



	Form No:	 <b>PE&amp;SD</b>	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>		<b>PY 51 735</b>	
			PURCHASE SPECIFICATION		Rev. No. 00	
			<b>IOCL PARADIP 525 TPD STANDBY SRU</b> <b>ENGINEERED BOLT-ON HEATING SYSTEM</b>		Page 1 of 22	
<p style="text-align: center;"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p style="text-align: center;"><b>Supply and Erection Supervision of Engineered Bolt-on Heating System</b></p> <p style="text-align: center;"><b>for IOCL Paradip 525 TPD Standby SRU Project</b></p>				
Refer Doc		PROJECT ENGINEERING & SYSTEMS DIVISION	PREPARED	CHECKED	APPROVED	DATE
			V.Uday Kumar	Srikanth G	Srikanth G	05.05.21

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1.0 INTRODUCTION

1.1 BHEL has received the order from IOCL for 525 TPD Standby SRU LSTK Contract for their Paradip Refinery. The order requires project management, residual process design, detailed engineering (including HAZOP study), procurement, fabrication, inspection, transportation, storage, assembly, erection, installation, construction, testing, statutory approvals, mechanical completion, pre-commissioning, commissioning, performance guarantee test run (PGTR) of standby Sulphur Recovery Unit (SRU) along with incinerator, waste heat exchanger, stack and interconnecting works for IOCL Paradip Refinery.

1.2 As a part of this order, BHEL is required to supply the Engineered Bolt-on Heating System. This system has to be installed on certain pipes in existing SRU units & also on new lines being erected as part of this new stand-by unit.

1.3 **The Engineered Bolt-on Heating (Tracing) System** is an improved and more efficient way of Steam tracing and will be installed to maintain incoming process temperature, prevent liquid processes from freezing and the prevention of vapor processes from condensing inside of piping, tanks, vessels, valves, equipment, etc. and shall accordingly be designed.

2.0 INTENT OF THE SPECIFICATION


2.1 The intent of this standard/specification is to describe the requirements governing the Scope, Design, Manufacture and Installation support for Engineered Pre-fabricated Bolt-On Heating (Tracing) System to be installed for Piping and Equipment as part of IOCL Paradip 525 TPD Standby SRU LSTK Project. The bolt-on heating system shall comprise of the following:

- Supply of Bolt-on Heating Elements (pre-fabricated to form bolt-on panels)
- Supply of Bolt-on Heating Jackets
- Supply of Flexible metal jump over hoses designed to connect the system
- Supply of Heat transfer compound, Installation Hardware and tooling
- Supervision of E&C of the Bolt-on heating system

2.2 It is not the intent to completely specify all the details of design and manufacturing. Nevertheless, the finished product shall confirm to highest standards of engineering & fabrication and shall be capable of performing in continuous commercial operation in a manner acceptable to the Purchaser and Client.

3.0 LEGEND / GLOSSARY OF TERMS


Purchaser	: BHEL
Owner/Client	: BHEL's Customer
Bidder	: Eligible vendors from whom offers are received against the Enquiry
Vendor/Supplier	: Successful Bidder of the Package on whom Order is placed

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#### 4.0 BIDDER QUALIFICATION CRITERIA

- 4.1 The bidder should be an OEM or Authorized Channel Partner of an OEM who had Designed, Manufactured and Supplied an Engineered Pre-fabricated Bolt-on Heating System backed by a Thermal Guarantee, in line with the requirements of this specification.
- 4.2 The Engineered Pre-fabricated Bolt-on Heating System should have been supplied to any of the process plants for guaranteed minimum wall temperatures in the following lines:
- ✓ Molten Sulphur
  - ✓ SRU Tail Gas
  - ✓ Sour Water Acid Gas
  - ✓ Amine Acid Gas
- 4.3 The bidder must have executed a single PO of value not less than 2 Million USD/ 15 Crore INR for supply of Engineered Pre-fabricated Bolt-on Heating System, for Core pipe sizes upto 48" NPS.
- 4.4 The reference bolt-on heating system as specified above must have been commissioned within the last 10 years ending on last day of the month immediately previous to the month in which last date of bid submission falls (in case of extended bid submission date, original bid submission date shall be considered) and should have been in satisfactory operation for at least 1 (one) year after commissioning. A copy of the following duly certified by the Owner/End User shall be submitted by the Intending Bidder along with the Techno-Commercial Part of the Bid for the reference job.
- ✓ Certificate for Satisfactory Operation for 1 year from client
- OR**
- ✓ Certificate of Release of full Security Deposit (Bank Guarantee) by Client against the defect liability period
- OR**
- ✓ Certificate of Completion of Performance Guarantee and Test run (PGTR) with completion date at least 1 year prior to bid submission
- OR**
- ✓ Certification by CEO/CFO with due notarization that Defect Liability Period is completed and there is no claim by client on account of performance of the system.
- The reference unit must not be captive unit. The unit will be considered as Captive unit where the bidder has equal to or more than 50% share capital in the company owning the facility.
- 4.5 The bidder should have the design and should have the capability in-house or under license with an OEM, to carry out the complete detailed engineering under thermal guarantee and to generate all the Engineering deliverables like Design Calculations meeting the Heating requirements, GA drawings, Isometrics, Fabrication Drawings etc. The above set of deliverables (for the reference job) are required to be submitted by the bidder along with the Bid, as a proof of their capability.
- 4.6 The bidder shall singly meet the criteria at para 4.1, 4.2 and 4.3 above.
- 4.7 **Acceptance of the Bidder's offer is subjected to end Client's approval.**

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**5.0 SCOPE OF SUPPLY AND SERVICES**

**5.1 Scope of Supply**

Bolt-on Heating System, which includes but not limited to, Bolt-on Heating Elements, Bolt-on Heating Jackets, Flexible metal jump over hoses, Heat transfer compound, Installation Hardware and Tooling, Installation and Commissioning Spares, for:

5.1.1 Existing Process lines in SRU-1 and SRU-2 Units including Common Headers **(Lot-1 Supplies)**

5.1.2 New Process lines and Equipment in SRU-3 Unit **(Lot-2 Supplies)**

**details of which, are provided as “Core Piping Input” (Annexure-B).**

**5.2 Scope of Services (Common to Lot-1 & Lot-2 Supplies)**

5.2.1 Complete System Design & Engineering, Material sourcing / Manufacturing, Fabrication, Assembly, Surface preparation, Shop painting, Marking, Packaging and Transport of the Engineered Bolt-on Heating System.

5.2.2 Inspection & Testing at Vendor’s works.

5.2.3 Obtaining BHEL’s approval on all applicable engineering documents.

5.2.4 Documentation as specified in this standard including shipping documentation, necessary statutory approvals, test certificates etc.

5.2.5 Correction of mismatches found w.r.t approved drawings without any price implication (to be carried out at site).

5.2.6 Rectification of damages caused during transportation without any price implication (to be carried out at site).


5.2.7 On-site training for Installation team.

5.2.8 On-site Supervision for Installation and Commissioning of Bolt-on Heating System.

5.2.9 On-site assistance to the Installation team, to carry out modifications required, if any, to suit to site conditions.

5.3 Any additional items, accessories, services etc., which are not specifically mentioned in this document, but required to make the bolt-on heating system complete in all respects for it’s safe, efficient, reliable and trouble free operation, in accordance with the intent of this standard, contractual agreement, statutory requirements, relevant codes/standards, good engineering practices, shall be deemed to be in bidder’s scope unless specifically excluded.

5.4 It will be the bidder’s sole responsibility to specifically highlight any of the missing items required for the proper & intended use of the bolt-on heating system as a part of their offer. In case nothing is highlighted by the bidder, it will be assumed that all the items are included in the bidder’s scope of supply for the desired operation.

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## 6.0 DESIGN, MANUFACTURING & TESTING

6.1 **Bolt-on Heating Elements (pre-fabricated to form bolt-on Panels), Heating Jackets and other accessories covered by this standard shall be designed, manufactured, and tested in compliance with the latest edition of the following references unless otherwise noted.**

6.2 Industry Codes and Standards:

6.2.1	ASME Section IX	Welding and Brazing Qualifications
6.2.2	ASME Section VIII Div I	Rules for Construction of Pressure Vessels
6.2.3	ASME Section V	Nondestructive Examination
6.2.4	ASME B31.1	Power Piping
6.2.5	ASME B31.3	Process Piping
6.2.6	ASNT SNT-TC-1A	Personnel Qualification and Certification in Nondestructive Testing

6.3 OEM References (Controls Southeast Inc., USA):

6.3.1	TRN-BOM-03	Bolt-On Heating Systems
6.3.2	QC-PTP-01	Pneumatic Testing Procedure
6.3.3	QC-HTP-01	Hydrostatic Testing Procedure
6.3.4	QC-CI-01	Application of Corrosion Inhibitor
6.3.5	QC-CP-01	Standard Coating Procedure
6.3.6	QC-EPS-01	Procedure for Export Packaging and Shipping
6.3.7	QC-FM-01	Filler Material Receipt, Logging, and Issue
6.3.8	QC-MD-01	Material Discrepancy Procedure
6.3.9	QC-MTE-01	Measuring and Test Equipment Calibration
6.3.10	QC-PGC-01	Pressure Gage Calibration
6.3.11	QC-PQC-01	NDE Personnel Qualification/Certification Practice
6.3.12	QC-VT-01	Visual Examination Procedure

**Equivalent Vendor Specifications meeting the design criteria specified in the above OEM references, are also acceptable. Onus is on the Bidder, to prove that the bidder's specifications are equivalent to that of OEM's.**


6.4 Design and Manufacture of Bolt-on Heating System is excluded from the purview of IBR (Indian Boiler Regulations) as per clause no 9.10.1 of "Engineering Design Basis for Piping Design" Doc.No. 080557C-088-JSD-1300-001 Rev B (Annexure-C).

## 7.0 CODE OF CONSTRUCTION

Bolt-on Heating Elements, Heating Inserts (pressure chamber) and Heating Jackets covered by this standard are to be designed and manufactured in accordance with the latest edition and addenda of ASME Section VIII Division 1.

## 8.0 TECHNICAL DESIGN

8.1 The bolt-on heating system shall be designed to maintain incoming process temperature, prevent liquid processes from freezing and the prevention of vapor processes from condensing inside of piping, tanks, vessels, valves, equipment, etc.

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**8.2 The bolt-on heating system design shall meet the Thermal Objective Specification,** attached as Annexure-A.

**8.3 The technical basis for Bolt-On Heating System design is to be supported by proof testing in accordance with ASME Section VIII Division 1, Paragraph UG101. Proof testing data along with detailed design calculations, shall be submitted along with the offer by the bidder. Non submission of the same will lead to rejection of the offer.**

8.4 The heating elements should be designed for as per operating parameters mentioned in 10.5.

8.5 Dimensions:

8.5.1 For main process piping diameters equal to or larger than 2" NPS, the heating elements shall have a nominal 2" X 1" rectangular cross section. One side of the 2" surface shall be formed with a concave radius that is consistent with the OD of the process piping to which they will be attached.

8.5.2 For main process piping diameters smaller than 2" NPS, the heating elements shall have a nominal 1½" X ⅞" rectangular cross section with a curvature to accommodate the contour of the OD of the pipe.

8.5.3 Lengths of the individual elements complete with supply and drain connections, should not exceed 12 m (40').

8.6 The bidder shall perform heat transfer calculations to determine the number of heating elements required to achieve the thermal requirements for each line.

8.7 Heat transfer compound is to be used to enhance heat transfer between the heating element and the piping. It shall be a thin layer applied between the heating element and the pipe and should remain pliable during repeated thermal cycling. A computer analysis or laboratory experiment data shall be provided by the bidder, to support the improved thermal performance expectations derived from the heat transfer calculations. Bidder shall also provide laboratory experiment data to verify the long term stability and thermal performance of any heat transfer compound.

8.8 The bolt-on heating elements shall be designed to span across welds.

**9.0 MATERIALS OF CONSTRUCTION**

The following materials are to be used in the design and manufacture of Bolt-On Heating System:

9.1 Heating Elements and Inserts:

9.1.1 ASME SA178 Grade A ERW 0.120" Nominal Wall Boiler Tube

9.1.2 ASME SA106 Grade B schedule 40


a) Panel headers

9.2 Supply and Return Connections:

9.2.1 ASME SA105 3000# Couplings

9.2.2 ASME SA106 Grade B schedule 160

a) JOE [JIC (per SAE J514) One End] inlet/outlet connection fittings.

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- 9.2.3 ASTM C12L14  
a) JIC adapters for coupling connection fittings.

- 9.3 End Caps:  
9.3.1 ASME SA36 Plate

- 9.4 Heating Jackets (Aluminum):  
9.4.1 ASTM A356-2


- 9.5 Jump Over Hoses:  
9.5.1 ASTM A240 Grade 321  
a) Flexible Hose  
9.5.2 ASTM A478 Grade 304  
a) Flexible Hose Reinforcement Braid  
b) Braid Sleeve

## 10.0 SYSTEM DESIGN AND ROUTING

- 10.1 Bidder shall design the bolt-on heating system to achieve the client's thermal requirements as stated in the P&ID's, piping line list, piping isometric drawings and/or Bolt-on Heating System Data Sheet.
- 10.2 Bidder shall perform heat transfer and pressure drop calculations to determine the number of heating elements and maximum allowable circuit lengths required to meet the thermal requirements. Bidder shall design the heating medium routing to optimize the quantity of supply and return points without exceeding the temperature and pressure drop limitations necessary for successful operation of the system.
- 10.3 Bidder shall evaluate the flange pairs and piping supports to determine if they pose a heat sink and will therefore require additional heating coverage. Additional required heating of these components shall be included in the design.
- 10.4 Bidder shall provide an engineering report which summarizes the thermal design of the system and includes heat transfer calculations, heating medium consumption per circuit and total heating medium consumption. The calculation must also support a thermal modeling and FEA calculation of the predicted piping wall temperature including the area of the pipe supports and flanges which act as heat sinks.
- 10.5 The available heating medium (operating) parameters are as follows:

	Option-1	Option-2
Medium Type	LP Steam	MP Steam
Normal Operating Pressure	4 Kg/cm <sup>2</sup> (g)	16 Kg/cm <sup>2</sup> (g)
Normal Operating Temperature	175 °C	201 °C
Consumption Limit (Total for both Lot-1 & Lot-2)	6.9 TPH Max	7.5 TPH Max

**Steam consumption shall be limited to the maximum values provided above for each option.** The Quantity of Steam required, for each option, shall be clearly indicated by the bidder in their offer.

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Bidder shall design the system and shall submit their most competitive offer for both the options above. Price bid formats shall be separate for both these options. It is mandatory for the bidder to quote for both the options, without which their offer is liable for rejection.

**Final option of the heating medium to be used shall be decided by BHEL at a later stage, during technical scrutiny of the offers received. Final Bid and Scope of supplies shall be decided accordingly.**

10.6 The minimum steam pressure available at the inlet of the steam trap, which shall ensure successful trap operation and condensate removal, shall be clearly indicated by the bidder in their offer, for each option.

10.7 The heating system design shall be documented with isometric installation drawings that detail individual heating elements, valve/component jackets and jump over hoses. The installation drawings shall clearly label each heating element/jacket/hose as well as the heating medium supply and return locations.

10.8 Each bolt-on heating element and valve/component jacket in the system shall have an inlet and outlet connection for the supply and drain of the heating medium. The connections shall consist of either ¾" FNPT extended couplings or ¾" NPS x ¾" MNPT JOE pipe fittings welded directly to the element. Bidder can provide ¾" MNPT X ¾" MJIC adapters to be field installed into the couplings. All connections shall be designed to extend beyond any insulation.


10.9 Bidder to note that supply/return manifolds and supply/return lines which connect the manifolds to the bolt-on heating system, are NOT in their scope of supply. However, successful bidder shall provide the BOQ for the same (including the specification for the Steam Trap), based on the Bolt-on Heating System Design. The tubing which connects the supply/return manifolds to the bolt-on heating system shall have a minimum diameter of ¾" and a maximum length of 30 m (100').

10.10 Vendor to provide an interference matrix to allow the piping designers to check for potential interferences between the heating medium connections and adjacent piping/components and floor penetrations.

10.11 **As the Job involves the installation of bolt-on heating system on the existing piping systems (Lot-1), a complete study of the execution methodology shall be done by the bidder. The bidder shall conduct a site visit to study the existing pipes, review the accessibility, erection feasibility and accordingly shall submit their Offer. Bolt-on Panel dimensions shall be designed according to feasibility of erection.**

**11.0 SYSTEM INSTALLATION**

11.1 Vendor shall supply all hardware, tooling and heat transfer compound necessary for installation of the bolt-on heating elements, jackets and hoses. Vendor shall also supply standard Installation and Commissioning Spares required. Vendor shall submit a list of Installation and Commissioning Spares, as part of their offer.

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11.2 Vendor shall furnish the “Installation drawings” and “Installation Checklist” as per which, the heating elements shall be installed.

11.3 The heating element shall be attached to the Pipe with either stainless steel banding (minimum thickness of 0.7mm) or a more durable method of attachment which will prevent dislocation due to thermal and/or pressure expansion. This banding material along with all the required hardware, shall also be supplied by Vendor.

11.4 Vendor shall provide on-site supervision services for installation & commissioning of the complete Bolt-on Heating System.

11.5 Vendor shall also provide on-site training to the installation crew. During this training, Vendor shall assess / certify the capabilities of the installation crew and verify the initial installation quality.

11.6 Vendor shall provide the Installation Checklist, which shall be used by the Installation team to confirm the proper installation of each Heating element and Jacket in the system. The Installation Checklist shall accompany the installation package to the site.

**12.0 PIPING DESIGN CONSIDERATIONS**

12.1 Piping Design Considerations shall be as per

12.1.1 Engineering Design Basis for Piping Design, Doc.No. 080557C-088-JSD-1300-001, Rev B (attached as Annexure-C).

12.1.2 Environmental Design Basis, Doc.No. 080557C-088-CN-0007-004, Rev. A (attached as Annexure-D).

12.2 The insulation type and thickness (as per process requirements) for each line to be traced, are provided in the “Core Piping Input” (Annexure-B). Bidder to review the Insulation thickness and indicate changes, if any, to be made due to provision of Bolt-on Heating.

**13.0 GENERAL FABRICATION REQUIREMENTS**


13.1 Heating Elements and Heating Inserts

13.1.1 Bolt-On Heating System consists of standard fabrication details supported by the technical design.

13.1.2 Manufacturing tolerances (Best Practices) have been established per the technical design of the system.

13.1.3 The heating element raw element material shall be extruded from SA178 Grade A ERW boiler tubing per OEM (CSI, USA) Procedure SOP-TE-02 or Equivalent. SOP-TE-02 references details for the appropriate radius and sizing of the Heating Element during extrusion.

13.1.4 The forming of Heating elements to various shapes to accommodate manufacturing and system design shall be per OEM (CSI, USA) Procedure SOP-CTF-02 or Equivalent.

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13.2 Jump Over Hoses

13.2.1 Jump over hoses shall be fabricated by welding a 304 stainless steel braid sleeve to the 304 stainless hose reinforcement braid and the 321 stainless steel flexible hose material. Under standard design conditions, an FJIC fitting shall then be welded to the braid sleeve.

13.3 Heating Jackets

13.3.1 Bolt-on Heating Jacket shall be cast aluminum jacket molded specifically to fit a unique piping component (i.e., valve, pump, instrument, or fitting) and shall be made from B-179 Grade A.356.2 copper-free aluminum, and shall contain the Heating element.

**14.0 GENERAL WELDING REQUIREMENTS**

14.1 All welding procedures and welders shall be qualified by the Vendor in accordance with the latest edition of ASME Section IX. Production welding continuity shall be maintained for each welder per process in accordance with ASME Section IX.

14.2 The preferred welding processes on Bolt-on Heating elements and Heating inserts are Gas Tungsten Arc Welding (GTAW) for open butt and branch welds and Gas Metal Arc Welding (GMAW) for fillet and non-pressure retaining welds.

14.3 All welds on fabricated jump over hoses shall be completed using the Gas Tungsten Arc Welding (GTAW) process.

14.4 The Bolt-on Heating Jackets are not pressure retaining components therefore all welds on the jackets shall be strictly superficial improvements made using the Gas Tungsten Arc Welding (GTAW) process.


**15.0 QUALITY REQUIREMENTS, INSPECTION & TESTING**

15.1 Inspection shall be either by purchaser, owner or purchaser's appointed third party agency as per the approved QAP.

15.2 Vendor is responsible for performance of all tests and inspection to ensure that the supplied package meets the requirements of this specification. Vendor may use their own facilities or any approved laboratory acceptable to purchaser / owner. Purchaser / owner reserves the right to inspect and witness any test prior to dispatch and as per "HOLD-POINTS" defined in the QA plan. Vendor shall give reasonable notice in writing of the date and place of any test and inspection by purchaser / owner.

15.3 Unless otherwise specified, BHEL reserves the right to test and inspect all the items at the Bidder works/at site.

15.4 Vendor to produce Welder Qualification Certificates for purchaser's review before start of fabrication. Alternatively purchaser may ask for Welder Qualification Testing at shop, which shall be witnessed and certified by a qualified third party agency and shall be reviewed by Purchaser/TPIA.

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15.5 Witness Inspection: Vendor shall offer all the items for pre-dispatch inspection and the following tests/ checks shall be carried out as a minimum:

- Physical and Dimensional Check.
- Review of all certificates and test reports as indicated at 25.7 below.
- BOM check
- Painting workmanship and finish
- Additional tests, if any – As agreed

15.6 Tests and Testing Procedure: Test procedure shall include but not be limited to the following list of tests. All the tests being conducted shall clearly be brought out in the Quality Assurance Plan (QAP) by Vendor.

15.6.1 Positive Material Identification (PMI)  
100% PMI shall be carried out for all Stainless Steel and Alloy Steel Material in presence of Purchaser/TPIA at the time of dispatch. Purchaser/TPIA at their discretion may choose to sample the lot for PMI.

15.6.2 Dimensional and physical check.

15.6.3 All welds shall be visually inspected in accordance with ASME Section VIII Division 1 and OEM (CSI, USA) procedure QC-VT-01 or Equivalent. The individual Bolt-on Heating element drawings shall be signed and dated acknowledging acceptance.

15.6.4 Each heating element or panel and all jump over hoses shall be pneumatically tested at 1.1 times the design pressure in accordance with ASME Section VIII Division 1 and OEM (CSI, USA) procedure QC-PTP-01 or Equivalent. A record of the test shall be maintained.


15.6.5 Bolt-on Heating elements and inserts may be hydrostatically tested as an alternative at 1.3 times the design pressure in accordance with ASME Section VIII Division 1 and OEM (CSI, USA) procedure QC-HTP-01 or Equivalent. A record of the test shall be maintained.


15.6.6 Technicians performing NDE and inspections shall be qualified in accordance with the guidelines of the latest edition of ASNT SNT-TC-1A and OEM (CSI, USA) procedure QCPQC-01 or Equivalent.

15.6.7 If any defects (which are not attributable to field welds/joints) were to be found at the time of field assembly of the Piping system, then the Vendor shall take necessary corrective action at site on their own expenses. No claim for any additional price will be allowed.

**16.0 QUALITY ASSURANCE PLAN (QAP)/ INSPECTION AND TEST PLAN (ITP)**

16.1 It is a document generated by the vendor with complete listing of various inspection stages, tests, material certification requirements and parties involved with their respective roles in inspection; indicating the requirements of Hold (H), Witness (W) Inspection, and Review (R) of Quality control documents / records for an item. QAP and ITP are considered synonymous.

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<b>COPYRIGHT AND CONFIDENTIAL</b> The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p>16.2 The bidder shall submit inspection &amp; testing Quality Assurance Plan for all critical raw materials, shop manufacture items, sub-vendor supplied items, shop testing of items etc. Guidelines for preparing the QAP will be submitted as part of the Enquiry. Bidder to submit their QAP strictly according to these Guidelines, without which their offer is liable for rejection.</p> <p>16.3 The shop QAP shall be approved by Purchaser / Owner and may indicate hold points. The vendor shall furnish minimum two weeks' time for all such shop inspection / testing - hold points.</p> <p>16.4 All shop testing shall be conducted by vendor at their own cost and measuring and testing equipment shall be made available by them and all shall have valid calibration certificate.</p> <p>16.5 All material test certificates and inspection test reports shall be submitted to Purchaser / owner for review / approval and final dispatch clearance note.</p> <p>16.6 The following definitions are provided for reference of the bidders while preparing QAP.</p> <p>16.6.1 <b>HOLD POINT:</b> A Hold Point is a stage designated in the ITP/QAP, which requires Witness Inspection by TPIA and/ or Purchaser/ PMC/ Owner before supplier can proceed with further processing, except where prior written permission for further processing or waiver of Witness Inspection by Purchaser/ PMC/ Owner is obtained.</p> <p>16.6.2 <b>WITNESS POINT:</b> A Witness point is a stage designated in the ITP/QAP, which requires witness inspection by TPIA, Purchaser, PMC and/ or Owner. Supplier/ Purchaser shall perform the activity after proper notification has been given to TPIA/ PMC and Owner for witnessing the activity. The Supplier/ Purchaser is not obliged to hold further processing, if TPIA/ PMC and/ or Owner are not available to witness the activity or does not provide the comments before the date notified with proper notification period.</p> <p>16.6.3 <b>REVIEW POINT:</b> A review point is a stage designated in the ITP/QAP which requires the concerned agencies i.e. Purchaser/ TPIA/ PMC/ Owner, to verify the documents for their correctness and to confirm that the said documents meet the requirements laid down.</p> <p>16.6.4 <b>THIRD PARTY INSPECTION AGENCY (TPIA):</b> Third Party Inspection Agency means an inspection agency appointed by the Supplier/ Purchaser/ PMC for carrying out Inspection and witness of tests of items and material being procured by the Supplier for the Project.</p> <p>16.6.5 <b>INSPECTION CATEGORY:</b> Inspection category determines the scope of Inspection by the Supplier, TPIA, Purchaser, PMC/ Owner for various items and material depending upon their use, serviceability, safety criteria and complexity.</p>		

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## 17.0 SURFACE PREPARATION AND PAINTING

- 17.1 Each heating element and/or panel shall be coated on the outside diameter with a rust inhibitor in accordance with OEM (CSI, USA) procedure QC-CI-01 or Equivalent. The rust inhibitor is intended to offer protection during storage at vendor works (for a minimum period of 6 months) and while in transit to site.
- 17.2 Each heating jacket shall be coated with oil-based Sherwin Williams Red Hot Aluminum paint per OEM (CSI, USA) standard painting procedure or Equivalent.
- 17.3 The product data sheets for the rust inhibitor and the paint/coating shall be furnished along with the offer.

## 18.0 SHIPPING AND HANDLING

- 18.1 All shipments shall properly be packed for transportation by ship/ rail or trailer.
- 18.2 Internal cleaning shall be accomplished per Pipe Fabrication Institute standard PFI ES-5 to ensure all loose debris has been removed.
- 18.3 The shipments may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage for adverse atmospheric conditions such as high humidity, salinity, heavy rains etc.
- 18.4 Shipping protection in the form of metal, wood or plastic covers shall be applied to all open, machined and flanged ends.
- 18.5 Each component shall be identified using either a self-adhesive plastic sticker tag or a stainless steel metal tag.
- 18.6 When shipping, the fabricated components shall be properly loaded with the largest items on the bottom. Suitable dunnage shall be used to separate and support the components and allow for safe loading and unloading. Loose small items shall be crated, boxed or palletized and shrink wrapped as appropriate depending on size and weight.
- 18.7 When export shipping, it is preferred to use open top containers to facilitate the ease and safety of loading and unloading. Some fabrication may be sized accordingly to maximize shipping. Instructions for export shipping per OEM (CSI, USA) procedure QC-ESP-01 or Equivalent.
- 18.8 Photographs shall be taken of each load prior to release for shipment for verification of safe loading.
- 18.9 A Shipping list with detailed breakup of the material being shipped and linkage to GAD/ Isometric/ Installation drg, shall be furnished before the start of Shipment.
- 18.10 It shall be bidder's sole responsibility to protect all the material during period of transportation against corrosion, incidental damage due to adverse atmospheric conditions, rough handling in transit including delays in transit. Bidder shall be responsible for any damage to material due to above reasons and shall take necessary corrective action at site without any price implication.

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## 19.0 DEVIATIONS TO SPECIFICATIONS


- 19.1 Bidder to note that all the applicable deviations / clarifications shall be listed separately in the format attached with the NIT and submitted to BHEL as a part of technical bid. All such applicable deviations / clarifications shall have cross reference to the specifications / annexures with proper reasons for the deviations for purchaser's consideration. Any such applicable deviations / clarification not listed under the above section, even if reflected in any other portion of the bidder's proposal shall not be considered applicable.
- 19.2 Except for those deviations/ variations covered as a part of pre bid clarification, it will be the responsibility of the bidder to fully meet the intent and the requirements of the specification within the quoted price. No other deviation whatsoever from this specification, except for those have been specifically agreed by purchaser as a part of pre-bid clarification shall be considered.
- 19.3 In case the bidder considers requirement of any other accessories / auxiliaries essential for safe and satisfactory operation of the equipment, he shall recommend the same along with reasons in a separate section as a part of pre-bid query to enable purchaser take a suitable decision on the requirement of the same.
- 19.4 Information like Bill of materials (BOM) and typical specifications etc., enclosed by the bidder as a part of their bid, shall be retained for information only and shall not be referred by contractor as contractual agreement. No implication shall be admissible on the basis of these documents during any stage of contract execution.

## 20.0 ENGINEERING GUARANTEE

- 20.1 Since Bolt-on Heating System Design is within bidder's scope which has a direct impact on the efficiency of Sulphur Recovery and the operation of SRU unit, it shall be the prime responsibility of the Vendor to carry out such design and engineering in accordance with good and sound engineering practices using International Standards and Indian Codes & Regulations wherever applicable to such design and/or engineering.
- 20.2 In case any error or omission in design or engineering of the bolt-on heating system, which results in any new requirements for equipment/ materials, the same shall be supplied and/or re-engineering shall be carried out by the vendor within the scope of relative work and/or supply and within the contractual period without extra cost to the purchaser or entitlement of extension of time.
- 20.3 Vendor shall guarantee that the bolt-on heating system design shall meet and comply with
- the SRU Licensor's Process package
  - the Engineering specifications, standard and design guides
  - the committed steam consumptions by the vendor during bid stage.

## 21.0 PERFORMANCE GUARANTEE

- 21.1 Bidder is not responsible for the process guarantees of the LICENSOR. Bidder however guarantees the Engineering and design of Bolt-on Heating System as set forth in clause 20.0. If the UNIT does not achieve the results set forth in the

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LICENSOR's process guarantees due to defect(s) or deficiency(ies) in bidder's Engineering, bidder shall within scope of their work and responsibilities, carry out re-engineering/fabrication and bear the cost of repair and/or replacement of such defective product(s).

21.2 Bidder's guarantees shall also cover the mechanical performance of such equipment/piping and their efficiencies affected primarily due to defective design/manufacture of bolt-on heating system by bidder. Bidder shall bear the cost of replacement or alteration or repair in parts or components or wholly (including dismantling, transportation, erection, hook-up, commissioning and performance test) of such equipment/piping which does not perform to the guarantees, primarily due to defective engineering by bidder, within the relative scope of supply and/ or services at no extra cost to BHEL and without entitlement of extension of time to bidder.

21.3 Bidder shall size the bolt-on heating system considering the economy of steam consumption and minimum condensate wastage, effluent or pollution discharge.

21.4 Bidder shall incorporate all the instruments required to establish performance in the design.

21.5 Bidder shall provide a list of laboratory test procedures and frequencies thereof required for validating Performance Guarantees.


21.6 Performance tests shall be started when the operation of the UNIT is stabilized under design conditions. The UNIT shall be operated and controlled in accordance with procedures set up beforehand. One or more performance test shall be carried out for a maximum of 120 hours under the technical direction of OWNER/LICENSOR and/or their designated representatives after successfully commissioning the UNIT in accordance with the procedures and conditions detailed in the Bid documents. At the end of the performance test, an uninterrupted period of 72 hours shall be selected by OWNER and average results obtained during that period shall form the basis of comparison between the actual performance and the guaranteed performance.

**22.0 DOCUMENTATION**

22.1 ALONG WITH THE OFFER

Bidder shall submit the following documents / drawings along with the offer, with respect to every item of the Purchaser's specifications. Any offer not confirming to this requirement is liable for rejection.

- Copy of purchaser's specification (Technical specification and all Annexures) and Check list duly stamped & signed by the Bidder.
- All the Engineering Inputs furnished along with the enquiry duly stamped & signed by the bidder.
- Deviation list, if any, in the format attached with this specification (In case of no deviation, 'NIL' to be mentioned in the format, duly signed and to be submitted along with offer). Offer without deviation list will not be evaluated & shall be liable for rejection.

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**22.2 AFTER PLACEMENT OF PO BEFORE START OF FABRICATION**

22.2.1 Purchaser shall issue the As-built Piping Isometrics for Lot-1 scope of supplies to the Vendor post order within 7 working days from placement of Order.

22.2.2 Purchaser shall issue the Engineering Piping Isometrics for Lot-2 scope of supplies to the Vendor tentatively by 31<sup>st</sup> March 2022.

22.2.3 Vendor shall review all the Isometrics and shall prepare and submit the following (editable copies prepared in PDMS/AutoCAD/Excel/Word) for Purchaser's approval **within 30 working days after receipt of Inputs:**

- Design Package with all the relevant Heat Transfer calculations
- GA / Isometric drawings of Bolt-on Heating System Package
- Fabrication drawings of Heating Elements, Heating Jackets etc.
- Bolt-on Panel table with the weights of the individual panels with a clear linkage to GA/Fabrication drawings
- Comprehensive Quality Assurance Plan. This Q.A. Plan is subject to approval by Purchaser and/or owner (The Q.A. Plan shall be comprehensive & shall include all inspection & test requirements of material, manufacturing, painting, packing, check points as per approved drawings and BOM)

22.2.4 Vendor shall finalize a Document Submission Schedule covering the above as a minimum, within 1 week of LOI/PO.

22.2.5 Revised documents shall be submitted by the Vendor within 1 week of receipt of comments from Purchaser.


22.2.6 Vendor shall start fabrication only after receipt of approval from the purchaser on the documentation submitted by the vendor.

22.2.7 It is the responsibility of the vendor to provide all required documentation and get the approval from the End customer i.e., IOCL/ Technip.

**22.3 BEFORE DISPATCH**

22.3.1 The following documents / drawings shall be submitted by vendor during final shop testing & before dispatch of the Bolt-on Heating System package:

- Final GA Drawings / Isometrics for the pre-fabricated Bolt-on Panels
- Final GA Drawings for the Heating Jackets
- Final GA Drawings of the Complete Bolt-on Heating System
- Final test certificates for the Heating Elements (Panels) and Jackets
- Material test certificates for all the input raw materials for review and acceptance by purchaser and / or owner as per approved QAP.
- Statutory approvals / certificates (including for those items procured from sub-vendors)

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#### 22.4 AFTER DISPATCH

Vendor shall furnish the details like LR numbers, Invoice details, Weight details etc for all the dispatches. **The data shall be furnished for every individual deliverable i.e., Panels, Jackets, loose elements, accessories etc.** Same shall be furnished in a spread sheet progressively as per schedule of dispatches.

#### 22.5 SUBMISSION & REVIEW OF DOCUMENTS POST ORDER

22.5.1 Revisions in drawings/ documents shall be clearly marked within clouds or Triangle mark indicating the revision mark. Revisions without clouding shall not be considered, reviewed and approved. All the revised drawings/ documents shall be associated with comments compliance report.

22.5.2 The approval and/ or review by the purchaser/ owner shall not be construed by the bidder as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and drawings.

### 23.0 BID SUBMISSION & EVALUATION

#### 23.1 BIDDER QUALIFICATION:

The bidders are expected to meet the Bidder Qualification Criteria as detailed in clause no 4.0. The same shall be evaluated during technical bid scrutiny. The offers made by the bidders not meeting the BQC are liable for rejection.

#### 23.2 CONFIDENTIALITY AGREEMENT:


23.2.1 Prospective Bidders, willing to work with BHEL and meeting the BQC as per clause 4.0 indicated above are required to sign a Confidentiality Agreement (CA) as per the format attached with NIT. Bidder shall submit duly signed CA within 2 days of receipt of NIT issued by BHEL via e-mail.

23.2.2 Technical Specs shall be shared with interested bidders, who meet the Bidder Qualification Criteria stated at clause 4.0 above, only after receipt of duly signed CA from them. No additional time shall be allowed to any of the bidders, on account of delay in CA formalities.

23.3 Bidder to quote strictly as per BHEL's price bid format. Any tampering/ modification/ change of the BHEL's price bid format is not allowed and the bidder's offer is liable for rejection.

23.4 All the items included in the price bid format shall be quoted as per tender specification and pre-bid clarifications, if any. Responsibility of ensuring correctness & completeness of scope of supply as per specification requirement solely lies with bidder.

23.5 The bid evaluation shall be on Lumpsum L1 basis (Lot-1 Supplies + Lot-2 Supplies + Supervision of E&C). Accordingly, the Bidder shall quote the Lumpsum Price in the attached Price Bid Format. Quotations submitted in partial will be summarily rejected. BHEL will not entertain any other expenses/ assumptions written separately elsewhere other than those specified in the price bid format.

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23.6 Basis for the offer: (Core Piping Input, Annexure-B, given by Purchaser as part of the Enquiry):

23.6.1 Lot-1 Supplies

- a) Final P&IDs
- b) Final Piping Isometrics / Piping GADs

The engineering input for Lot-1 supplies is final. However, the bidder shall verify the same as stated in clause 10.12.

23.6.2 Lot-2 Supplies

- a) Preliminary P&IDs
- b) Preliminary Piping BOQ / Reference Piping Isometrics / GADs

The engineering input for lot-2 supplies is preliminary and is subjected to change based on the finalized layout engineering.

23.7 **Bidder shall work out consolidated detailed service wise / line wise BOQ of items to be heat traced, based on the Inputs provided by purchaser as per above clause.**

The bidder shall submit a table of the above BOQ along with the unit rates of bolt-on heating system for the corresponding items (**Unit Rate Table**), as an Annexure to the Price Bid Format. The summation of the unit rates multiplied by the quantities considered shall be equal to the lumpsum price quoted by the bidder.


The Unit Rate Table shall be provided under the following heads as a minimum:

- Pipe length	- Heated Supports
- Cross/Tees Fittings	- Control Valves
- Other Fittings	- Instruments
- Valves	- Specialties
- Flanges	- Equipment

**The Unit Rate Table shall be binding on the bidder and shall be valid for the complete duration of the Contract. These unit rates, shall be used by the Purchaser to arrive at the final purchase order price based on the finalized Core Piping Input.**

23.8 The percentage limitation of the variation in Price of the overall package, from the time of PO to Final Execution of the order, shall be +/- 20%, i.e., **the overall price of the Engineered Bolt-on Heating System package arrived at based on the Final Core Piping Input as per clause 23.7, may vary upto +/- 20% from the PO Value.** Bidder shall make a note of the same while submitting the bid.

23.9 Unpriced Price Bid Format along with the Unit Rate Table indicating as "QUOTED" against each applicable item shall be submitted duly signed & stamped along with technical offer by bidder as a token of submission of the offer for the relevant items. The offer shall be liable for rejection in case if the un-priced price bid format along with the unit rate table, is not submitted or any modification is carried out in price bid format.

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23.10 Bidder shall mandatorily submit the following documents along-with Technical offer, failing which bidder's offer is liable for rejection.

- ✓ Unpriced Price-bid Format along with Unpriced Unit Rate Table
- ✓ Filled-in Checklist.
- ✓ Deviation Schedule ("NIL" to be mentioned, if no deviations)
- ✓ Stamped & Signed copies of Technical Specification and all the Annexures
- ✓ Stamped & Signed copies of Engineering Inputs provided by Purchaser
- ✓ Pre-bid queries, if any (within 6 days of receipt of enquiry from purchaser, failing which it is presumed that bidder does not have any pre-bid queries)

In case of ambiguity of any technical requirement among the above referred documents, a clarification/ query shall be raised by the bidder and get clarified from Purchaser during pre-bid stage itself.

**24.0 DELIVERY PERIOD**

24.1 **Supplies:** Delivery period (ex-site) for Lot-1 & Lot-2 supplies shall be **24 Weeks** from the Date of Issue of Final Core Piping Input.

24.2 **Supervision of E&C:** Vendor shall be informed 2 weeks before the start of Erection of the Bolt-on Heating System. Erection activity for each lot may tentatively take up to 2 months. Vendor shall depute the supervision personnel accordingly.


**25.0 SPECIAL NOTES/INSTRUCTIONS TO BIDDER**

25.1 Since the item being enquired is proprietary in nature and from OEM (Controls Southeast Inc., USA) as per Customer Contract Specification, OEM Specifications are referred in this Standard. OEM Specifications referred in this standard are Proprietary material owned by OEM. Bidder to obtain the same from OEM.

25.2 Usage of OEM Specifications / Technology by bidder, shall be with written Authorization from OEM (Controls Southeast Inc., USA). Authorization letter shall be part of Bidder's offer, non-submission of which, will lead to rejection of the offer.

25.3 It shall be bidder's sole responsibility to clearly bring out/ highlight any discrepancy distinctively in his pre-bid queries within 6 working days from the receipt of enquiry, so as to enable Purchaser to furnish their decision/clarification. If such issues/ requirements are not duly addressed by bidder during the pre-bid stage and if such issues/ requirements are observed later during order execution stage, it shall be binding on the bidder to comply with the final decision made by Purchaser subsequently, without any cost, delivery, or any other implication.

25.4 Any specific design/fabrication requirement which is mandated as per governing design code or statutory requirements or system design, but not listed in this specification or its enclosures, shall be deemed to be included in bidder's offer.

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25.5 Compliance with this specification shall not relieve the vendor of the responsibility of producing the engineered bolt-on heating system of proper design, materials and workmanship to meet the specified operating conditions and guarantees.

25.6 The design information, specifications and datasheets etc provided along with the enquiry, indicate only the minimum requirements and are intended to enable Bidders to ascertain the extent of the work involved. Bidders are expected to supplement the information included in this specification as required and submit a comprehensive bid.

25.7 Bidder shall provide replies / clarifications within 4 working days from the date of the queries / comments raised by Purchaser, during technical scrutiny of bidder’s offer and execution of the order. Any further delay will be seriously viewed by Purchaser and bidder’s offer may not be considered for evaluation.

25.8 Before Code-1 approval of the Fabrication drawings of the Bolt-on Panels, any modification arising in the Core Piping Input, to suit the engineering requirements and not calling for any additional material shall be borne by vendor without any additional price implication, commercial implication and any delivery extension.

25.9 The final fit-up of the bolt-on panels at site as per the approved fabrication drawings, shall match 100% to the Core Piping Isometric without any deviation. Any mismatch shall be corrected at site by the Vendor without any price implication, commercial implication and any delivery extension.


25.10 It is vendor’s sole responsibility to clearly bring out/ highlight any missing information on the Core Piping Isometrics/ drawings issued as an Input for fabrication of Bolt-on Panels before start of fabrication activity so as to enable the purchaser to furnish their decision/ clarification. Only after the receipt of clarification in writing from purchaser, vendor should proceed with the manufacturing / fabrication of the relevant items.

**26.0 OTHER INSTRUCTIONS**

26.1 Vendor shall ensure that they possess the latest revisions of various national and international standards, codes of practices, statutory & environmental regulations etc. as applicable, for execution of the work. Purchaser shall not provide any such documents to Vendor. Engineers of Vendor assigned for this project shall have familiarity on relevant documents as mentioned above for their use and application.

26.2 Bidder shall familiarize fully with the standards/ procedures/ practices/ safety protocols of Purchase/ Owner, to avoid any dispute at later date and after order placement.

26.3 Vendor shall keep all information/data/drawings etc. related to the work as confidential information and shall not divulge or use the information indirectly or directly in any way detrimental to the interest of Purchaser/ Owner. All drawings, documents, manuals, design calculations including all originals prepared or obtained during the work shall remain the property of Purchaser/ Owner and shall be handed over to Purchaser/ Owner on demand.

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- 26.4 Since speedy completion of project is essential for a tight project schedule, it shall be responsibility of the Vendor to ensure timely delivery of all milestones.
- 26.5 Vendor shall comply with the laws and regulations of the country, the state and territories concerned, during the progress of the work.
- 26.6 Vendor shall submit progress report on the status of the work entrusted to them periodically and as mutually agreed upon.
- 26.7 Vendor shall ensure optimal & economic design while executing the work, but without sacrificing the customer specification requirements/ Statutory regulations/ code provisions/ safety aspects.


## 27.0 INDEMNITY

Vendor shall fully indemnify and keep indemnified the Purchaser against all claims which may be made in respect of the use of Design/ System/ Software/ Item(s)/ Services rendered by the vendor, for infringement of any rights protected by patent, registration of designs or trademarks or legality of the Design/Software. All such claims in this regard will be settled as per Indian laws. In the event of any such claims being made against Purchaser, Purchaser will inform in writing to the vendor who shall at his own risk and cost, either settle such dispute or conduct such litigation that may arise there from.

## 28.0 LIST OF ENCLOSURES / ANNEXURES

Sl No	Doc Number	Document Description	Document Number
1	Annexure-A	Thermal Objective Specification	
2	Annexure-B	Core Piping Input	
3	Annexure-C	Engineering Design Basis for Piping Design	080557C-088-JSD-1300-001, Rev B
4	Annexure-D	Environmental Design Basis	080557C-088-CN-0007-004, Rev. A
5	Annexure-E	Price Bid Format	
6	Annexure-F	Checklist Format	
7	Annexure-G	Format for Deviation Schedule	
8	Annexure-H	Format for Pre-bid Queries	
9	Annexure-I	Format for Manufacturing Quality Assurance Plan	

+ + +

Form No:	 <b>PE&amp;SD</b>	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>	<b>PY 51 735</b>
		<b>PURCHASE SPECIFICATION</b>	Rev. No. 00
		<b>IOCL PARADIP 525 TPD STANDBY SRU</b> <b>ENGINEERED BOLT-ON HEATING SYSTEM</b>	Page 22 of 22

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**VARIANT TABLE:**

Var No	Item Description	Material Code
01	IOCL Paradip 525 TPD Standby SRU : Supply of Engineered Pre-fabricated Bolt-on Heating System, (Lot-1) Existing Lines	PY9751735017
02	IOCL Paradip 525 TPD Standby SRU : Supply of Engineered Pre-fabricated Bolt-on Heating System (Lot-2) New Lines	PY9751735025
03	IOCL Paradip 525 TPD Standby SRU : E&C Supervision for Engineered Pre-fabricated Bolt-on Heating System	PY9751735033

**RECORD OF REVISIONS:**

Rev No	Date	Revision Detail	Revised by	Approved by
00	05.05.2021	First Issue	V Uday Kumar	Srikanth G