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Engg. Hall-7, Trombay  
MUMBAI – 400 085

GOVERNMENT OF INDIA  
BHABHA ATOMIC RESEARCH CENTRE  
Reactor Safety Division

Ref: RSD/CSSS/DM/009/MF/2022/ P-42298

April 28, 2022

29

Sub: Minor Repairs/ fabrication- invitation to quote

Dear Sirs,

Sealed quotations are invited by Head, Reactor Safety Division, BARC for the minor fabrication work as per the following requirements:

**SCOPE:**

It is proposed to undertake minor fabrication work related to Supply, fabrication and testing of experimental setup for radiation heat transfer interaction among horizontal tubes in DRCRE facility at IITB, Mumbai.

The work broadly involves:

- (i) Supply of material as mentioned in Technical Note
- (ii) Fabrication of components as mentioned in Technical Note
- (iii) Testing of components as mentioned in Technical Note

Quantity: 1 SET

**GENERAL**

1. The quotations must reach Head, RSD, Engg. Hall No. 7, BARC, Trombay, Mumbai- 400085 on or before **18.05.2022**. The envelope should be super scribed "**Minor Fabrication: Supply, fabrication and testing of experimental setup for radiation heat transfer interaction among horizontal tubes in DRCRE facility at IITB, Mumbai** " and indicate the **DUE DATE** and Office **Ref. No.** clearly. The envelope should be sealed and should be sent only through **SPEED POST. Any other mode of delivery will not be accepted.**
2. The quotation will be opened on **19.05.2022** at 14.30 Hrs.
3. The necessary items as given in the enclosed technical specifications will be provided by the supplier.
4. The bidder shall quote the item wise cost of each of the works described above. The bidder shall submit a list of material required including the quantity.
5. **In case the bidder needs to obtain the technical note and clarify and understand the full scope of his work before submitting the quotation, he may do so by prior appointment with Shri O. S. Gokhale, SO/F, R. S. D., Engg. Hall No. 7, BARC, Trombay, Mumbai- 400 085 on phone no. 25596907.**
6. Work should be completed within 90 working days from the date of receipt of the order.
7. The price quoted should be valid for at least 120 days from the date of opening of the quotation.

8. A brief list of similar works executed, if any and the name of the organization for which the work was carried out should be furnished with the quotation.
9. Firms willing to bid for above mentioned job shall have been vetted by Security Section of BARC.
10. All the supervisors and workers should have valid Police Verification Certificate (PVC).
11. All Taxes and excise duty shall be quoted separately. Form H and excise duty exemption certificate shall be given along with the order if necessary.
12. Payment will be made as per Government Rules after successful and satisfactory completion of the work.
13. Head, Reactor Safety Division reserves the right to accept/ reject any or all of the quotations received without assigning any reason whatsoever.
14. The minor fabrication work will be subject to inspection/ supervision by the indenting officer or his authorised representative.



(D. Mukhopadhyay)  
OS, Head, CSSS, RSD

**डॉ. डी. मुखोपाध्याय / DR. D. MUKHOPADHYAY**  
**अध्यक्ष, कोर सुरक्षा अध्ययन अनुभाग / Head, Core Safety Studies Section**  
**रिएक्टर सुरक्षा विभाग / Reactor Safety Division**  
**भारत सरकार / Government of India**  
**भा.प.अ.केन्द्र, ट्रोम्बे, मुंबई-85 / BARC, Trombay, Mumbai-85**

## Technical Specifications for Supply, Fabrication and Testing of Experimental Setup for Radiation Heat Transfer Interaction among Horizontal Tubes

### 1. General

This part of the tender document deals with the detailed specifications defining the technical requirements of Supply, fabrication and testing of experimental setup to be fabricated at IITB, Mumbai.

These specifications are governed by the technical conditions of the contract attached herewith. The general hardware namely bolts, nuts, identification ferrules etc., shall be provided by the contractor. The contractor shall bring special tools such as tube bender, tube cutter, spanners, cable stripper, etc.

Contractor shall note that BARC reserves the right to increase or decrease the quantum of work mentioned here in this tender document.

Any person entering IITB shall comply with all the requirements that are imposed by Security of IITB, from time to time.

All industry safety rules like using safety shoes, belts, helmets and any other protective gears required should be complied with.

### 2. Scope of Work

Table 1 gives the scope of supply of material, fabrication and testing of various components shown in Figure 1.

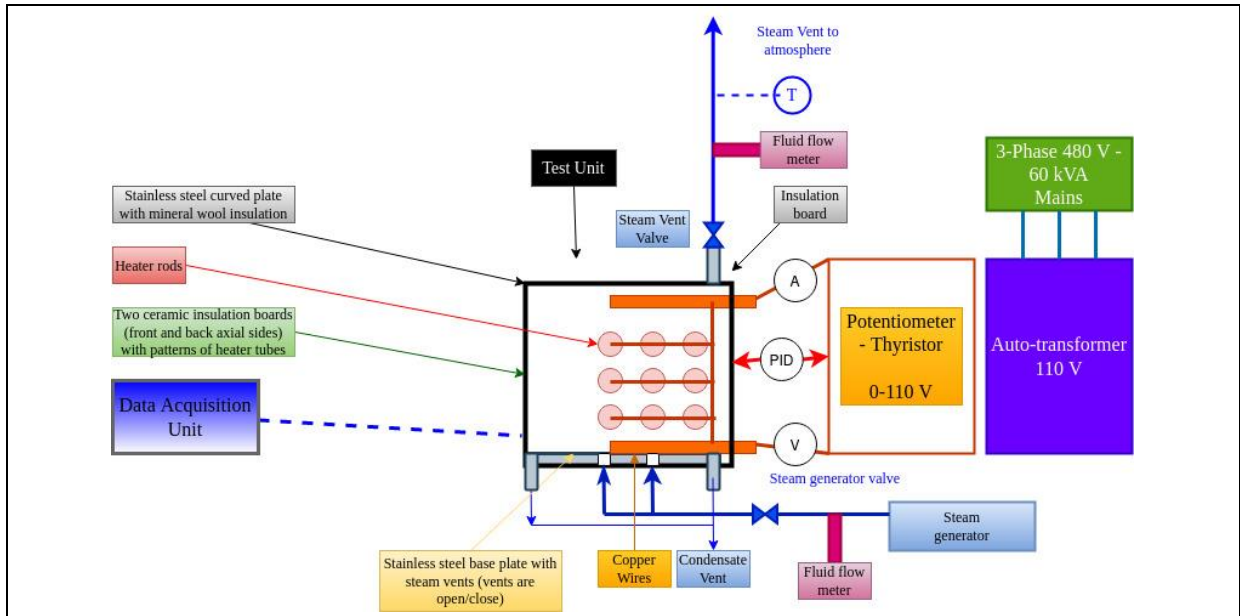
**Table 1.** Scope of supply of material, fabrication and testing

Sr No.	Description	Quantity
<b>I</b>	<b>Fabrication of tubular heaters:</b>	
1.1	Specification of Tubular Heaters: Dimensions: 1 inch, Power = 2 kW, Heated Length = 0.56 m, unheated length (both sides) = 0.030 m (Ceramic Plugs).	36
1.2	Specification of end terminals: Connection of end terminals of tubular heaters in parallel or delta formation to the Thyristor. Connections to be made with appropriately rated electrical connectors.	1

<b>II</b>	<b>Supply of materials and fabrication of test set-up</b>	
2.1	<p><b>a) Supply of plates for test set-up housing</b></p> <p>Specification of test set-up housing - Material: Mild Steel. Dimensions: Thickness: 5-6 mm, Length*Breadth: 0.6 m * 0.375 m.</p>	1
	<p><b>b) Supply of end-plate</b></p> <p>Specification of end plates - Material: Mild Steel. Dimensions: Thickness: 5-6 mm, Length*Breadth: 0.375 m * 0.375 m.</p>	1
	<p><b>c) Supply of test set-up insulation</b></p> <p>i) Specification of test set-up housing insulation - Material: Ceramic insulation boards. Dimensions: Thickness: 4 – 5 inch, Length*Height: 0.6 m* 0.375 m</p> <p>ii) Specification of end-plate insulation – Material: Ceramic insulation boards. Dimensions: Thickness: 4 – 5 inch, Length*Height: 0.375 m* 0.375 m</p>	1 unit ( test section housing insulation) * 8 end plates insulation
2.2	<p><b>a) Fabrication of test set-up housing</b></p> <p>The plates supplied for test set-up housing to be assembled using bolted l-type flange for easy assembly and disassembly. The L-type flanges are to be provided with expansion slots with bolts. L-type flange dimensions: L*W*T: 0.375*0.025*0.002 mm.</p> <p>The bottom and top plates of the test set-up housing are to be provided with 1 inch cut hole for steam inlet and outlet, respectively as indicated in Figures 4-5.</p>	1
	<p><b>b) Fabrication of end-plate</b></p> <p>The horizontal rod pattern design to be cut in the steel plate as indicated in Figure 7-11. Ceramic plugs to be provided to close the voids without any heater rod.</p>	8
	<p><b>c) Fabrication of test set-up wall insulation</b></p> <p>i) Specification of test set-up housing insulation - 1 pair of bottom and top insulation boards to have 1 inch cut hole for</p>	8

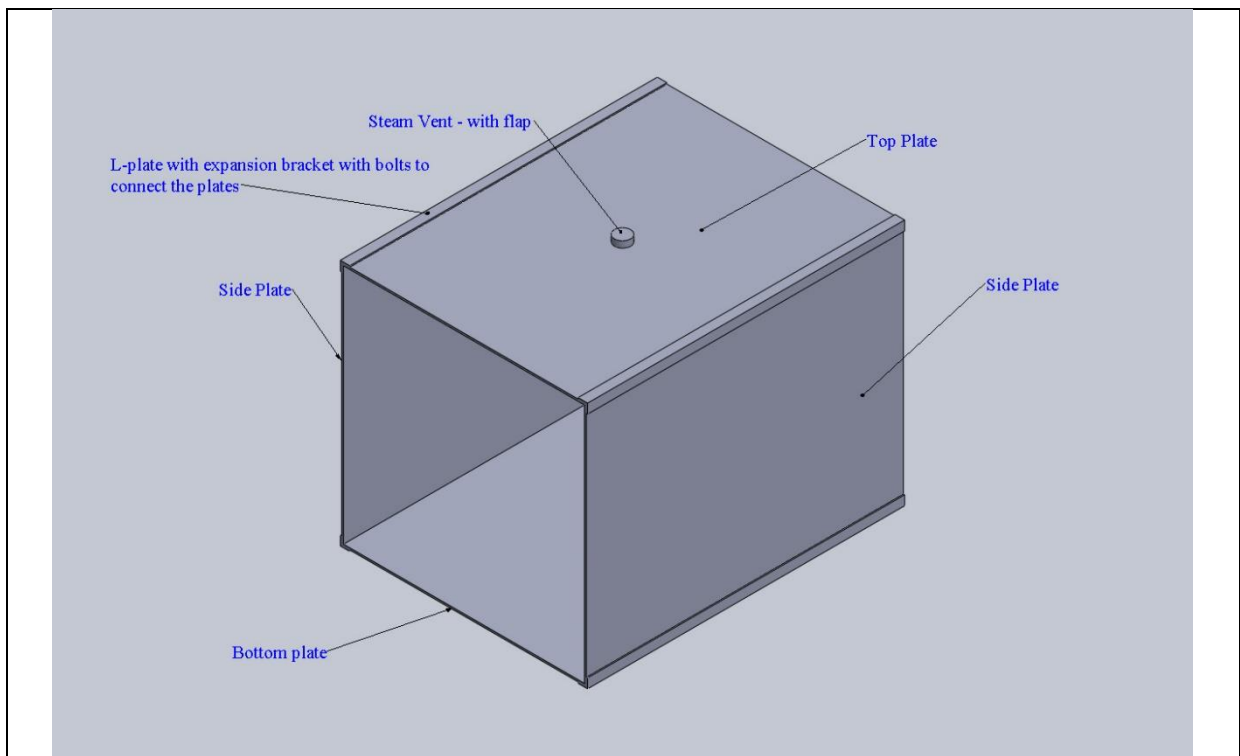
	<p>steam inlet and outlet, respectively.</p> <p>ii) Specification of end-plate insulation - horizontal rod pattern to be cut in the end-plate insulation boards as indicated in Figure 7-11.</p>	
	<p><b>d) Assembly of test set-up</b></p> <p>The mild steel plated test set-up housing, pattern-cut end plates along with test set-up housing and end plate insulation boards to be assembled together to form a test set-up with inset heater rods.</p>	1
<b>III</b>	<b>Supply and fabrication of electrical equipment for monitoring and control</b>	
3.1	<p><b>Supply of Variable/ Step-down transformer</b></p> <p>Specification -</p> <p>Input – 60 kVA - 440 V; Output: 0-110 V or 110 V (step-down)</p> <p>Requisite connections between mains to transformer and, transformer to thyristor to be made for design electrical power rating by the fabricator.</p>	1
3.2	<p><b>Supply of Thyristor</b></p> <p>Specification -</p> <p>PID feedback for power ramping – 110 V; 30 kW.</p> <p>Temperature feedback through thermocouple placed at desired horizontal header rod. Requisite connections for the Thyristor-PID-Thermocouple feedback to be made by the fabricator.</p>	1
3.3	<p><b>Supply of Electrical Panel with Terminals</b></p> <p>Specification -</p> <p>Primary side Cable (Transformer to Thyristor), Secondary side cable (Thyristor to Heater), Star-Delta Connections, Test set-up stand, Electrical Panel including wiring, box, ammeters, voltmeters, thermocouple and temperature control.</p> <p>Electrical panel components to be made with design electrical power rating. The electrical connections between the components of the test section are in the scope of the fabricator.</p>	1
3.4	<p><b>Fabrication of thin wire mesh</b></p> <p>Specification -</p>	4

	Thin wire mesh with horizontal rod pattern design cut, for locating and placing thermocouples.	
3.5	<b>Assembly of electrical equipment for monitoring and control</b> The supplied transformer, thyristor and electrical panel to be assembled with appropriate connections.	1
<b>IV</b>	<b>Supply of piping components</b>	
4.1	<b>Supply of ball valves</b> Specification - Diameter: 1 – inch; Material: Stainless Steel.	2
4.2	<b>Supply of pipe</b> Specification - Diameter: 1 – inch; Material: Mild Steel; Length: 2 m.	1
4.3	<b>Fabrication of hydraulic components</b> One ball valve to be placed along the steam inlet line from steam generator to test set-up. The other ball valve to be placed along the steam outlet line from test set-up. The mild steel piping to be provided, with inline ball valve, from steam outlet to steam condenser.	1
<b>V</b>	<b>Testing of equipment and integrated test set-up:</b>	1
5.1	Testing of heaters and end connections up to the maximum power rating (2 kW – Operation time up to 2 hours).	1
5.2	Testing of variable / step-down transformer for the rated electrical power.	1
5.3	Testing of Thyristor for the rated electrical power.	1
5.4	i) Testing of electrical panel with transformer, thyristor and heaters together. ii) A zero-run of the integrated test set-up (test set-up housing, heaters and electrical equipment) to be performed for a horizontal rod pattern.	1



**Fig 1. Schematic of the experimental set-up**

*Figure 1 is only for representation purpose. Items of Figure 1 which are not described in Table 1 are not in the scope of the supplier.*



**Fig 2. Unit Cell Setup – without end plates (patterned) – with expansion brackets (l-type)**

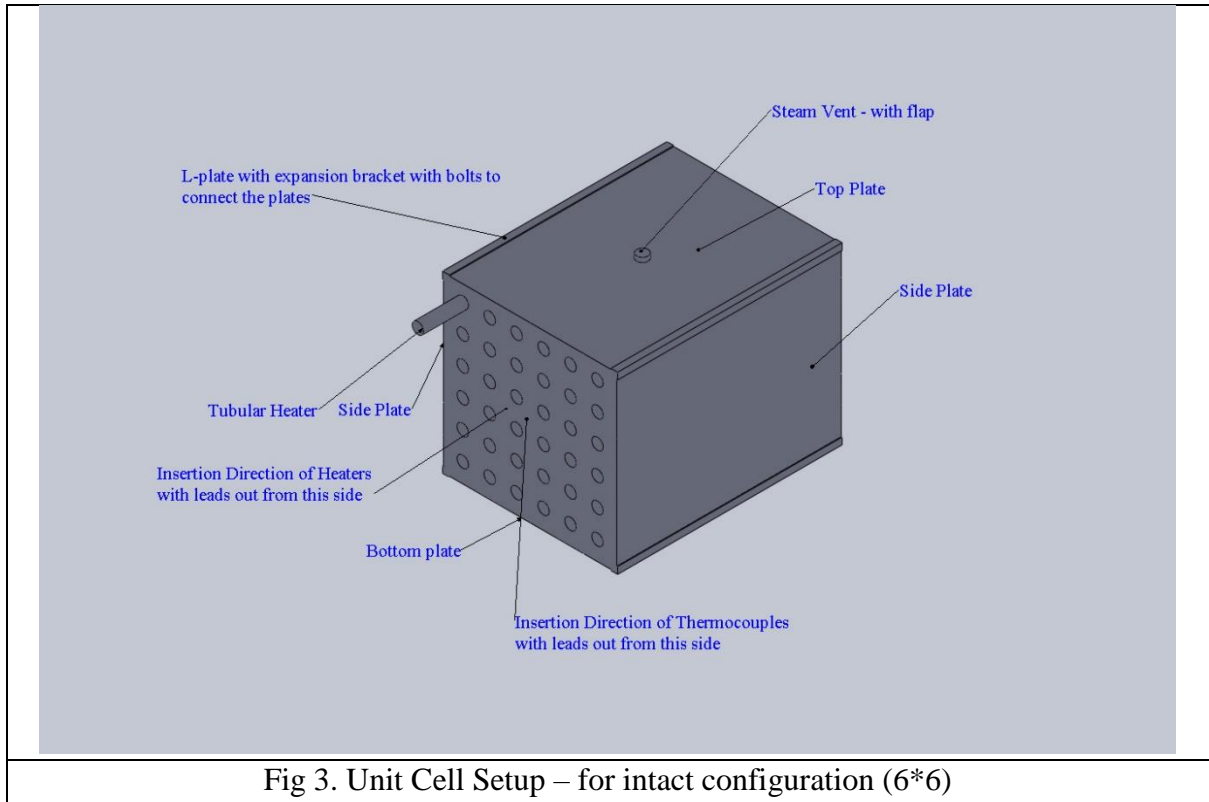


Fig 3. Unit Cell Setup – for intact configuration (6\*6)

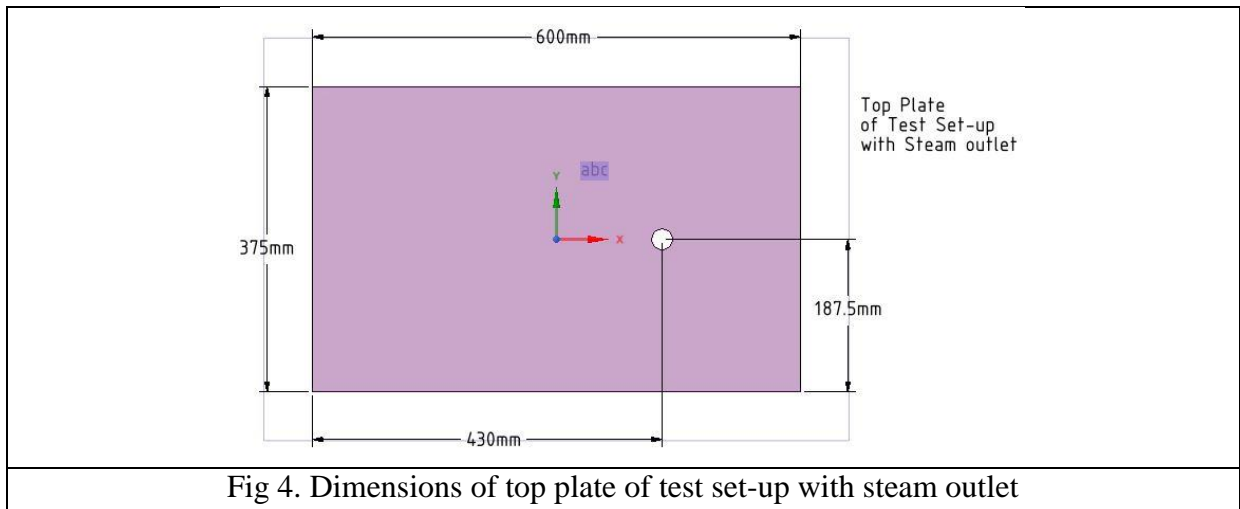


Fig 4. Dimensions of top plate of test set-up with steam outlet



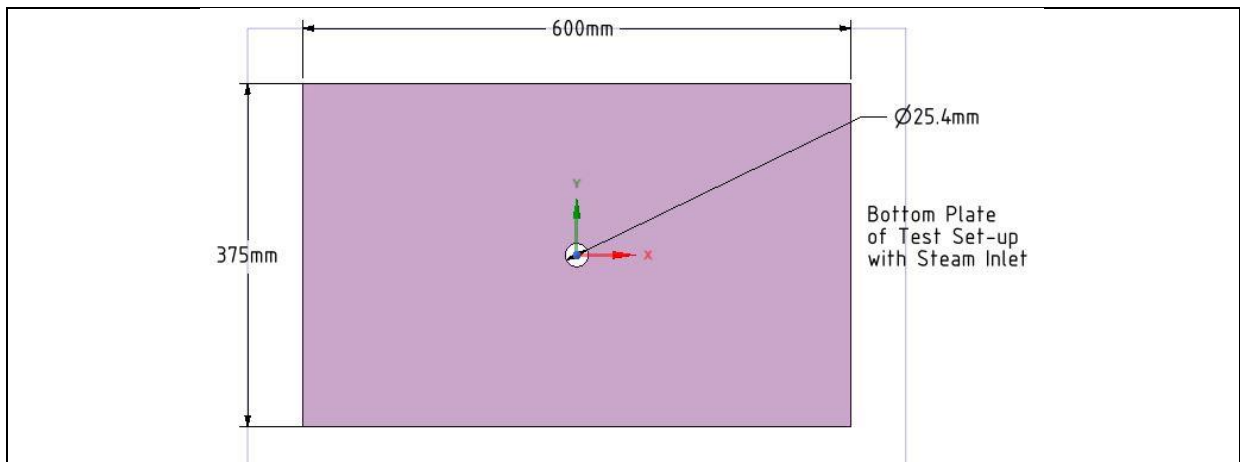


Fig 5. Dimensions of bottom plate of test set-up with steam inlet

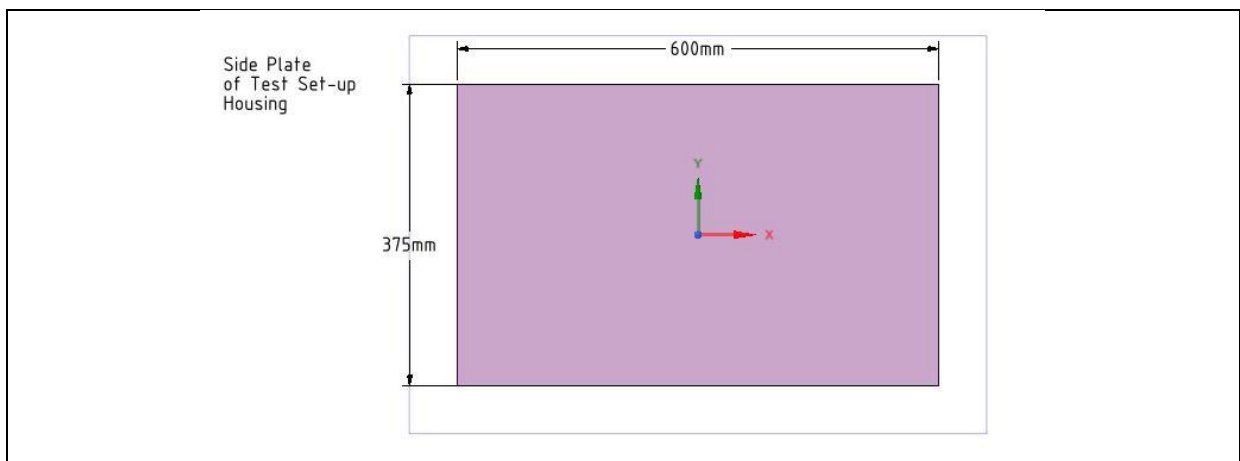


Fig 6. Dimensions of side plate of test set-up

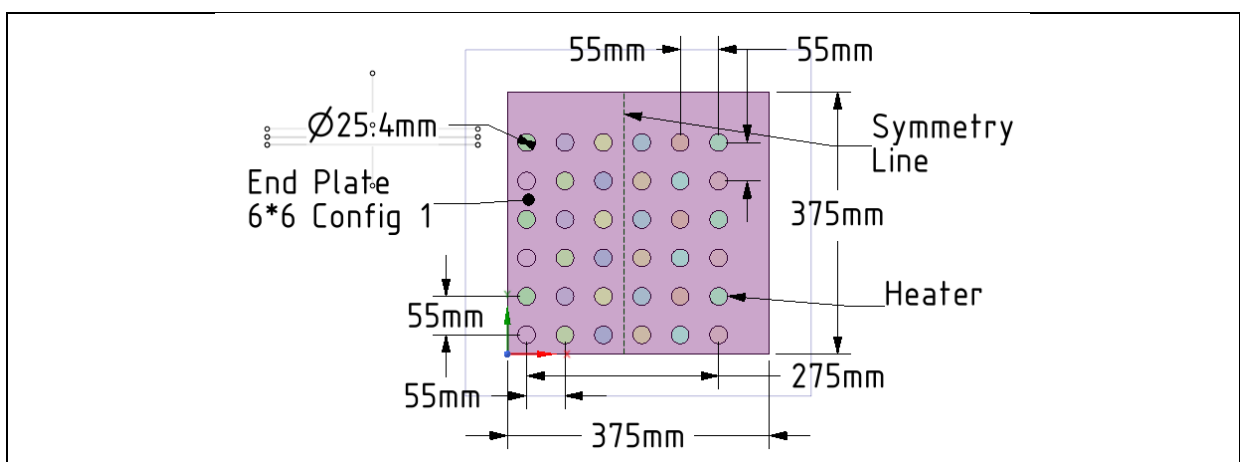


Fig 7. End Plate for 6\*6 pattern configuration # 1

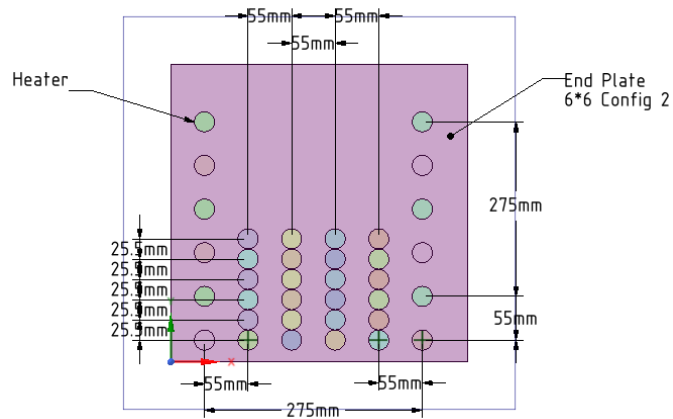


Fig 8. End Plate for 6\*6 pattern configuration # 2

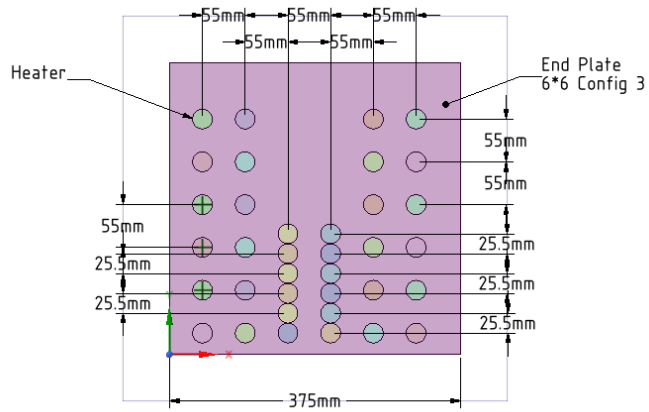


Fig 9. End Plate for 6\*6 pattern configuration # 3

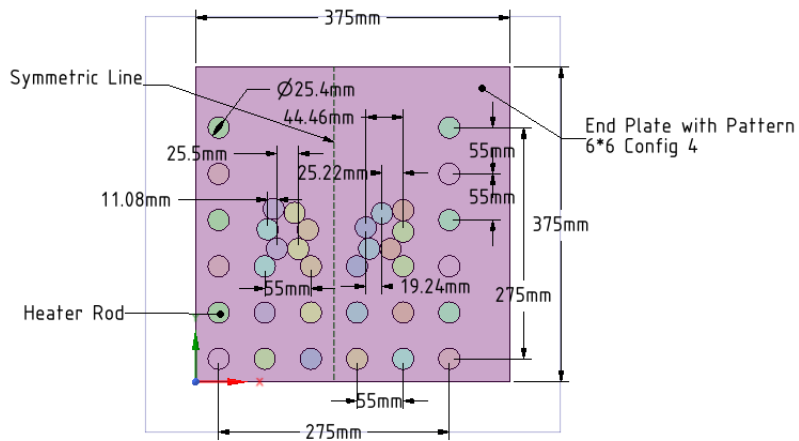


Fig 10. End Plate for 6\*6 pattern configuration # 4

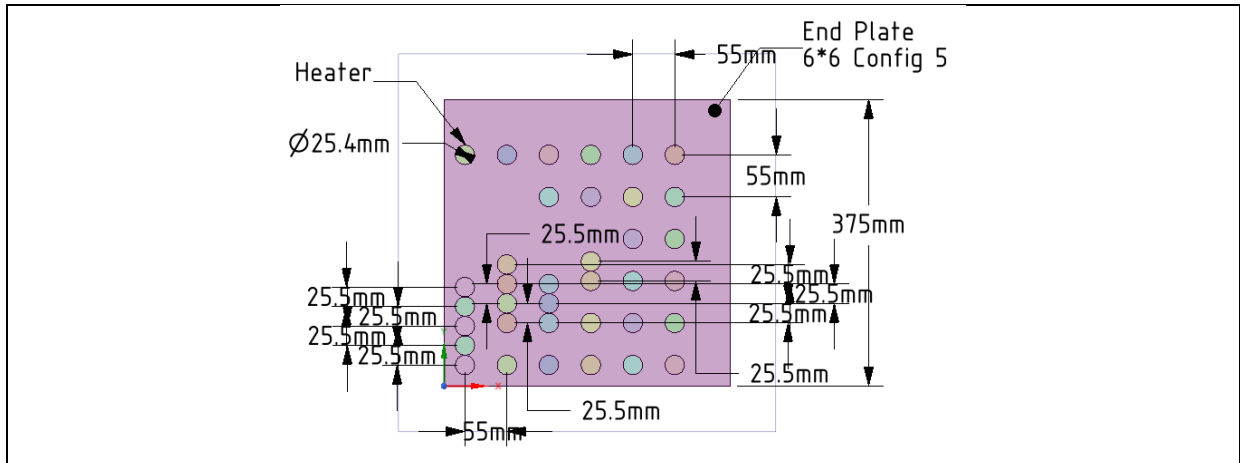


Fig 11. End Plate for 6\*6 pattern configuration # 5

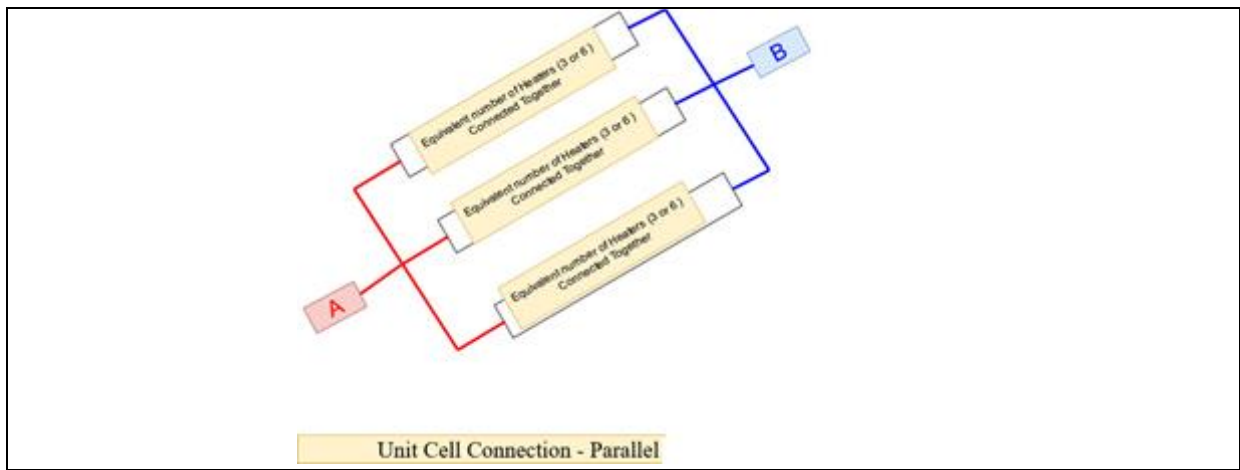


Fig 12. Electrical circuit connection schematic for parallel connection

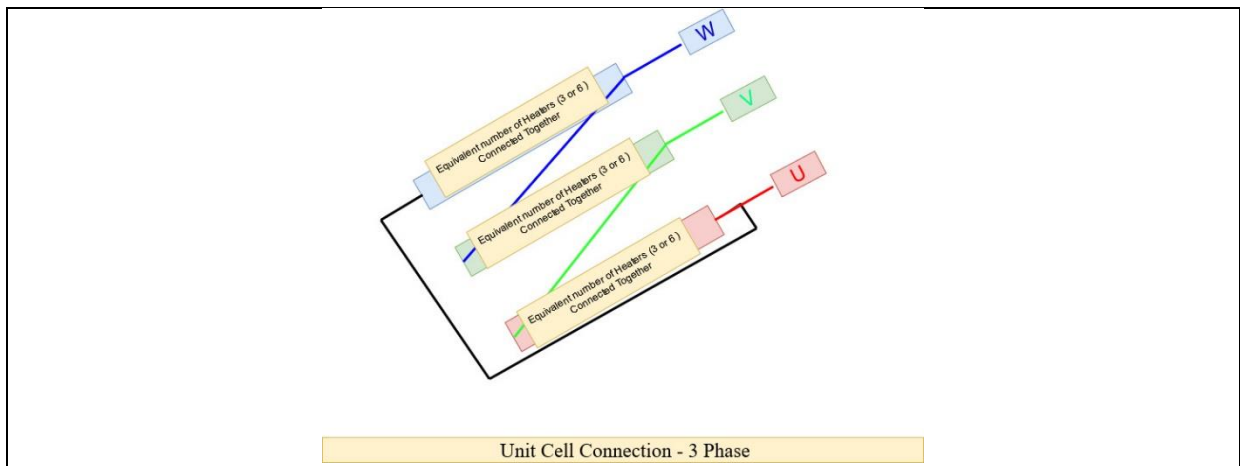


Fig 13. Electrical circuit connection schematic for delta connection

**Notes to Contractor:**

1. Variations in dimensions shall be within tolerance limits.
2. General good quality of product finish shall be ensured.

3. Required drawings/sketches will be provided to contractor as and when required.
4. Minor changes suggested by BARC in design, if any, should be accommodated during fabrication.

### **3. Fabrication and Installation**

The fabrication and installation of all the components given in the Table 1 shall be done according to the relevant design practices and as directed by concerned engineer.

The equipment and tools required for executing this work shall be arranged by the contractor. Free electricity will be provided by the concerned department of IITB. However, hooking any instruments to the mains power supply shall be subjected to the necessary approval of the concerned engineer.

### **4. Testing and Commissioning**

The testing and commissioning of all the components given in the Table 1 shall be done according to the relevant practices and as directed by concerned engineer.

### **5. Price Schedule**

The bidder shall quote unit rates for each item of work given in Table 1 for supply of material, fabrication, installation, testing and commissioning work. The amount for each item shall be worked out and the requisite total shall be given. **NOT GIVING THIS BREAK-UP TO THE FULLEST DETAIL AS REQUIRED IN THE TABLE SHALL BE SUFFICIENT CAUSE FOR OUTRIGHT REJECTION OF THE OFFER WITHOUT ANY CONSIDERATION.**

### **6. Completion of Contract**

The works to be executed by the contractor shall be deemed to be completed only when

- i. The supply, fabrication, installation, testing and commissioning are carried out as per the technical requirements given in this tender document.
- ii. Any defects, deficiencies brought out during testing are rectified and retested wherever necessary to the satisfaction of the engineer.