

Annexure – 1

1. **Item:** Electrical Heaters Silicon Rubber type, Silicon cloth tape type, Band heaters
2. **Scope:** Design, Fabrication, Testing, documentation, guarantee, forwarding, transportation and delivery at BARC, Trombay, Mumbai of electrical heaters as per the specification (Annexure-1)
3. **Applicable Standards**
 - a) ASTM B267 – 07-2018: Standard Specification for Wire for Use In Wire-Wound Resistors
 - b) ANSI/IEEE 515: IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Industrial Applications
 - c) BS 6351: Specification for Electric surface heating device.
 - d) ASTM B344-14: Standard specification for Drawn or rolled nickel or nickel-chromium and nickel chromium-iron alloys for Electrical Heating cables.
 - e) IS 8130-2001: Specification for conductors for insulated electric cables and flexible cords.
 - f) IS 5352-1995: Specification for glass woven fiber tape for electrical purpose.
 - g) NEMA Type 3 or higher rating- Terminal Box enclosures.
4. **Process Conditions**
 - a) The heating cables will be placed over the bare pipelines and equipments carrying chemicals such as Iodine and acids. The pipelines and equipments will then be thermally insulated. The heaters shall be able to operate continuously at different surface temperature with range of 100-950°C at rated voltage.
5. **General**
 - a) These components shall conform, in all aspects, to high standards of engineering practices and be capable of performing trouble free operation with vendor's guarantee in a manner acceptable to purchaser.
 - b) In the event of any conflict between or within the various sections of this specification or in case of any doubt, vendor is supposed to clarify the same well before the quotation is submitted. In case the vendor fails the interpretation of the purchaser shall be final and binding to both the parties.
 - c) Expenditure incurred in all the steps of scope of supply shall be borne by the vendor.
 - d) Post supply inspection in respect of supplies made is not permitted. Any offer containing the condition of post supply inspection will be out-rightly rejected.
 - e) All the component drawings, QAP and catalogue shall be submitted at the time of Quotation.
 - f) The electrical insulation over the connecting lead shall be made of Poly Tetra Fluoro Ethylene (Teflon) / Fiberglass.
 - g) Built-in Bracket Latch: **The Built-In Bracket with a spring loaded screw, for absorbing thermal expansion is to be supplied for band heaters.**
 - h) Terminal Boxes: Terminal boxes should be with NEMA 3 or higher ratings. Terminal boxes design shall be such that all electrical shock or electrical shorts are avoided.
 - i) Following Design Features of heaters are required:
 - i. Built-In thermal insulation
 - ii. Minimum heat loss
 - iii. Fully flexible for easy installation
 - iv. Good temperature uniformity
 - v. Longer heater life

- j) Metal sheath shall be of high temperature oxidation resistant and highest grade mica insulation for good electrical insulation at high temperatures and resistant to moisture.
- k) Clamping band shall be of low thermal expansion stainless steel construction designed to maintain clamping pressure at elevated temperatures.
- l) Nickel/Chromium resistance wire shall evenly wound for uniform heat distribution and reliable accuracy.
- m) Spring loaded clamping arrangement where ever possible shall be provided.
- n) ***Band Heaters with one custom holes or slots for thermocouples is to be considered. Exact location and size will be intimated during approval of QAP and drawings.***
- o) ***All heaters are single phase unless specified.***
- p) ***Pipe sizes mentioned are of ANSI standard with Schedule 40 thickness.***

6. Eligibility of the bidder

- (a) Offers from heater manufacturers and authorized dealers of heater manufacturers only will be considered.
- (b) Offers received from unauthorized traders shall not be considered.
- (c) Bidder shall submit one number each type of heater confirming to tender specifications as a sample for technical evaluation.
- (d) Sample heater will be tested by the purchaser at rated power and at rated temperature for 100 hours to check the performance. If the heater fails, the offer shall be summarily rejected
- (e) Bidders shall submit chemical composition certificates for Nichrome wire, SS sheath and insulation along with the bid.
- (f) Bids without sample heater and chemical composition certificates for heating element, sheath and insulation will be summarily rejected
- (g) Dealers should submit valid authorized dealership certificate along with the bid.

7. Test Laboratories

- a) All the material tests shall be carried out in reputed and renowned test laboratories only, approved by BARC.

8. Quality Assurance Plan:

- a) The party shall submit a detailed QAP indicating the sequence of various manufacturing operations.
- b) The QAP shall be approved by the purchaser before manufacturing of the items.
- c) Right from the preparation of fabrication drawing to the delivery of the items all the steps in the scope of supply shall be in conformation with this QAP.
- d) Any deviation from the QAP shall be with written permission of the purchaser

9. Material Requirements

- a) All the materials & consumables required for fabrication & testing shall be in the scope of the vendor.
- b) All materials used in the construction of the heating cable shall be such that the heaters shall comply with the provisions of this specification and shall pass the tests specified therein.
- c) Original mill test certificates for each material such as stainless steel 316 or equivalent used for sheath, Nichrome conductor used for heater element, ceramic insulation, leads to bear conformance to the relevant material specification listed above shall be submitted to Purchaser for verification prior to start of manufacture. Samples for testing at purchaser's end or by an approved laboratory stipulated by them shall be arranged by the supplier if desired by the purchaser. The cost for testing in outside laboratory is to be born by the vendor.

- d) Wherever the use of a material to an alternative specification is proposed the alternative shall be subject to prior approval by purchaser.
- e) Materials, which do not conform to any standard, shall be subject to approval by purchaser before start of manufacture.
- f) All electrical components such as contactors, fuse, indicating lamp. Heating elements etc shall be of standard make and party shall indicate the make of component in the offer.
- g) All the instruments shall be of standard make and party shall indicate make in their offer.

10. Fabrication:

- a) No part of the work shall be subcontracted without written consent from purchaser. The manufacturer shall be responsible for the execution of the subcontracted work. Necessary inspection & quality control measures shall be taken to ensure compliance of the work to this specification.
- b) Prior to fabrication, all the materials shall be checked and confirmed to be of the required quality for the intended purpose. Material testing shall conform to the approved QAP
- c) All items shall be neatly finished in a good workmanship manner. All exposed metal surfaces shall be smooth and free from burrs and sharp corners etc.

11. Dimensional requirements and power rating:

- a) The table given below describes the type heater required and its wattage, temperature and dimension requirement along with tag no.
- b) Similar items has to be clubbed during quote. However tag number to be provided on each heaters.
- c) **Please note exact dimensions of heaters will be intimated at the time of approval of QAP and drawing. Such changes will be +/-10% maximum.**
- d) **All the band heaters to be provided with inbuilt K type thermocouple.**
- e) **In case of silicon rubber heater, in build RTD sensor to be provided.**
- f) **Quantities of heaters are given in the main indent page.**
- g) **Thickness of Silicon rubber heaters shall not be more than 2 mm.**

| Sl No | Tag No. | Wattage- kW | Type of Heater | Temperature (Max deg C) | Dimensions |
|-------|---------|-------------|-----------------------|-------------------------|---|
| 1 | H-101 | 0.75 | SILICON RUBBER HEATER | 220 | 530 mm X 400 mm |
| 2 | H-102 | 1 | BAND TYPE | 250 | 500 mm Length, Suitable for 2 Inch Pipe |
| 3 | H-103 | 1 | BAND TYPE | 250 | 500 mm Length, Suitable for 2 Inch Pipe |
| 4 | H-104 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 5 | H-105 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 6 | H-106 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 7 | H-107 | 1 | SILICON | 220 | 530 mm X 400 mm |

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|----|-------|-------------|-----------------------|-----|---|
| | | | RUBBER HEATER | | |
| 8 | H-108 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 9 | H-109 | 0.75 | SILICON RUBBER HEATER | 220 | 530 mm X 400 mm |
| 10 | H-110 | 0.5 | BAND TYPE | 200 | 500 mm Length, Suitable for 1 1/2 Inch Pipe |
| 11 | H-111 | 0.75 | SILICON RUBBER HEATER | 220 | 530 mm X 400 mm |
| 12 | H-112 | 1 | BAND TYPE | 250 | 500 mm Length, Suitable for 2 Inch Pipe |
| 13 | H-113 | 1 | BAND TYPE | 250 | 500 mm Length, Suitable for 2 Inch Pipe |
| 14 | H-114 | 1 | SILICON RUBBER HEATER | 220 | 530 mm X 400 mm |
| 15 | H-115 | 1 | SILICON RUBBER HEATER | 220 | 530 mm X 400 mm |
| 16 | H201 | 1 | BAND TYPE | 450 | 400 MM- 59 mm OD of pipe |
| 17 | H202 | 1 | BAND TYPE | 500 | 400 MM- 79 mm OD of pipe |
| 18 | H203 | 1 | BAND TYPE | 500 | 400 MM- 79 mm OD of pipe |
| 19 | H204 | 0.5 | BAND TYPE | 950 | 400 MM- 79 mm OD of pipe |
| 20 | H205 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 21 | H-301 | 0.5 | BAND TYPE | 250 | 500 mm Length, Suitable for 2 Inch Pipe |
| 22 | H-305 | 2 | BAND TYPE | 550 | 500 mm- suitable for 6 Inch pipe |
| 23 | H-306 | 2 | BAND TYPE | 550 | 500 mm- suitable for 6 Inch pipe |
| 24 | H-309 | 0.75 | SILICON RUBBER HEATER | 220 | 530 mm X 400 mm |
| 25 | H-310 | 0.75 | SILICON RUBBER HEATER | 220 | 530 mm X 400 mm |
| 26 | H-311 | 0.75 | SILICON RUBBER HEATER | 220 | 530 mm X 400 mm |
| 27 | H-312 | 5 (3 phase) | BAND TYPE | 300 | 500 mm- Suitable for 4 Inch pipe |
| 28 | H-314 | 0.5 | SILICON RUBBER | 220 | 2000 mm X 100 mm |

| | | | HEATER | | |
|----|----------|------|-----------------------|-----|----------------------------------|
| 29 | H-316 | 4 | BAND TYPE | 250 | 500 mm- suitable for 6 Inch pipe |
| 30 | H-319 | 0.75 | SILICON RUBBER HEATER | 220 | 530 mm X 400 mm |
| 31 | H-335 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 32 | H-337 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 33 | H339 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 34 | H340 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 35 | H-342 | 0.75 | SILICON RUBBER HEATER | 220 | 530 mm X 400 mm |
| 36 | H-344 | 0.75 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 37 | H 346 | 2 | BAND TYPE | 250 | 500 mm- Suitable for 4 Inch pipe |
| 38 | H 347 | 0.75 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 39 | H-601 | 2 | BAND TYPE | 250 | 500 mm-suitable for 2 Inch Pipe |
| 40 | LTH 115A | 0.75 | SILICON RUBBER HEATER | 220 | 530 mm X 400 mm |
| 41 | LTH 115 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 42 | LTH 201 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 43 | LTH 202 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 44 | LTH 203 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 45 | LTH 204 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 46 | LTH 322 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |

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|----|---------|-----|---------------------------|-----|--------------------------------------|
| 47 | LTH 341 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 48 | LTH 342 | 0.5 | SILICON RUBBER HEATER | 220 | 2000 mm X 100 mm |
| 49 | SP-1 | 0.5 | BAND HEATER | 300 | 500 mm- suitable for 1 Inch pipe |
| 50 | SP-2 | 0.5 | BAND HEATER | 500 | 500 mm- suitable for 1 Inch pipe |
| 51 | SP-3 | 0.5 | BAND HEATER | 500 | 300 mm- suitable for 1 Inch pipe |
| 52 | SP-4 | 1 | BAND HEATER | 500 | 300 mm- suitable for 1 Inch pipe |
| 53 | SP-5 | 1 | BAND HEATER | 500 | 200 mm- suitable for 1 1/2 Inch pipe |
| | SP-6 | 2 | BAND HEATER | 500 | 600 mm- suitable for 1 1/2 Inch pipe |
| 54 | SP-7 | 1 | BAND HEATER | 500 | 300 mm- suitable for 2 Inch pipe |
| 55 | SP-8 | 0.5 | SILICON CLOTH TAPE HEATER | 450 | 2000 mm |
| 56 | SP-9 | 1 | SILICON CLOTH TAPE HEATER | 450 | 2000 mm |
| 57 | SP-10 | 2 | SILICON CLOTH TAPE HEATER | 450 | 2000 mm |
| 58 | SP-11 | 3 | SILICON CLOTH TAPE HEATER | 450 | 2000 mm |
| 59 | SP-12 | 0.5 | SILICON CLOTH TAPE HEATER | 450 | 1000 mm |
| 60 | SP-13 | 1 | SILICON CLOTH TAPE HEATER | 450 | 1000 mm |
| 61 | SP-14 | 2 | SILICON CLOTH TAPE HEATER | 450 | 1000 mm |
| 62 | SP-15 | 0.5 | SILICON CLOTH TAPE HEATER | 450 | 500 mm |
| 63 | SP-16 | 1 | SILICON CLOTH TAPE HEATER | 450 | 500 mm |
| 64 | SP-17 | 2 | SILICON CLOTH TAPE HEATER | 450 | 500 mm |

12. Instrument requirement:

a) Type: RTD PT 100, 4 wire (Class B)

It should conform to IEC 751 standards, Transmitter output: 4-20mA

b) Type: K type thermocouple:

Standard Plug and socket arrangement. It should conform to IEC 60584 standards
Accuracy: +/- 2.2°C or +/- .75%.

13. Inspection & testing:

- a) All the tests and inspections shall be carried out in conformation with the approved QAP. Any deviation shall be with written permission of the purchaser
- b) The party shall submit a detailed QAP along with the quotation.
- c) In the event of component or any part thereof fails to meet the examination or test requirements specified herein the vendor shall notify the purchaser in writing. The vendor shall obtain written permission from purchaser before repair and subsequent use of the part.
- d) The test procedure shall be proposed by the supplier and approved by the purchaser well in advance. All the instruments used for tests shall have valid calibration certificate.
- e) Continuity Test: The continuity of the heater circuit for each heating cable shall be determined by resistance measurement using a Wheatstone bridge (or other resistance measurement instrument) with an accuracy of 0.5 percent or better.
- f) High Voltage Test
- g) Insulation Resistance Test: The insulation resistance should be measured on the heating cable after the high voltage test.
- h) Verification of Sheath Temperatures: The maximum allowable watt density of the heating cable and maximum sheath surface temperature declared by the manufacturer will be verified by conducting tests on specific test installation. Observed values shall not vary more than +/- 5%.

14. Bid Evaluation criteria:

- a) Purchase order will be placed on technically suitable lowest offer

15. Marking:

- a) Each heater shall have a tag bearing the serial number and all details of heater. These markings shall not peel away during transport and storage at site. Each package consisting of a number of heaters shall have the following information marked on it.
 - i. Purchase Order No.
 - ii. Gross weight of the package.
 - iii. Size of the package.
 - iv. Instructions for handling.
 - v. Purchaser's address.
 - vi. Supplier's address.
- b) All markings shall be legible and durable. They shall be resistant to heat, rust or tarnish.

16. Final Acceptance:

After checking and ascertaining satisfactory performance of all the heaters based on inspection and test results as per S.no 13, dispatch clearance will be given to the supplier. Further the following tests will be conducted on all the heaters by the purchaser after receipt of heaters at purchaser's site.

- i. Visual inspection
- ii. Measurement of resistance
- iii. Measurement of Insulation Resistance

Final acceptance will be given after ascertaining satisfactory performance of above tests.

17. Rights and Privileges of Purchaser:

- a) Authorized inspector reserves the right to inspect any machinery, material and equipment furnished or used by vendor under this scope of supply and to reject any, which is found defective.

- b) Authorized inspector shall be permitted free access to vendor's or his sub-vendor's workshop / stores (if any) at all the working hours for the purpose of inspecting work at all stages of progress.
- c) Authorized inspector shall be given full assistance in the form of necessary tools, instruments, equipments and qualified operators to facilitate inspection.
- d) Authorized Inspector reserves the right to call for certificate of origin and test certificates of all raw materials in addition to the calibration certificate of the instruments being used.
- e) The authorized inspector shall have a right to conduct any additional examination, inspection or testing, if he/she feels is necessary.

18. Guarantee:

- a) The vendor shall guarantee that the items mentioned in this scope of supply are new and of high quality and that the items will be free from defects in material fabrication and workmanship as per the requirements of this technical specification for a period of twelve months (12 months) after the completion of all delivery.
- b) If within the guarantee period stipulated above, the items mentioned in the scope of supply or any part of the same are found defective because of bad materials, improper fabrication or any mistake in the operations carried out by the vendor in completion of the scope of supply, then the vendor at his own expense either repair them preferably on the site or transport them to their workshop and repair / replace them & to be delivered at site again. The decision of repair and replacement will be taken in consideration with the function, end use and life of that component.

19. Packing, Transportation & Delivery:

- a) The components shall be packed in such a manner as to provide maximum protection against physical damage.
- b) All components shall have proper face protectors to avoid damages during transportation and storage.
- c) Details of packing procedure and packing are subject to purchaser's approval.
- d) All packing cases and packing material shall become the property of the Purchaser, after delivery.
- e) Vendor shall be responsible for any damage to the equipment during transit due to improper and inadequate packing.
- f) All items shall be protected for the entire period of dispatch, storage (in transit delay) and transportation; against corrosion, sun-light, rain, high temperature, humid atmosphere, rough handling in transportation and storage in the open.
- g) No material shall be dispatched without prior written consent of purchaser or his representative.