50 °C by using duel fuel (LPG/PNG) gas burner.

Secondary chamber assembly consists of gas inlet port connecting to primary chamber, main rectangular secondary chamber, gas outlet port to gas cleaning system, auxiliary air inlet port, duel fuel gas burner, R-type thermocouple, pressure gauge, service platform and support structure for secondary chamber assembly. The lining material is comprises of (a) refractory layer; (b) insulation layer (The details of all these insulation layer is given in sub-section 4.1) which is used to minimize the heat losses. The schematic of secondary chamber assembly is shown in figure 2 and figure 3. The material of construction (MOC) for secondary chamber is specified in the drawings under Appendix -I. The detailed specifications of secondary chamber assembly are given in sub-section 4.1.

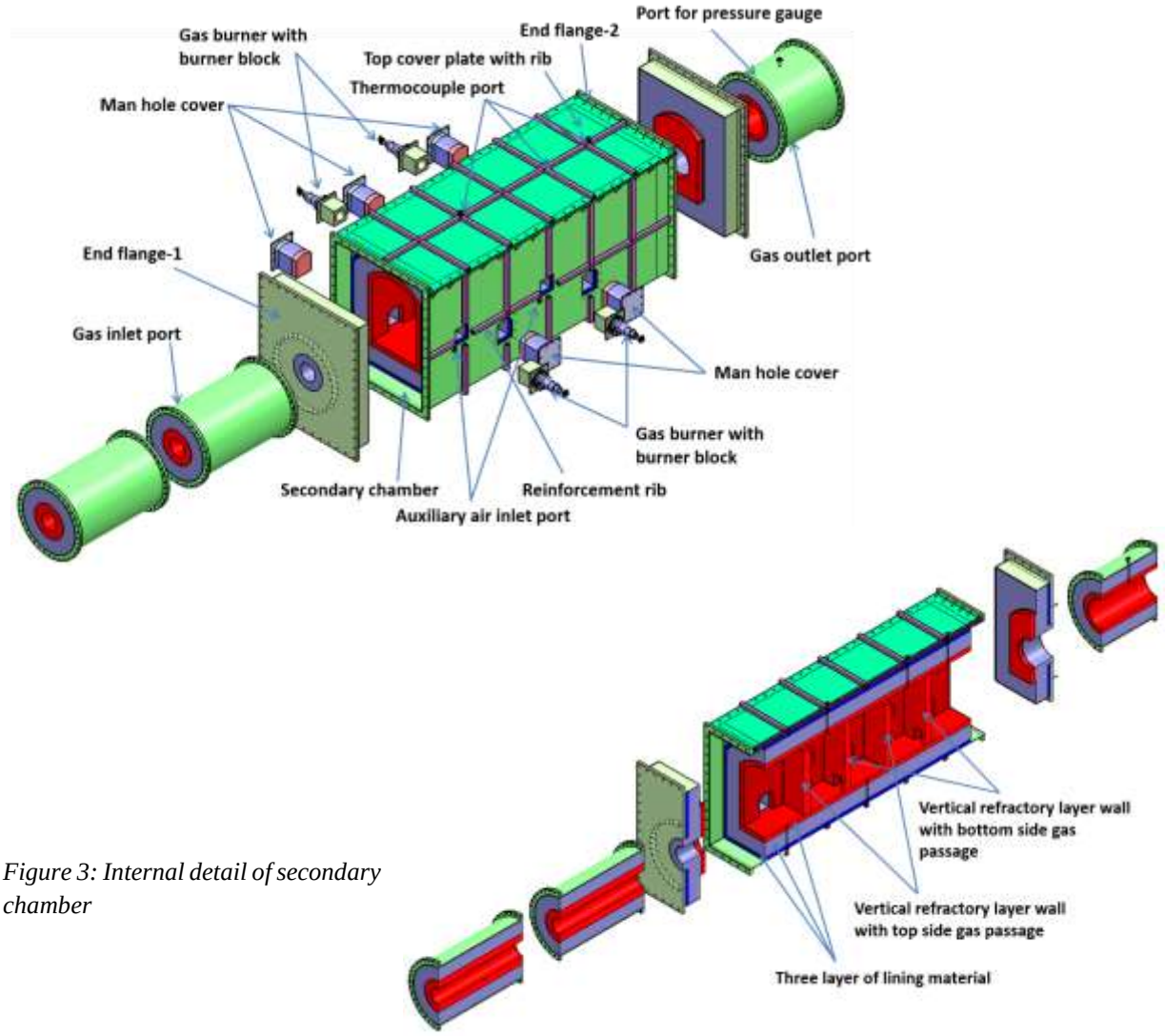

Figure 3: Internal detail of secondary chamber

2. Scope of work

2.1. The secondary chamber assembly comprise the followings which technical specifications are mentioned in section 4.1

Sr. no.	Item description	Quantity	Remarks
1.	**Secondary chamber**	**01 set.**	
	➢ Gas inlet port	02 no.	
	➢ Left side end flange	01 nos.	
	➢ Main rectangular chamber with top cover	01 nos.	
	➢ Right side end flange	01 nos.	
	➢ Gas outlet port	01 nos.	
	➢ Duel fuel gas burner	04 nos.	
	➢ R-type thermocouple	05 nos.	
	➢ Pressure gauge	01 nos.	
2.	**Support structure and service platform**	01 nos.	

2.2. The job consist of two items (i) Secondary chamber and (ii) support structure and service platform for various component and sub assembly mentioned in the 2.7 below. The design and analysis of item (1) is perform by IPR and respective engineering drawings are attached in Appendix I. the vendor shall responsible for fabrication, inspection, installation and testing of component and sub assembly as per tender specification for item no (1) for item no (2) vendor shall responsible for design, analysis, fabrication, inspection, erection and testing as per tender specification.

2.3. Vendor shall be responsible for raw material procurement, precision fabrication, lining material installation, welding joints, assembly, inspection, supply, installation and testing of the secondary chamber assembly as per the IPR's tender specifications & engineering drawing attached in Appendix-1.

2.4. Vendor shall prepare 3D CAD model (preferably use CATIA / AutoCAD / Solid works software), detailed manufacturing/fabrication drawings of components and assemblies with tolerances from supplied IPR's engineering drawings and submit to IPR for approval.

2.5. The Vendor shall quantify structural materials, lining material, high temperature gasket, gas burner etc. for successful fabrication, inspection, assembly and testing of secondary chamber assembly. Detailed Bill of Material (BOM) to be submitted to IPR for review and approval before start of procurement.

2.6. Vendor shall also prepare a list of additional items such as anchor, stud, clamp, suitable binder, mortar, castable material, retaining plate/ring, oxidizing materials etc. which would be necessary for holding and installing lining material inside the secondary chamber assembly. Vendor shall also have to submit BOM of such items to IPR for review and approval before start of procurement.

2.7. Vendor should follow the below mentioned point during the support structure and service platform design;

a) The support structure should be design by considering the load mentioned in the Appendix –V
b) The support structure has to be design by considering the 7 mm elongation of secondary chamber (due to the wall temperature of 80 ^{o}C) during heating from inside.
c) The center height of the secondary chamber is ~3.7 meter from ground.
d) The support structure has to be design in such a way so that the fuel line and air line for gas burner should be accommodated with appropriate support.
e) The service platform should be design by considering to access individual components during service, repair and maintenance.

f) The secondary chamber assembly including support structure and service platform are going to be installed and commissioned **Homi Bhaha Cancer Hospital (HBCH), Varanasi City site** after completion of successful erection and site acceptance test at FCIPT, Gandhinagar. The performance of support structures and service platforms is responsibility of vendor. Thus, Vendor shall perform design and analysis of support structures, service platforms and foundation taking in to consideration relevant constrains and conditions at Varanasi City. The analysis shall be performed considering three different cases ie. (1) Normal thermal (80 °C) and gravity (2) Seismic load (3) Combination of thermal, gravity and seismic.

g) The Gandhinagar city (Gujarat) and Varanasi city(Uttar Pradesh) fall under seismic zone III.

h) Vendor should consider the seismic zone III data for seismic analysis.

i) Vendor should follow IS 1893 (part 4): 2005 for seismic analysis.

j) Vendor should submit the safe design and analysis report for support structure and service platform to IPR for approval.

2.8. Vendor shall also have to provide weight details of each component including lining materials installed in it for review by IPR.

2.9. Vendor also has to provide details of lifting lugs & hooks on various components and assemblies for safe handling, transportation and also for safe maintenance work performed using crane. The location of the Lugs & hooks should be ensured considering center of gravity of the components.

2.10. Vendor shall prepare the components surface as per recommendation from OEM paint supplier and components should be painted externally with heat resistance alumina paint (two coats) suitable to withstand temperature up to 250°C with proper surface preparation.

2.11. Support structure and service platform shall be painted using black color after applying two coats of suitable anti corrosive chemical.

2.12. The vendor must follow, supply and assemble the components as per the list of preferred make prepared by IPR enclosed under Appendix –II.

2.13. Vendor's scope of work also includes the following points:

a) During the preparation of fabrication/manufacturing drawings, Vendor shall also study the fabrication feasibility and shall intimate to IPR for any modifications that may seem to be necessary for successful manufacturing/fabrication of components, sub-assemblies & assembly. After approval from IPR, vender shall incorporate necessary modification.

b) The manufacturing/fabrication drawing shall clearly indicate the welding process, weld serial no. and weld joint design considered for production of joints during assembly.

c) Vendor must also submit the fabrication methodology plan along with schedule in respect of section 11(delivery schedule) of this technical specification to IPR for approval.

d) Vendor should submit manufacturing and inspection Plan (MIP) to IPR for approval.

e) Vendor must also make a periodical review plan (part of MIP document) to be conducted by IPR's engineers at vendor's site.

f) Procurement of bought out items should be from original equipment manufacturer (OEM) or their authorized distributers/suppliers.

g) Procurement of all necessary raw materials, items and equipment with test certificates, wherever applicable. The test certificates should be submitted to IPR for approval.

h) Design, development and manufacturing of tools, jigs, fixtures and other accessories required for manufacturing of components & assemblies for secondary chamber assembly and lining materials installation.

i) Fabrication of all components, sub-assemblies and assembly according to the approved fabrication drawings by IPR as per delivery schedule shown in section 11.

j) Inspection & Testing of the materials, components & sub-assemblies at appropriate stages before the final assembly. Submission of appropriate test report to IPR before pre-dispatch inspection to be performed by IPR's engineers.
k) Factory acceptance tests shall be carried out at vendor site in presence of IPR's engineers.
l) Assembly of components and mechanical integrity shall be demonstrated by the vendor at factory site and IPR site.
m) Packaging and delivery of components to IPR with appropriate unloading instructions at IPR site after the dispatch clearance by IPR.
n) Vendor has to make arrangement for unloading, installation and testing of the secondary chamber assembly at IPR site.

2.14. Vendor should submit the assembly sequence for the secondary chamber assembly.
2.15. Vendor should use suitable anchor bolt for foundation of support structure at IPR site.

3. Code and Standard

I. All aspects of manufacturing, welding, heat treatment, inspection, etc. shall be performed in accordance to ASME Boiler & Pressure Vessel Code and/or relevant ASTM standards.
II. The material shall be procured in accordance with ASME section II of Boiler & Pressure Vessel Code for Materials and relevant ASTM standards.
III. Welding qualification shall be performed in accordance with the guidance provided in ASME section IX of Boiler & Pressure Vessel Code.
IV. Non-destructive examinations shall be performed in accordance with procedures mentioned in ASME section V of Boiler & Pressure Vessel Code.
V. Vendor shall define/propose additional Codes and standards as per good engineering practice for smooth execution.

4. Technical specification

Note: All dimensional details are included in the drawings. All the other fabrication related details have to be worked out by vendor and approval should be taken from IPR before starting of fabrication.

4.1 Secondary chamber assembly

Description	Specifications
Gas inlet port	➢ MOC: Specified in the engineering drawings under Appendix I. ➢ Lining materials thickness: (standard brick size: 230 x 115 x 75 mm, size tolerance : ± 1% or ± 1.0mm whichever is greater) (a) refractory layer = 115 mm (thick) (b) insulation layer type 1 = 200 mm (thick) (c) insulation layer type 3 = 5 mm (thick) ➢ Lining materials specification: lining materials should be procured as per detail given under Appendix –II and Appendix-III respectively.
Left side end flange	➢ MOC: Specified in the engineering drawings under Appendix I. ➢ Flange Type: Rectangular and integral type flange as per 2D drawings. ➢ Surface finish of gasket contact area of flange should be 3∇, other area shall have 2∇.

Main rectangular chamber with top cover	➢ MOC: Specified in the engineering drawings under Appendix I. ➢ Lining materials thickness: (standard brick size: 230 x 115 x 75 mm, size tolerance : ± 1% or ± 1.0mm whichever is greater) (a) refractory layer = 75 mm (thick) (b) insulation layer type 1 = 230 mm (thick) (c) insulation layer type 2 = 50 mm (thick) ➢ Lining material specification: lining materials should be procured as per detail given under Appendix –II and Appendix-III respectively. Vendor shall make support structure for connecting gas burners, fuel line, Air Line and its accessories.
Right side end flange	➢ MOC: Specified in the engineering drawings under Appendix I. ➢ Flange Type: Rectangular and integral type flange as per 2D drawings. ➢ Surface finish of gasket contact area of flange should be 3∇, other area shall have 2∇.
Gas outlet port	➢ MOC: Specified in the engineering drawings under Appendix I. ➢ Lining materials thickness: (standard brick size: 230 x 115 x 75 mm, size tolerance : ± 1% or ± 1.0mm whichever is greater) (a) refractory layer = 75 mm (thick) (b) insulation layer type 1 = 200 mm (thick) (c) insulation layer type 3 = 5 mm (thick) ➢ Lining materials specification: lining materials should be procured as per detail given under Appendix –II and Appendix-III respectively.
Duel fuel gas burner	➢ Gas burner with standard cast iron mounting: (a) Fuel used: LPG/PNG (b) Burner standard: ISO 13577-2:2014 (c) Mode of operation: Automatic i. Burner should be operated with temperature feedback control. ii. The air fuel ratio should be control automatic using PID controller for each burner. (d) Each burner capacity: 100000 Kcal/hr (±10%). (e) Operating temperature in the secondary chamber: 1050 ±50°C (f) Total no of Burner: 04 nos. (g) Each burner has separate control and maintains the temperature in each segment in the secondary chamber. (h) Each burner should be operated in the range of 40% to 100% of its capacity. (i) Assembled long last burner block with SS tile jacket for gas burner (j) All accessories for proper functioning of burner such as (a) Air Line accessories (such as but not limited to, wafer style butterfly valve with modulating motor/servo control motor for each burner, air pressure gauge, air pipe line for combustion and atomizing air) (b) Combustion and atomizing blower (c) Auto ignition and flame failure safety device (Pilot burner) with airline, gas line and control accessories.

	(d) Gas line accessories (such as but not limited to gas pressure gauge, gas pressure regulator, ball valve, gas filter, gas solenoid valve, flame shut off valve, pressure reducing valve, air fuel ratio valve for each burner, gas pipe line) (e) Gas train (f) Gas flow meter (g) Gas vaporizer (appropriate capacity) (h) Control panel (i) Flame sensor (UV) Note: All four nos. of burners and its accessories should be mounted on the secondary chamber assembly and its support structure. **Acceptance criteria : according 10.1 and 10.2**
Support structure	➢ MOC: Mild Steel (M.S.) IS 2062 GRADE E300/E350 Quality A or BR. ➢ The support structure should enough to take load as per Appendix-V
Service platform	➢ MOC: Mild Steel (M.S.) IS 2062 GRADE E300/E350 Quality A or BR. ➢ To access individual components during service, repair and maintenance. ➢ The width for service platform shall have to accommodate minimum 3 persons during operation, repair and maintenance. ➢ The service platform should be sturdy enough to take load of minimum 3 persons and /or other structures connecting it. ➢ The design of service platform should be such that it can be dismantled and/or move away during repair/replacement of any components of secondary chamber assembly.
Thermocouple for gas burner feedback control	➢ R-type , ceramic sheath covered ➢ Length of thermocouple: 500 to 550 mm long ➢ Diameter of ceramic sheath pipe: ~ 20mm ➢ Total number of thermocouple: 05 nos.
Pressure gauge	➢ Compound type pressure gauge ➢ Pressure range: -ve 1 mbar to 2 bar (g) ➢ Total number of pressure gauge: 01 nos.
Sealing requirement	➢ Ceramic fiber gasket or equivalent properties gasket of min. 5 mm thickness that can withstand temperature of 1000 ^{o}C. ➢ Fasteners MOC: SA-193 B7 heavy hexagonal type.

Note: All dimensional details are included in the drawings. All the other fabrication related details have to be worked out by vendor and approval should be taken from IPR before starting of fabrication.

5. Materials

I. The secondary chamber, support structures and service platform and other components should be made up of the material as indicated under section 4 and Appendix-II respectively.

II. The structural materials shall be tested by the vendor in procured condition for its chemical and mechanical properties as well as for any internal defect.

III. The lining materials shall also be tested by the vendor for its thermo-physical properties mentioned under Appendix-III. The test certificate should clearly indicate the properties mentioned under Appendix-III for each lining material.

IV. Vendor shall submit test certificates of structural materials and lining materials to IPR issued by **NABL accredited laboratory or else Government Organization laboratory** for acceptance of material properties by IPR before starting of the fabrication and lining work at factory site.

V. Vendor shall supply test specimens of structural materials and lining materials as per relevant ASTM standards. IPR may get the materials tested from third parties and in case, if material is found non-complying with IPR specification then the material will be rejected.

VI. Vendor shall have to submit technical data sheet of lining materials in respect of properties mentioned in under Appendix-III specifying particular brand/make for properties verification and technical qualification. Vendor shall also have to submit detail of recommended binders to be used for lining materials.

VII. Vendor shall submit proof of materials procurement (i.e. invoice copy/challans/bills/purchase order along with delivery note from OEM/authorized distributes/dealers) in respect of Appendix-II.

VIII. Vendor shall use fastener (bolts, studs, nut, etc.) confirming to ASME/ASTM standards unless otherwise specified in this document.

6. Instruction to vendor

I. The Load bearing capacity of construction shed floor area is 3 tons/m^2

II. IPR reserves right to participate and review the progress of the work at any stage. The vendor shall agree to make appropriate arrangement for this at vendor's premises or at any other place where such activities may be carried out.

III. IPR will have exclusive right on the activities related to work contract and the vendor shall not disclose any information to others at anytime, anywhere without prior written permission from IPR as it is highly confidential.

IV. All documents related to fabrication submitted by vendor shall be the intellectual property of IPR.

V. The vendor shall provide proper aesthetic to secondary chamber assembly along with support structures and service platform.

VI. All scaffolding, hoisting arrangements, lifting devices, tools, ladders and equipment's etc. required for facilitating of frame structure erection at FCIPT shall be provided and removed on completion work by the vendor, at vendor's own expense. The scaffolding, hoisting arrangement, ladders etc. shall be strong enough to withstand all live, dead and impact loads expected to act. However, Vendor shall be solely responsible for the safety of the scaffolding, hoisting arrangement, ladders, work and workmen, personnel etc.

VII. Supply and installation of Hardware needed for supporting like Clamps/Steel Chain for mounting, Bolts/Nuts, Anchor bolts and Screws for mounting on other Structure shall be borne by the vendor during the execution of the work.

VIII. Erection in general, of the entire/part structure shall be carried out as per the requirement. Positioning and levelling of the structure, alignment and plumbing and fixing every member of the structure shall be in accordance with the relevant drawings and to the complete satisfaction of IPR.

IX. Qualified welders, fitters, painters and other manpower required for workmanship (like steel works, cutting, welding, bolting, material handling, painting etc.) for assembly and erection of secondary chamber assembly.

X. All standard safety measures have to be followed during execution of the work. The Vendor shall be responsible for comprehensive workmanship compensation insurance for any accidents/incidents of the personnel at IPR work site.

XI. The rate includes cost of all material, labour, erection, hoisting, scaffolding, safety measures and sundry required for proper completion of the item of work, at all heights. This shall also include transportation and delivery, handling, loading, unloading and storing etc. required for completion the item described above including necessary wastage involved.

XII. The area of construction shed where this assembly is to be installed and commissioned with other sub-systems is 30 meter (long) x 10 meter (width). The height from ground level to bottom of the hook of installed overhead crane is 12 meter. The EOT crane is of 10 Ton capacity.

7. Machining, Fabrication and cleaning

I. The cutting of material from the supplied lot should ensure sufficient margin to avoid heat affected areas causing material degradation.

II. During machining, the cutting fluids used shall be water soluble, non-halogenated and phosphorus and sulphur free.

III. The components/assemblies shall be mechanically cleaned for removal of all weld tacks, sharp edges & projections, dust and particles generated during grinding. Remove gross contamination from all interior and exterior surfaces (including flange faces) by cleaning.

IV. The interface surface of connecting components shall be grounded smooth to 2∇ surface finish unless otherwise specified under section 4.

V. Machined parts and fabricated components shall be degreased using solvents or alkaline detergents, rinsed with demineralized water, and dried completely before starting welding job.

VI. Vendor has to submit WPS, PQR, and WPQ and weld plan to IPR for approval before executing the work.

VII. Vendor shall provide assembly marking on fabricated components for ease of assembly and disassembly of components of assemblies during repair and maintenance.

VIII. The welding shall be carried out only by qualified welders. Qualification of welders shall be accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section IX.

IX. Full penetration weld should be employed wherever it is possible. Trapped volume should be avoided during welding.

X. Single pass weld up to a maximum extent is preferred. Interruption during welding should be reduced to a minimum possible extent.

XI. If leak develops; weld metal shall be removed and joint shall be re-welded with appropriate weld repair procedure.

XII. Filler material, if used, should be compatible with the parent material.

XIII. All welds should be grounded smooth and flush with adjoining surfaces with convex curvature.

XIV. Remove material markings etc. with acetone followed by cleaning with Phosphate free alkaline detergent and rinsing with DM water.

XV. Drying will be accomplished by blowing clean dry air over the component. Inspect and cover the component as soon as after drying as possible and store in clean area. Avoid contamination from unfiltered shop air.

XVI. Immediately after inspection, cover the components with double wrap of clean, oil-free polyethylene and seal them.

XVII. Welder qualification will be witness by IPR engineers at factory site.

8. Lining materials installation

I. Vendor shall start installation of lining materials at factory after getting acceptance form IPR on submitted test certificates of lining materials.

II. Vendor shall carry out lining material installation as per approved fabrication drawings including lining work.

III. IPR representative will witness lining materials installation work carried out by vendor at factory site.

IV. Vendor shall deploy adequate number of skilled refractory masons and experienced supervisors along with un-skilled workers as per lining work job at factory site.

V. Vendor may use high temperature castable instead of layers of brick lining where brick lining is not possible due to inadequate space, components shape/orientation, etc. In such case, vendor has to do the following:

1. Vendor shall provide proper justification for such relaxation in the bid.
2. Vendor shall demonstrate mechanical integrity and homogenous structure of castable material through prototype component trials before actual work. At those location all layers shall be of same castable materials.
3. The properties of **castable material** should be in compliance with those mentioned under Appendix- III.
4. Installation of castable material with anchor made up of SS-316.

VI. For acceptance of lining materials such as Refractory layer, Insulation layer type 1 and insulation layer type 2 respectively, the thermal conductivity measurement test to be carried out by vendor is permitted to perform at lower temperature but not less than 550 degree Celsius subject to condition that vendor has to prove the test result achieved is in compliance with the value shown in lining material data sheet at particular temperature of respective manufacture. The measurement value of other properties are identical as shown in respective table under Appendix-III

9. Inspection and Testing procedure

I. All the fabrication drawings with dimensions and tolerances shall be checked and should be submitted to IPR for necessary approval.

II. IPR representative shall have access to all manufacturing and fabrication facilities, inspection and testing facilities, tools, drawings etc. during all stages of manufacturing.

III. Vendor has to submit final fabrication drawings and testing reports to IPR, based on which, IPR can decide to do or not to do the Pre-dispatch Inspection.

IV. The components manufacturing, fabrication and assemblies should be done as per tolerances given in IS 2102-1 1993 tolerance class c respectively.

V. All the components and/or sub-assemblies should be checked for surface finish and dimensional accuracy. Vendor has to submit the dimensional check and surface check report for components and assemblies.

VI. Dye Penetrant (DP)/Liquid Penetrant Test (LPT) is mandatory for all weld joints.

VII. 10% Radiography Test (RT) shall be carried out for all butt weld joints as per relevant ASME/ASTM standard. In case, RT is not feasible due to technical reason than Ultrasonic Examination in lieu of Radiography test to be carried out.

VIII. All the components shall be delivered only after shipment clearance from IPR.

IX. The vendor shall submit inspection and testing procedures to IPR for review and approval before starting the FAT

X. The preferred inspection and/or testing methods and respective acceptance criteria are described below;

a) Visual inspection

(i) Visual inspection shall be performed as per ASME Section V_Subseciton A - Article 9.
(ii) Visual inspection of components for any defects, crack, flaws etc.
(iii) A visual inspection shall be made of exterior and interior surfaces.
(iv) Visible particulates or actual contamination shall be removed.

b) Liquid Penetrant Test (LPT)

(i) All welded joints shall be tested by vendor with Liquid Penetrant Test as per guidance provided in ASME Section V_Subseciton A - Article 6.

(ii) The Liquid Penetrant tested areas shall be cleaned by hot detergent wash. The water temperature shall be kept at 60°C and then these tested areas shall be dried completely. In ase, vendor finds unacceptable defect, the same shall be notified to IPR.

(iii) The procedure for testing shall be submitted to IPR for review and approval.

(iv) Acceptance criteria;

(1) Imperfections producing indications with major dimensions greater than 1⁄16 in. (1.5 mm) shall be considered relevant imperfections.

(2) Imperfections producing the following indications are also unacceptable:

- Any cracks or linear indications with length three times greater than the width;
- Rounded indications with dimensions greater than 3⁄16 in. (5 mm);
- Four or more rounded indications in a line separated by 1⁄16 in. (1.5 mm) or less edge to edge;
- Ten or more rounded indications in any 6 sq in. (4000 mm^2) of surface with the major dimension of this area not to exceed 6 in. (150 mm) with the Area taken in the most unfavorable location relative to the indications being evaluated.

c) Dimensions check

(i) The dimensions with specified tolerance shall be measured and verified for components, sub-assemblies and assembly with those mentioned in the approved fabrication drawings including lining material.

(ii) If the components, sub-assemblies and assembly are not found as per approved fabrication drawings, then faulty components, sub-assemblies and assemblies shall be rejected by IPR.

(iii) New components, sub-assemblies and assemblies need to be freshly fabricated by vendor if the vendor fails to prove the inspection.

d) Radiography Testing

(i) Radiography testing for weld joints shall conform to guidance provided in ASME section V_ Subsection A - Article 2.

(ii) Radiographic film interpretation shall be done by ASNT level II certified personnel.

(iii) For all thickness X-rays shall be used as source of radiation. Gamma rays shall be employed only when X-rays is not feasible.

(iv) Procedure for Radiography testing shall be submitted to IPR for review and approval.

(v) Acceptance criteria;

(1) Cracks, Lack of Penetration (LOP), Lack of Fusion (LOF), Oxidation, Undercuts, Linear and angular defects of any type, surface defects in the region of weld and HAZ involving either stress raisers or loss of wall thickness, root concavities shall not be acceptable.

(2) Porosity and spherical inclusions in excess of limits stated below:

- Plate thickness 3mm & less: Defect free weld is required.
- Plate thickness > 3mm and ≤ 6mm: Isolated globular inclusions / porosity permitted provided they are not larger than 0.8 mm diameter in any portion of the weld and do not exceed 4 in number in any length of 300 mm and are separated from each other by at least 4 times their diameter.
- Plate thickness >6mm and ≤ 16mm: Isolated globular inclusions / porosity permitted provided they are not larger than 1.5 mm diameter in any portion of the weld and do not exceed 4 in number in any length of 300 mm and are separated from each other by at least 4 times their diameter.
- Plate thickness >16mm and < 50mm : Isolated globular inclusions / porosity permitted provided they are not larger than 4 mm diameter in any portion of the weld and do not exceed 4 in number in any length of 300 mm and are separated from each other by at least 4 times their diameter.

(3) Indications shown on the radiographs of welds and characterized as imperfections are unacceptable under the following conditions:

- Any indication characterized as a crack or zone of incomplete fusion or penetration;
- Any other elongated indication that has a length greater than
  - (i) 1⁄4 in. (6 mm) for t up to 3⁄4in. (19 mm), inclusive
  - (ii) 1⁄3t fort from 3⁄4in. to 2 &1⁄4 in. (19 mm to 57 mm), inclusive
  - (iii) 3⁄4 in. (19 mm) for t over 2 &1⁄4 in. (57 mm)

Where t is the thickness of the thinner portion of the weld

e) Ultrasonic Examination (In lieu of Radiography testing)

(i) Ultrasonic examination shall be carried in accordance with ASME section V_Subseciton A – Article 4.

(ii) The Ultrasonic Examination procedure shall be submitted to IPR for review and approval.

(iii) Acceptance criteria:

Imperfections which produce a response greater than 20 % of the reference level shall be investigated to the extent that the operator can determine the shape, identity, and location of all such imperfection and evaluate them in terms of the acceptance standards given in (I) Below;

I. Imperfections are unacceptable if the indications exceed the reference level amplitude and lengths exceeding:

(i) ¼ in. (6 mm) for t up to ¾ in. (19 mm), inclusive

(ii) 1/3rd t for t from ¾ in. (19 mm) to 2 ¼ in. (57 mm), inclusive

(iii) ¾ in. (19 mm) for t over 2 ¼ in. (57 mm)

10.Acceptance test

10.1 Factory Acceptance Test (FAT)

- The vendor is responsible for necessary arrangement for inspection and testing during FAT as per approved Manufacturing and Inspection Plan (MIP).
- The inspection and testing shall be performed are mentioned in the table below;

	Inspection and testing as per approved MIP
01	➢ All the test certificates, stages inspection reports, verified and check. ➢ Dimensions of components and/or sub-assemblies, support structure and overall assembly of secondary chamber assembly including tolerance shall be measured and verified. ➢ Weld joints inspection to be performed followed by IPR approved NDT methods. ➢ Assembly of the system will be checked. ➢ Visual inspection of lined materials for any damage, crack, etc. to be performed. ➢ Marking for assembly and disassembly of components, sub-assemblies and assembly will be checked. ➢ Integrity and interface requirement as per drawings.(DRG No: IPR/APD/CBWTF200/A3/SEC/01)
02	Gas burner testing: Vendor has to demonstrate two number of testing cycle as followings; ➢ Continuous operation of individual gas burner (including spare burner) without integration and with full capacity (100000 Kcal/hr ±10%) for 2 hour in open atmosphere without interruption of the flame.

	➢ Continuous operation of the all four gas burner (integrated with secondary chamber) in the secondary chamber for 6 hour without any interruption and system will be cooled down subsequently in normal atmosphere before start second testing cycle, during this operation the carbon monoxide and NOx in the exhaust gas shall be < 100 ppm and < 400 mg/Nm^3 respectively. ➢ The vendor has to demonstrate the burner capacity (100000 Kcal/hr ±10%) by gas consumption using gas flow meter. ➢ The burner should have proper control mechanism to control the capacity (100000 Kcal/hr ±10%) in the range of 40% to 100% will be checked. ➢ The operation of gas burner at set value of the temperature (up to 1100°C) in the controller. ➢ All necessary arrangements including consumable like gas PNG/LPG, piping/couplings, shall be arranged by the vendor at the time, until the successful completion of FAT. Vendor shall ensure all the safety requirements during the testing

10.2 Site Acceptance Test (SAT)

➢ Vendor is responsible for necessary arrangement for inspection and testing during SAT as per approved Manufacturing and Inspection Plan (MIP) at IPR site.

➢ The inspection and testing are mentioned in below table;

Sr. no.	Inspection and testing
01	➢ Visual inspection for any damage, cracks, etc. in structural components and installed lining materials to be checked. ➢ Assembly of the system will be checked. ➢ Installation of secondary chamber assembly along with gas burner assembly. The chamber assembly will be installed on the support structure at IPR site by the vendor. And assembly will be checked.
02	Gas burner testing: Vendor has to demonstrate two number of testing cycle as followings; Vendor has to demonstrate two number of testing cycle as followings; ➢ Continuous operation of individual gas burner (including spare burner) without integration and with full capacity (100000 Kcal/hr ±10%) for 2 hour in open atmosphere without interruption of the flame. ➢ Continuous operation of the all four gas burner (integrated with secondary chamber) in the secondary chamber for 6 hour without any interruption and system will be cooled down subsequently in normal atmosphere before start second testing cycle,

	during this operation the carbon monoxide and NOx in the exhaust gas shall be < 100 ppm and < 400 mg/Nm^3 respectively. ➢ The vendor has to demonstrate the burner capacity (100000 Kcal/hr ±10%) by gas consumption using gas flow meter. ➢ The burner should have proper control mechanism to control the capacity (100000 Kcal/hr ±10%) in the range of 40% to 100% will be checked. ➢ The operation of gas burner at set value of the temperature (up to 1100°C) in the controller. ➢ All necessary arrangements (excluding gas PNG/LPG) piping/couplings shall be arranged by the vendor at the time, until the successful completion of SAT. Vendor shall ensure all the safety requirements during the testing. ➢ IPR will arrange gas bank for testing at IPR site.

11. Delivery schedule

Phase	Deliverable	Time from acceptance of P.O (T0)
I	Submission of Quality plan, MIP including PERT chart and Support structures & service platforms design and analysis report to IPR	T0 + 04 weeks = T1
II	Review and approval by IPR of documents and/or reports submitted against point I above.	T1 + 04 weeks = T2
III	Submission of Manufacturing/Fabrication drawing, engineering drawings including lining material installation, Lining material installation procedure and assembly & disassembly procedure to IPR	T2 + 04 weeks = T3
IV	Review and approval by IPR of documents and/or reports submitted against point III above.	T3 + 03 weeks = T4
V	Submission of Material Test Certificates, Material identification and marking Procedure, Welding Consumable Test Certificate, Welder qualification and test reports and WPS , PQR , WPQ and Weld Plan to IPR	T4 + 5 week = T5
VI	Review and approval by IPR of documents and/or reports submitted against point V above.	T5 + 02 week = T6
VII	Fabrication of components/sub-assemblies including lining material installation and completion of Factory Acceptance Test (FAT) as per PO.	T6 + 24 week = T7
VIII	Issuance of dispatch clearance by IPR after successful completion of FAT.	T7 + 01 weeks = T8
IX	Delivery and physical verification of items as per PO at FCIPT	T8 + 02 weeks = T9

X	Installation, erection and testing of assembly and successful completion of Site acceptance (SAT) test as per PO.	T9 + 03 weeks = T10

12. Document to be submitted

12.1 The following documents shall be submitted to IPR (Total 1 set of soft copy & 2 set of Hard copy) for approval.

1. Quality Plan
2. Manufacturing and Inspection plan
3. Support structures and service platforms design and analysis report
4. Manufacturing/Fabrication and engineering drawings file including lining material installation
5. Lining material installation procedure
6. Assembly and disassembly Procedure
7. Material Test Certificates
8. Material identification and marking Procedure
9. Welding Consumable Test Certificate
10. Welder qualification and test reports
11. WPS , PQR , WPQ and Weld Plan
12. Gas burner operation manual.

12.2 The following documents shall be submitted to IPR (Total 1 sets of soft copy & 2 set of hard copy) before Factory Acceptance Test (FAT)

1. As Built Drawings file
2. NDT report
3. Reports on weld repairs and other rectification if any

13. Insurance, packing, handling and Supply

I. Vendor/Contractor shall pack all the components with the proper material to avoid damages during transportation.

II. Vendor/Contractor shall inform IPR authority before supply of the material to IPR.

14. Warranty

Twenty four (24) months from date of final acceptance of the system at IPR site for poor workmanship, welding/fabrication/painting, lining work installation, faulty material, electronics items etc. During this period if any fault occurs/detected in contractor's services, contractor shall rectify the same at no extra cost at IPR site. In the event contractor fails to fulfil his obligations, IPR shall have the right to remedy or to have remedied the defect/fault, in both cases to contractor's account.

15. Post warranty support

The vendor shall confirm that they will provide the post-warranty support for additional three years after expiry of warranty period i.e. 2 year for any of the mechanical damages or lining material damages in the supplied assembly at **Homi Bhaha Cancer Hospital (HBCH), Varanasi City**. However, the cost for such post-warranty support is **"Not To Be Included"** in the quotation against the present tender. **Vendor has to give agreement certificate for post warranty support.**

Appendix – I

Please find attached separately engineering drawings of secondary chamber assembly (pdf version). The list of attached drawing are mentioned here below

Sr. no.	Drawing number
01	IPR/APD/CBWTF200/A3/SEC/01(Assembly)
02	IPR/APD/CBWTF200/A3/SEC/01-1
03	IPR/APD/CBWTF200/A3/SEC/01-2
04	IPR/APD/CBWTF200/A3/SEC/01-3
05	IPR/APD/CBWTF200/A3/SEC/01-4
06	IPR/APD/CBWTF200/A3/SEC/01-5
07	IPR/APD/CBWTF200/A3/SEC/01-6
08	IPR/APD/CBWTF200/A3/SEC/01-7
09	IPR/APD/CBWTF200/A3/SEC/01-8
10	IPR/APD/CBWTF200/A3/SEC/01-9
11	IPR/APD/CBWTF200/A3/SEC/01-10
12	IPR/APD/CBWTF200/A3/SEC/01-11
13	IPR/APD/CBWTF200/A3/SEC/01-12
14	IPR/APD/CBWTF200/A3/SEC/01-13
15	IPR/APD/CBWTF200/A3/SEC/01-14
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18	IPR/APD/CBWTF200/A3/SEC/01-17
19	IPR/APD/CBWTF200/A3/SEC/01-18
20	IPR/APD/CBWTF200/A3/SEC/01-19
21	IPR/APD/CBWTF200/A3/SEC/01-20
22	IPR/APD/CBWTF200/A3/SEC/01-21
23	IPR/APD/CBWTF200/A3/SEC/01-22
24	IPR/APD/CBWTF200/A3/SEC/01-23
25	IPR/APD/CBWTF200/A3/SEC/01-24
26	IPR/APD/CBWTF200/A3/SEC/01-25

Appendix – II

LIST OF SUGESTED MAKE

Sr. No.	Item Description	Make/brand
1.	Plate, pipe, forged, rod, etc. of materials as specified in the engineering drawings under Appendix-I.	Tata, SAIL, RINL, Jindal, Fortran Steel Private Limited, Phenix creation simplified **or equivalent make/brand**.
2.	Structural Rolled Steel sections- beams, channels, tee, flats, angles, bars (round, square, hexagonal) of Mild Steel (M.S.) IS 2062	Tata, SAIL, RINL, Jindal, Fortran Steel Private Limited, Phenix creation simplified **or equivalent make/brand.**

	GRADE E300/E350 Quality A or BR.	
3.	Structural Hollow steel sections (Square & Rectangular) and tubular sections of Mild Steel (M.S.) IS 2062 GRADE E300/E350 Quality A or BR.	Tata, Asian, APL Apollo tubes Ltd., Phenix creation simplified, Fortran Steel Private Limited **or equivalent make/brand.**
4.	Structural tubular sections of Mild Steel (M.S.) IS 2062 GRADE E300/E350 Quality A or BR.	Tata, Asian, APL Apollo tubes Ltd., Phenix creation simplified, Fortran Steel Private Limited **or equivalent make/brand.**
5.	Duel fuel Gas burner	Continental thermal engineers Pvt. Ltd. , Honeywell kromschroder, Encon thermal engineers, Bloom engineering, Hotwork combustion technology ltd. **or equivalent make/brand.**
6.	Refractory layer.	Brick of Calderys, Carborundum Universal Limited (CUMI), MG Materials India, Promat, Mogan Advance materials or **equivalent make/brand** that conforms to technical specification mentioned under Appendix-III.
7.	Insulation layer type 1.	Brick of Calderys, Carborundum Universal Limited (CUMI), Promat, MG Materials India, Mogan Advance materials **or equivalent make/brand** that conforms to technical specification mentioned in Appendix-III.
8.	Insulation layer type 2.	Ceramic fiber board of Mogan Advance materials, Unifrax, Ceramaterials, gtlproduct, Calderys, MG Materials India, Carborundum Universal Limited (CUMI) **or equivalent make/brand** that conforms to technical specification mentioned in Appendix-III.
9.	Insulation layer type 3.	Ceramic fiber paper of Mogan Advance materials, Unifrax, Ceramaterials, Calderys, MG Materials India, Carborundum Universal Limited (CUMI) **or equivalent make/brand** that conforms to technical specification mentioned in Appendix-III.
10	Castable material	Calderys, Carborundum Universal Limited (CUMI), Promat, MG Materials India, Mogan Advance materials **or equivalent make/brand** that conforms to technical specification mentioned in Appendix-III.
10.	Welding rod.	Esab India (7018 or 7014) or equivalent
11.	Construction chemicals (if any).	M.C.Bauchemie, FosrocSika, Cico, Pidilite, Sika, Ashford, BAL, Krishnaconchem or equivalent.
12.	Joint Filler/silicon paint.	Wacker, Dowcorning, Sika, Chokshi or equivalent.
13.	Paint, primer, putty.	Asian, Berger, Nerolac, ICI, Birla (putty) Roofit(Putty) or equivalent.
14.	Polish.	MRF, Asian, ICI, Taralac or equivalent.
15.	Adhesives.	Fevicol, Kitcol, Araldite, BAL or equivalent.
16.	Anchor fastener/bolts.	Sundaram, Hilti.Fischer or equivalent.

Appendix – III

Technical specification for lining materials

I. Refractory layer (size: ~ 230 x 115 x 75 mm)

Parameters	Properties
Maximum service temperature, (℃)	1600℃ - 1850℃
Bulk density, (kg/m3)	1100 - 1300 kg/m3
Cold Crushing strength (kg/cm^2)	≥ 30 kg/cm2
Thermal conductivity, (W/m-K)	≤ 0.61 W/m-K @ temperature 800℃
Note: Side arc/End arc brick is recommended wherever applicable.	

II. Insulation layer type 1 (size: ~ 230 x 115 x 75 mm)

Parameters	Properties
Classification temperature, (℃)	1250℃ - 1550℃
Bulk density, (kg/m3)	700 - 950 kg/m3
Cold Crushing strength (kg/cm^2)	≥ 20 kg/cm^2
Thermal conductivity (W/m-K)	≤ 0.41 W/m-K @ temperature 800℃
Note: Side arc/End arc brick is recommended wherever applicable.	

III. Insulation layer type 2 (Size: ~1000 x 500 x 50mm)

Parameters	Properties
Classification temperature, (℃)	1150℃ – 1450 ℃
Bulk density, (kg/m3)	650 - 800 kg/m3
compressive strength (kg/cm^2)	≥ 20 kg/cm^2
Thermal conductivity (W/m-K)	≤ 0.14 W/m-K @ temperature 550℃

IV. Insulation layer type 3 (Size: ~ 1220 x 12000 x 5 mm)

Parameters	Properties
Classification temperature, (℃)	1250℃ - 1550℃
Bulk density, (kg/m3)	150 - 250 kg/m3
Tensile strength (kPa)	≥ 200 kPa
Thermal conductivity, (W/m-K)	≤ 0.10 W/m-K @ temperature 400℃

V. Castable material

Parameters	Properties
Classification temperature, (^{0}C)	1200^{0}C - 1700^{0}C
Bulk density, (kg/m3)	700 - 1300 kg/m3
Cold Crushing strength, (kg/cm^2)	≥ 25 kg/cm^2
Thermal conductivity (W/m-K)	≤ 0.40 W/m-K @ temperature 600^{0}C

Appendix – IV

List of spare items

The vendor shall submit the quote for the following **spares mandatorily in price Bid**. Vendor should also specify the quantity offered.

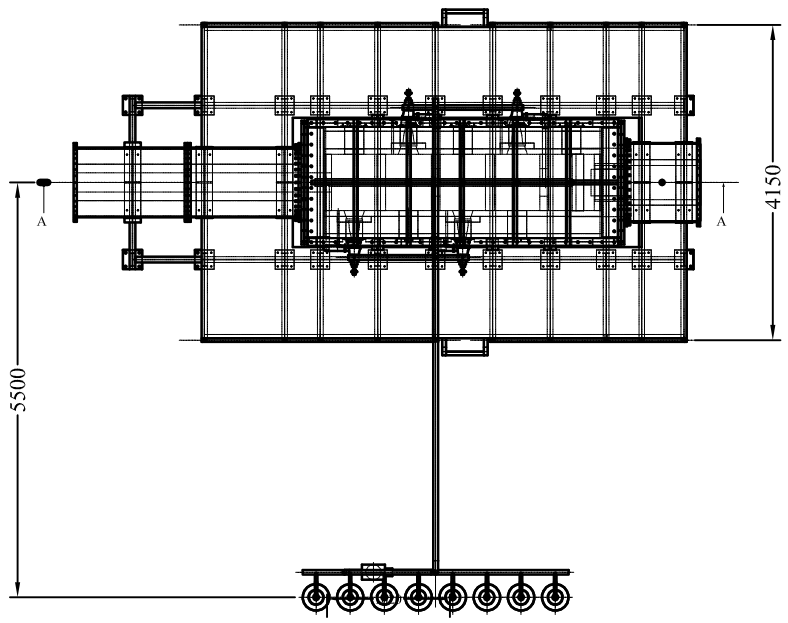
Sr. no.	Descriptions	Qty
01	Refractory layer **(size: ~ 230 x 115 x 75 mm)**	85 nos.
02	Insulation layer type 1 **(size: ~ 230 x 115 x 75 mm)**	366 nos.
03	Insulation layer type 2 **(Size: ~1000 x 500 x 50mm)**	06 nos.
04	Insulation layer type 3 (Roll) **(Size: ~ 1220 x 12000 x 5 mm)**	01 nos.
05	Gas burner block (specification mentioned in 4.1)	02 nos.
06	Duel fuel burner (LPG/PNG) (specification mentioned in 4.1)	01 no.
07	R-type thermocouple (specification mentioned in 4.1)	02 nos.

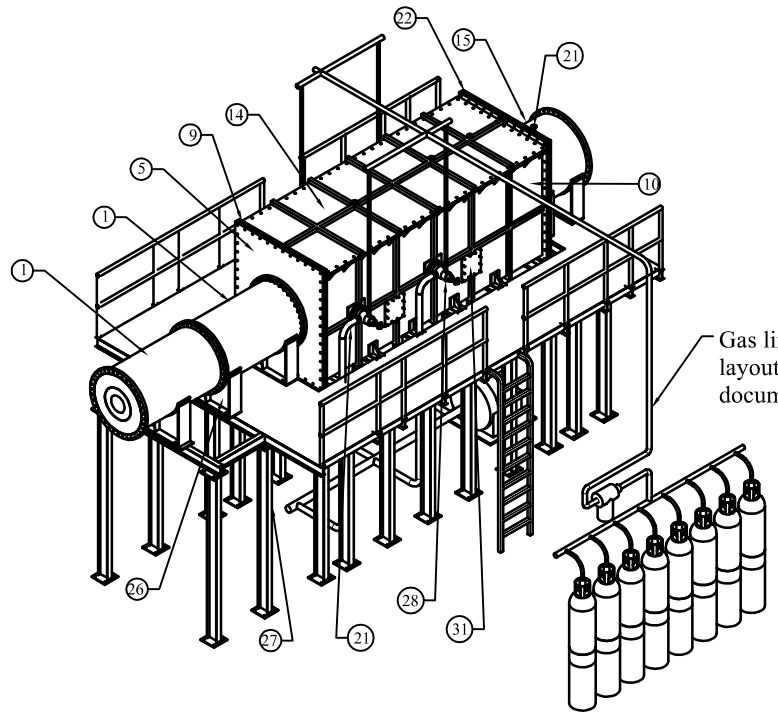
Appendix – V

The vendor has to consider to below mentioned load during support structure design.

Sr. no.	Descriptions	Load in kg
01	Load of gas inlet port	1550
02	Load of left side end flange	1800
03	Load of main rectangular chamber with thermal insulation lining	8950
04	Load of right side end flange	1800
05	Load of gas out let port	1200
06	Load of gas burner with burner block	
	Total load =	15300

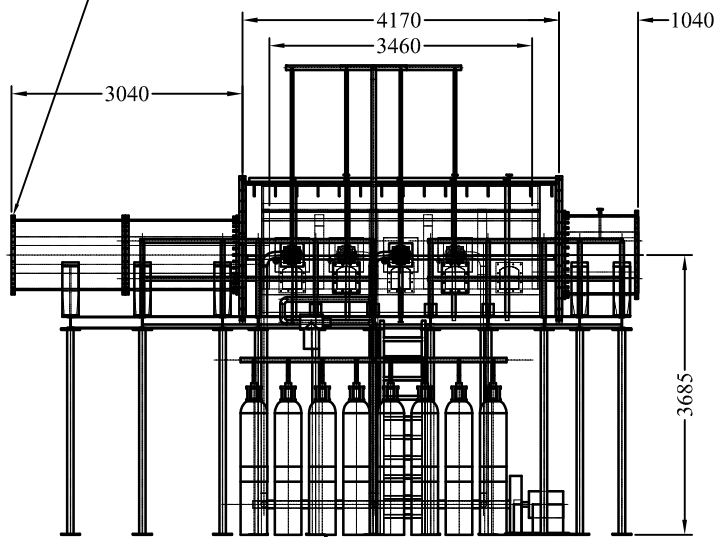
Appendix-1

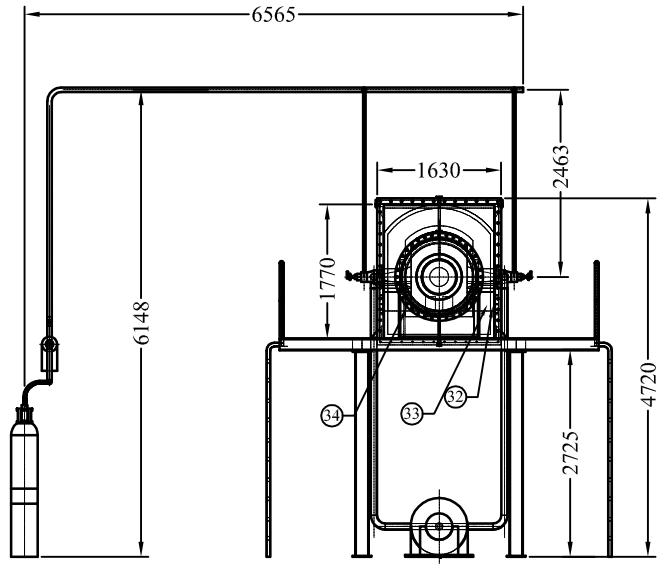


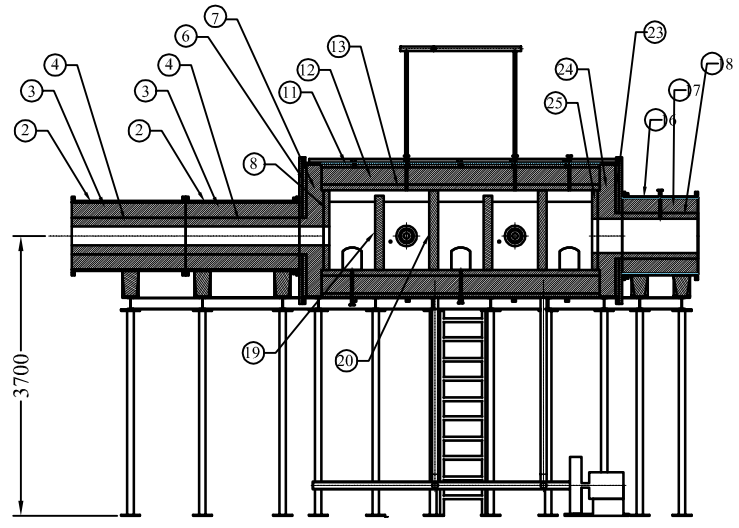


Gas line and air line for burner is shown in this drawings for piping layout purpose, all control and regulating assessories as per tendor documents shoud be mount for proper functioning of burners

The vendor had to supply this flange in loose and weld during the installation at IPR site.







Section-AA

Sr. No.	Description	Qty.	Ref. Drg. No.
01	PART-1	02no.	IPR/APD/CBWTF200/A3/SEC/01-1
02	PART-2	02no.	IPR/APD/CBWTF200/A3/SEC/01-2
03	PART-3	02no.	IPR/APD/CBWTF200/A3/SEC/01-3
04	PART-4	02no.	IPR/APD/CBWTF200/A3/SEC/01-4
05	PART-5	01no.	IPR/APD/CBWTF200/A3/SEC/01-5
06	PART-6	01no.	IPR/APD/CBWTF200/A3/SEC/01-6
07	PART-7	01no.	IPR/APD/CBWTF200/A3/SEC/01-7
08	PART-8	01no.	IPR/APD/CBWTF200/A3/SEC/01-8
09	PART-9	02no.	IPR/APD/CBWTF200/A3/SEC/01-9
10	PART-10	01no.	IPR/APD/CBWTF200/A3/SEC/01-10
11	PART-11	01no.	IPR/APD/CBWTF200/A3/SEC/01-11
12	PART-12	01no.	IPR/APD/CBWTF200/A3/SEC/01-12
13	PART-13	01no.	IPR/APD/CBWTF200/A3/SEC/01-13
14	PART-14	01no.	IPR/APD/CBWTF200/A3/SEC/01-14
15	PART-15	01no.	IPR/APD/CBWTF200/A3/SEC/01-15
16	PART-16	01no.	IPR/APD/CBWTF200/A3/SEC/01-16
17	PART-17	01no.	IPR/APD/CBWTF200/A3/SEC/01-17
18	PART-18	01no.	IPR/APD/CBWTF200/A3/SEC/01-18
19	PART-19	02no.	IPR/APD/CBWTF200/A3/SEC/01-19
20	PART-20	02no.	IPR/APD/CBWTF200/A3/SEC/01-20
21	PART-21	10 no.	IPR/APD/CBWTF200/A3/SEC/01-21
22	PART-22	01no.	IPR/APD/CBWTF200/A3/SEC/01-22
23	PART-23	01no.	IPR/APD/CBWTF200/A3/SEC/01-23
24	PART-24	01no.	IPR/APD/CBWTF200/A3/SEC/01-24
25	PART-25	01no.	IPR/APD/CBWTF200/A3/SEC/01-25
26	PART-26	05no.	Support Bracket
27	PART-27	01no.	Support structure
28	PART-28 (Gas burner)	04no.	brought out item
29	PART-29 (R-type thermocouple)	05no.	Ceramic sheath, L-500mm
30	PART-30 (Pressure gauge)	01no.	-ve 1 bat to +ve 2 bar
31	PART-31	05no.	IPR/APD/CBWTF200/A3/SEC/01-26
32	PART-32	05no.	IPR/APD/CBWTF200/A3/SEC/01-26
33	PART-33	05no.	IPR/APD/CBWTF200/A3/SEC/01-26
34	PART-34	05no.	IPR/APD/CBWTF200/A3/SEC/01-26

Note:
1. Design for part no-26 and 27 are in scope of vendor as spesified in tender document.
2. Specifications of part no-28,29 and 30 are in Tendor document.
3. Part no-28, 29 and 30 are brought out item
4. Material: As Per Tender Document unless otherwise specified.
5. Raised face of 2mm to be machined in addition to be machined in addition to the flange thickness

Scale : 1:2

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION:	APD-IPR	SIZE	A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED			
SCALE	NTS	DATE	
DRAWN	Adam	25.10.20	
CHECKED	Adam	25.10.20	
APPROVED	Dr. M K Gupta		

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

THIRD ANGLE PROJECTION

TITLE: SECONDARY CHAMBER-200

REF DRG NO:

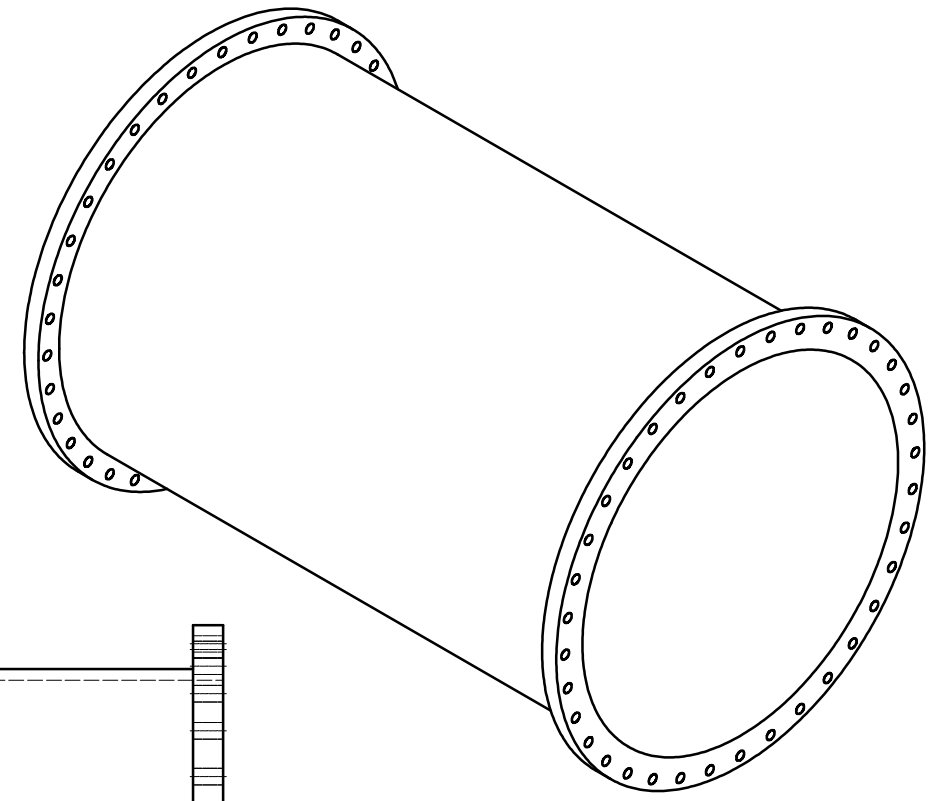
REV 00

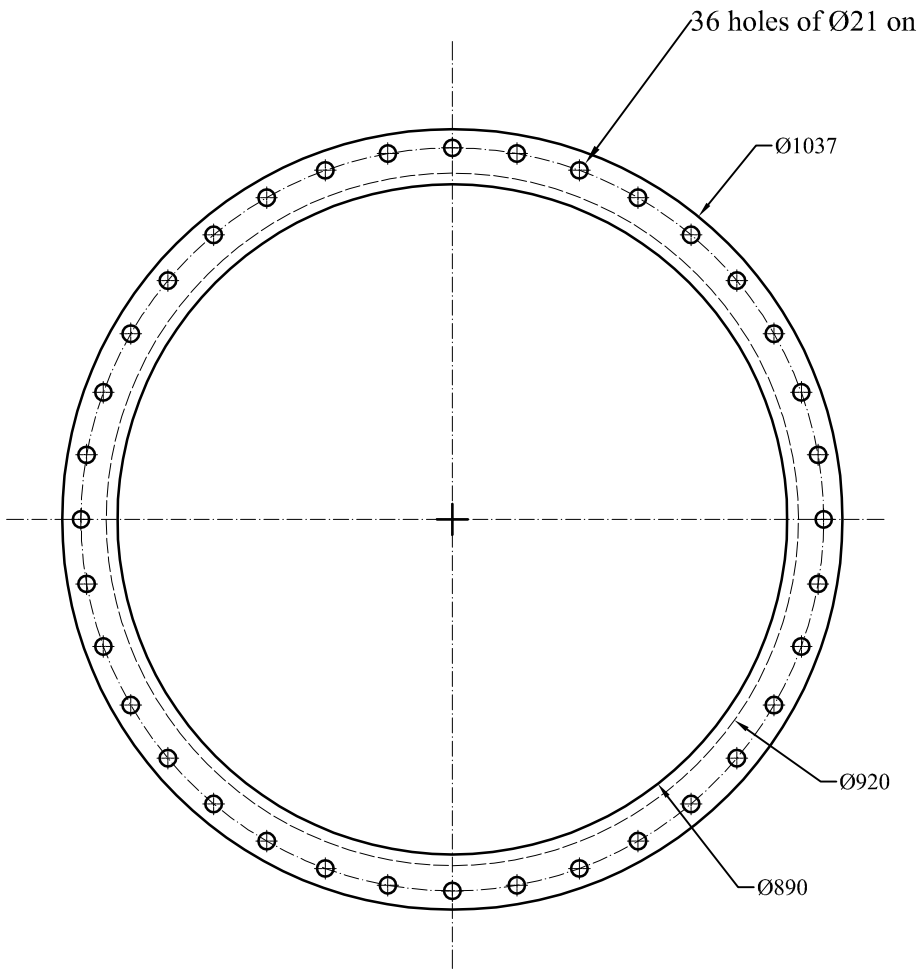
DRG.NO: IPR/APD/CBWTF200/A3/SEC/01

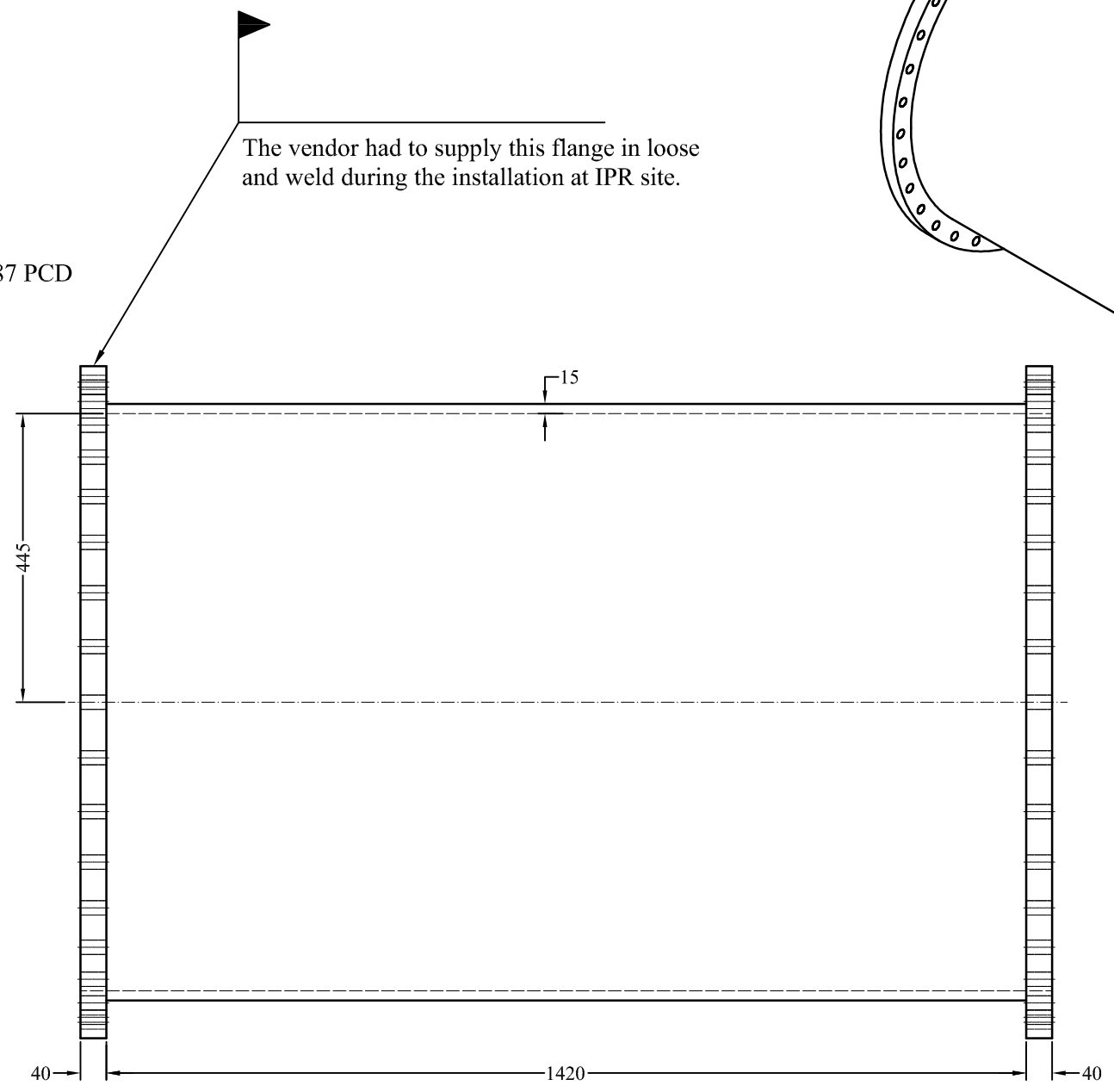
SHEET 1 OF 1

Description	Qty.	Material
Part-1	02no.	SA-516 GR -60, flange SA-105 (forging grade)

NOTES :-
1. INTIGRAL TYPE FLANGE SHOULD BE FABRICATED.
2. RAISED FACE THICKNESS OF 2 mm SHALL BE MACHINED IN EXCESS OF FLANGE THICKNESS.







Scale : 3:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION: APD-IPR	SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED	

SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

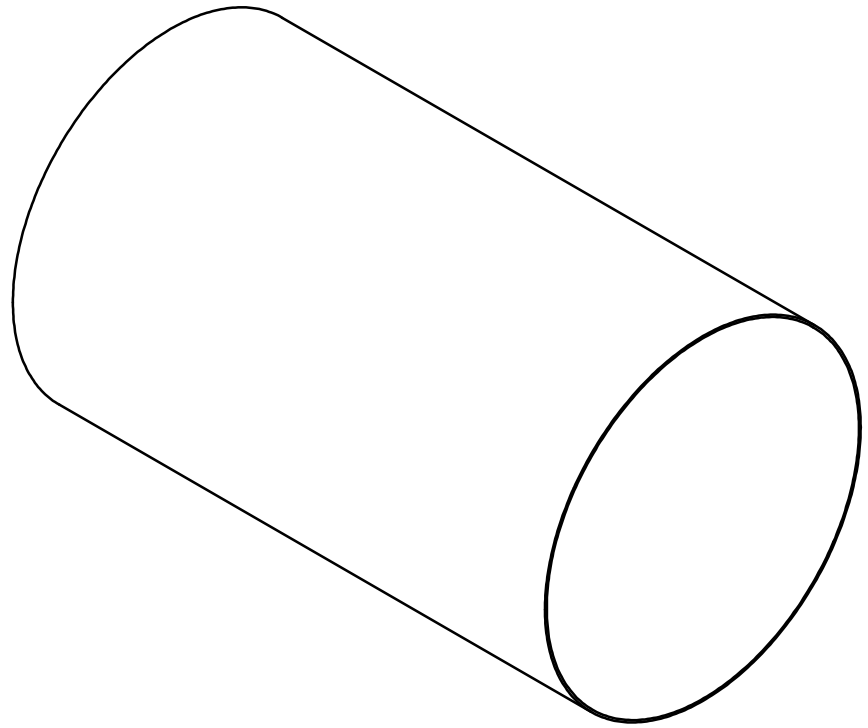
THIRD ANGLE PROJECTION

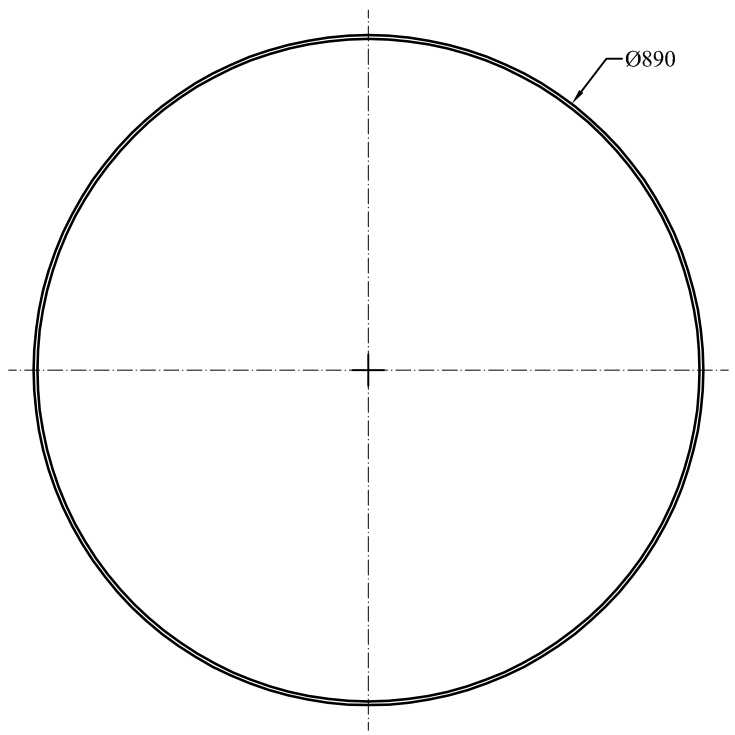
TITLE: SECONDARY CHAMBER-200

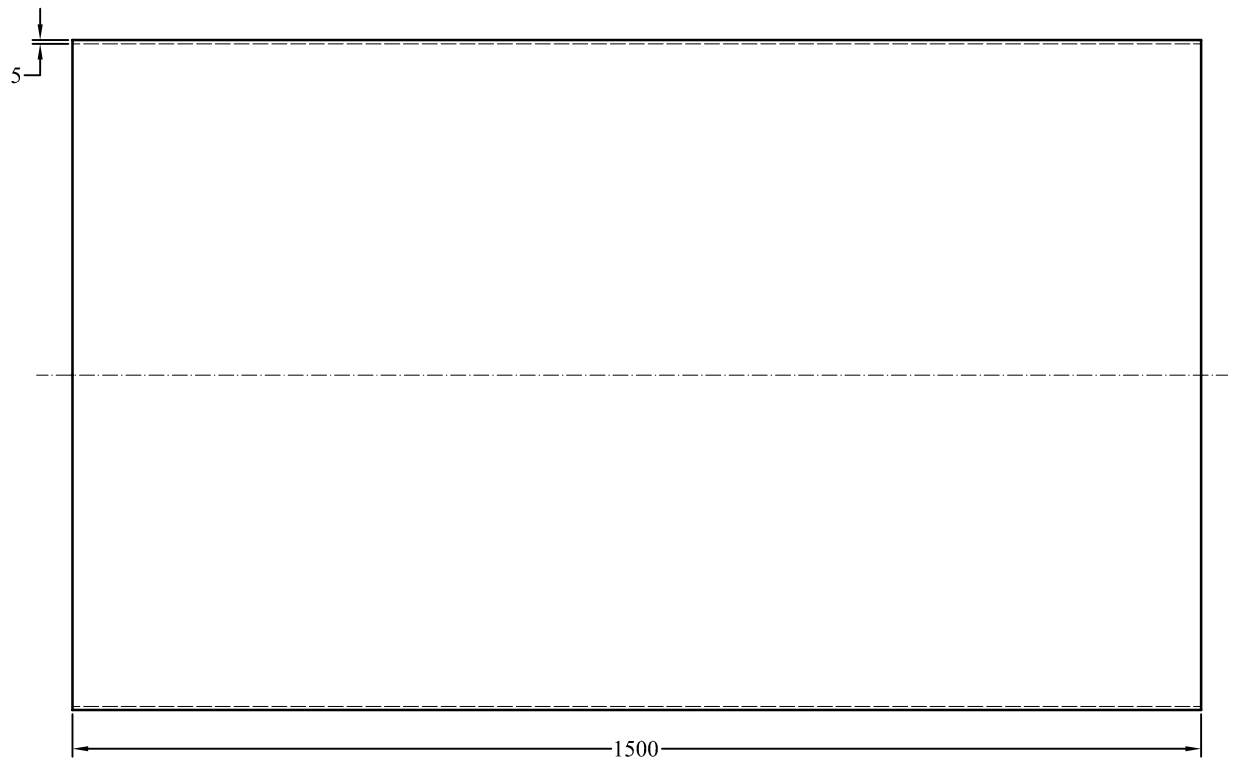
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO IPR/APD/CBWTF200/A3/SEC/01 -1 SHEET 1 OF 1

Description	Qty.	Material
Part-2	02no.	Insulation layer type 3







Scale : 3:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION: APD-IPR		SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		
SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

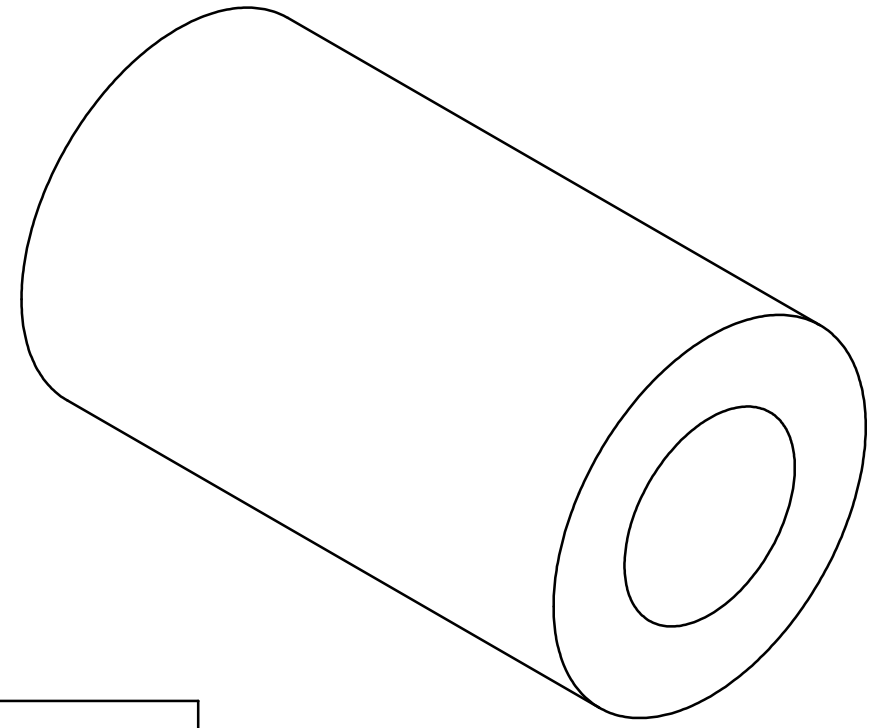
THIRD ANGLE PROJECTION

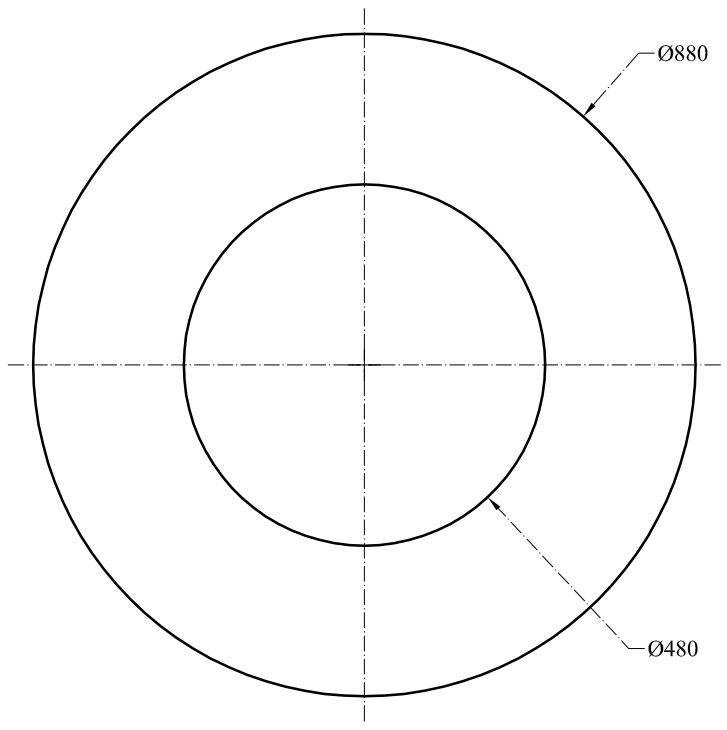
TITLE: SECONDARY CHAMBER-200

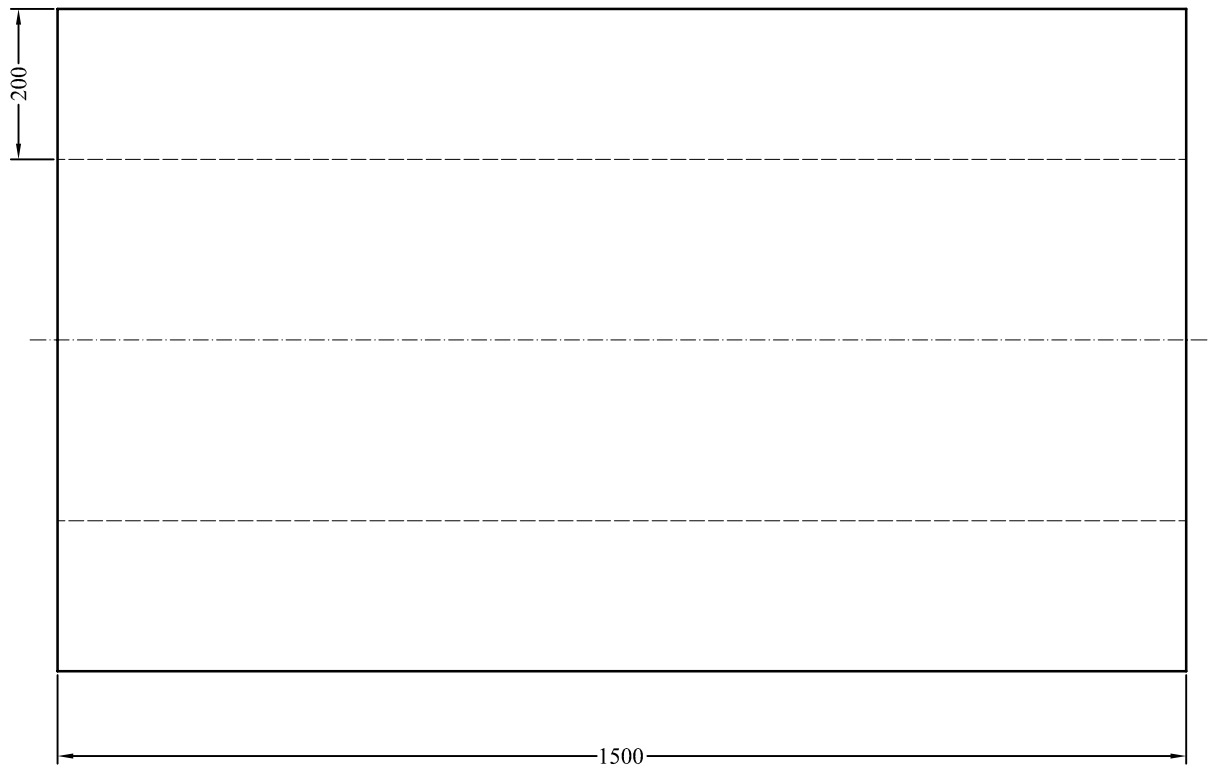
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO IPR/APD/CBWTF200/A3/SEC/01 -2 SHEET 1 OF 1

Description	Qty.	Material
Part-3	02no.	Insulation layer type 1







Scale : 3:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN

REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION: APD-IPR		SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		
SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

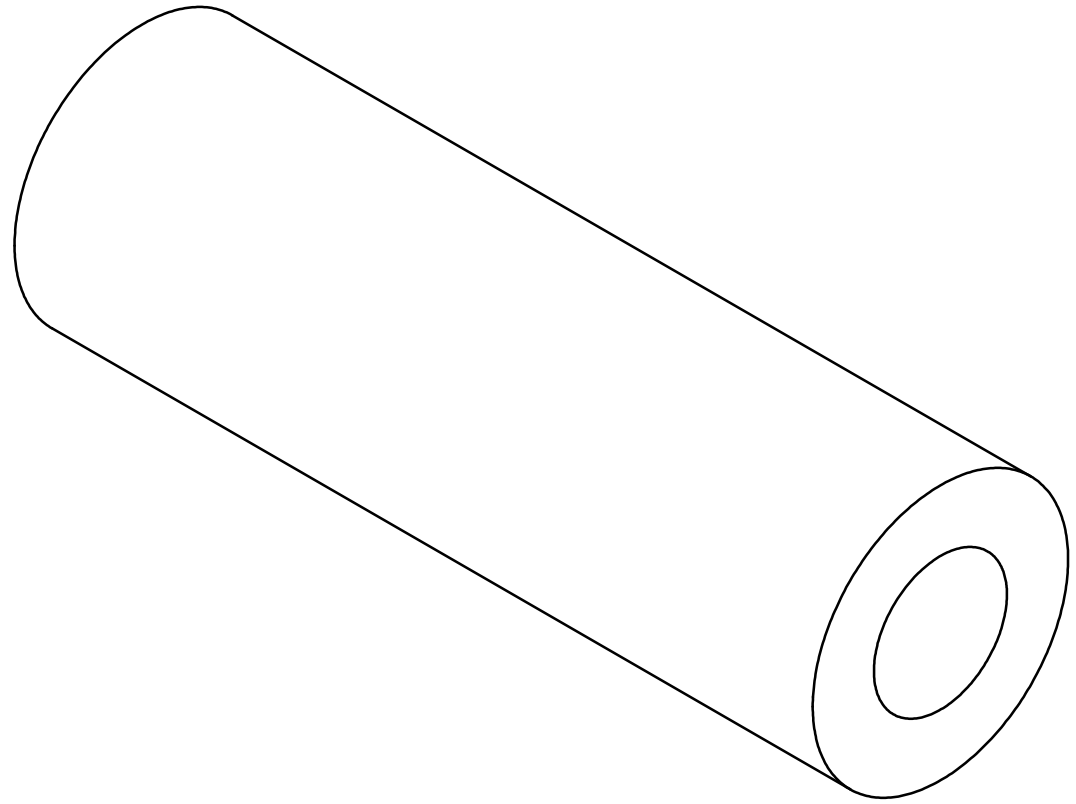
THIRD ANGLE PROJECTION

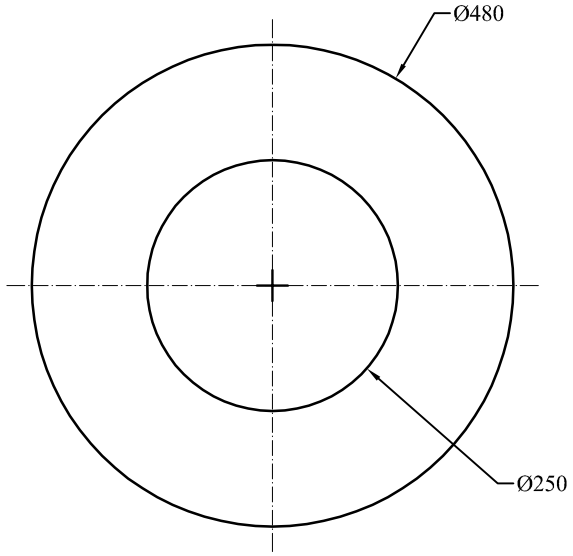
TITLE: SECONDARY CHAMBER-200

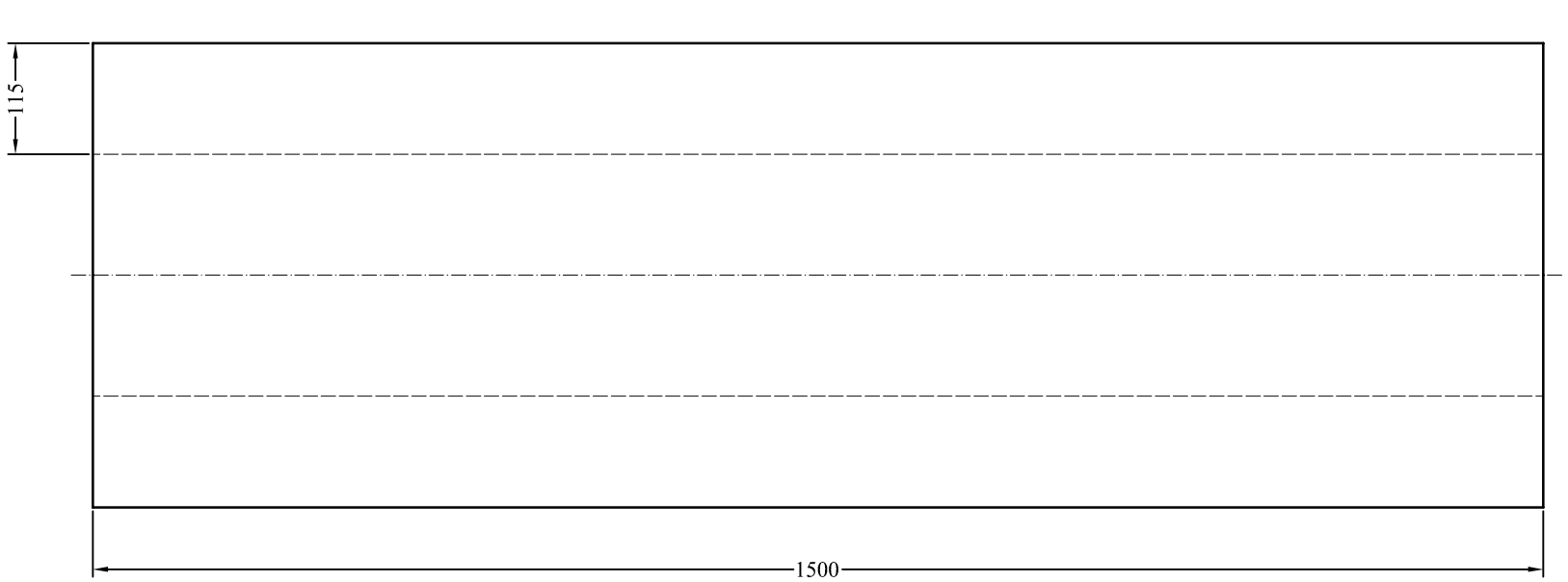
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO IPR/APD/CBWTF200/A3/SEC/01 -3 SHEET 1 OF 1

Description	Qty.	Material
Part-4	02no.	Refractory layer







Scale : 4:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION: APD-IPR		SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		
SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

THIRD ANGLE PROJECTION

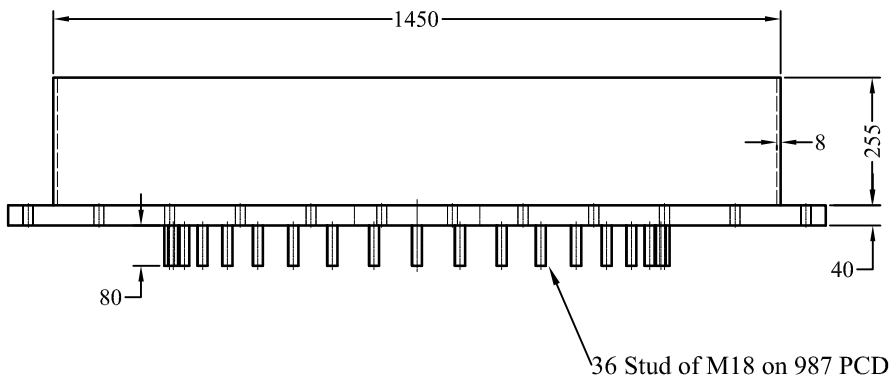
TITLE: SECONDARY CHAMBER-200

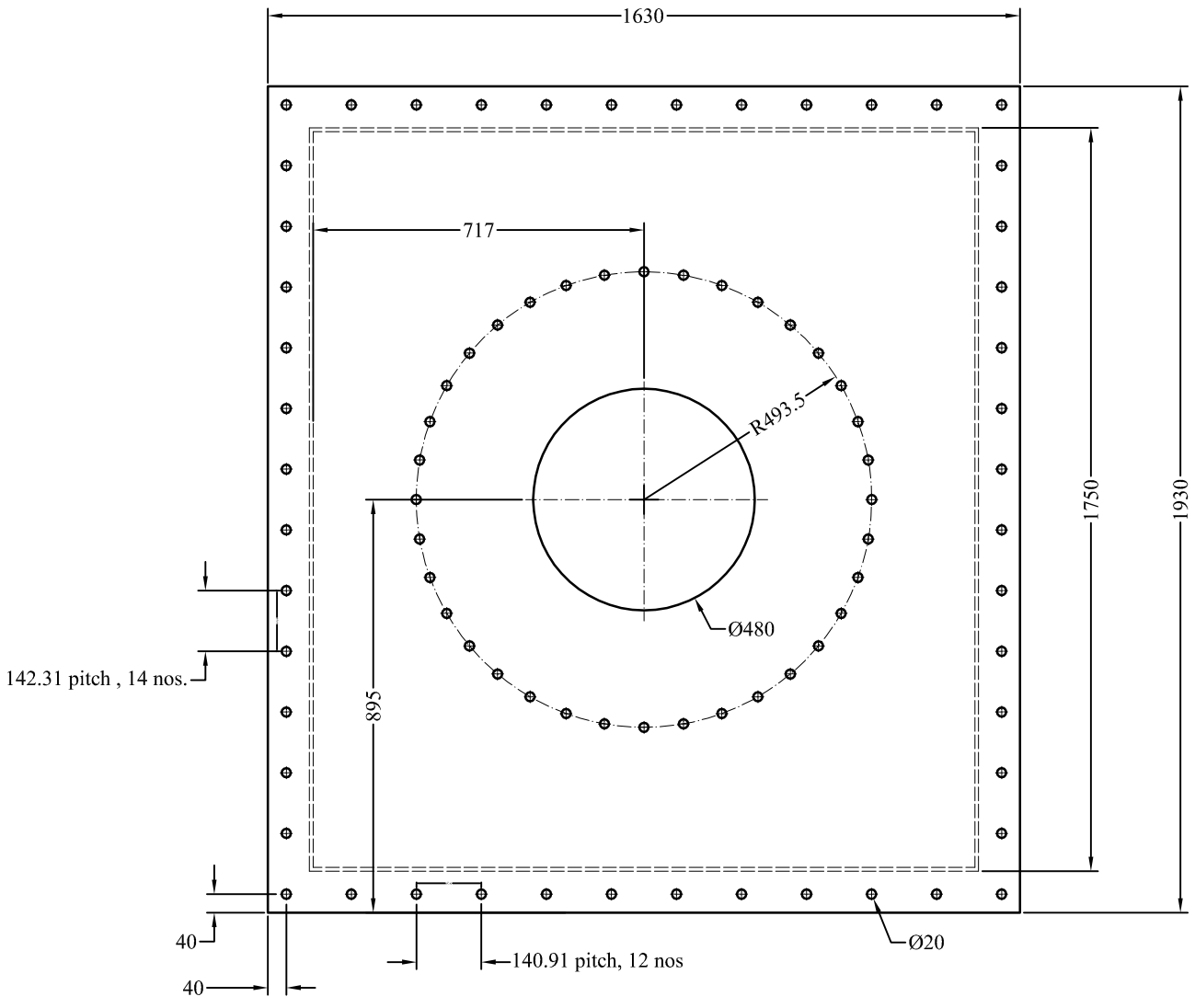
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

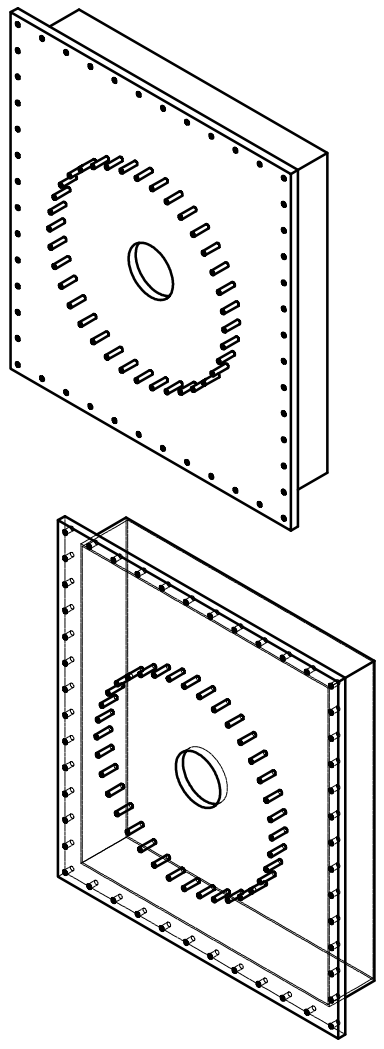
DRG.NO: IPR/APD/CBWTF200/A3/SEC/01 -4 SHEET 1 OF 1

Description	Qty.	Material
Part-5	01no.	SA-516 GR -60, flange SA-105 (forging grade)

NOTES :-
1. INTIGRAL TYPE FLANGE SHOULD BE FABRICATED.
2. RAISED FACE THICKNESS OF 2 mm SHALL BE MACHINED IN EXCESS OF FLANGE THICKNESS.







Scale : 2:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION: APD-IPR		SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		
SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

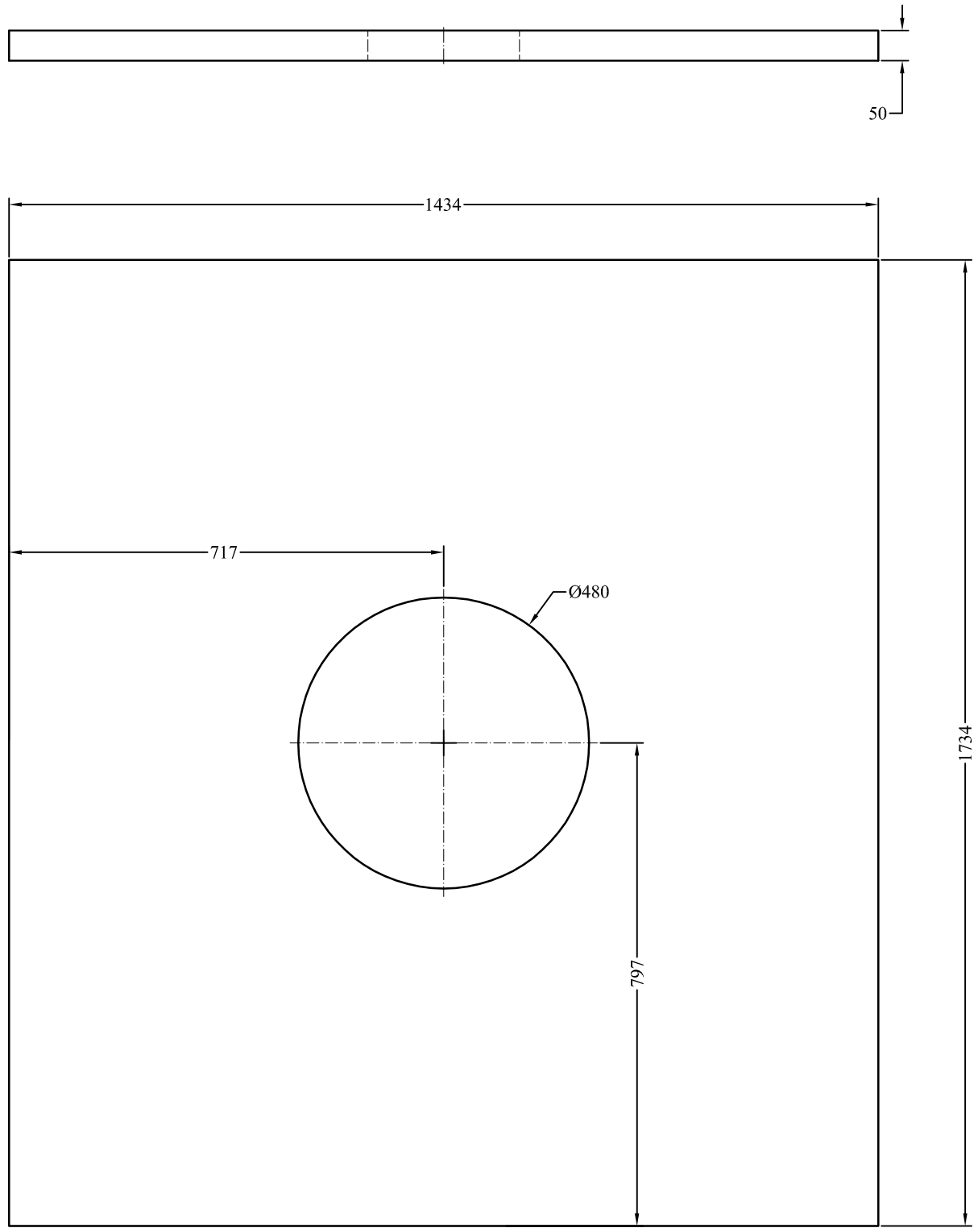
THIRD ANGLE PROJECTION

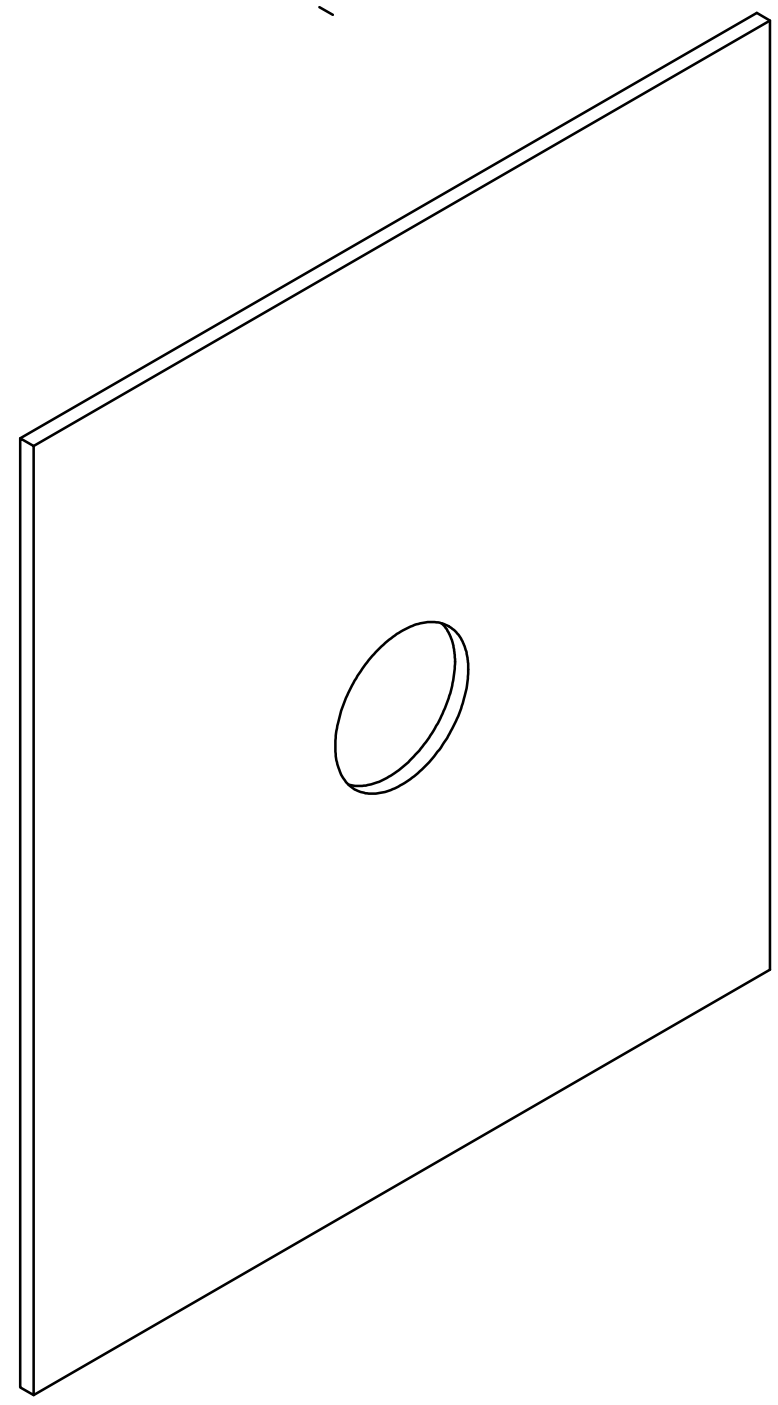
TITLE: SECONDARY CHAMBER-200

REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO: IPR/APD/CBWTF200/A3/SEC/01-5 SHEET 1 OF 1

Description	Qty.	Material
Part-6	01no.	Insulation layer type 2





Scale : 3:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION: APD-IPR	SIZE A3	
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		
SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

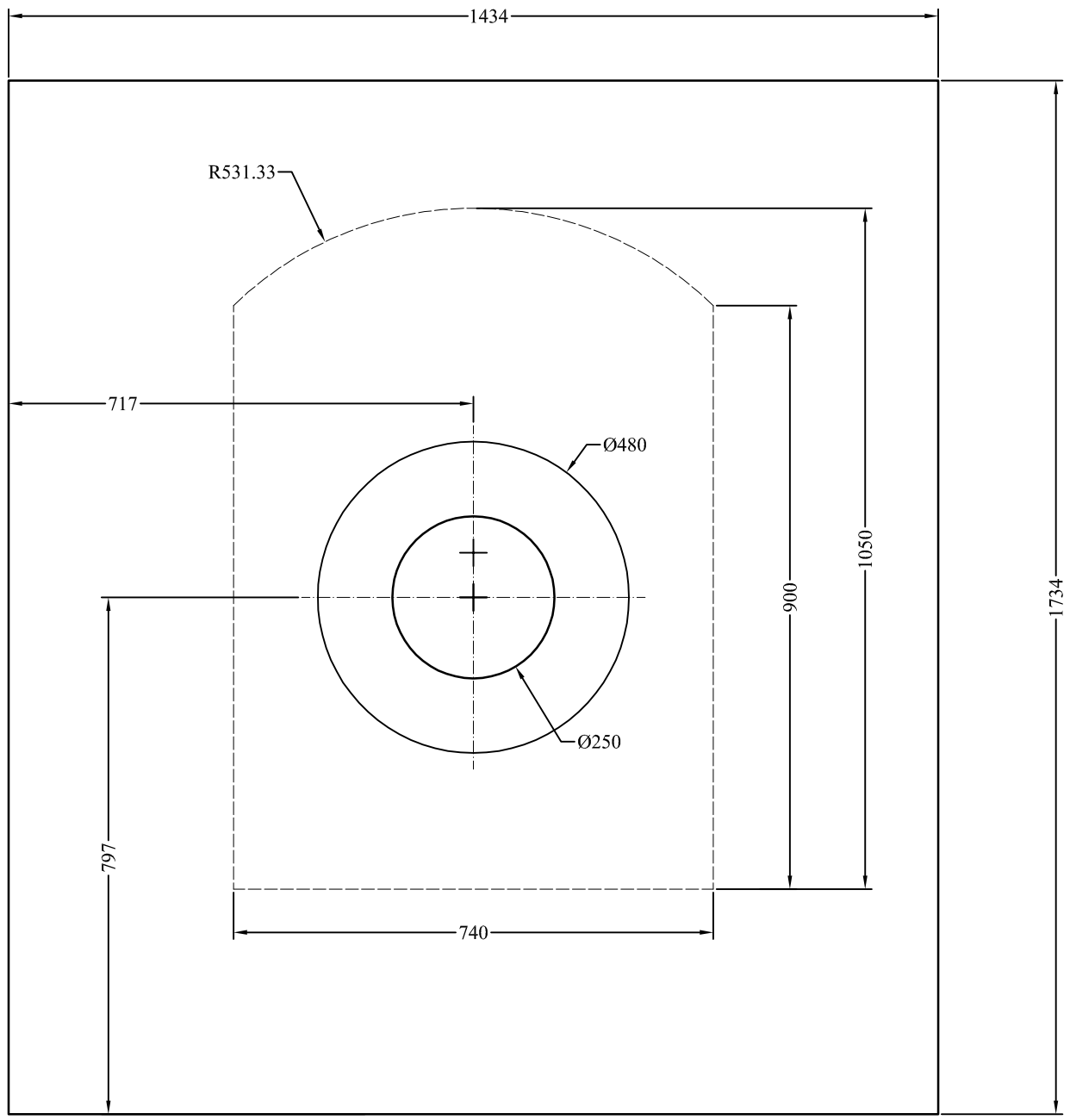
THIRD ANGLE PROJECTION

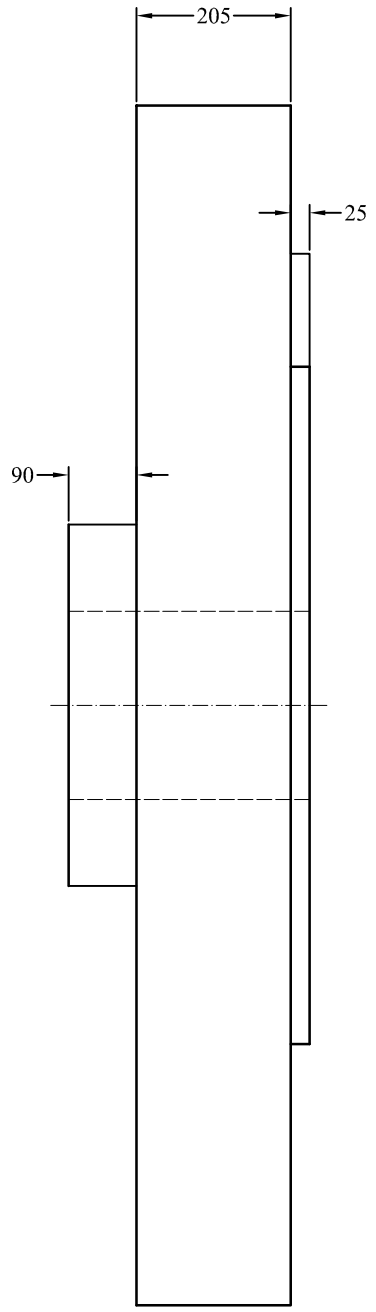
TITLE: SECONDARY CHAMBER-200

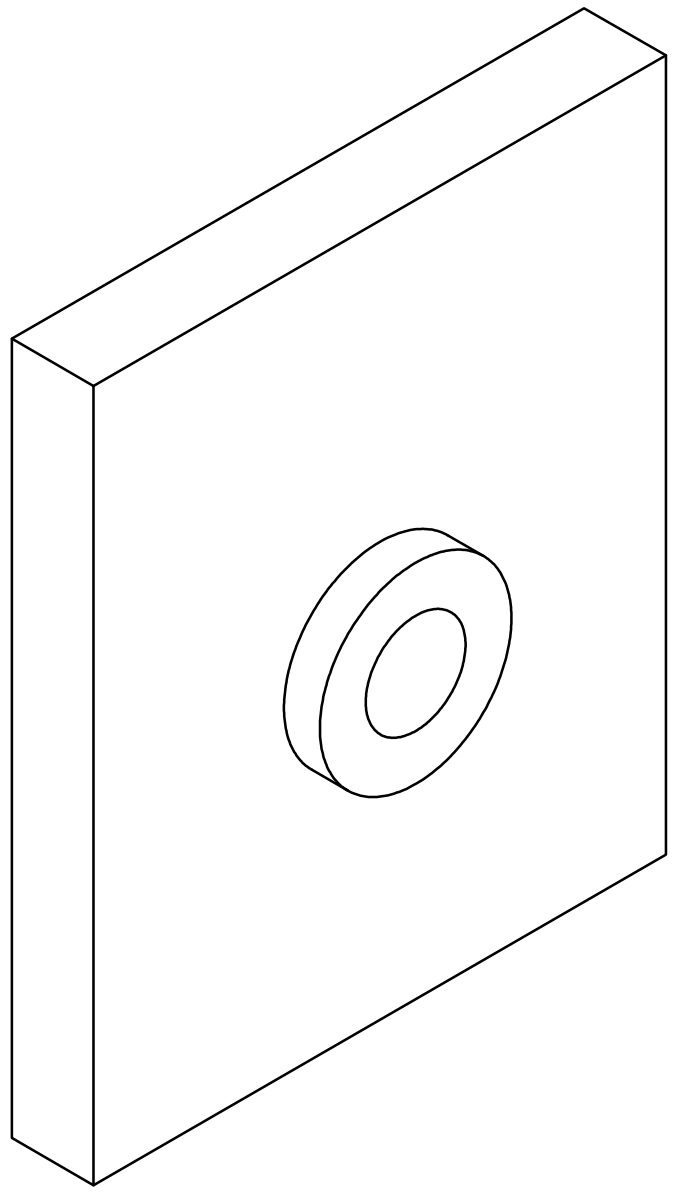
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO IPR/APD/CBWTF200/A3/SEC/01-6 SHEET 1 OF 1

Description	Qty.	Material
Part-7	01no.	Insulation layer type 1







Scale : 3:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

REVISION COLUMN

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

ASS'Y GROUP/ DIVISION:	APD-IPR	SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		

SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

THIRD ANGLE PROJECTION

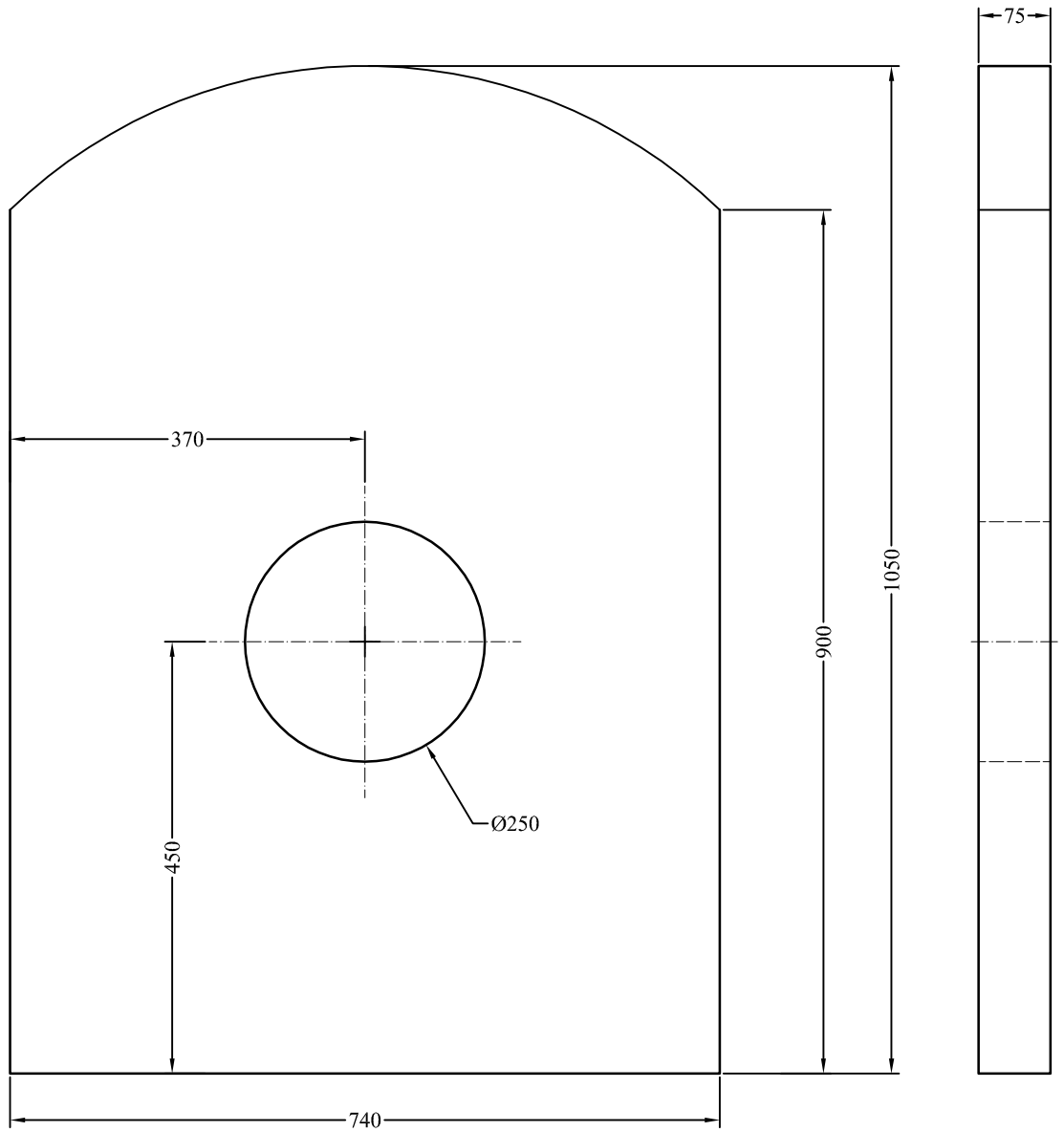
INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

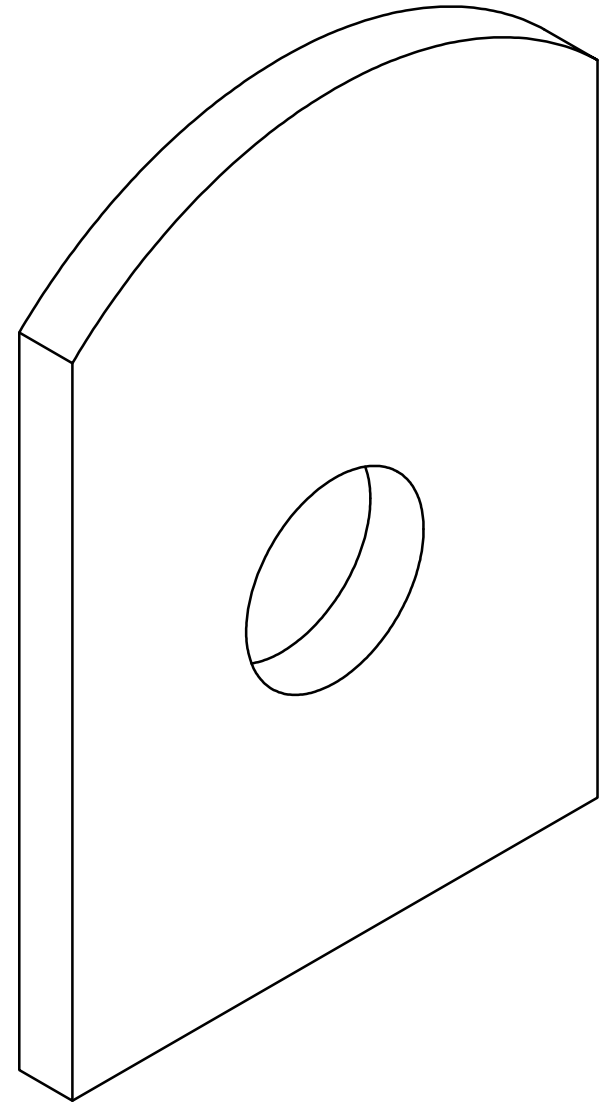
TITLE: SECONDARY CHAMBER-200

REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO IPR/APD/CBWTF200/A3/SEC/01 -7 SHEET 1 OF 1

Description	Qty.	Material
Part-8	01no.	Refractory layer





Scale : 4:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN

REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION: APD-IPR			SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED			
SCALE	NTS	DATE	
DRAWN	Adam	25.10.20	
CHECKED	Adam	25.10.20	
APPROVED	Dr. M K Gupta		

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

THIRD ANGLE PROJECTION

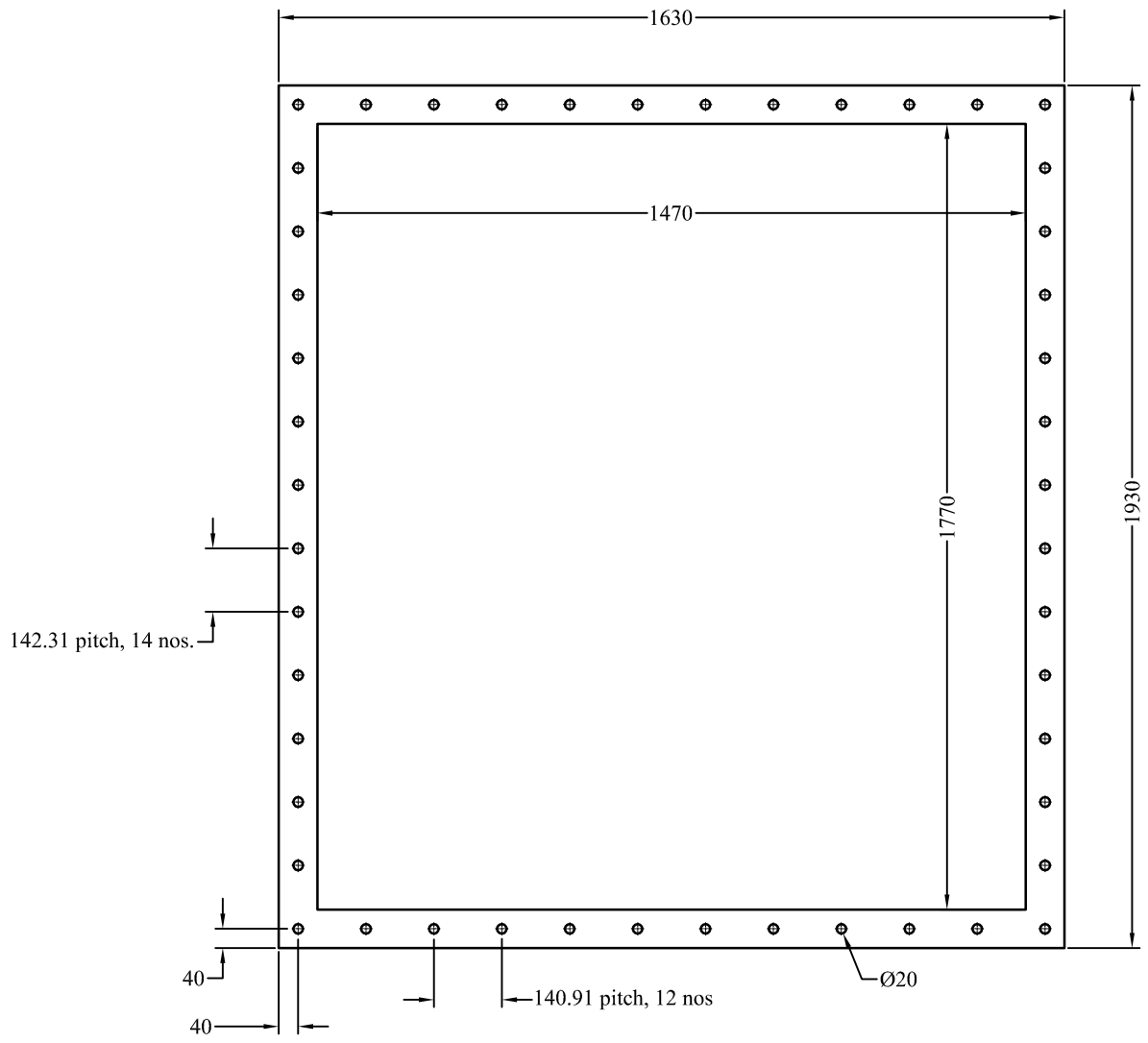
TITLE: SECONDARY CHAMBER-200

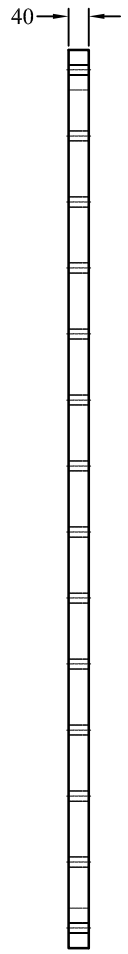
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

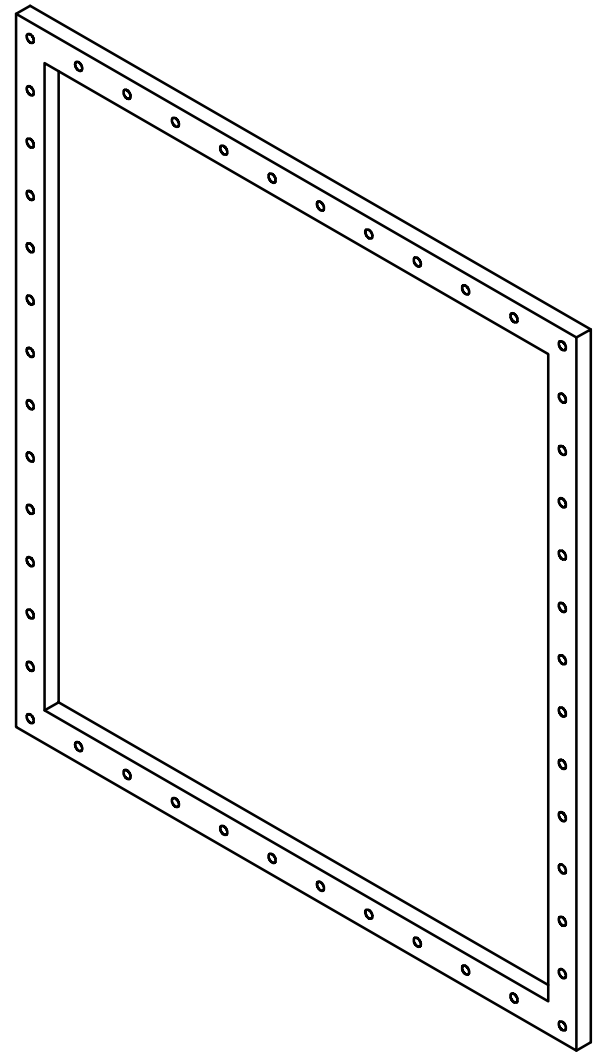
DRG.NO IPR/APD/CBWTF200/A3/SEC/01-8 SHEET 1 OF 1

Description	Qty.	Material
Part-9	02no.	SA-105 (forging grade)

NOTES :-
1. INTIGRAL TYPE FLANGE SHOULD BE FABRICATED.
2. RAISED FACE THICKNESS OF 2 mm SHALL BE MACHINED IN EXCESS OF FLANGE THICKNESS.







Scale : 2:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS								
LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION:	APD-IPR	SIZE	A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED			

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

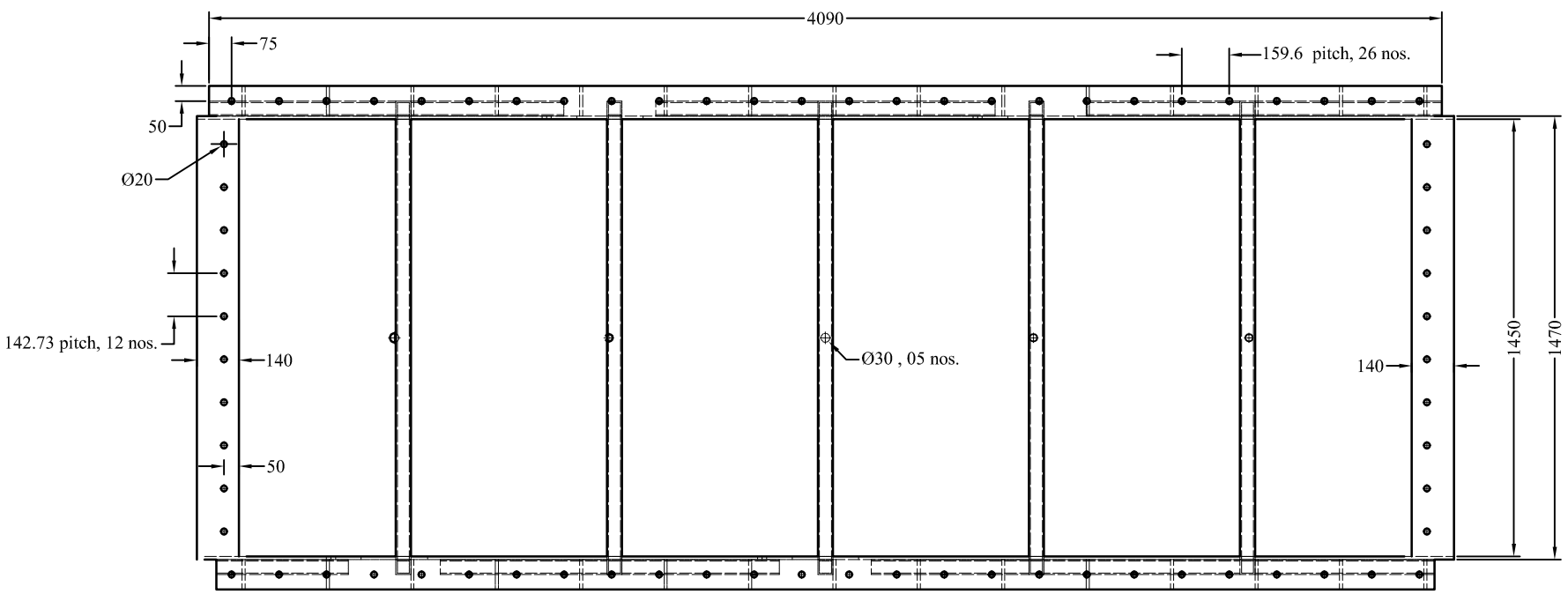
SCALE	NTS	DATE	
DRAWN	Adam	25.10.20	THIRD ANGLE PROJECTION
CHECKED	Adam	25.10.20	
APPROVED	Dr. M K Gupta		

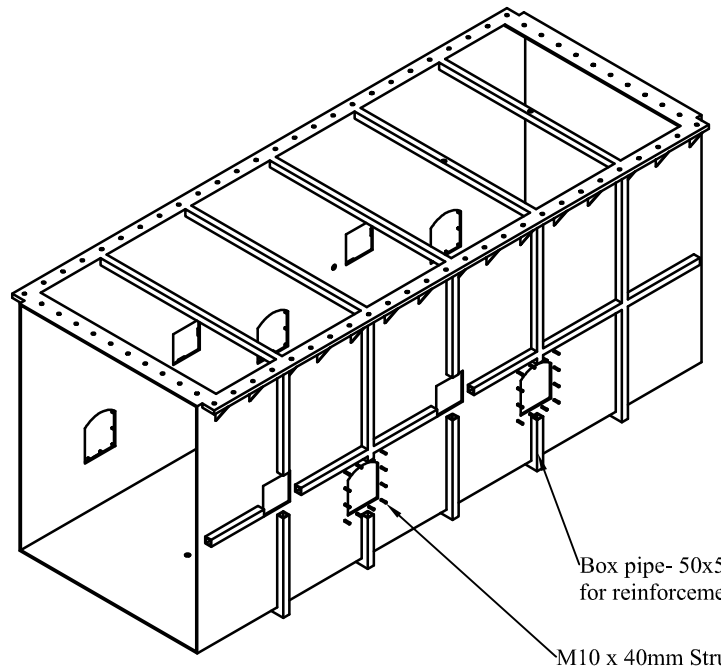
TITLE: SECONDARY CHAMBER-200

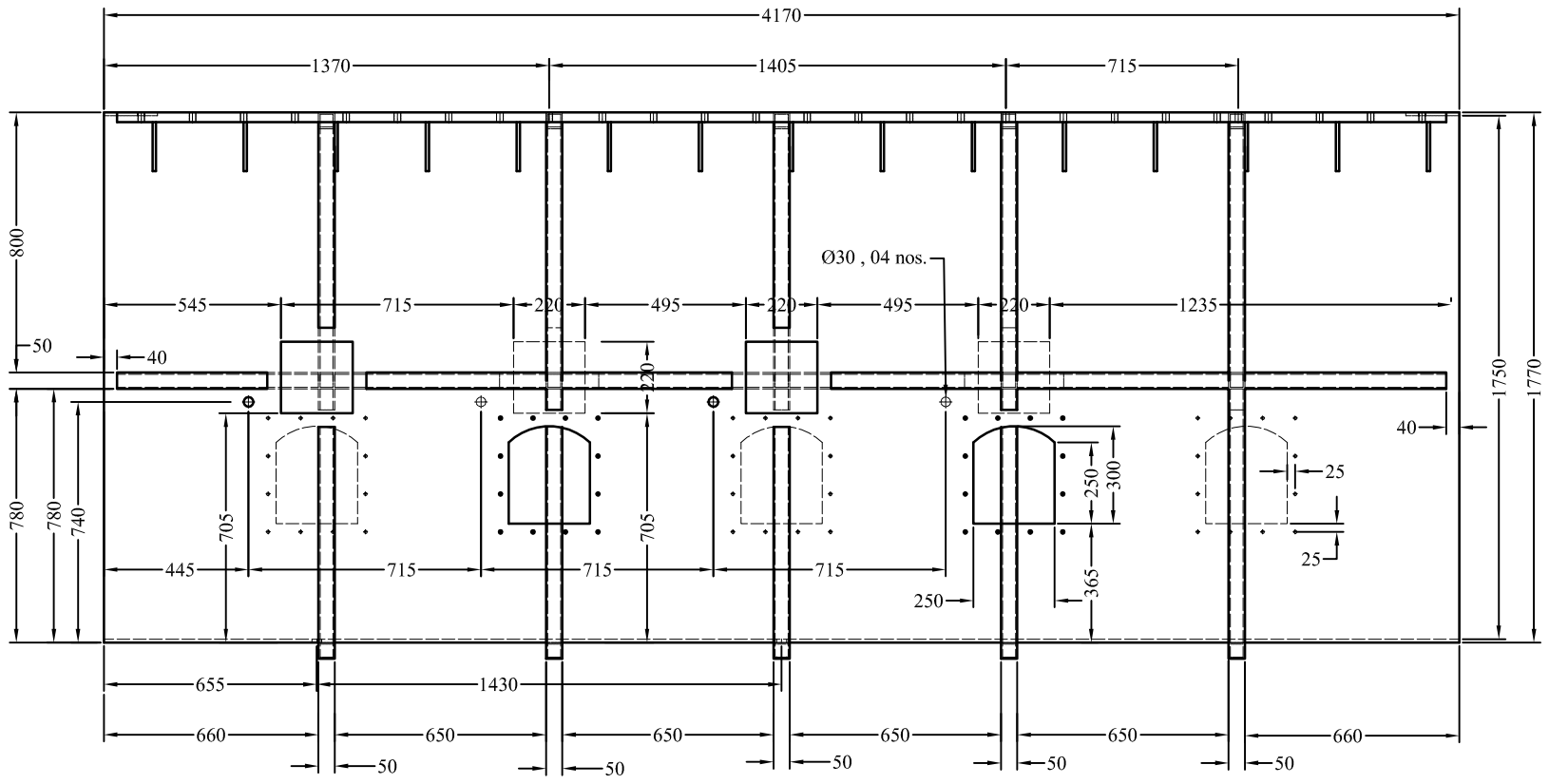
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

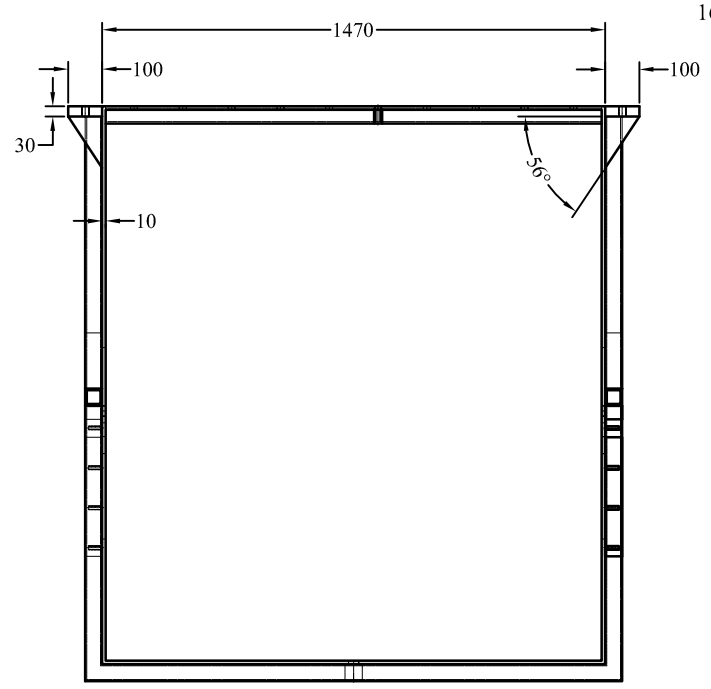
DRG.NO IPR/APD/CBWTF200/A3/SEC/01 -9 SHEET 1 OF 1

Description	Qty.	Material
Part-10	01no.	SA-516 GR -60, flange SA-105 (forging grade)









Scale : 1.5:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS								
LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

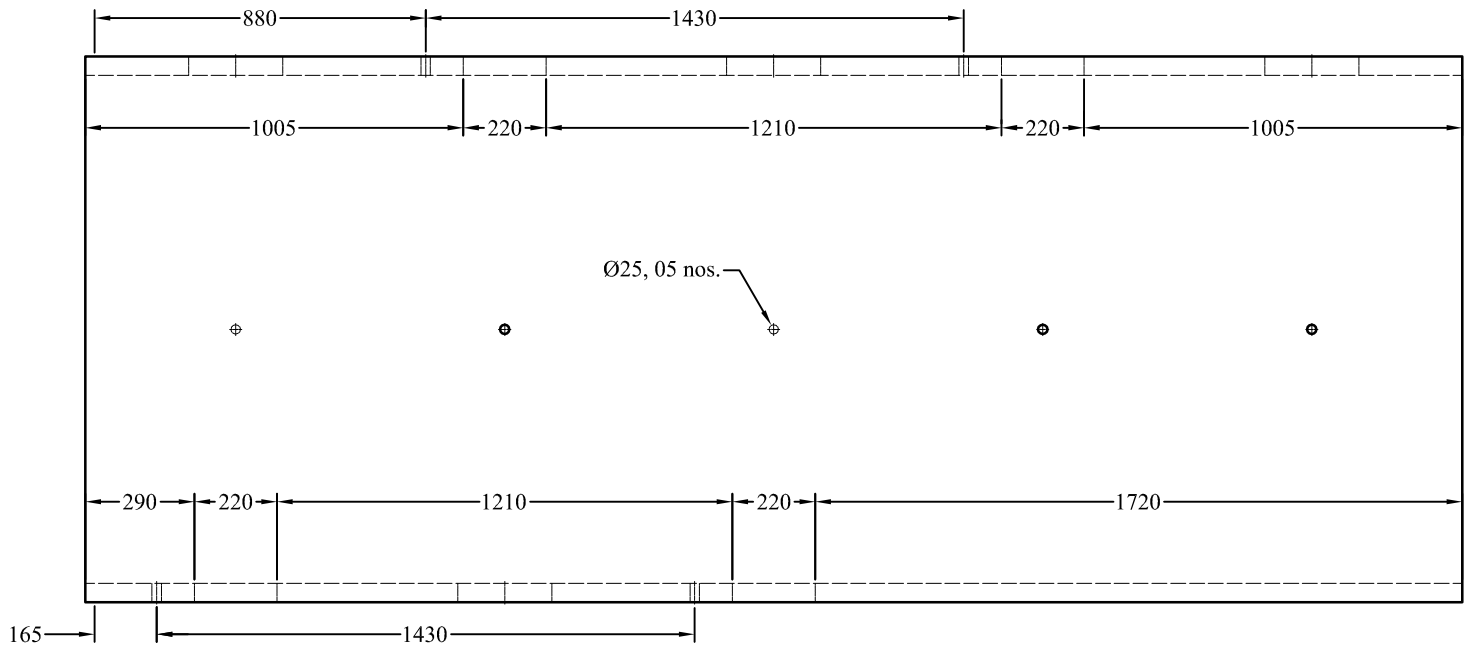
REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

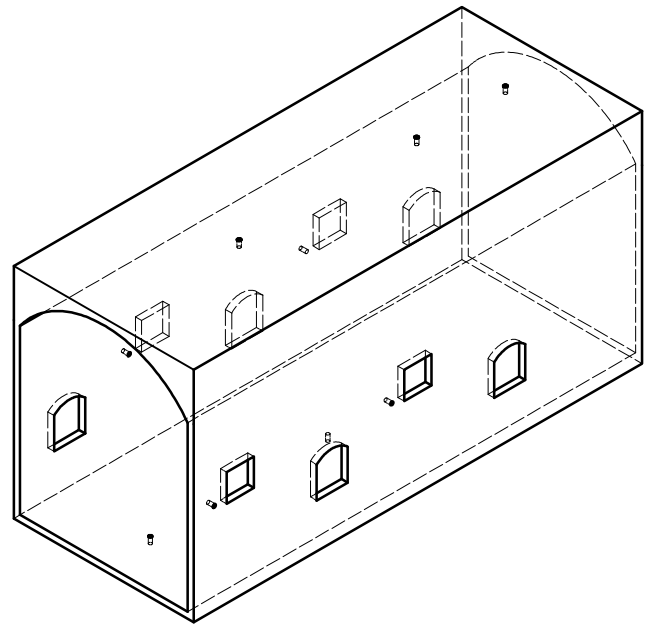
ASS'Y GROUP/ DIVISION:	APD-IPR	SIZE	A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED			

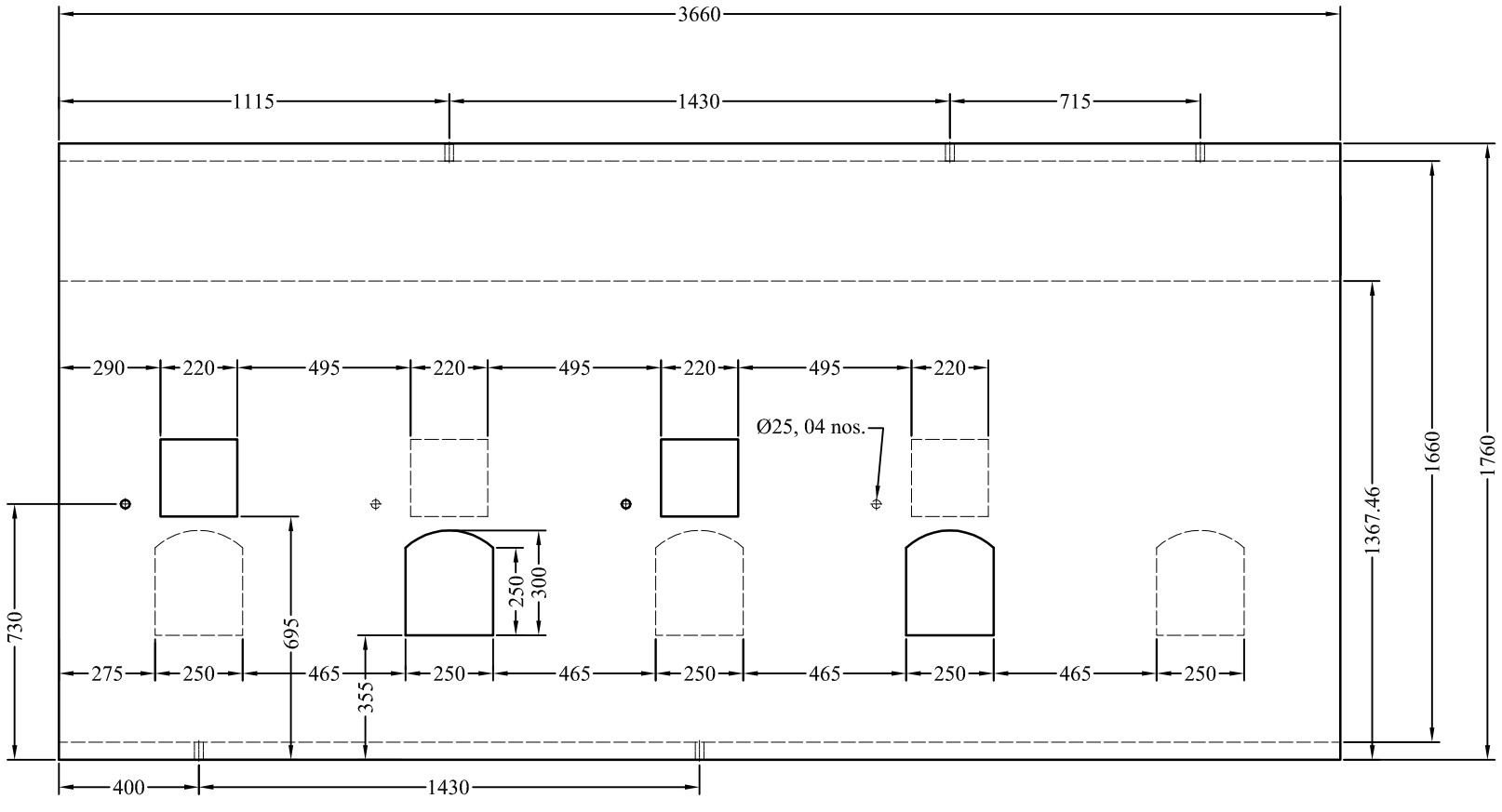
INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

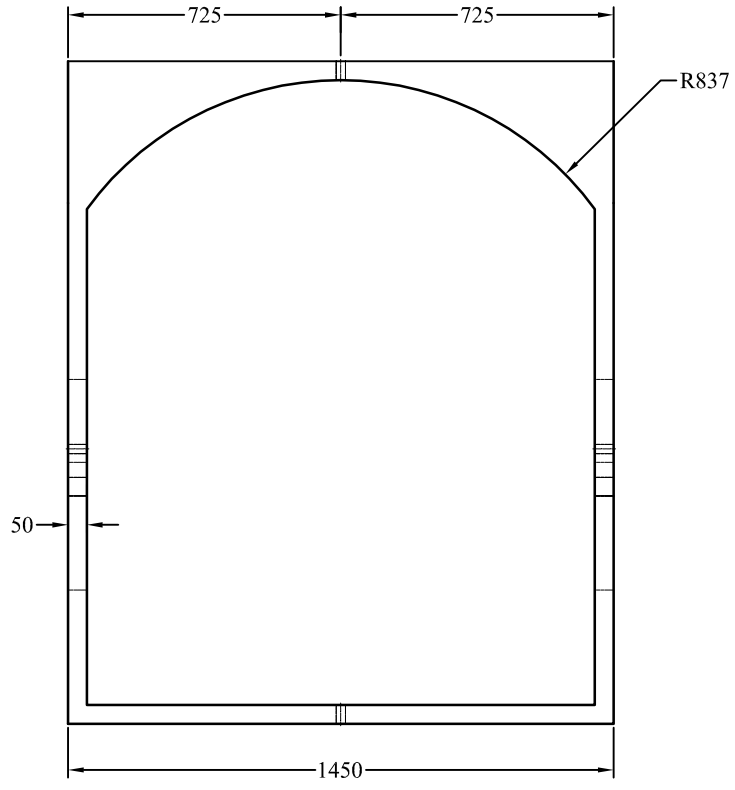
SCALE	NTS	DATE	TITLE	SECONDARY CHAMBER-200
DRAWN	Adam	25.10.20	THIRD ANGLE PROJECTION	
CHECKED	Adam	25.10.20	REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01	REV 00
APPROVED	Dr. M K Gupta		DRG.NO IPR/APD/CBWTF200/A3/SEC/01-10	SHEET 1 OF 1

Description	Qty.	Material
Part-11	01no.	Insulation layer type 2









Scale : 1.5:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS								
LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

ASS'Y GROUP/ DIVISION:	APD-IPR	SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

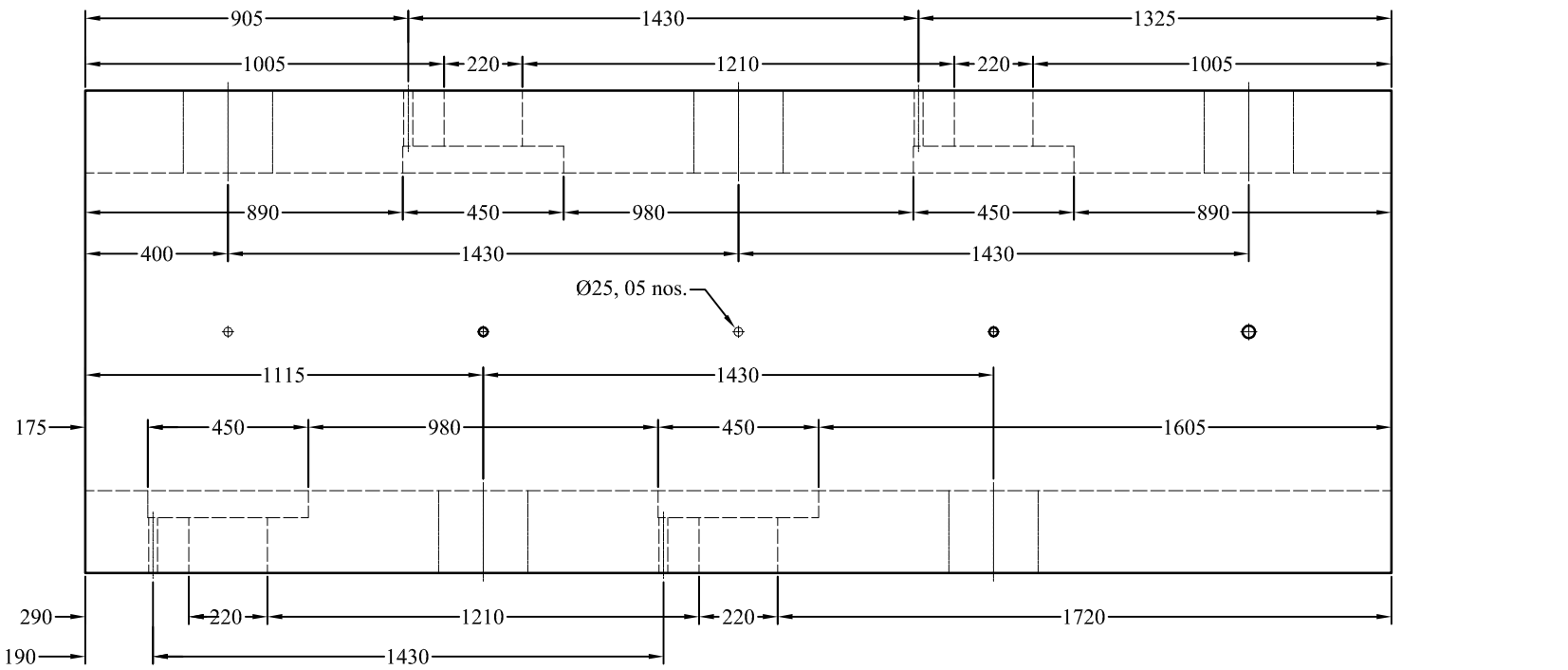
THIRD ANGLE PROJECTION

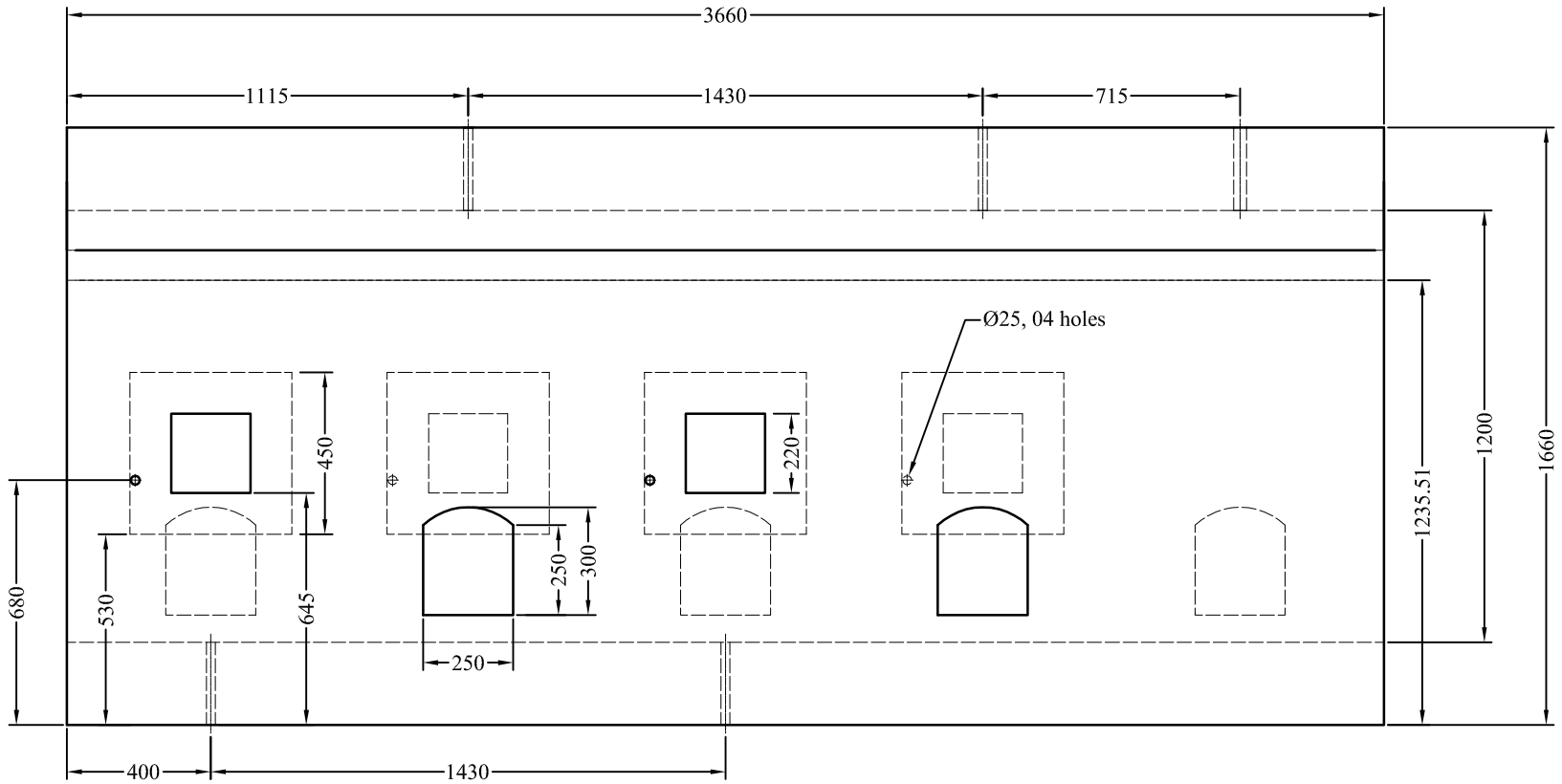
TITLE: SECONDARY CHAMBER-200

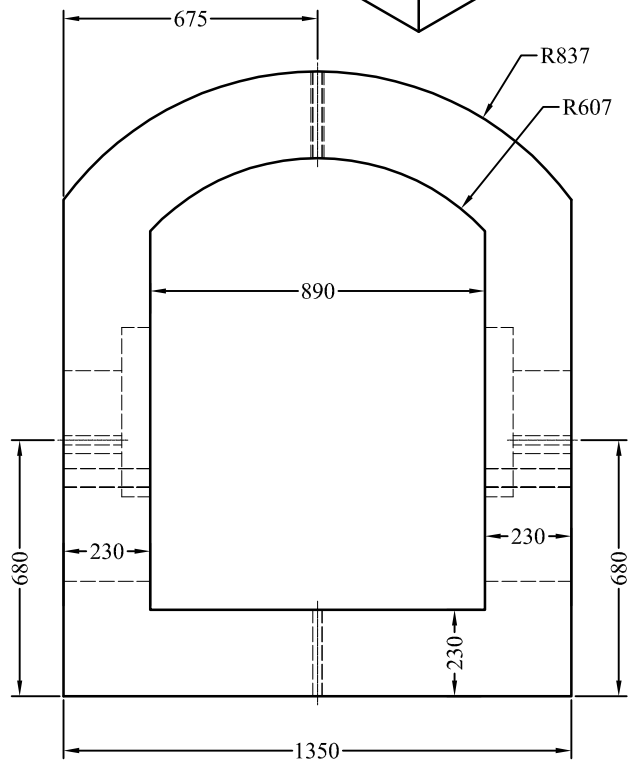
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

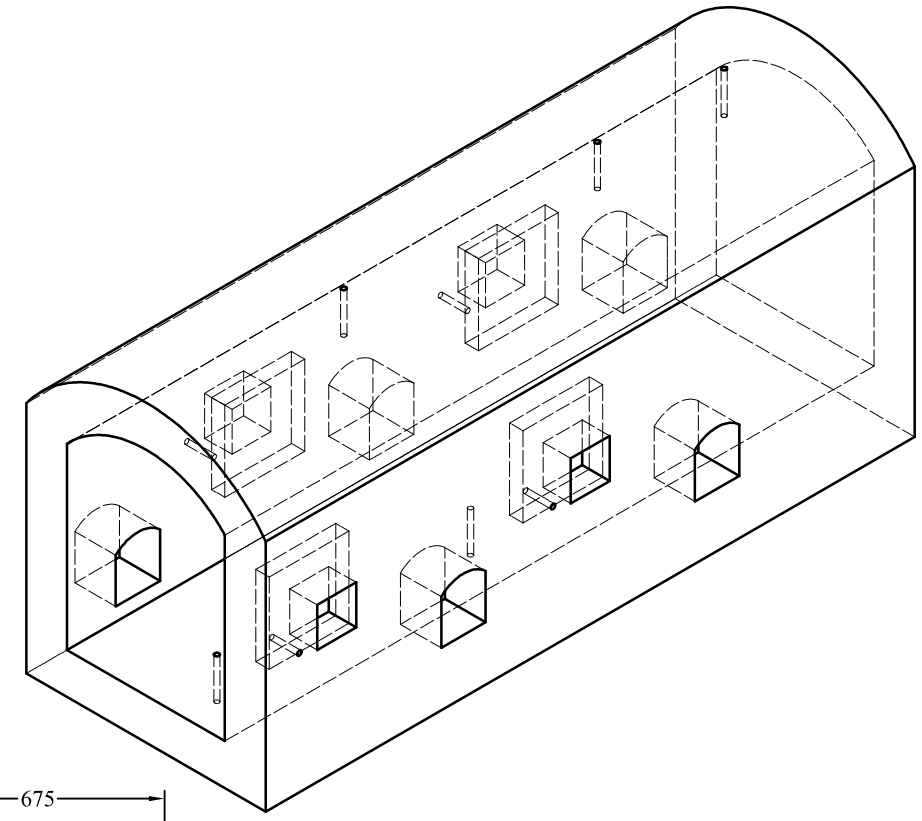
DRG.NO: IPR/APD/CBWTF200/A3/SEC/01-11 SHEET 1 OF 1

Description	Qty.	Material
Part-12	01no.	Insulation layer type 1









Scale : 1.5:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				
MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS				

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION:	APD-IPR	SIZE	A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED			

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

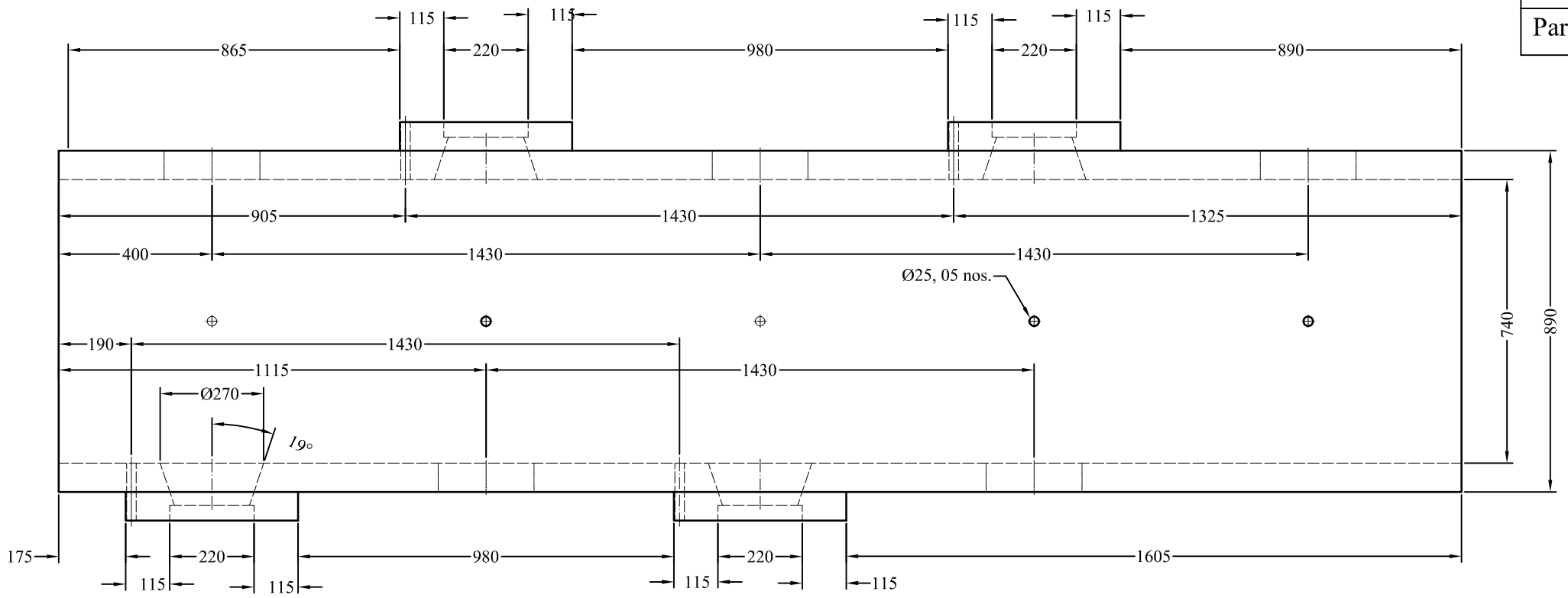
SCALE	NTS	DATE	
DRAWN	Adam	25.10.20	THIRD ANGLE PROJECTION
CHECKED	Adam	25.10.20	
APPROVED	Dr. M K Gupta		

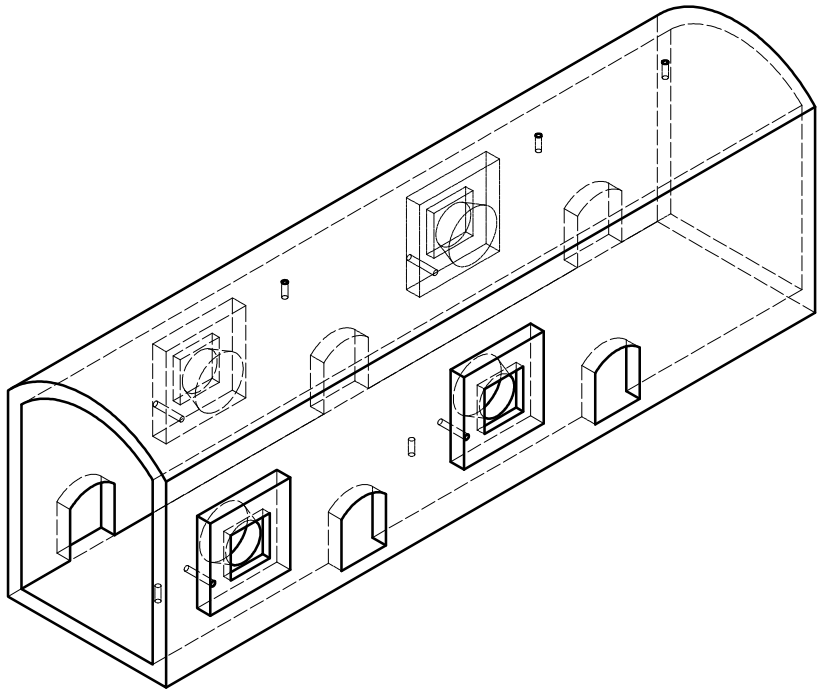
TITLE: SECONDARY CHAMBER-200

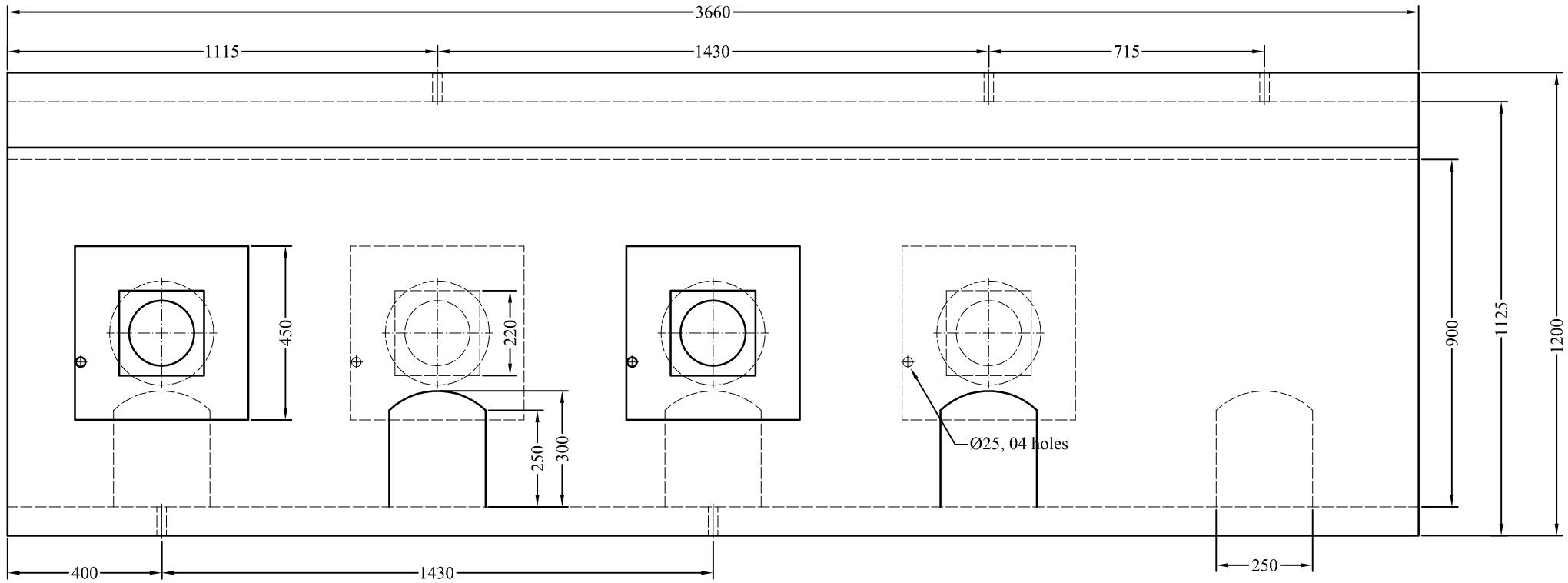
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

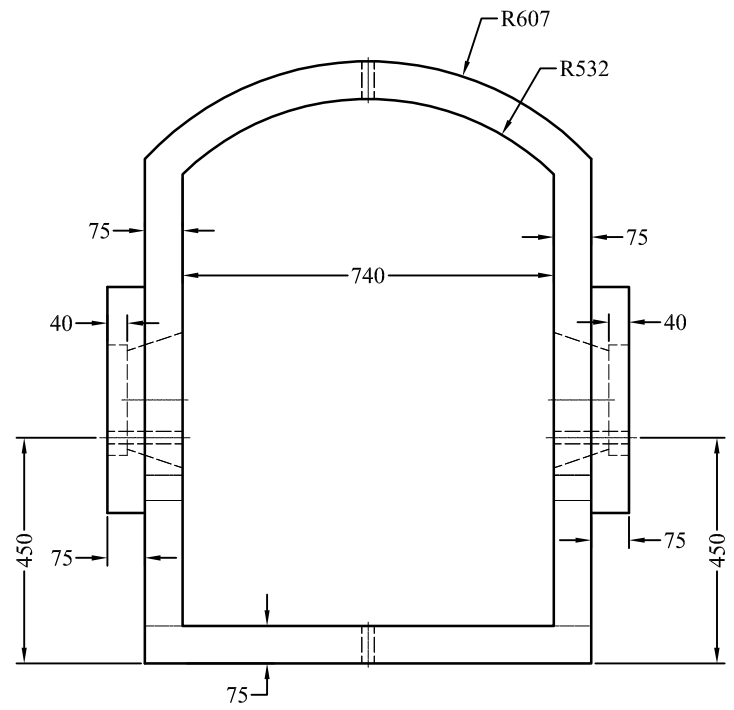
DRG.NO: IPR/APD/CBWTF200/A3/SEC/01-12 SHEET 1 OF 1

Description	Qty.	Material
Part-13	01no.	Refractory layer









Scale : 2:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

REVISION COLUMN

ASS'Y GROUP/ DIVISION:	APD-IPR
SIZE	A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED	

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

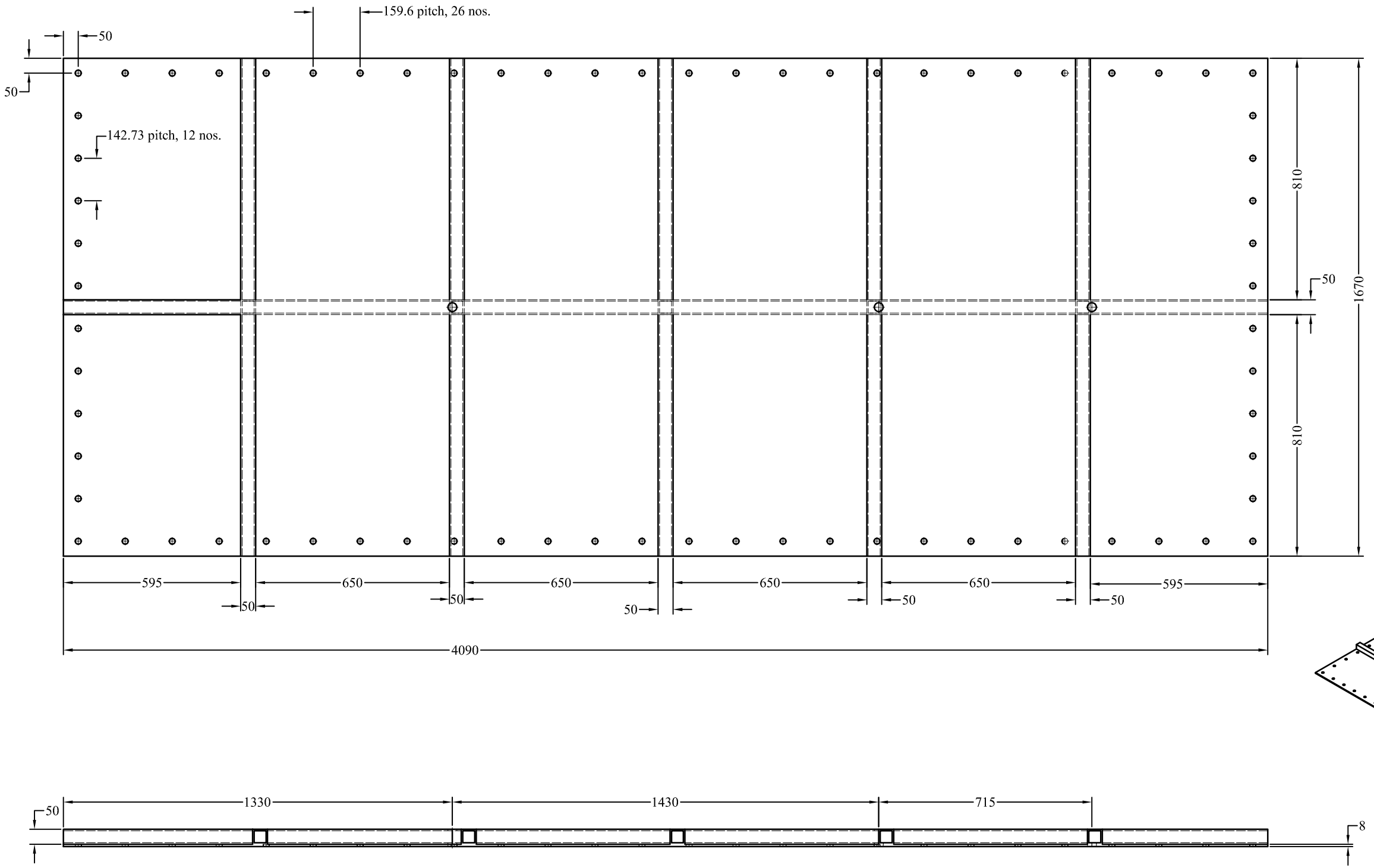
THIRD ANGLE PROJECTION

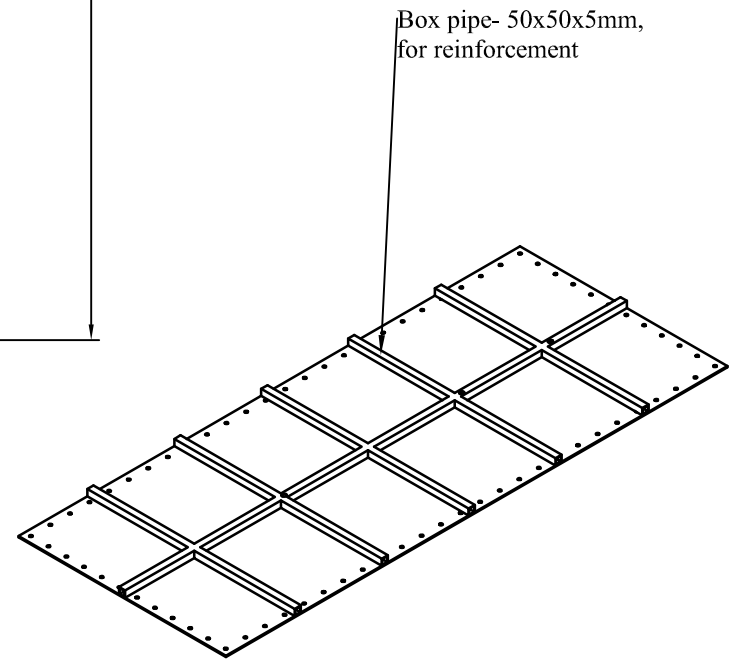
TITLE: SECONDARY CHAMBER-200

REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO: IPR/APD/CBWTF200/A3/SEC/01-13 SHEET 1 OF 1

Description	Qty.	Material
Part-14	01no.	SA-516 GR -60





Scale : 2:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN

REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION: APD-IPR		SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		
SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

THIRD ANGLE PROJECTION

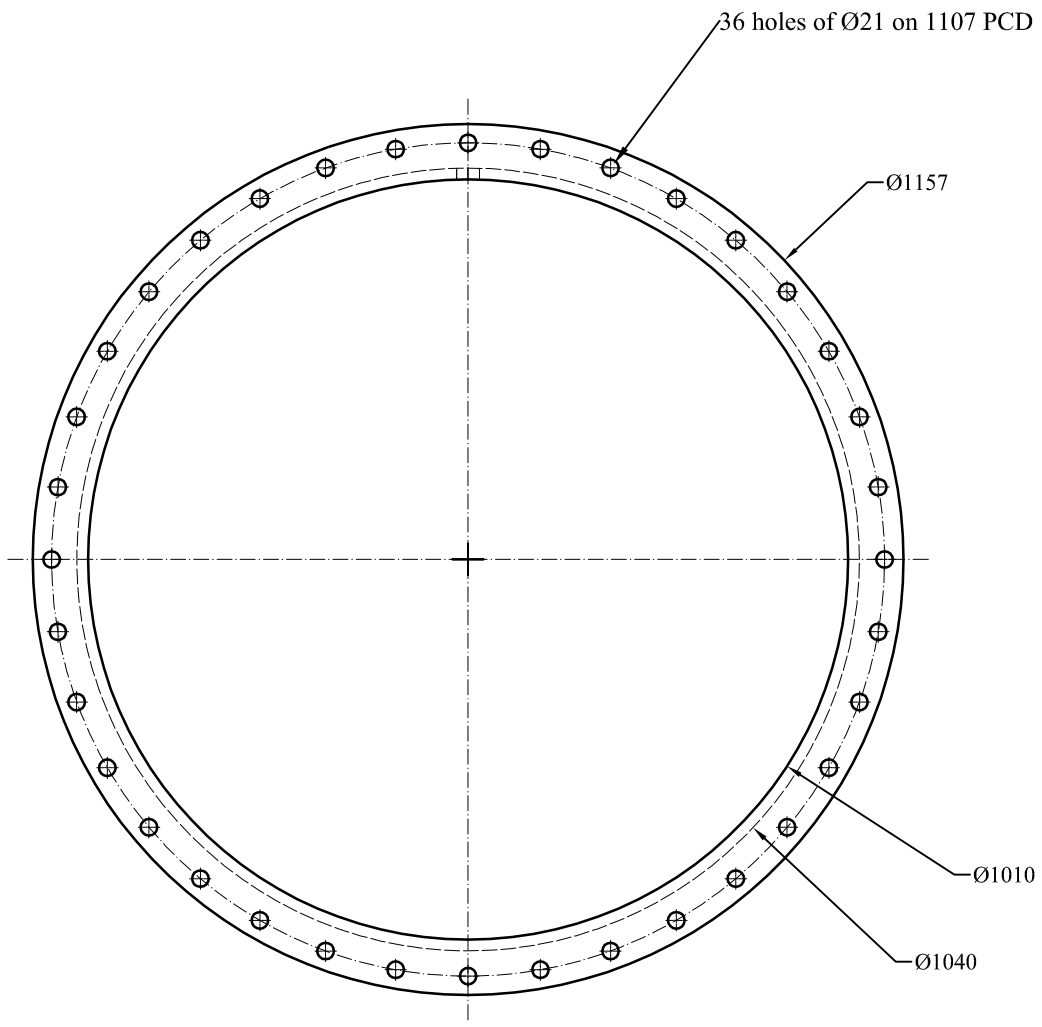
TITLE: SECONDARY CHAMBER-200

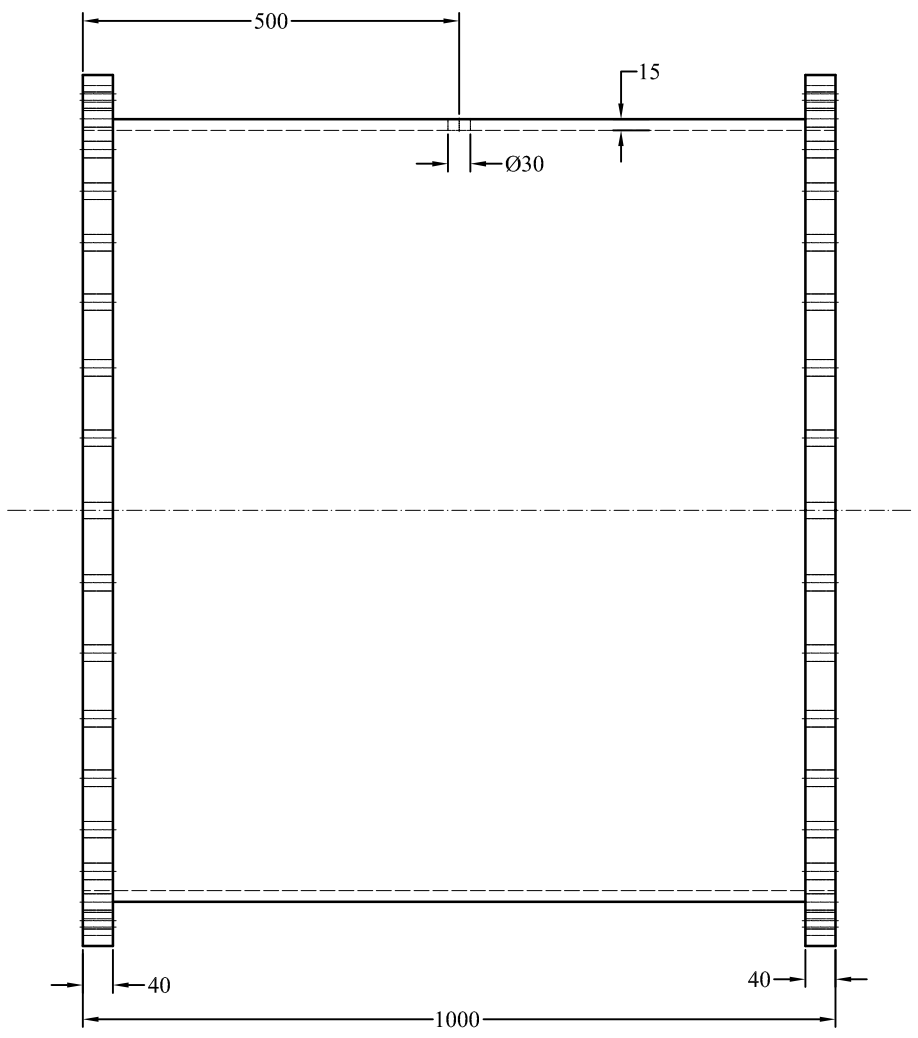
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

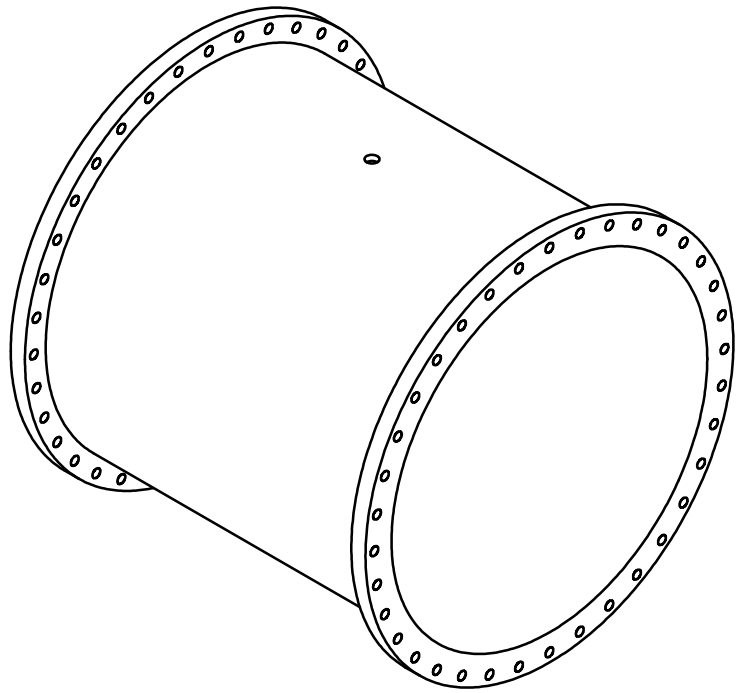
DRG.NO IPR/APD/CBWTF200/A3/SEC/01-14 SHEET 1 OF 1

Description	Qty.	Material
Part-15	01no.	SA-516 GR -60, flange SA-105 (forging grade)

NOTES :-
1. INTIGRAL TYPE FLANGE SHOULD BE FABRICATED.
2. RAISED FACE THICKNESS OF 2 mm SHALL BE MACHINED IN EXCESS OF FLANGE THICKNESS.







Scale : 3:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS									
LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION:	APD-IPR	SIZE	A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED			
SCALE	NTS	DATE	
DRAWN	Adam	25.10.20	
CHECKED	Adam	25.10.20	
APPROVED	Dr. M K Gupta		

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

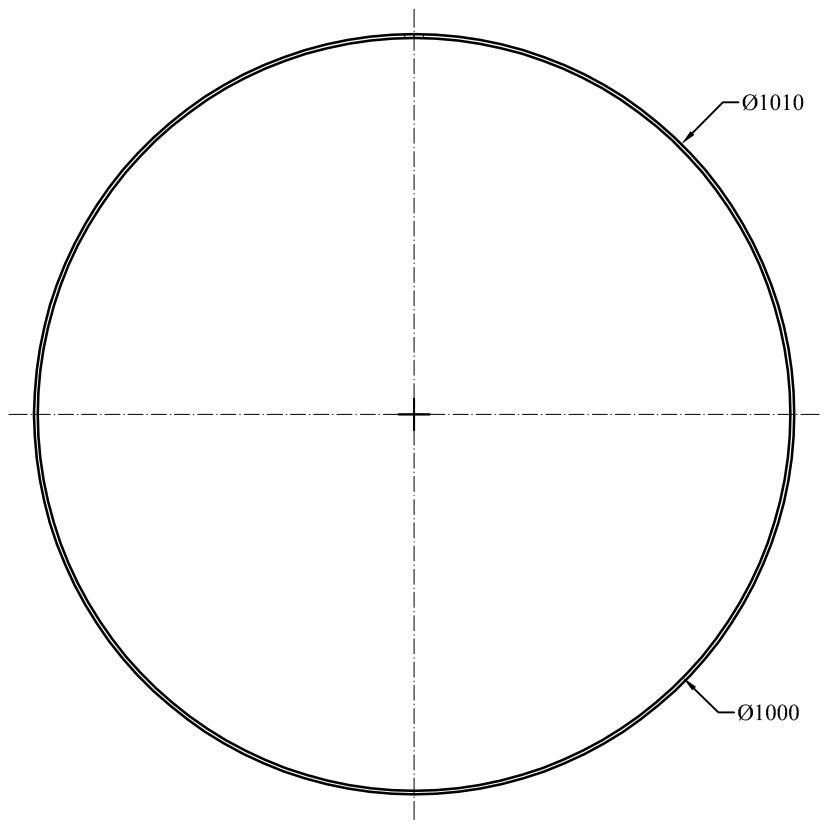
THIRD ANGLE PROJECTION

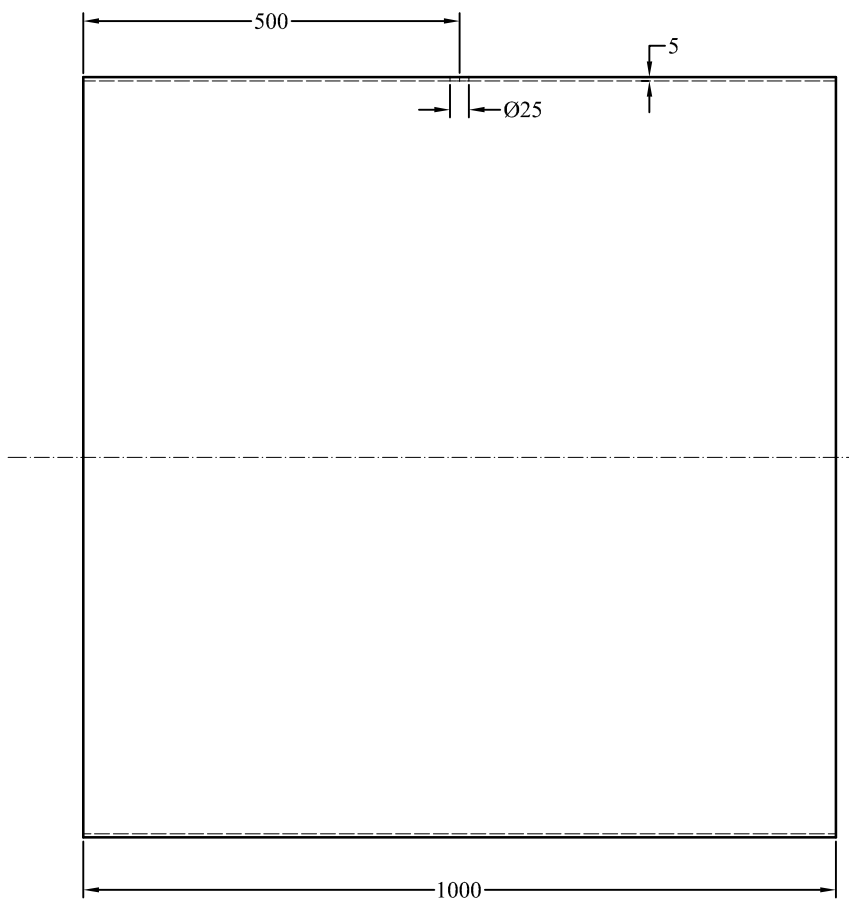
TITLE: SECONDARY CHAMBER-200

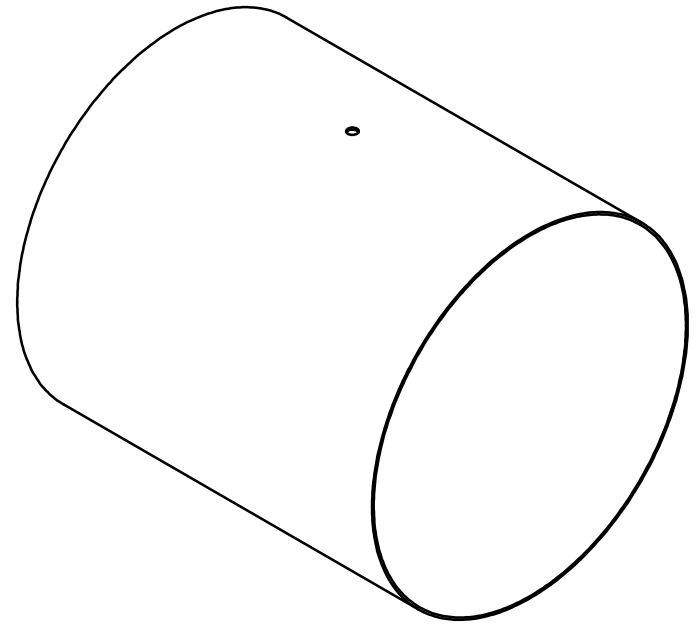
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO: IPR/APD/CBWTF200/A3/SEC/01-15 SHEET 1 OF 1

Description	Qty.	Material
Part-16	01no.	Insulation layer type 3







Scale : 3:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS									
LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION: APD-IPR		SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		
SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

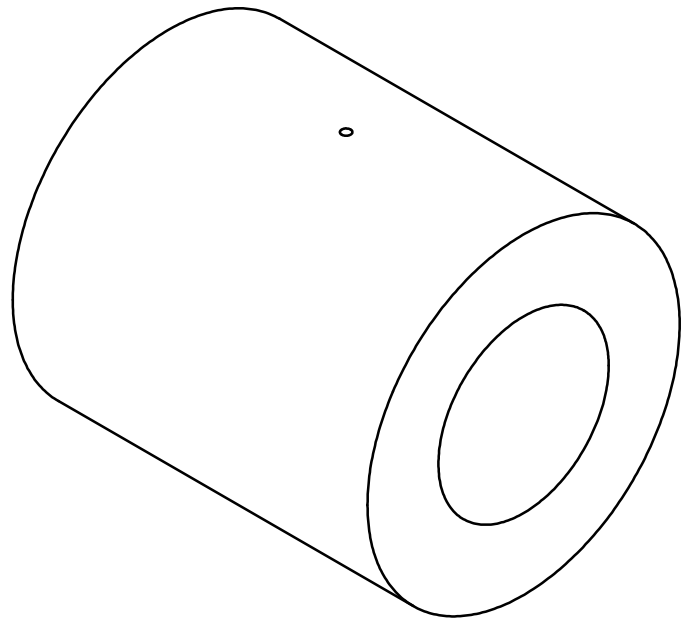
THIRD ANGLE PROJECTION

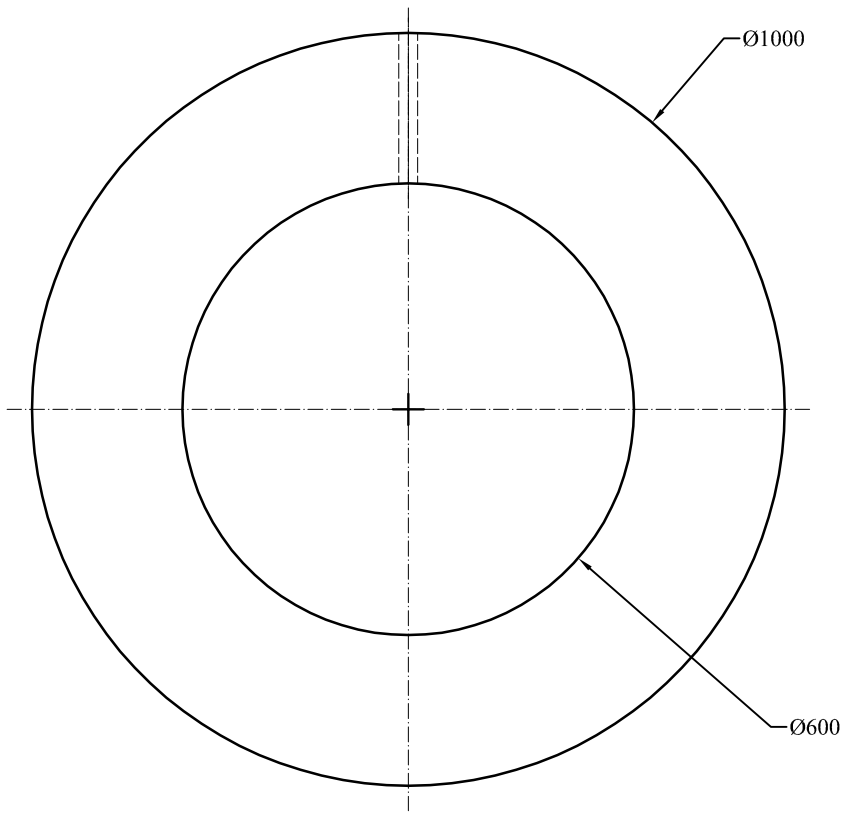
TITLE: SECONDARY CHAMBER-200

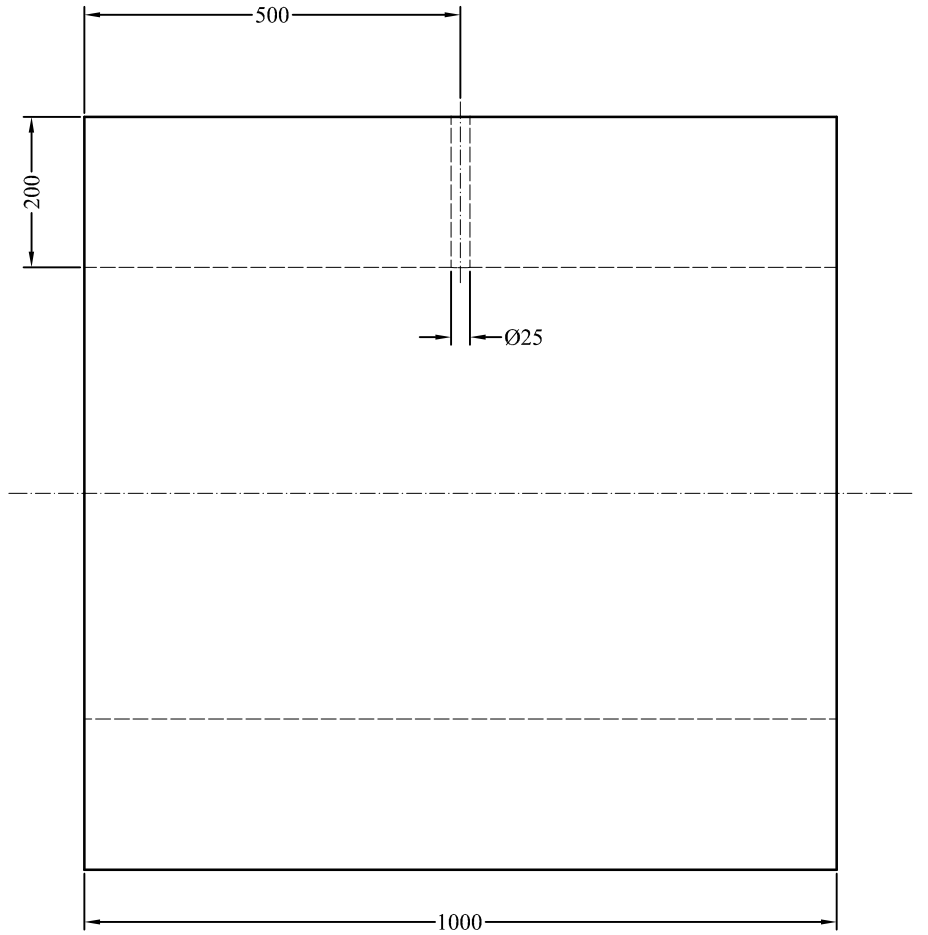
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO IPR/APD/CBWTF200/A3/SEC/01-16 SHEET 1 OF 1

Description	Qty.	Material
Part-17	01no.	Insulation layer type 1







Scale : 3:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION: APD-IPR		SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		
SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

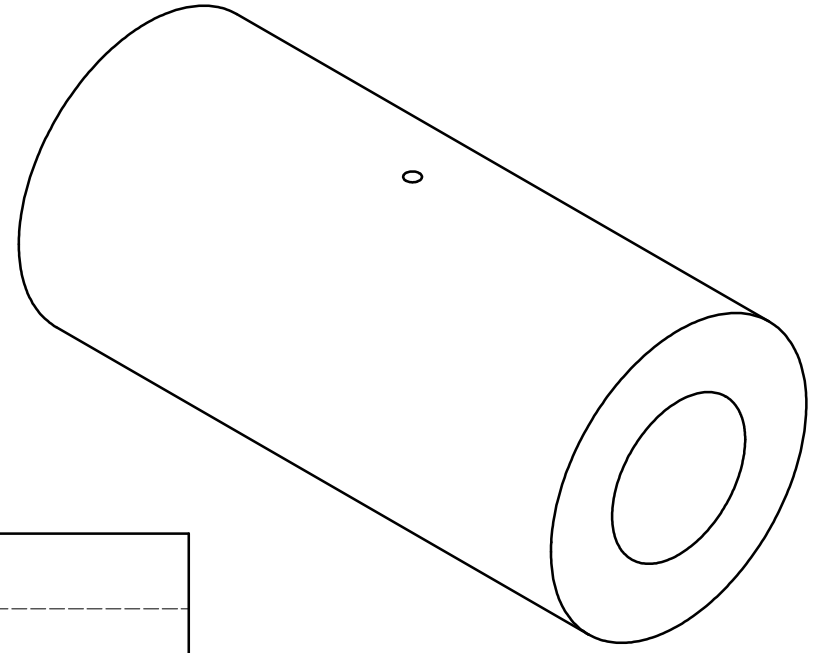
THIRD ANGLE PROJECTION

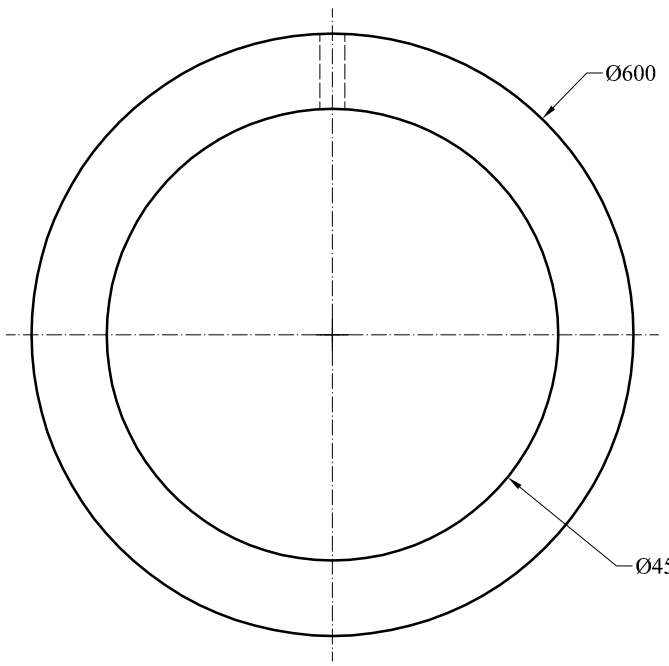
TITLE: SECONDARY CHAMBER-200

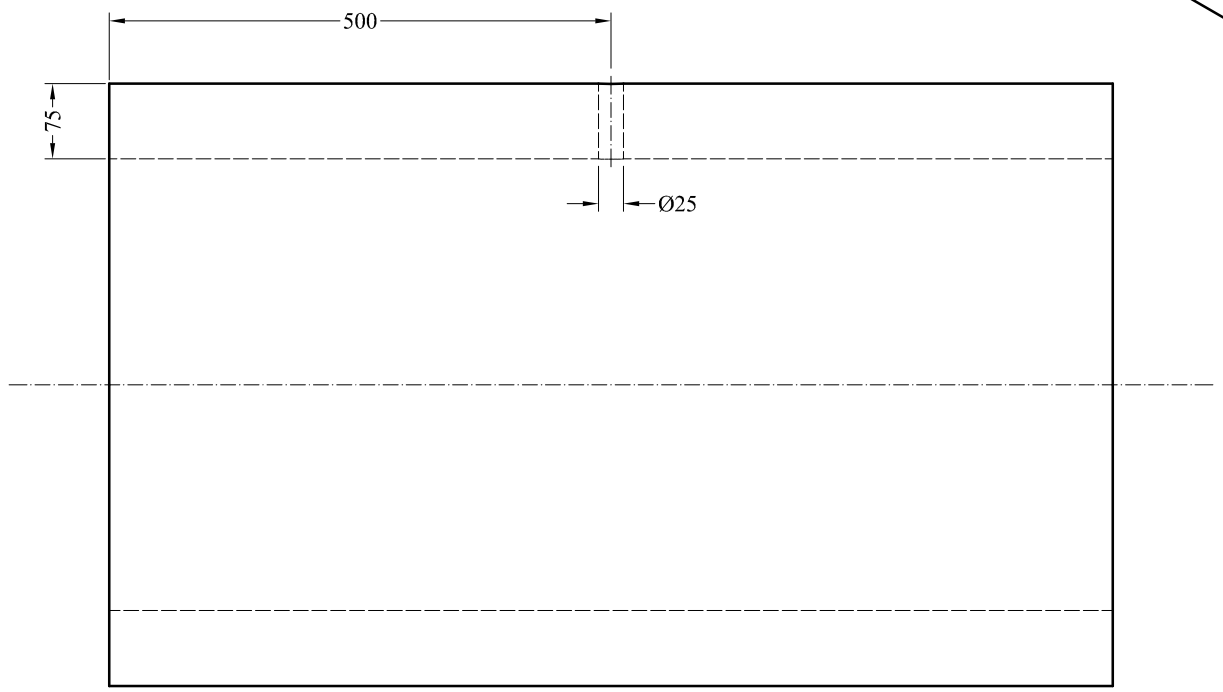
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO: IPR/APD/CBWTF200/A3/SEC/01-17 SHEET 1 OF 1

Description	Qty.	Material
Part-18	01no.	Refractory layer







Scale : 4:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY
REVISION COLUMN					

ASS'Y GROUP/ DIVISION:	APD-IPR	SIZE	A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED			
SCALE	NTS	DATE	
DRAWN	Adam	25.10.20	
CHECKED	Adam	25.10.20	
APPROVED	Dr. M K Gupta		

THIRD ANGLE PROJECTION

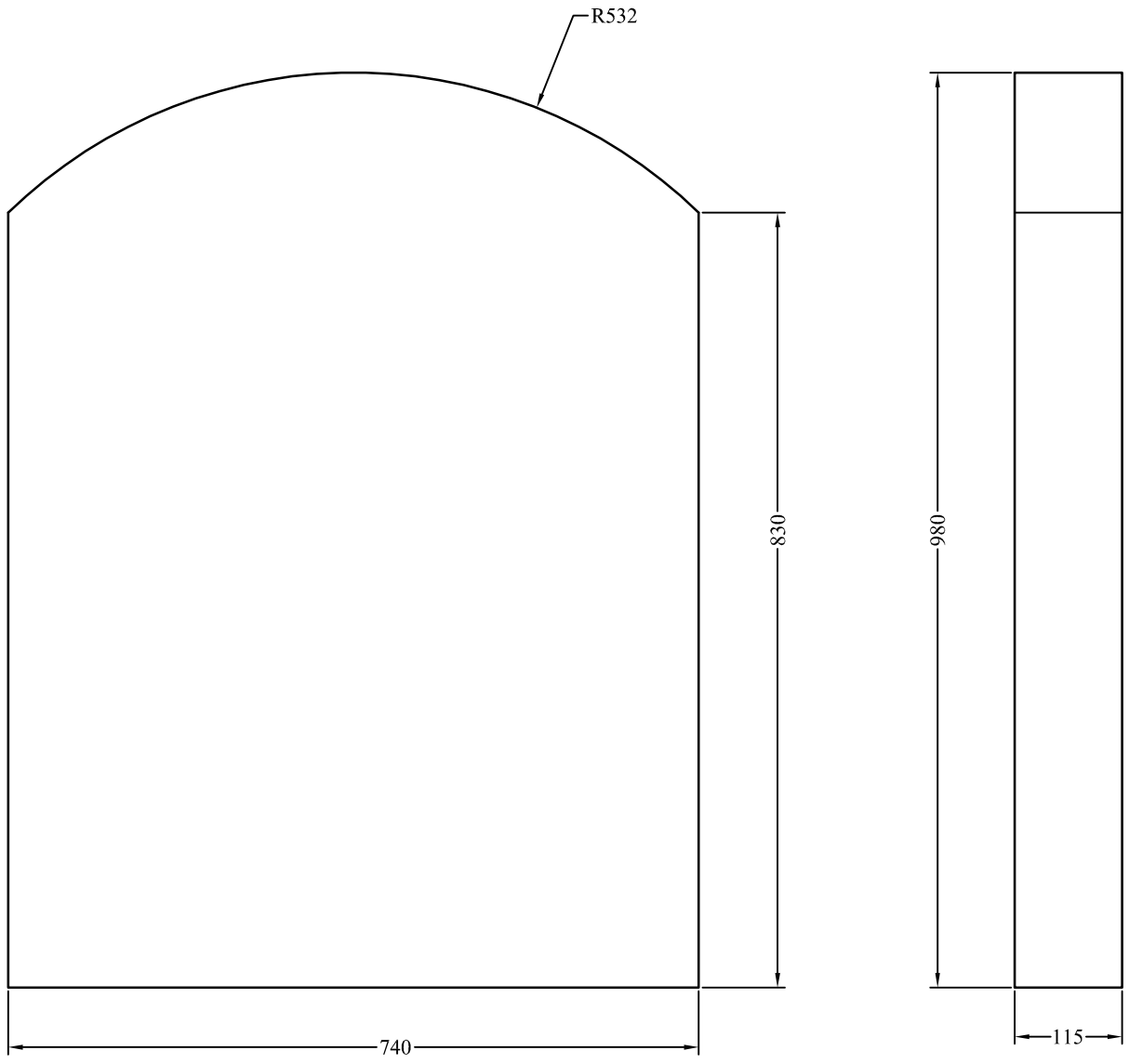
INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

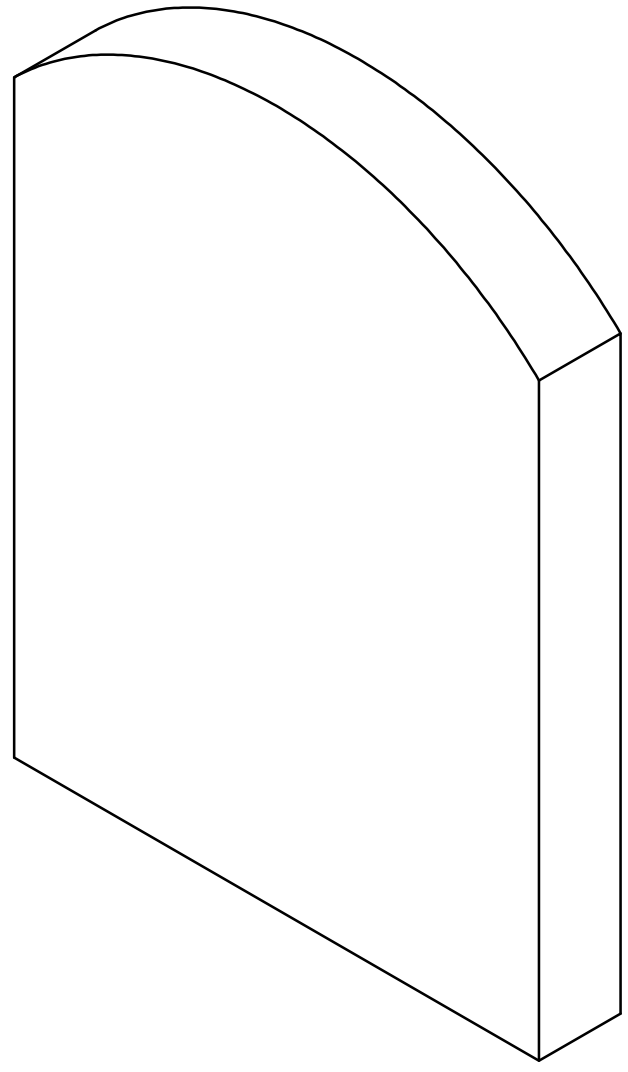
TITLE: SECONDARY CHAMBER-200

REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO: IPR/APD/CBWTF200/A3/SEC/01-18 SHEET 1 OF 1

Description	Qty.	Material
Part-19	02no.	Refractory layer





Scale : 4:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

REVISION COLUMN

ASS'Y GROUP/ DIVISION: APD-IPR		SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		
SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

THIRD ANGLE PROJECTION

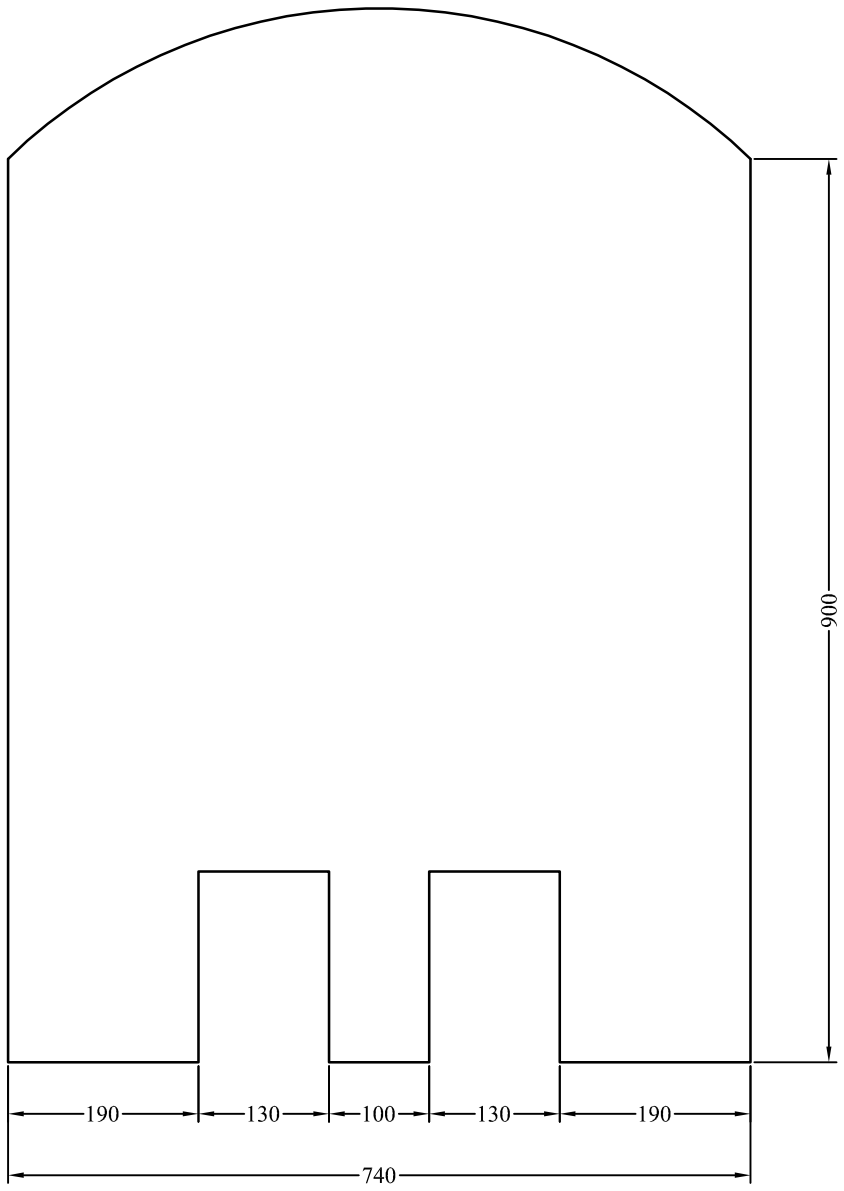
INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

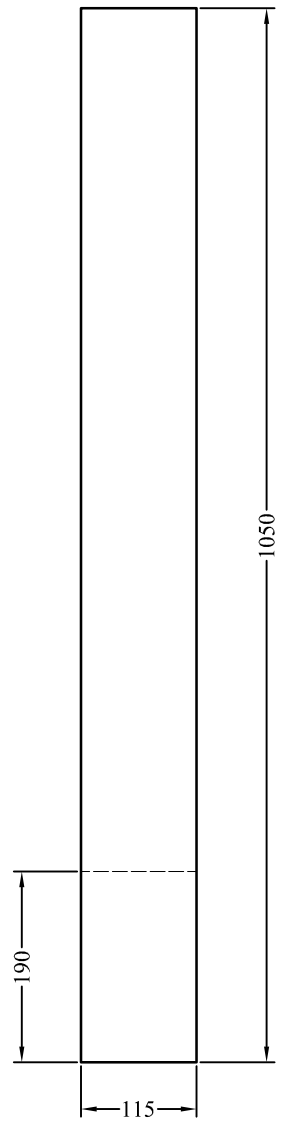
TITLE: SECONDARY CHAMBER-200

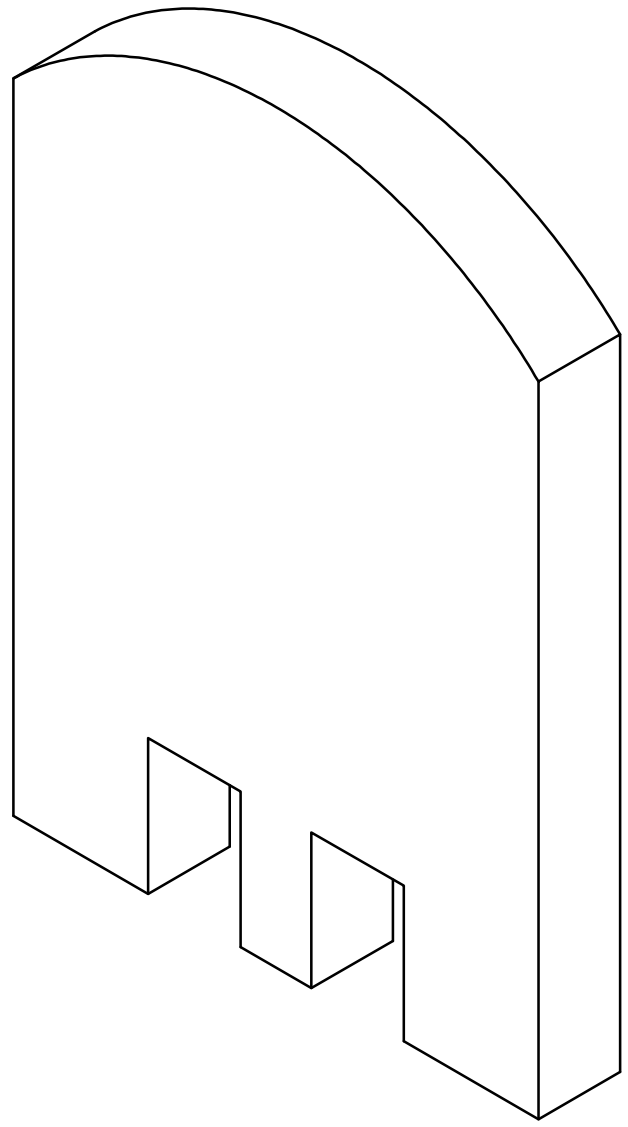
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO IPR/APD/CBWTF200/A3/SEC/01-19 SHEET 1 OF 1

Description	Qty.	Material
Part-20	02no.	Refractory layer







Scale : 4:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS									
LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION: APD-IPR	SIZE A3	
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		
SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

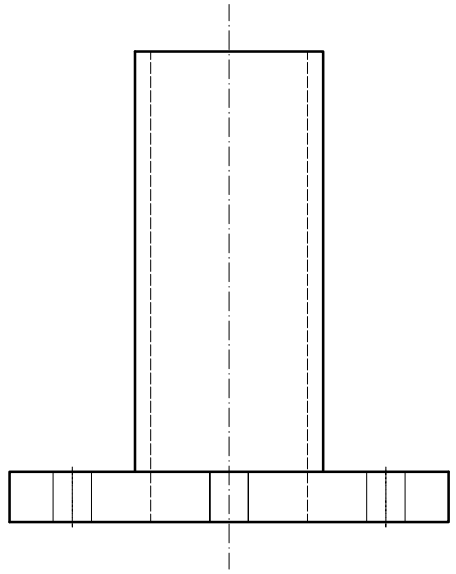
THIRD ANGLE PROJECTION

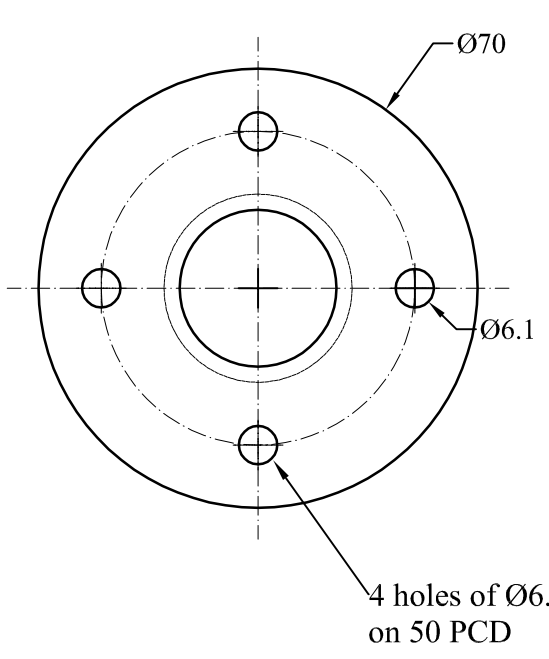
TITLE: SECONDARY CHAMBER-200

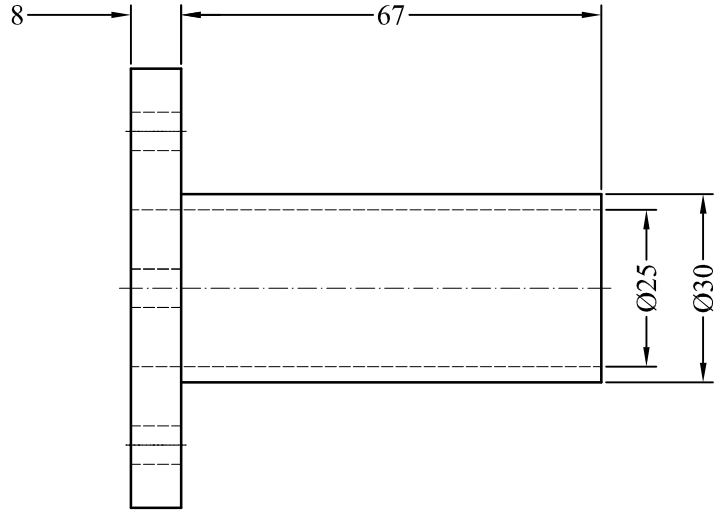
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

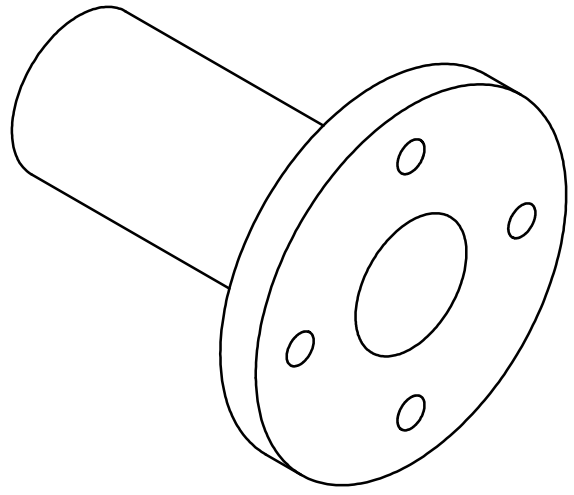
DRG.NO IPR/APD/CBWTF200/A3/SEC/01-20 SHEET 1 OF 1

Description	Qty.	Material
Part-21	10 no.	SA-516 GR -60, flange SA-105 (forging grade)









NOTES :-
1. INTIGRAL TYPE FLANGE SHOULD BE FABRICATED.
2. RAISED FACE THICKNESS OF 2 mm SHALL BE MACHINED IN EXCESS OF FLANGE THICKNESS.

Scale : 20:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION: APD-IPR	SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED	

SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

THIRD ANGLE PROJECTION

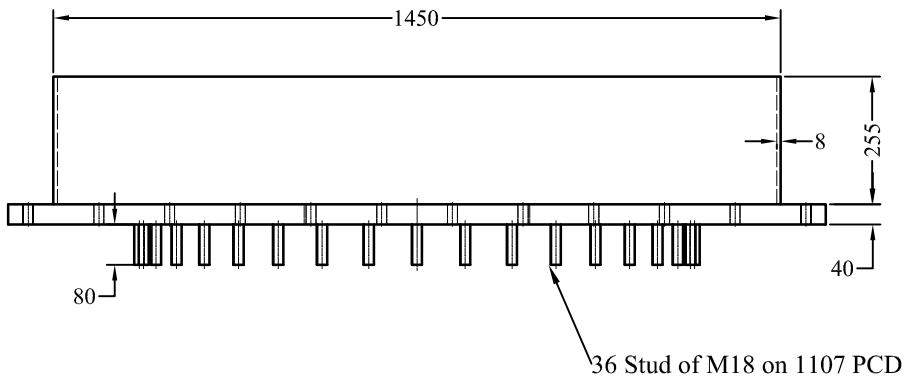
TITLE: SECONDARY CHAMBER-200

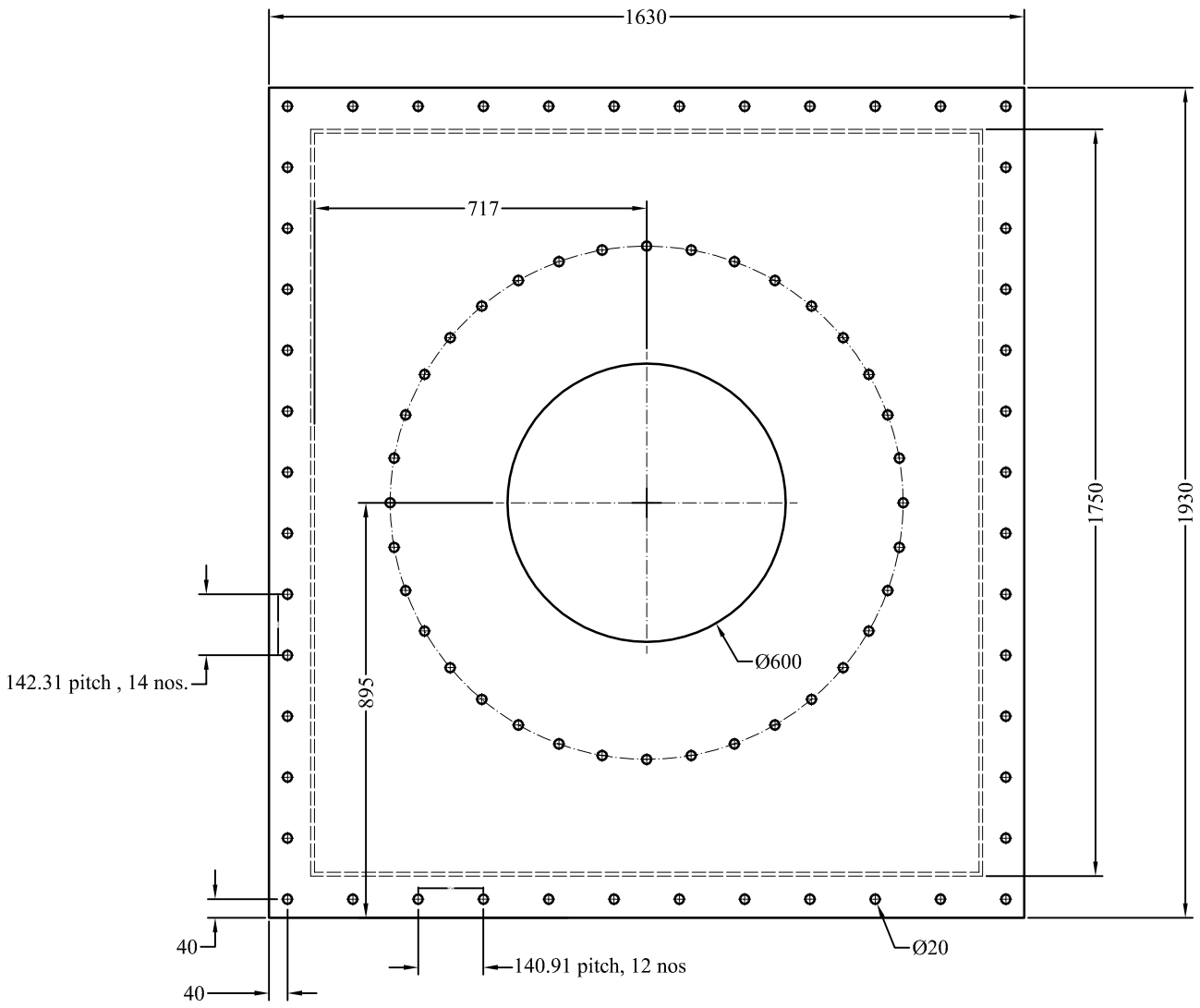
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

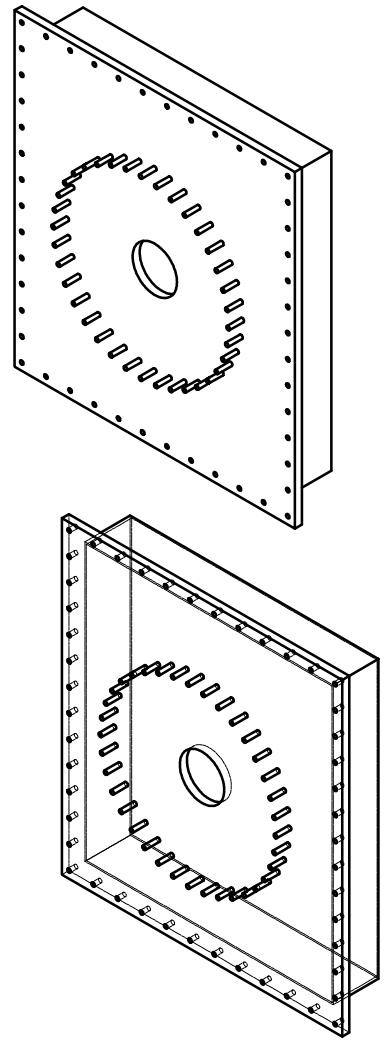
DRG.NO: IPR/APD/CBWTF200/A3/SEC/01-21 SHEET 1 OF 1

Description	Qty.	Material
Part-22	01no.	SA-516 GR -60, flange SA-105 (forging grade)

NOTES :-
1. INTIGRAL TYPE FLANGE SHOULD BE FABRICATED.
2. RAISED FACE THICKNESS OF 2 mm SHALL BE MACHINED IN EXCESS OF FLANGE THICKNESS.







Scale : 2:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY
REVISION COLUMN					

ASS'Y GROUP/ DIVISION: APD-IPR			SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED			
SCALE	NTS	DATE	
DRAWN	Adam	25.10.20	
CHECKED	Adam	25.10.20	
APPROVED	Dr. M K Gupta		

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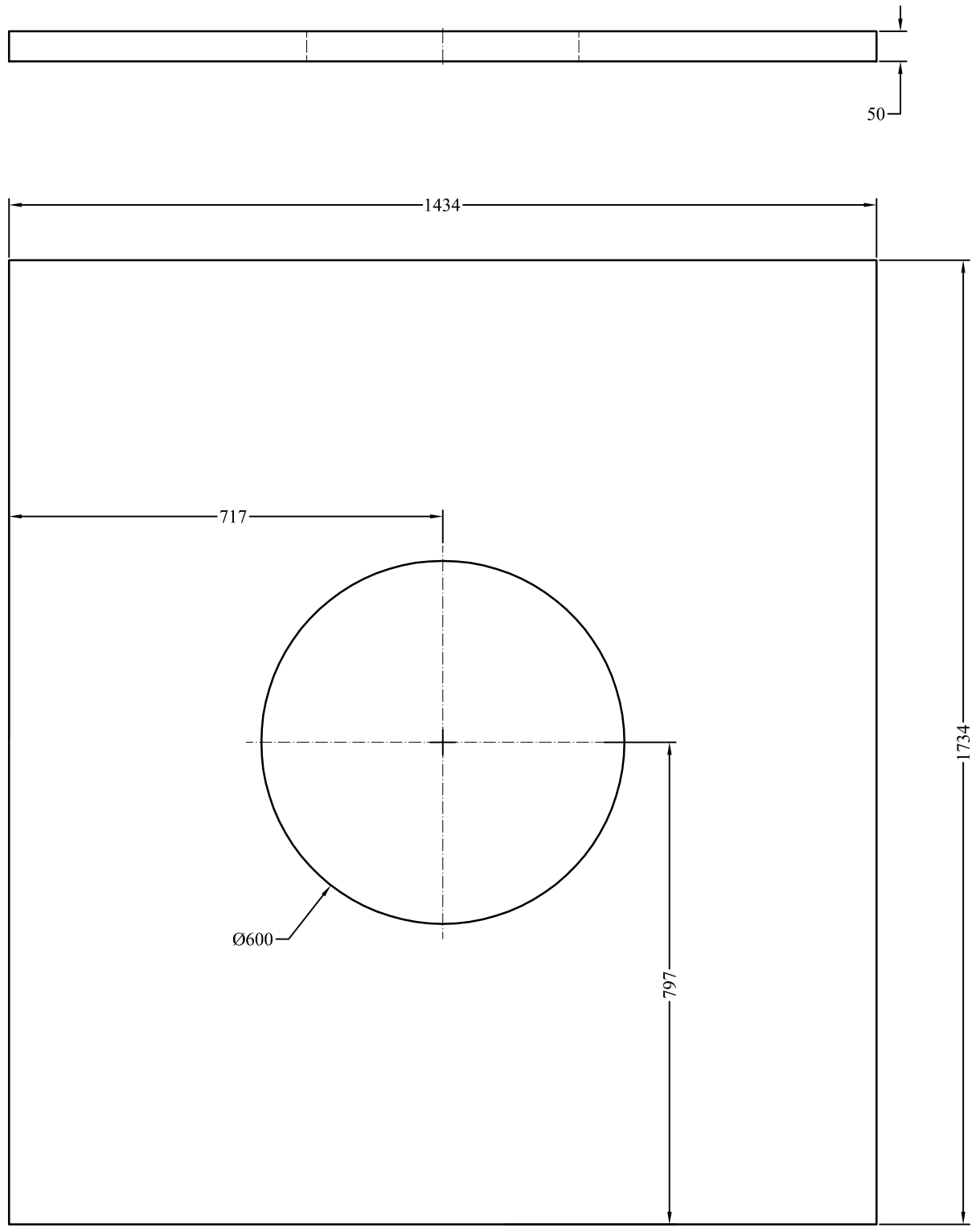
THIRD ANGLE PROJECTION

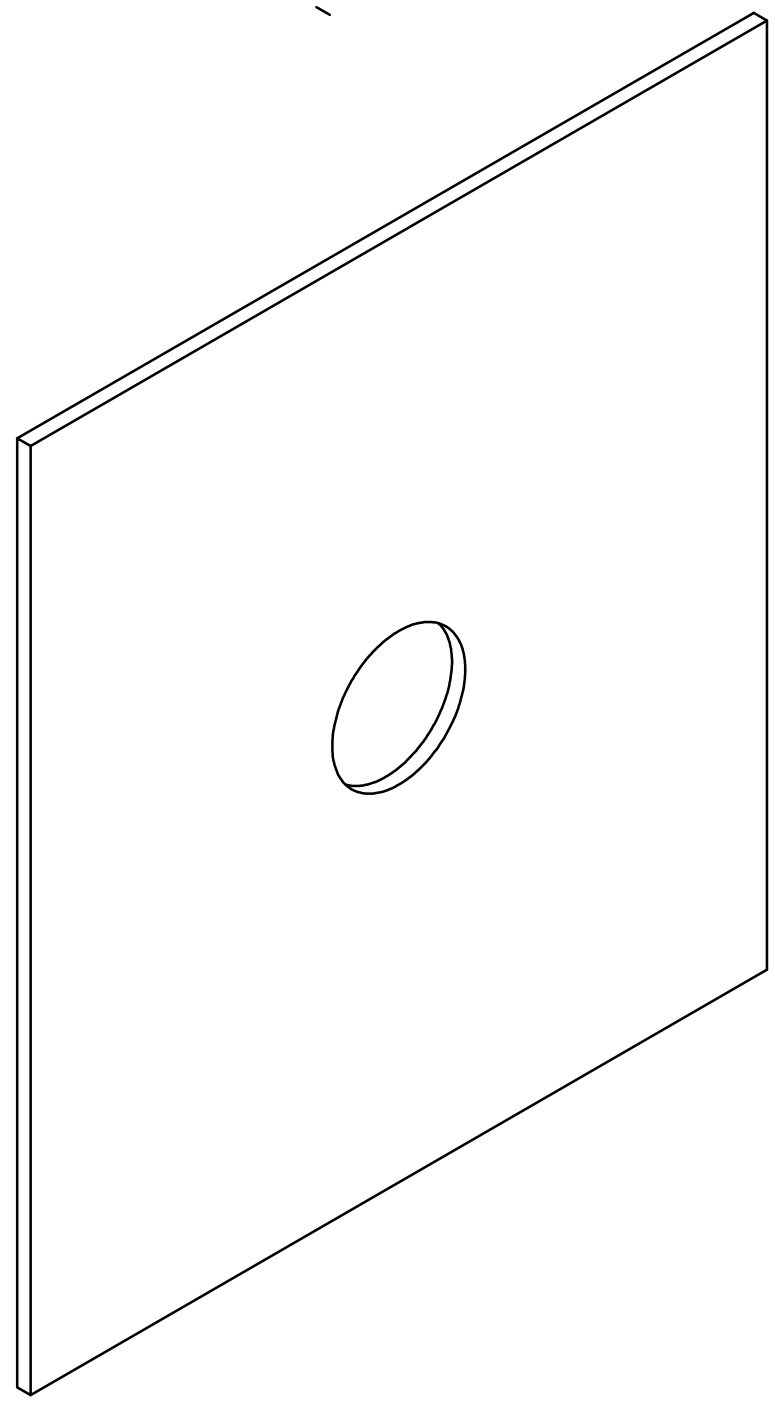
TITLE: SECONDARY CHAMBER-200

REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO: IPR/APD/CBWTF200/A3/SEC/01-22 SHEET 1 OF 1

Description	Qty.	Material
Part-23	01no.	Insulation layer type 2





Scale : 3:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION: APD-IPR	SIZE A3	
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		
SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

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INDIA

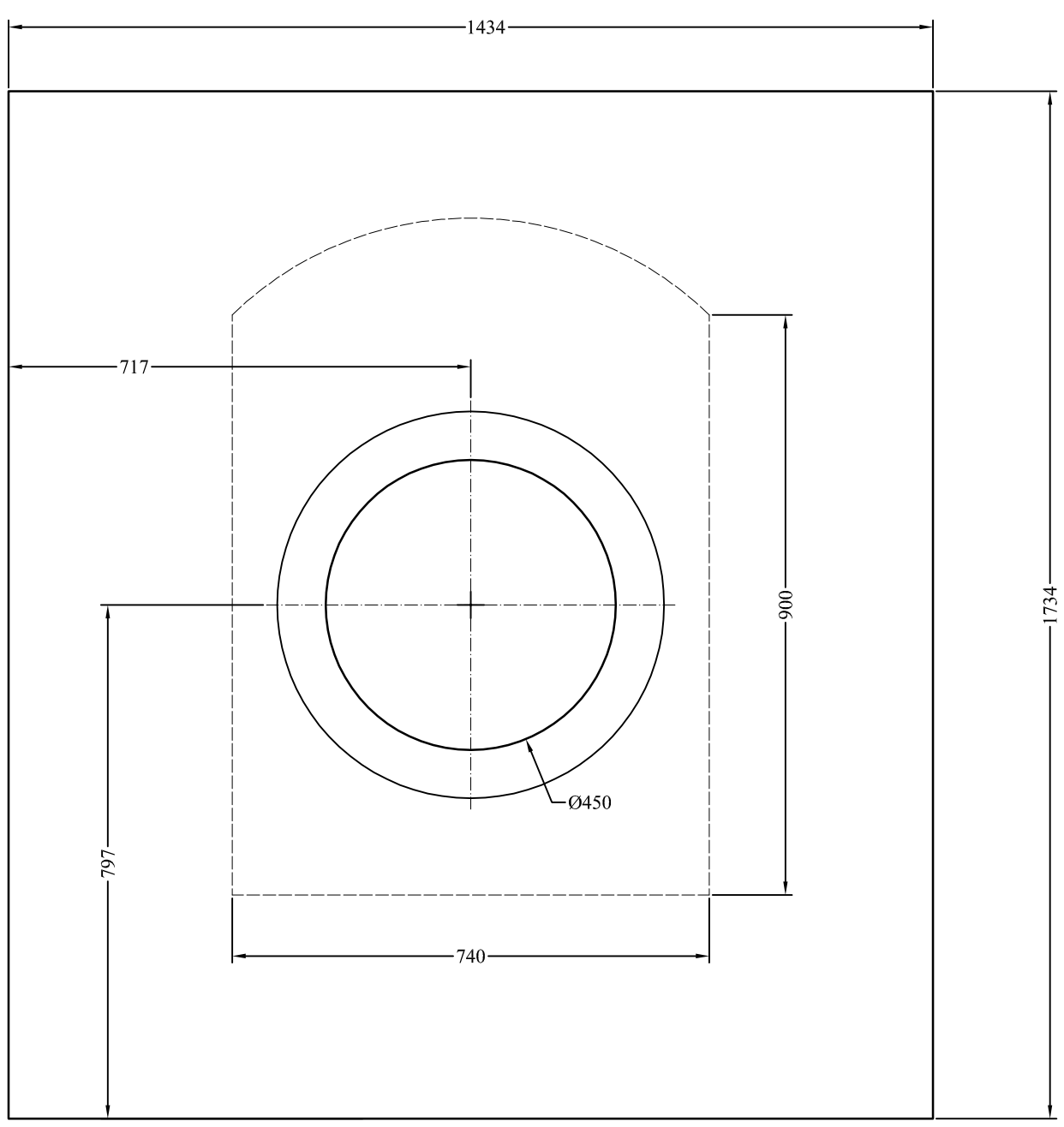
THIRD ANGLE PROJECTION

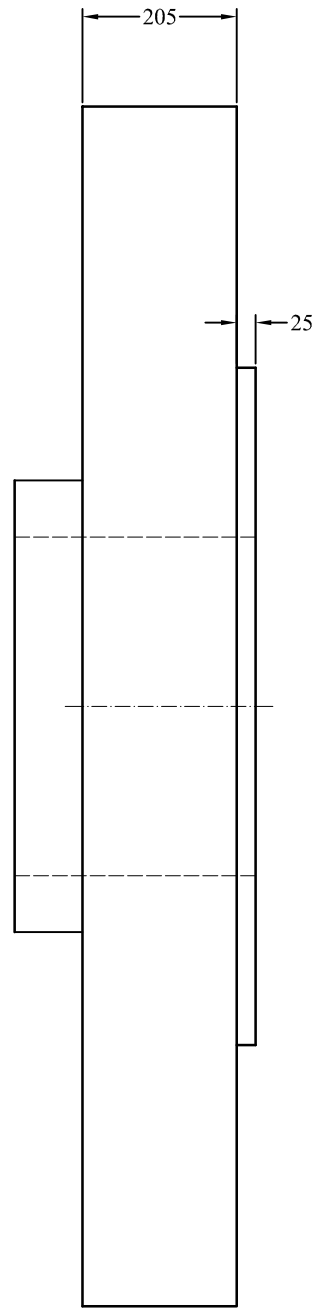
TITLE: SECONDARY CHAMBER-200

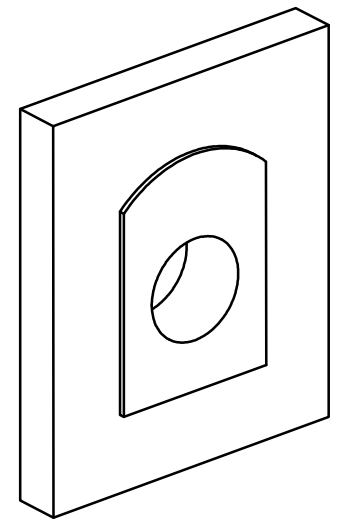
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

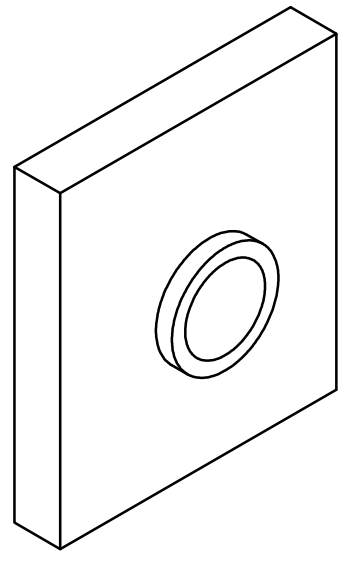
DRG.NO: IPR/APD/CBWTF200/A3/SEC/01-23 SHEET 1 OF 1

Description	Qty.	Material
Part-24	01no.	Insulation layer type 1









Scale : 3:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS									
LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REVISION COLUMN					
REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

ASS'Y GROUP/ DIVISION:	APD-IPR	SIZE	A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED			
SCALE	NTS	DATE	
DRAWN	Adam	25.10.20	
CHECKED	Adam	25.10.20	
APPROVED	Dr. M K Gupta		

INSTITUTE FOR PLASMA RESEARCH
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INDIA

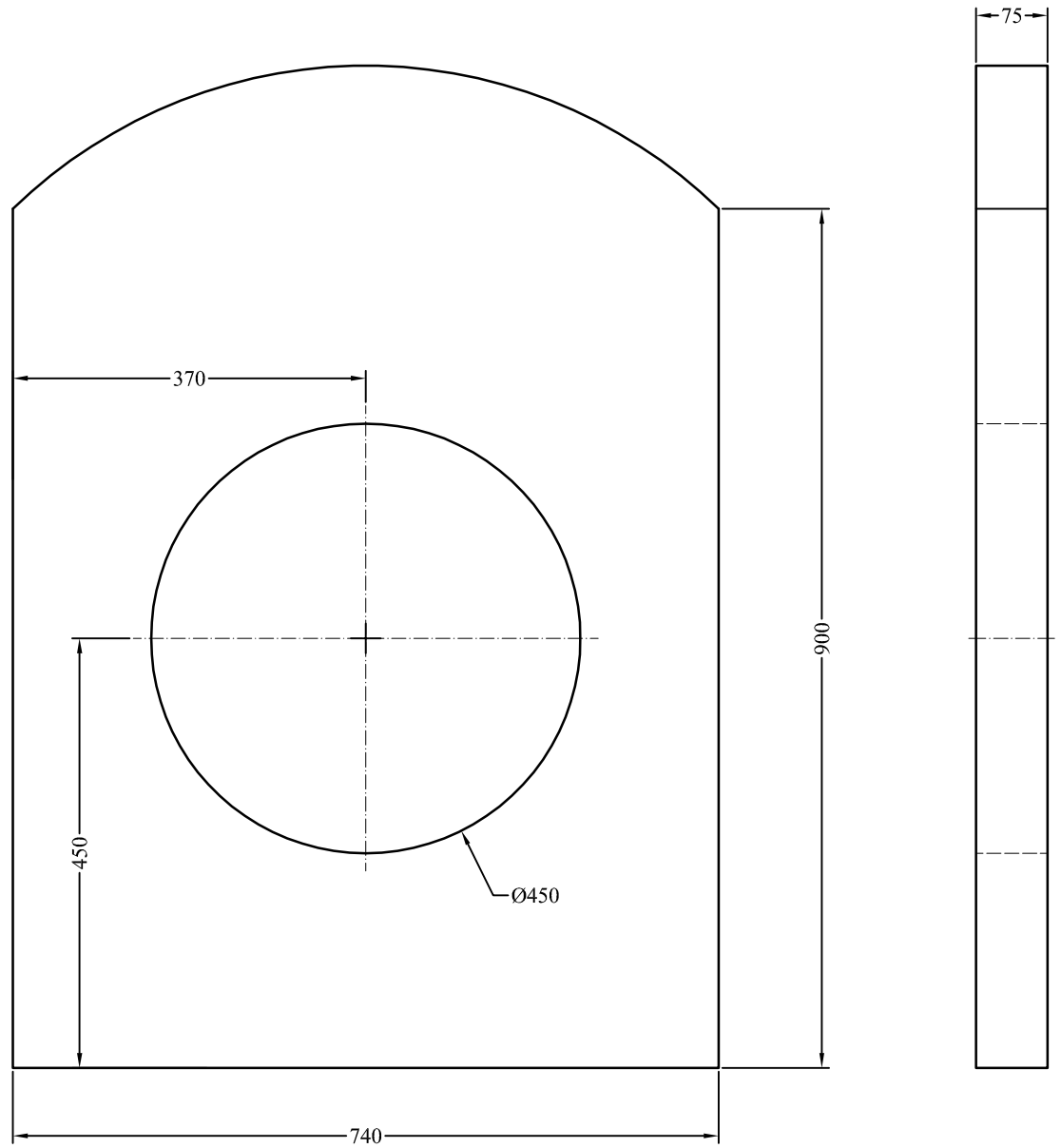
THIRD ANGLE PROJECTION

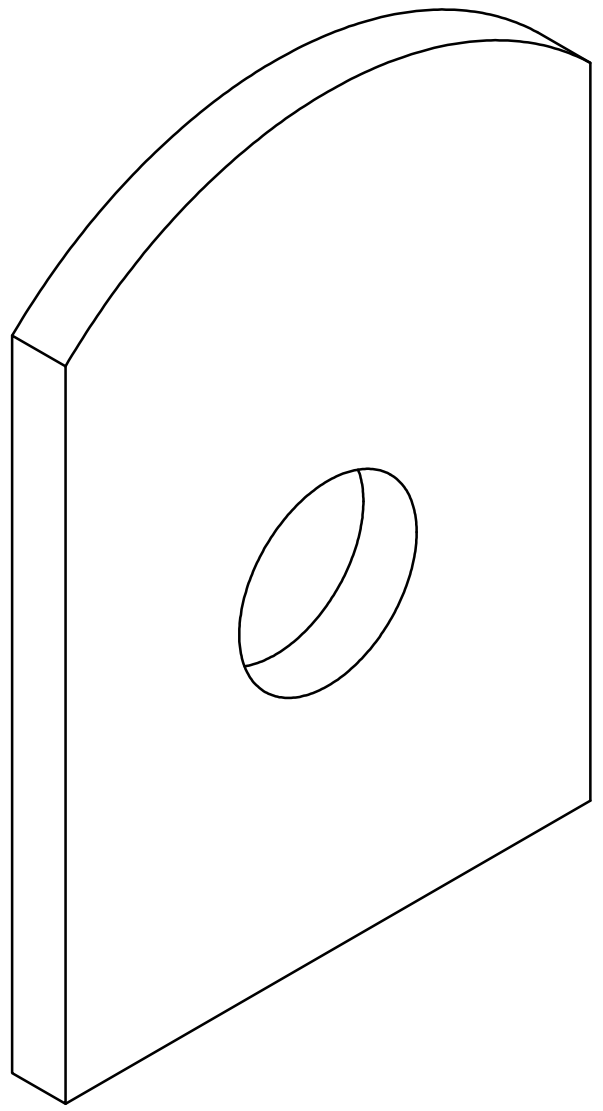
TITLE: SECONDARY CHAMBER-200

REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO: IPR/APD/CBWTF200/A3/SEC/01 -24 SHEET 1 OF 1

Description	Qty.	Material
Part-25	01no.	Refractory layer





Scale : 4:1

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

REVISION COLUMN

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

ASS'Y GROUP/ DIVISION:	APD-IPR	SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		

SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

THIRD ANGLE PROJECTION

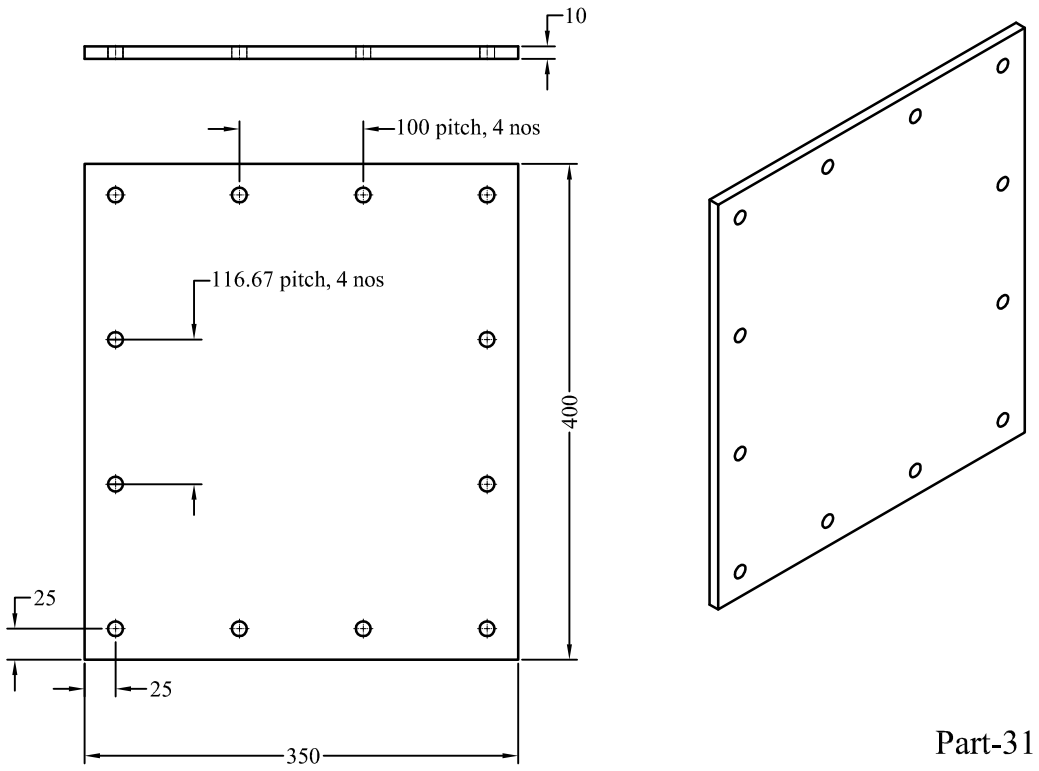
INSTITUTE FOR PLASMA RESEARCH
BHAT, GANDHINAGAR-382 428.
INDIA

TITLE: SECONDARY CHAMBER-200

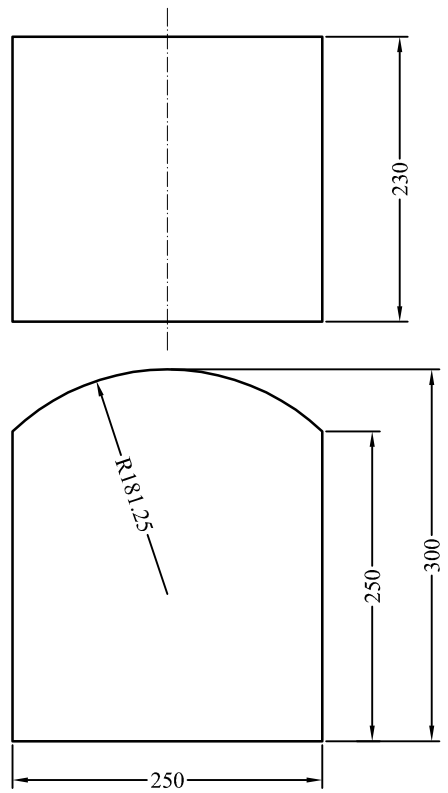
REF DRG NO: IPR/APD/CBWTF200/A3/SEC/01 REV 00

DRG.NO: IPR/APD/CBWTF200/A3/SEC/01-25 SHEET 1 OF 1

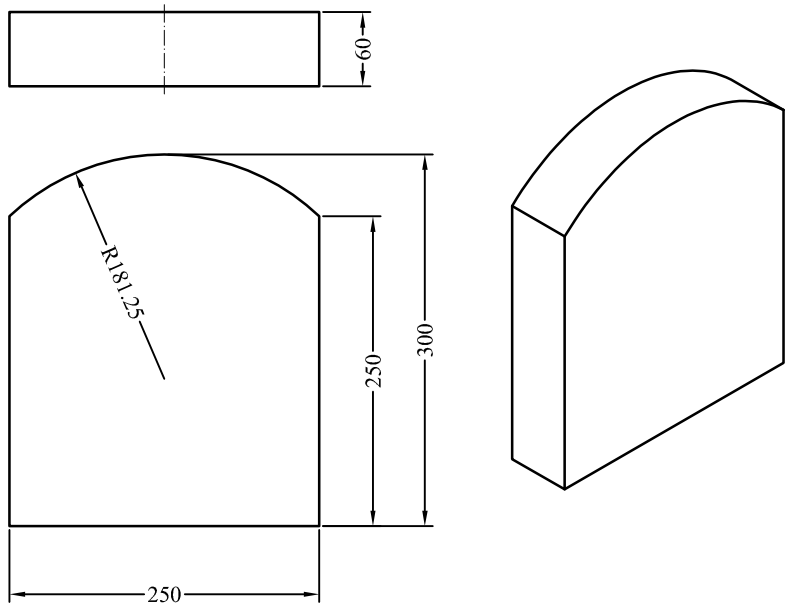
Description	Qty.	Material
Part-31	05no.	SA-105 (forging grade)
Part-32	05no.	Insulation layer type 2
Part-33	05no.	Insulation layer type 1
Part-34	05no.	Refractory layer



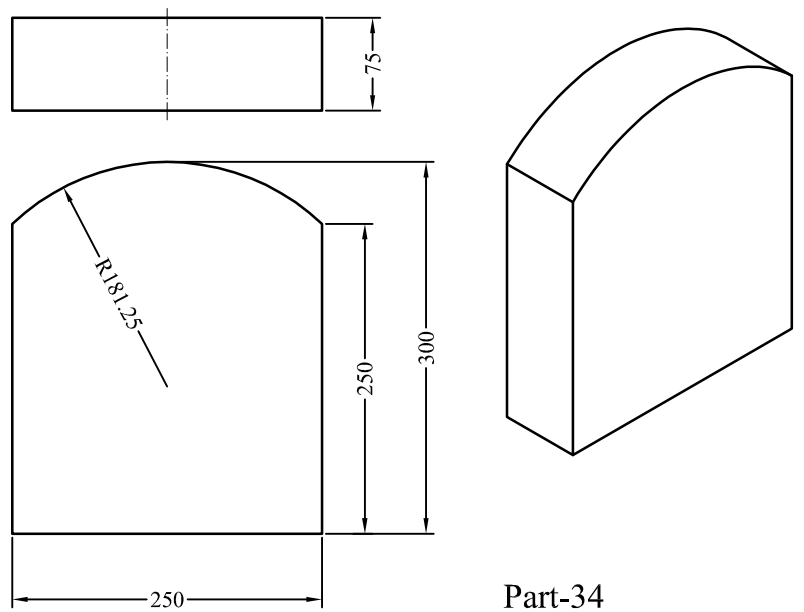
Part-31



Part-33



Part-32



Part-34

Note: part no-32,33,34 should be anchered with part no-01

DRG.NO	▽ 8-25	▽▽ 1.6-8	▽▽▽ 0.025-1.6	▽▽▽▽ < 0.025
CO-ORDINATED BY				

MACHINING DEVIATIONS FOR NON-TOLERANCED DIMENSIONS

LENGTH IN mm OF SHORTER SIDE OF ANGLES				LENGTH OR DIA	UPTO 6	6-30	30-120	120-315
UPTO 10	10-50	50-120	OVER 120-400					
±1°	±0°-30'	±0°-20'	±0°-10'		±0.1	±0.2	±0.3	±0.5

REV	ZONE	DESCRIPTION	DATE	REMARKS	APPROVED BY

REVISION COLUMN

ASS'Y GROUP/ DIVISION: APD-IPR		SIZE A3
ALL DIMENSIONS ARE IN `mm' UNLESS OTHERWISE STATED		
SCALE	NTS	DATE
DRAWN	Adam	25.10.20
CHECKED	Adam	25.10.20
APPROVED	Dr. M K Gupta	

INSTITUTE FOR PLASMA RESEARCH
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INDIA

THIRD ANGLE PROJECTION

TITLE: SECONDARY CHAMBER-200

REF DRG NO:

REV 00

DRG.NO IPR/APD/CBWTF200/A3/SEC/01-26

SHEET 1 OF 1

Vendor compliant sheet

Reference: Tender document For preparation of fabrication drawings, supply, installation and testing of Secondary Chamber assembly

The vendor shall provide their acceptance/confirmation for each point.

- Please avoid to write Yes/Agree/Comply for numeric value/parameters in this compliance sheet.

Sr. no.	IPR technical specification		Vendor acceptance /remarks
1.	**Introduction:** Vendor shall confirm that they have read the introduction part carefully and has clear understanding of components application.		
2.	**Scope of work:**		
2.1	The secondary chamber assembly comprise the followings which technical specifications are mentioned in section 4.1		
	Item description	Quantity	
	1. Secondary chamber	**01 set.**	
	➢ Gas inlet port	02 no.	
	➢ Left side end flange	01 nos.	
	➢ Main rectangular chamber with top cover	01 nos.	
	➢ Right side end flange	01 nos.	
	➢ Gas outlet port	01 nos.	
	➢ Duel fuel gas burner	04 nos.	
	➢ R-type thermocouple	05 nos.	
	➢ Pressure gauge	01 nos.	
	2. Support structure and service platform	01 nos.	
2.2	The job consist of two items (i) Secondary chamber and (ii) support structure and service platform for various component and sub assembly mentioned in the 2.7 below. The design and analysis of item (1) is perform by IPR and respective engineering drawings are attached in annexure I. the vendor shall responsible for fabrication, inspection, installation and testing of component and sub assembly as per tender specification for item no (1) for item no (2) vendor shall responsible for design, analysis, fabrication, inspection, erection and testing as per tender specification.		
2.3	Vendor shall be responsible for raw material procurement, precision fabrication, lining material installation, welding joints, assembly, inspection, supply, installation and testing of the secondary chamber assembly as per the IPR's tender specifications & engineering drawing attached in Annexure-1.		
2.4	Vendor shall prepare 3D CAD model (preferably use CATIA / AutoCAD / Solid works software), detailed manufacturing/fabrication drawings of components and assemblies with tolerances from supplied IPR's engineering drawings and submit to IPR for approval.		

2.5	The Vendor shall quantify structural materials, lining material, high temperature gasket, gas burner etc. for successful fabrication, inspection, assembly and testing of secondary chamber assembly. Detailed Bill of Material (BOM) to be submitted to IPR for review and approval before start of procurement.	
2.6	Vendor shall also prepare a list of additional items such as anchor, stud, clamp, suitable binder, mortar, castable material, retaining plate/ring, oxidizing materials etc. which would be necessary for holding and installing lining material inside the secondary chamber assembly. Vendor shall also have to submit BOM of such items to IPR for review and approval before start of procurement.	
2.7	Vendor should follow the below mentioned point during the support structure and service platform design; a) The support structure should be design by considering the load mentioned in the Annexure –V b) The support structure has to be design by considering the 7 mm elongation of secondary chamber (due to the wall temperature of 80 ^{o}C) during heating from inside. c) The center height of the secondary chamber is ~3.7 meter from ground. d) The support structure has to be design in such a way so that the fuel line and air line for gas burner should be accommodated with appropriate support. e) The service platform should be design by considering to access individual components during service, repair and maintenance. f) The secondary chamber assembly including support structure and service platform are going to be installed and commissioned **Homi Bhaha Cancer Hospital (HBCH), Varanasi City site** after completion of successful erection and site acceptance test at FCIPT, Gandhinagar. The performance of support structures and service platforms is responsibility of vendor. Thus, Vendor shall perform design and analysis of support structures, service platforms and foundation taking in to consideration relevant constrains and conditions at Varanasi City. The analysis shall be performed considering three different cases ie. (1) Normal thermal (80 degree) and gravity (2) Seismic load (3) Combination of thermal, gravity and seismic. g) The Gandhinagar city (Gujarat) and Varanasi city(Uttar Pradesh) fall under seismic zone III. h) Vendor should consider the seismic zone III data for seismic analysis.	

	i) Vendor should follow IS 1893 (part 4): 2005 for seismic analysis. j) Vendor should submit the safe design and analysis report for support structure and service platform to IPR for approval.	
2.8	Vendor shall also have to prosvide weight details of each component including lining materials installed in it for review by IPR.	
2.9	Vendor also has to provide details of lifting lugs & hooks on various components and assemblies for safe handling, transportation and also for safe maintenance work performed using crane. The location of the Lugs & hooks should be ensured considering center of gravity of the components.	
2.10	Vendor shall prepare the components surface as per recommendation from OEM paint supplier and components should be painted externally with heat resistance alumina paint (two coats) suitable to withstand temperature up to 250°C with proper surface preparation.	
2.11	Support structure and service platform shall be painted using black color after applying two coats of suitable anti corrosive chemical.	
2.12	The vendor must follow, supply and assemble the components as per the list of preferred make prepared by IPR enclosed under Annexure –II.	
2.13	Vendor's scope of work also includes the following points: a) During the preparation of fabrication/manufacturing drawings, Vendor shall also study the fabrication feasibility and shall intimate to IPR for any modifications that may seem to be necessary for successful manufacturing/fabrication of components, sub-assemblies & assembly. After approval from IPR, vender shall incorporate necessary modification. b) The manufacturing/fabrication drawing shall clearly indicate the welding process, weld serial no. and weld joint design considered for production of joints during assembly. c) Vendor must also submit the fabrication methodology plan along with schedule in respect of section 11(delivery schedule) of this technical specification to IPR for approval. d) Vendor should submit manufacturing and inspection Plan (MIP) to IPR for approval. e) Vendor must also make a periodical review plan (part of MIP document) to be conducted by IPR's engineers at vendor's site.	

	f) Procurement of bought out items should be from original equipment manufacturer (OEM) or their authorized distributers/suppliers. g) Procurement of all necessary raw materials, items and equipment with test certificates, wherever applicable. The test certificates should be submitted to IPR for approval. h) Design, development and manufacturing of tools, jigs, fixtures and other accessories required for manufacturing of components & assemblies for secondary chamber assembly and lining materials installation. i) Fabrication of all components, sub-assemblies and assembly according to the approved fabrication drawings by IPR as per delivery schedule shown in section 11. j) Inspection & Testing of the materials, components & sub-assemblies at appropriate stages before the final assembly. Submission of appropriate test report to IPR before pre-dispatch inspection to be performed by IPR's engineers. k) Factory acceptance tests shall be carried out at vendor site in presence of IPR's engineers. l) Assembly of components and mechanical integrity shall be demonstrated by the vendor at factory site and IPR site. m) Packaging and delivery of components to IPR with appropriate unloading instructions at IPR site after the dispatch clearance by IPR. n) Vendor has to make arrangement for unloading, installation and testing of the secondary chamber assembly at IPR site.	
2.14	Vendor should submit the assembly sequence for the secondary chamber assembly.	
2.15	Vendor should uses suitable anchor bolt for foundation of support structure at IPR site.	
3.	**Code and Standards:** The vendor shall comply with code and standards mentioned.	
4.	**Technical Specification:**	
4.1	Secondary chamber assembly (The vendor shall provide acceptance/clarification in separate sheet attached).	
5.	**Materials:**	
II	The structural materials shall be tested by the vendor in procured condition for its chemical and mechanical properties as well as for any internal defect.	
III	The lining materials shall also be tested by the vendor for its thermo-physical properties mentioned under Annexure-III. The	

	test certificate should clearly indicate the properties mentioned under Annexure-III for each lining material.	
IV	Vendor shall submit test certificates of structural materials and lining materials to IPR issued by **NABL accredited laboratory or else Government Organization laboratory** for acceptance of material properties by IPR before starting of the fabrication and lining work at factory site.	
V	Vendor shall supply test specimens of structural materials and lining materials as per relevant ASTM standards. IPR may get the materials tested from third parties and in case, if material is found non-complying with IPR specification then the material will be rejected.	
VI	Vendor shall have to submit technical data sheet of lining materials in respect of properties mentioned in under Annexure-III specifying particular brand/make for properties verification and technical qualification. Vendor shall also have to submit detail of recommended binders to be used for lining materials.	
VII	Vendor shall submit proof of materials procurement (i.e. invoice copy/challans/bills/purchase order along with delivery note from OEM/authorized distributes/dealers) in respect of Annexure-II.	
VIII	Vendor shall use fastener (bolts, studs, nut, etc.) confirming to ASME/ASTM standards unless otherwise specified in this document.	
6.	**Instruction to vendor:** Vendor shall confirm that they have read each point of this section and has agreed with it.	
7.	**Machining, Fabrication and cleaning:**	
VI	Vendor has to submit WPS, PQR, and WPQ and weld plan to IPR for approval before executing the work.	
VII	Vendor shall provide assembly marking on fabricated components for ease of assembly and disassembly of components of assemblies during repair and maintenance.	
VIII	The welding shall be carried out only by qualified welders. Qualification of welders shall be accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section IX.	
X	Single pass weld up to a maximum extent is preferred. Interruption during welding should be reduced to a minimum possible extent.	
8.	**Lining materials installation:**	
I	Vendor shall start installation of lining materials at factory after getting acceptance form IPR on submitted test certificates of lining materials.	
II	Vendor shall carry out lining material installation as per approved fabrication drawings including lining work..	
III	IPR representative will witness lining materials installation work carried out by vendor at factory site.	
V	Kindly provide confirmation on point no. V under section 8.	
9	**Inspection and testing procedure :**	

	The vendor shall read and accept all points mentioned in this section. For deviation in respective point, vendor should write clearly.	
10.	**Acceptance test:**	
10.1	**Factory Acceptance Test (FAT)** Vendor has to comply with acceptance test described under this section.	
10.2	**Site Acceptance Test (SAT)** Vendor has to comply with acceptance test described under this section.	
11.	**Delivery schedule:** Vendor shall follow the delivery schedule provided under this section. Any deviation should clearly indicate.	
12.	**Document to be submitted:** The vendor shall submit the document as listed under point 12.1 and 12.2 respectively.	
13.	**Insurance, packing, handling and supply:** Vendor shall agree with insurance, handling and supply terms?	
14.	**Warranty:** Twenty (24) months from date of final acceptance of the system at IPR site for poor workmanship, welding/fabrication/painting, lining work installation, faulty material, electronics items etc. During this period if any fault occurs/detected in contractor's services, contractor shall rectify the same at no extra cost at IPR site. In the event contractor fails to fulfil his guarantee obligations, IPR shall have the right to remedy or to have remedied the defect/fault, in both cases to contractor's account.	
15.	**Post warranty support:** The vendor shall confirm that they will provide the post-warranty support for additional three years after expiry of warranty period i.e. 1 year for any of the mechanical damages or lining material damages in the supplied assembly at **Homi Bhaha Cancer Hospital (HBCH), Varanasi City**. However, the cost for such post-warranty support is **"Not To Be Included"** in the quotation against the present tender. Vendor has to give agreement certificate for post warranty support.	

Annexures	Vendor Acceptance/ remarks
Annexure – I:	Vendor shall study each drawing of assembly, sub-assemblies, parts and BOM provided in respective drawing numbers. Kindly provide your acceptance.
Annexure – II	Provide your confirmation in separate sheet attached.
Annexure – III	Provide your confirmation in separate sheet attached.
Annexure – IV	Provide your confirmation in separate sheet attached.

4.1 Secondary chamber assembly

Description	Specifications	Vendor Acceptance/ remarks
Gas inlet port	➢ MOC: Specified in the engineering drawings under Annexure I. ➢ Lining materials thickness: (standard brick size: 230 x 115 x 75 mm, size tolerance : ± 1% or ± 1.0mm whichever is greater) (a) refractory layer = 115 mm (thick) (b) insulation layer type 1 = 200 mm (thick) (c) insulation layer type 3 = 5 mm (thick) ➢ Lining materials specification: lining materials should be procured as per detail given under Annexure –II and Annexure-III respectively.	
Left side end flange	➢ MOC: Specified in the engineering drawings under Annexure I. ➢ Flange Type: Rectangular and integral type flange as per 2D drawings. ➢ Surface finish of gasket contact area of flange should be 3∇, other area shall have 2∇.	
Main rectangular chamber with top cover	➢ MOC: Specified in the engineering drawings under Annexure I. ➢ Lining materials thickness: (standard brick size: 230 x 115 x 75 mm, size tolerance : ± 1% or ± 1.0mm whichever is greater) (a) refractory layer = 75 mm (thick) (b) insulation layer type 1 = 230 mm (thick) (c) insulation layer type 2 = 50 mm (thick) ➢ Lining material specification: lining materials should be procured as per detail given under Annexure –II and Annexure-III respectively. Vendor shall make support structure for connecting gas burners, fuel line, Air Line and its accessories.	
Right side end flange	➢ MOC: Specified in the engineering drawings under Annexure I. ➢ Flange Type: Rectangular and integral type flange as per 2D drawings. ➢ Surface finish of gasket contact area of flange should be 3∇, other area shall have 2∇.	
Gas outlet port	➢ MOC: Specified in the engineering drawings under Annexure I. ➢ Lining materials thickness: (standard brick size: 230 x 115 x 75 mm, size tolerance : ± 1% or ± 1.0mm whichever is greater) (a) refractory layer = 75 mm (thick) (b) insulation layer type 1 = 200 mm (thick) (c) insulation layer type 3 = 5 mm (thick)	

	➢ Lining materials specification: lining materials should be procured as per detail given under Annexure –II and Annexure-III respectively.	
Duel fuel gas burner	➢ Gas burner with standard cast iron mounting: (a) Fuel used: LPG/PNG (b) Burner standard: ISO 13577-2:2014 (c) Mode of operation: Automatic i. Burner should be operated with temperature feedback control. ii. The air fuel ratio should be control automatic using PID controller for each burner. (d) Each burner capacity: 100000 Kcal/hr (±10%). (e) Operating temperature in the secondary chamber: 1050 ±50°C (f) Total no of Burner: 04 nos. (g) Each burner has separate control and maintains the temperature in each segment in the secondary chamber. (h) Each burner should be operated in the range of 40% to 100% of its capacity. (i) Assembled long last burner block with SS tile jacket for gas burner (j) All accessories for proper functioning of burner such as (a) Air Line accessories (such as but not limited to, wafer style butterfly valve with modulating motor/servo control motor for each burner, air pressure gauge, air pipe line for combustion and atomizing air) (b) Combustion and atomizing blower (c) Auto ignition and flame failure safety device (Pilot burner) with airline, gas line and control accessories. (d) Gas line accessories (such as but not limited to gas pressure gauge, gas pressure regulator, ball valve, gas filter, gas solenoid valve, flame shut off valve, pressure reducing valve, air fuel ratio valve for each burner, gas pipe line) (e) Gas train (f) Gas flow meter (g) Gas vaporizer (appropriate capacity) (h) Control panel (i) Flame sensor (UV) Note: All four nos. of burners and its accessories should be mounted on the secondary chamber assembly and its support structure.	

	Acceptance criteria : according 10.1 and 10.2	
Support structure	➢ MOC: Mild Steel (M.S.) IS 2062 GRADE E300/E350 Quality A or BR. ➢ The support structure should enough to take load as per Annexure-V	
Service platform	➢ MOC: Mild Steel (M.S.) IS 2062 GRADE E300/E350 Quality A or BR. ➢ To access individual components during service, repair and maintenance. ➢ The width for service platform shall have to accommodate minimum 3 persons during operation, repair and maintenance. ➢ The service platform should be sturdy enough to take load of minimum 3 persons and /or other structures connecting it. ➢ The design of service platform should be such that it can be dismantled and/or move away during repair/replacement of any components of secondary chamber assembly.	
Thermocouple for gas burner feedback control	➢ R-type , ceramic sheath covered ➢ Length of thermocouple: 500 to 550 mm long ➢ Diameter of ceramic sheath pipe: ~ 20mm ➢ Total number of thermocouple: 05 nos.	
Pressure gauge	➢ Compound type pressure gauge ➢ Pressure range: -ve 1 mbar to 2 bar (g) ➢ Total number of pressure gauge: 01 nos.	
Sealing requirement	➢ Ceramic fiber gasket or equivalent properties gasket of min. 5 mm thickness that can withstand temperature of 1000 ^{o} C. ➢ Fasteners MOC: SA-193 B7 heavy hexagonal type.	
Note: All dimensional details are included in the drawings. All the other fabrication related details have to be worked out by vendor and approval should be taken from IPR before starting of fabrication.		

Annexure – II: LIST OF SUGESTED MAKE

Sr. No.	Item Description	Make/brand	**Vendor Acceptance/ remarks**
1.	Plate, pipe, forged, rod, etc. of materials as specified in the engineering drawings under Annexure-I.	Tata, SAIL, RINL, Jindal, Fortran Steel Private Limited, Phenix creation simplified **or equivalent make/brand**.	
2.	Structural Rolled Steel sections-beams, channels, tee, flats, angles, bars (round, square, hexagonal) of Mild Steel (M.S.) IS 2062 GRADE E300/E350 Quality A or BR.	Tata, SAIL, RINL, Jindal, Fortran Steel Private Limited, Phenix creation simplified **or equivalent make/brand.**	
3.	Structural Hollow steel sections (Square & Rectangular) and tubular sections of Mild Steel (M.S.) IS 2062 GRADE E300/E350 Quality A or BR.	Tata, Asian, APL Apollo tubes Ltd., Phenix creation simplified, Fortran Steel Private Limited **or equivalent make/brand.**	
4.	Structural tubular sections of Mild Steel (M.S.) IS 2062 GRADE E300/E350 Quality A or BR.	Tata, Asian, APL Apollo tubes Ltd., Phenix creation simplified, Fortran Steel Private Limited **or equivalent make/brand.**	
5.	Duel fuel Gas burner	Continental thermal engineers Pvt. Ltd. , Honeywell kromschroder, Encon thermal engineers, Bloom engineering, Hotwork combustion technology ltd. **or equivalent make/brand.**	
6.	Refractory layer.	Brick of Calderys, Carborundum Universal Limited (CUMI), MG Materials India, Promat, Mogan Advance materials or **equivalent make/brand** that conforms to technical specification mentioned under Annexure-III.	
7.	Insulation layer type 1.	Brick of Calderys, Carborundum Universal Limited (CUMI), Promat, MG Materials India, Mogan Advance materials **or equivalent make/brand** that conforms to technical specification mentioned in Annexure-III.	
8.	Insulation layer type 2.	Ceramic fiber board of Mogan Advance materials, Unifrax, Ceramaterials, gtlproduct, Calderys, MG Materials India, Carborundum Universal Limited (CUMI) **or equivalent make/brand** that conforms to technical specification mentioned in Annexure-III.	
9.	Insulation layer type 3.	Ceramic fiber paper of Mogan Advance materials, Unifrax, Ceramaterials, Calderys, MG	

		Materials India, Carborundum Universal Limited (CUMI) **or equivalent make/brand** that conforms to technical specification mentioned in Annexure-III.	
10	Castable material	Calderys, Carborundum Universal Limited (CUMI), Promat, MG Materials India, Mogan Advance materials **or equivalent make/brand** that conforms to technical specification mentioned in Annexure-III.	
10.	Welding rod.	Esab India (7018 or 7014) or equivalent	
11.	Construction chemicals (if any).	M.C.Bauchemie, FosrocSika, Cico, Pidilite, Sika, Ashford, BAL, Krishnaconchem or equivalent.	
12.	Joint Filler/silicon paint.	Wacker, Dowcorning, Sika, Chokshi or equivalent.	
13.	Paint, primer, putty.	Asian, Berger, Nerolac, ICI, Birla (putty) Roofit(Putty) or equivalent.	
14.	Polish.	MRF, Asian, ICI, Taralac or equivalent.	
15.	Adhesives.	Fevicol, Kitcol, Araldite, BAL or equivalent.	
16.	Anchor fastener/bolts.	Sundaram, Hilti.Fischer or equivalent.	

Annexure – III: Technical specification for lining materials

I. Refractory layer (size: ~ 230 x 115 x 75 mm)

Parameters	Properties	**Vendor acceptance/remark**
Maximum service temperature, (^{0}C)	1600^{0}C - 1850^{0}C	
Bulk density, (kg/m3)	1100 - 1300 kg/m3	
Cold Crushing strength, (kg/cm^2)	$\geq$ 30 kg/cm^2	
Thermal conductivity, (W/m-K)	$\leq$ 0.61 W/m-K @ temperature 800^{0}C	
Note: Side arc/End arc brick is recommended wherever applicable.		

II. Insulation layer type 1 (size: ~ 230 x 115 x 75 mm)

Parameters	Properties	**Vendor acceptance/remark**
Classification temperature, (^{0}C)	1250^{0}C - 1550^{0}C	
Bulk density, (kg/m3)	700 - 950 kg/m3	
Cold Crushing strength, (kg/cm^2)	$\geq$ 20 kg/cm^2	
Thermal conductivity (W/m-K)	$\leq$ 0.41 W/m-K @ temperature 800^{0}C	
Note: Side arc/End arc brick is recommended wherever applicable.		

III. Insulation layer type 2 (Size: ~1000 x 500 x 50mm)

Parameters	Properties	**Vendor Acceptance/ remarks**
Classification temperature, (℃)	1150℃ – 1450 ℃	
Bulk density, (kg/m3)	650 - 800 kg/m3	
compressive strength (kg/cm^2)	≥ 20 kg/cm^2	
Thermal conductivity (W/m-K)	≤ 0.14 W/m-K @ temperature 550℃	

IV. Insulation layer type 3 (Size: ~ 1220 x 12000 x 5 mm)

Parameters	Properties	**Vendor acceptance/remark**
Classification temperature, (^{0}C)	1250^{0}C - 1550^{0}C	
Bulk density, (kg/m3)	150 - 250 kg/m3	
Tensile strength, (kPa)	≥ 200 kPa	
Thermal conductivity, (W/m-K)	≤ 0.10 W/m-K @ temperature 400^{0}C	

V. Castable material

Parameters	Properties	**Vendor acceptance/remark**
Classification temperature, (^{0}C)	1200^{0}C - 1700^{0}C	
Bulk density, (kg/m3)	700 - 1300 kg/m3	
Cold Crushing strength, (kg/cm^2)	≥ 25 kg/cm^2	
Thermal conductivity (W/m-K)	≤ 0.40 W/m-K @ temperature 600^{0}C	

Annexure – IV

The vendor shall submit the quote for the following **spares mandatorily in price Bid**. Vendor should also specify the quantity offered.

Sr. no.	Descriptions	Qty	**Vendor acceptance/remark**
01	Refractory layer **(size: ~ 230 x 115 x 75 mm)**	85 nos.	
02	Insulation layer type 1 **(size: ~ 230 x 115 x 75 mm)**	366 nos.	
03	Insulation layer type 2 **(Size: ~1000 x 500 x 50mm)**	06 nos.	
04	Insulation layer type 3 (Roll) **(Size: ~ 1220 x 12000 x 5 mm)**	01 nos.	
05	Gas burner block (specification mentioned in 4.1)	02 nos.	
06	Duel fuel burner (LPG/PNG) (specification mentioned in 4.1)	01 no.	
07	R-type thermocouple (specification mentioned in 4.1)	02 nos.	