



# **Request for Proposal**

**for**

Design, Performance Testing, Supply,  
Installation and Commissioning Of  
Thermal Circulating Unit(TCU) for  
Thermo Vacuum Test Facility As Per  
Specification for VELC Project  
at  
Prof.MGKML, CREST Hosakote

**Indian Institute of Astrophysics  
Bangalore**

**May 2019**



## **1. Introduction**

Indian Institute of Astrophysics (IIA) is developing Visible Emission Line coronagraph (VELC) to be launched on board Aditya L1 mission, India's second satellite for Astronomy research. In order to qualify the design and do the performance checks, the payload sub system will be tested in thermo vacuum environment. The payload subsystem includes visible and IR detectors, Mechanism elements, electronic packages etc.,

Keeping in view of complex and technologically demanding inter-disciplinary nature of activities, the executing agency is expected to have or has access to established expertise in design, fabrication and engineering of thermo vacuum chambers, cryogenic and thermal circulation systems. Similarly, total familiarity with practices of automation, control & data dissemination adopted in modern circulators is a pre-requisite.

## **2. Scope of work**

The bidder shall be responsible for Design, Performance Testing, Supply, Installation and Commissioning of Thermal Circulating Unit (TCU) for Thermo vacuum Test Facility for VELC Project at Prof.MGKML, CREST Hosakote as per the details mention in the RFP (Except Sl. No 4 to Sl.No.8). Bidders with all or maximum facility and technical capability to realize this system will be preferred. Bidder who has realised similar kind of systems will be preferred. Bidder shall provide PO copies of the similar systems supplied, commissioning report, list of customers with contact details etc.,

The items shall be supplied in accordance with the applicable drawings/documents/standards specified herein and the schedules set forth. The following are the objective and scope of work of this RFP in detail.

## **3. Location and Environment**

The Thermo vacuum plant to be installed in a class 10,000/1,00,000 cleanroom at Prof.MGK Menon Lab for Space Sciences at CREST Campus of IIA, Hosakote.

## **4. Existing Vacuum Chamber (IIA's Scope)**

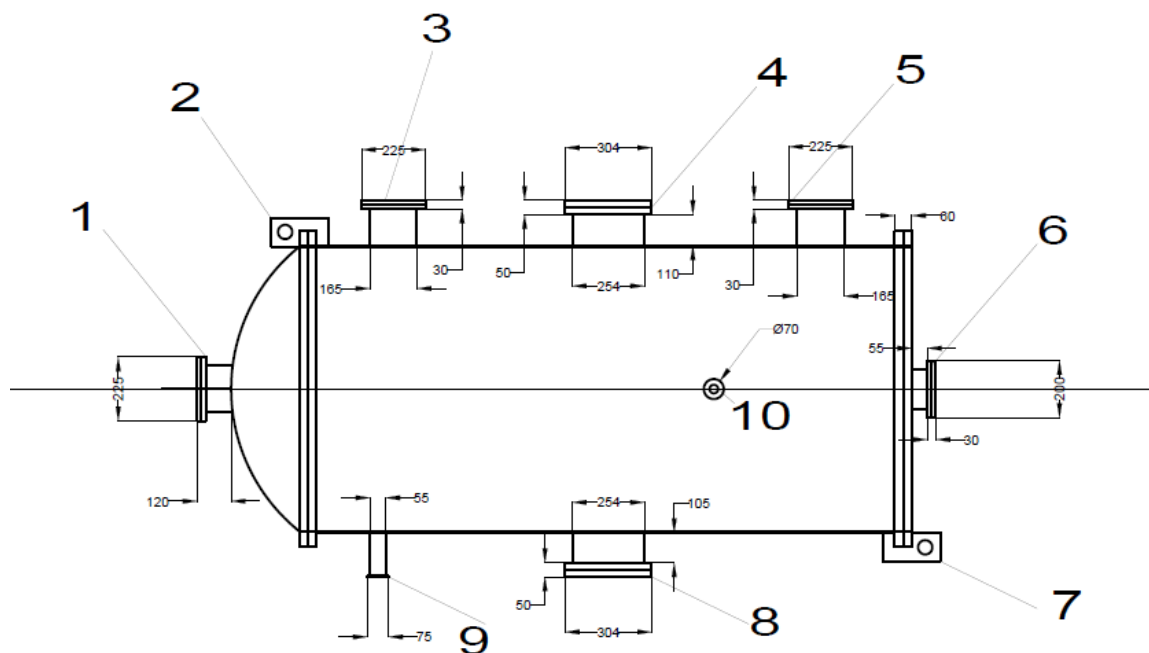
The existing vacuum chamber will be converted as thermo vacuum chamber.

Existing chamber is the part of the vacuum system which was used for our payload testing.



The existing chamber comprises of

- a) Cylindrical shell of 2.12 m (L) and inner diameter is 1.0 m. clear length excluding the depth of Dished ends (i.e. Flange to flange length of the shell).
- b) Two hinged doors at both sides, Torispherical end dish at one end & flat end at other end of the shell
- c) Material of Construction : SS304L
- d) Existing Chamber dimensional details:

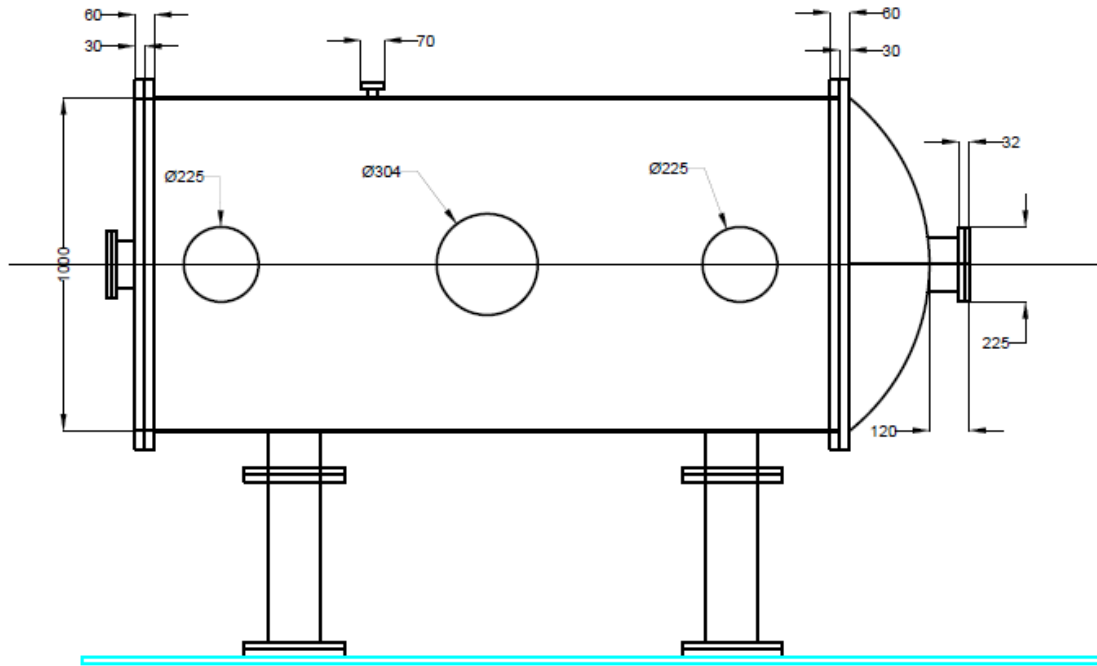


### Ports Name

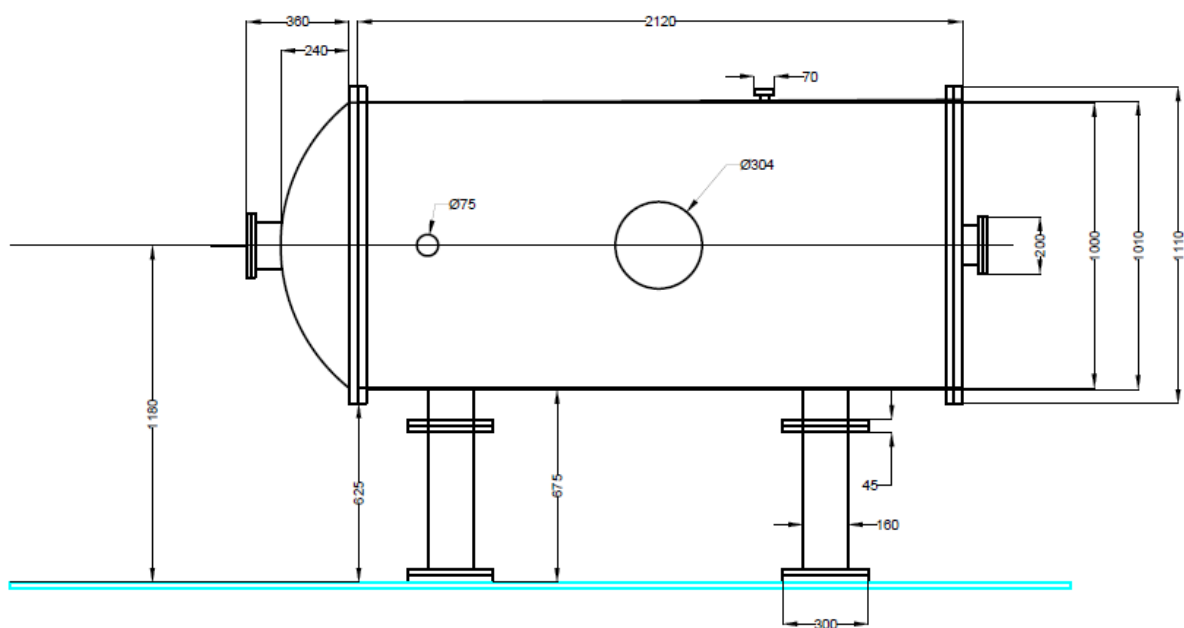
- |                      |                              |
|----------------------|------------------------------|
| 1. Source Inlet port | 6. Source Inlet Port         |
| 2. Hinge             | 7. Hinge                     |
| 3. Feed Through Port | 8. Turbo Pump Port           |
| 4. Turbo Pump port   | 9. Roughing Pump bellow Port |
| 5. Feed Through Port | 10. Gauge Sensor Port        |



## Side View -L



## Side View -R





## 5. Existing Evacuation System Details (IIA's Scope)

The existing chamber was reaching  $10e-6$  in 40 minutes using following pumps. Meets the standard leak rate requirement of  $1 e-8$  m bar lit/sec. The required Roughing and High Vacuum Pumps are available with IIA. The details of the pumps are

- a). Turbo pump: Peiffer Make, ATH2303 M250CF
- b). Roughing Pump: Make Alcatel, ACP40

## 6. Refurbishment plan for the existing Chamber (IIA's Scope)

The chamber & accessories will be fabricated from SS 304L and all the materials inside the chamber shall be vacuum compatible. Adequate ports and fittings will be provided to meet the requirements of evacuation, purging, venting, sensors, feed through etc.,

The following will be incorporated in the refurbished thermo vacuum chamber and the evacuation system design

- Concept Design
- Base plate/Loading platform design & thermal shroud design. SS base plate shall be provided with 100mm grid M6 tapped holes. Base plate shall be capable of taking ~ 100 kg load.
- Clear working space: **1800(L) X 850mm (D)** above the top plate.
- Valves and gauges from Standard Companies like Pfeiffer, Alcatel etc.,
- All the Plumbing with SS 304L.

## 7. Proposed Thermal system

- a) Thermal shrouds of cycling box which are blister or embossed type
- b) Thermal Conditioning Units (TCU's)-Bidder's scope
- c) Accessories: SS pipe lines (grade AISI 304L), gate valves, relief valves, cryogenic valves, super insulated thermal lines etc.



## **8. Thermal shrouds of cycling box which are blister or embossed type (IIA's Scope)**

For heating and cooling the test object kept inside the chamber a thermal shroud will be mounted around the test object and the shroud is kept inside the vacuum chamber with thermal insulated support systems. The shroud will consist of 3 segments, viz., a hollow cylindrical shroud and 2 nos. of circular type shroud. Also another rectangular base plate of SS 304L shall be provided to mount the test object (DUT-Device Under Test). The shroud will be fabricated by sandwiching two SS 304L sheet of 0.6-0.8mm thick, which are embossed to allow flow of fluid through the shroud. Seam welding by roller welding method along the length will be done at regular interval covering the entire shroud for unobstructed thermic fluid flow and ensures uniformity of temperature within the specified limits. The outer periphery and circular cut-outs (if any) are to be TIG Argon Arc welded. Reinforcement at suitable positions to be provided to prevent warping / distortions of the shroud.

The sequence of fabrication to be as follows:

The sheets are to be embossed independently & jointed together in such a way that channels are formed and seam welding is carried out. Then the jointed sheet is to be rolled with appropriate Spacer plates and required cut-outs are made and TIG welded around openings. Inner surface of the shroud to be sand blasted and painted with space qualified low degassing black paint (Aeroglaze Z 306) to achieve thermal emissivity of 0.9 or better and the outer surface is electro polished to achieve thermal emissivity of 0.1 or better. Similarly other shroud segments are to be fabricated and all the shroud segments are to be mounted inside the vacuum chamber. The plate type shrouds/disc type shroud are to be mounted vertically at the ends of the cylindrical shroud. All the shrouds are mounted inside with thermally insulated support like G10 / G11 material from the chamber inside.

A rectangular shroud will be provided for quick thermal cycling. The rectangular shroud of size 500mm (W) X 500mm (L) is to be fixed from the front opening door and in this rectangular shroud the test object will be mounted.

The shroud embossing will be pressure tested for 8kg/cm<sup>2</sup> for 24 hours and therefore is designed for 12kg/cm<sup>2</sup>. Fluid inlet/outlet ports will be provided and these ports are to be connected to the liquid feed through with the help of metallic flexible hoses.



## 9. Thermal Conditioning Units (TCU's)- Bidder's Scope

Standard Heating/ Refrigerating circulator shall be used for temperature cycling of thermal plate kept inside the Chamber. In-let and out-let pipes for thermal plate shall enter the Chamber through leak proof feed through. The circulation bath will have Integrated programmer with real time clock to load, save and execute the temperature cycling. All the necessary system safely interlocks will be the standard features of the circulator. Circulator shall be located adjacent to the Chamber and flexible lines with good thermal insulation shall be used to connect the bath with thermal plate. No complex electrical circuitry or computer is envisaged for system operation.

Heating and cooling of thermal plate & shrouds are envisaged by this thermal bath.

Temperature cycling on the thermal plate & shrouds kept inside the Chamber shall be executed by the circulating bath having integrated programmer to execute the profile with all safety interlocks and alarms. Thermal plate & shrouds are to be fabricated from SS material. These components shall be manufactured to remain leak proof after several thermal cycling at high and low temperatures during its usage under high vacuum.

The bath shall have standard features like – LCD dialog display for convenient interactive operation, key pad for set points and menu functions, self optimizing temperature control, PT-100 external sensor and it's connection for measurement and control, required safety.

interlocks and alarm system for smooth operation, High temperature cut-off, Rs.232/485 / Ethernet interface for on line communication, active and proportional cooling control, pump of adequate capacity to circulate fluid etc. The bath shall have adequate Heating / cooling capacity to achieve and maintain different temperatures in specified time.

Heating/Cooling system design shall consider 150W heat from the DUT, heat transfer efficiency and heat load generated by circulating pumps of thermal bath, etc.,

## 10. Temperature Range

Chamber inside temperature range	: -80deg C to + 150 deg C
Temperature control required on DUT/Subsystem	: -70deg C to + 140 deg C
Temperature stability	: +/-1 deg on the set point
Rate of heating/Cooling	: 1.5 deg C per Minute (Minimum) 5 deg C per Minute (Maximum)



Bidder shall clearly mention the circulating medium and its temperature limits. The options like rapid heating & cooling , selection of input power to the heaters, etc., shall be available.

Temperature stability in the circulation medium : +/- 0.05 Deg C

bidder has to clearly mention the heating power and cooling power at different temperatures and shall provide the details how the proposed system is going to meet the required temperature on the DUT.

Bidder shall clearly mention the pump details like flow capacity, pressure etc.,

Sound level shall be less than 70dBA at 1m from the equipment.

The digital interfaces Required: RS232, Ethernet, USB, RS485, Modbus, sd memory card, etc.,

Note: **The system expected shall be fully air cooled type requiring no other utilities.**

## 11. Accessories

a) Required male and female connectors, Flexible plumbing lines, Insulation shall be quoted separately as accessories.

For Example: SS pipe lines (grade AISI 304L), gate valves, relief valves, cryogenic valves, super insulated thermal lines etc. All components, piping, joints, valves, traps, etc

b) All components, piping and valves used should be AISI-304L based.

## 12. Preliminary Design of the system offered

Bidder shall provide preliminary design calculations of the system offered along with the Technical offer. Summary of the design calculation shall clearly bring out design margins included in the system design.

## 13. Calibration Certificates

Bidder shall provide calibration test for the system & Temperature sensors provided in the system for monitoring as well as for control purpose. These test certificates shall be valid





throughout the period of warranty/guarantee after the completion of installation and handling over of the system to the purchaser site.

#### **14. Electrical Power and other utilities required**

Bidder shall clearly specify the estimated connected power as well as estimated peak power consumption of the system offered considering different operation mode described above.

#### **15. Manuals, Maintenance & Spares**

Detailed manuals shall be provided with subsystem descriptions including electrical and mechanical drawings, circuit diagrams, interconnections and layout details.

Operational procedures shall be provided for cleaning, evacuation, Maintenance etc.,

Safety precautions and interlock/alarm recovery procedures shall be provided.

Instruction and maintenance manuals, trouble shooting and fault finding procedures and recovery methods.

#### **16. Demonstration of specifications, Acceptance test and Transportation**

Bidders shall organize for required loading/unloading shifting of all system components to the place of installation of this system. Bidder shall assemble and integrate the system at CREST campus of IIA, Hosakote. Acceptance test plan shall be generated by bidder during the course of execution in consultation with the purchaser.

#### **17. Training to operators of the purchaser**

Bidder shall provide a thorough on job training to at least 3 operation personnel for a period of 3 days at purchaser's site prior to system acceptance.

#### **18. Guarantee Period**

Bidder shall guarantee the failure free operation of the system for a period of not less than **24 months** from the date of acceptance of the system at purchaser's site. **This is mandatory requirement and must be complied in the offer.**

#### **19. Compliance and Deviation Table**

Bidder shall furnish detailed compliance table w.r.t. all the specifications described above.



Bidder shall furnish detailed deviation list, if any w.r.t. above specification. Bidder shall give detailed justification for proposed deviation.

## **20. Bidder's experience and eligibility criteria**

a) It is essential that bidder possess the adequate experience in executing custom designed Thermal conditioning units. Bidder must mention such experience clearly in their offer.

## **21. Technical bid**

Bidder shall furnish following details / documents in their technical bid

- a) Detailed description of the system offered w.r.t. each of the above specification.
- b) Detailed drawings showing the dimensions of the system and major components
- c) Detailed list of scope of supply included in the offer.
- d) List of major items along with make and model number.
- e) Catalogues, leaflets, brochures, application notes etc. for all the major components and equipment's proposed.
- f) Preliminary design calculation made to arrive at sizes of various equipments and components.
- g) Compliance table with remarks.
- h) Deviation table if any with remarks and detailed justification.
- i) Un-priced commercial bid.
- j) Any other details relevant to the requirement.

## **22. Miscellaneous**

- Clear Specifications (quality, quantity, fitting or piping specification, rate of supply, pressure etc.) shall be given on any auxiliary requirements which are necessary for the operation of the system such as power, coolant etc., Price shall be quoted for optional items separately. Any other requirement like ventilation, structural support etc shall be clearly specified.
- The company shall provide training about the operation of the system and precautions related to the system.
- Packing and transport of all the components to site is in bidder scope.
- Installation and commissioning is in bidder scope.



## 23. Schedule

Supply shall be within 6-9 weeks from our purchase order

## 24. Acceptance Test

All the required acceptance tests to be performed at site after commissioning. Final performance matrix shall be generated for final acceptance.

## 25. Note to the Bidder

1. The technical proposal shall contain the details like tentative sketches of the system with support structure, Internal details of the system , Drawings of the system with dimensions, etc.
2. IIA reserves the right to alter, whenever necessary, specifications and drawings. As from the date, the Stores shall be in accordance with the specifications, patterns and drawings so altered, which the contractor is bound to comply with. In the event of such alteration involving a revision in the cost, or in the delivery period, the same shall be discussed and mutually agreed to, taking into account the unit rates of similar items in the Contract. In case of disagreement, the decision of IIA, in the cost or the delivery period, shall be final and conclusive.
3. **Minor modifications / Additional Scope of Work:** Minor modifications /additional scope of work to the tune of 2% of the total contract value shall be carried out by the contractor without any extra cost to IIA.
4. **Subletting or Assignment of Contract:** The Contractor shall not sublet, transfer or assign the Contract or any part thereof or bills or any other benefits, accruing there from or under the contract without the prior written consent of IIA (All Subcontractors are required to be appraised and approved by IIA before placement of orders by the Contractor/Bidder). However, such consent shall not be unreasonably withheld by IIA, if such stores are not normally manufactured by the Contractor, such assignment or subletting shall not relive the Contractor from any contractual obligation or responsibility under the Contract.



Any breach of this condition shall entitle IIA to cancel the Contract or any part thereof and to purchase from other sources at the risk and cost of the Contractor and shall recover from the Contractor damages arising from such cancellations.

In case the Contractor sublets, transfers or assigns any part of the Contract with the prior written consent of the Purchaser, all payments to the Sub- Contractor shall be the responsibility of the Contractor and any requests from such sub- Contractor shall not be entertained by IIA.

5. **Past performance:** In case the past performance of the tenderer is not found to be satisfactory with regard to quality, delivery, warranty obligation and non-fulfilment of terms and conditions of the contract, their offer is liable to be rejected by IIA.
6. The bidder is required to submit all supporting documents as proof for the compliance. Bids received without valid documents and/or incomplete and irrelevant documents are likely to be rejected.
7. IIA's decision to consider as to whether a bidder has met with the eligibility criteria or not is final.
8. The items mentioned in Sl. No 4 to Sl.No.8 are in IIA's scope except thermal conditioning unit. All other points are in the scope of bidder.

## **26. Check list for No. of documents to be enclosed in the offer**

### **a) Technical bid: Bidder shall furnish following details / documents in their technical bid:**

Detailed description of the system offered w.r.t. each of the above specification.

- i) Detailed list of scope of supply included in the offer.
- ii) List of major items along with make and model number.
- iii) Catalogues, leaflets, brochures, application notes etc. for all the major components and equipment's proposed.
- iv) Preliminary design calculation made to arrive at sizes of various equipments and components.
- v) Compliance table with remarks.
- vi) Deviation table if any with remarks and detailed justification.
- vii) Un-priced commercial bid.
- viii) Any other details relevant to the requirement.



**b) Commercial bid: Bidder shall furnish following details / documents in their commercial bid:**

- i) Commercial bid with price
- ii) Price break up for various accessories
- iii) Price break up for Control & data acquisition system including temperature sensors
- iv) Price break up for Miscellaneous items if any (Include all left out elements giving details)