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Heavy Plates & Vessels Plant
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INVITATION TO TENDER

Ref.: OS/21-22/2438/LAS PV/32/004 Date: 17.04.2021

Sub: **Fabrication of HP Flare K.O. Drum (LAS with SS Clad) Vessel against S.O. 2438 at HPVP-Lovagarden site, Visakhapatnam**

Dear Sir,

Sealed tenders are invited for the subject work in **two part bid** system from Vendors who are experienced in fabrication of similar jobs subject to the following eligibility criteria:

ELIGIBILITY CRITERIA:

1.1 Average annual turnover of the bidder during the last 3 financial years ending 31st March 2021 should be at least Rs. 30 Lakhs. Bidders shall enclose Turnover Certificate (duly certified by a practitioner CA), IT Returns and other necessary documents in support of the same.

1.2 The bidder should have an experience of executing similar works of value as specified below during the last 7 years ending on 31st March 2021.

1.2.1 Three similar completed works costing ≥ Rs.35 Lakhs each **OR**

1.2.2 Two similar completed works costing ≥ Rs.45 Lakhs each **OR**

1.2.3 One similar completed work costing ≥ Rs.70 Lakhs

1.3 Similar works means Fabrication of Higher Diameter i.e., ≥ 3 Meters Columns / Pressure Vessels for process industries.

Note: Work Order and Work Completion Certificate / any other relevant document from the customer shall be enclosed in support of successful and satisfactory completion of the work w.r.t. point no. 1.2 & 1.3 above.

1.4 Bidders shall have to enclose the documents of Registration of Firm / Certificate of Incorporation / Factory License, EPF, ESI, PAN, GSTIN, Udyog Aadhar Memorandum (if registered with MSME) etc.

1.5 The works executed in the own name of individual / firm of the tenderer will only be considered for eligibility criteria.

1. LOCATION OF WORK SPOT:

1.1 The fabrication work is to be carried out at Lovagarden Site (a Sea Front facility of BHEL - HPVP near Hindustan Shipyard Limited - OPF Site), Visakhapatnam, Andhra Pradesh.

2. VENDOR'S SCOPE OF WORK:

2.1 Details of the Vessel to be fabricated for HPCL, Vizag project of M/s. LTHE is as follows:

HP Flare K.O. Drum (LAS with SS Clad) - Tag No. 504-V-805A: 1 No. @ 191 MT

It may be noted that the weight indicated above is tentative and may vary on both sides due to revision in the drawings, if any.

2.2 Complete fabrication of the Vessel **excluding rolling of Shell segments** as per **ASME U Code**, applicable approved drawings, QAP, WPS, Painting Schedule, Approved Procedures, Specifications & Standards, etc. and it includes the following activities but not limited to the same:

2.2.1 Unloading of Loose Petals & Crowns received from Dished End Vendor

2.2.2 Forming of Dished Ends which involves assembly of the Petals & Crown segments, Fit-up, Welding, NDT as per approved drawings along with Production Test Coupons as per approved QAP

2.2.3 All welding edges of Dished Ends, Main Shell and Shell to Dished Ends shall be checked by MP & UT as per approved QAP.

2.2.4 DP Test of Weld for Base plate of Petals & Crown to be carried out followed by 100% RT.

2.2.5 MPT shall be carried out for back gouging prior to back welding of L-seam.

2.2.6 100% RT of L-seam welds before clad restoration

2.2.7 100% PT on prepared surfaces before clad restoration & welding of Dished ends, Main Shell and shell to dished ends

2.2.8 Clad Restoration on L-seam & C-seam welds of Dished Ends, Main Shell and Shell to Dished Ends

2.2.9 100% PT on Clad restoration of each layer of Dished Ends, Main Shell and Shell to Dished Ends as per approved QAP / NDE procedure

2.2.10 Chemical Analysis of samples collected during Clad Restoration / Weld Overlay of Dished Ends, Main Shell and Shell to Dished Ends as per approved QAP

2.2.11 100% UT for Dis-bondment check of surface of Knuckle Area and Straight Face of the Dished End as per approved QAP / NDE procedure

2.2.12 100% MT on Knuckle inside & outside including Welds and Weld Edge Preparation after forming & heat treatment of Dished Ends as per approved QAP / NDE procedure

2.2.13 100% RT of L-seam welds & C-seam welds of Dished Ends after forming and Heat Treatment as per approved QAP / NDE procedure

2.2.14 Spot UT to check dis-bondment for Rolled Clad Sections and Weld Overlay as per approved QAP / NDE procedure

2.2.15 Central Hole, if any, on the Dished End shall be plugged followed by 100% RT.

2.2.16 Height Marking, Cutting of extra height and Edge preparation at SF as per the applicable drawings / QAP

2.2.17 100% UT of Complete Dished End as per ASME SA578 Level-C

2.2.18 PWHT / SR of Dished Ends shall be carried out along with the vessel after assembly & welding of Dished Ends to the Shell sections **by a separate agency engaged by HPVP.**

2.2.19 TATA ALC Crane 75 T (One No.) and Demag Crane 300T (One No.) along with Operator and fuel will be mobilised to Lovagarden site by HPVP. Diesel required for Operation of TATA ALC Crane 75 T (One No.), DEMAG Crane 300T (One No.), DG Set and for PWHT (if by Diesel firing) will be free issued by HPVP. However, Vendor has to arrange for the transportation of the same from HPVP to Lovagarden site by engaging Vehicles & Manpower.

2.2.20 Collection of all Free Issue Materials, Rolled Shell Segments, Fabricated Components, BOC etc., from BHEL-HPVP Shops / Stores and Transportation to Lovagarden site including unloading at Site

2.2.21 Mobilisation of Rolling Machine suitable for the shell thickness of the vessel for Re-rolling, **if required so**

2.2.22 Assembly, Fit-up & Welding of L-seams of Main Shell as per drawings along with Production Test Coupons including MPT for back gouging prior to back welding of L-seams as per approved QAP / NDE procedure

2.2.23 Weld Edge Preparation including MP & UT, Assembly, Fit-up & Welding of C-seams of Shell to Shell, Shell to Dished End including MPT for back gouging prior to back welding of C-seams as per approved QAP / NDE procedure

2.2.24 100% RT of all L-seam Welds & C-seam Welds before clad restoration and Production Test Coupons as per approved QAP / NDE procedure

2.2.25 UT of Clad Weld edges as per EIL Specification 6-12-0003

2.2.26 PMI Check for Clad Weld Overlay of the vessels as per approved QAP / NDE procedure

2.2.27 PT of the entire surface shall be performed before PWHT as per Appendix 8 of ASME Section–VIII, Div.1 / Div.2 as per approved QAP / NDE procedure.

2.2.28 Ferrite number check with a calibrated equipment as per approved QAP / NDE procedure

2.2.29 Hardness shall be checked for all pressure joints on Welds / Heat Affected Zone / Parent Metal as per approved QAP / NDE procedure.

2.2.30 Spot PT on internals & external welds after Hydro testing as per approved QAP / NDE procedure

2.2.31 Pickling & Passivation of SS Clad Surface of Shells & Weldments, Dished Ends and Weld Overlays of Nozzles, including Cleaning & Drying, as per ASTM A-380 and as per approved procedure & QAP after Hydro testing of vessel. **An approved specialised agency shall be engaged by the Vendor for the Pickling & Passivation job. Specialised agency shall be identified in advance and credentials & procedure for Pickling & Passivation to be submitted to BHEL for approval. After according of approval only, the agency is to be engaged for Pickling & Passivation job.**

2.2.32 Ferroxyl Test after Pickling & Passivation of the vessel as per approved QAP / procedure

2.2.33 100% RT of Insert plate to Shell, Insert Plate to SR Nozzles and SR Nozzle to Shell as per approved QAP / NDE procedure

2.2.34 100 % UT where attachments are welded directly to the cladding as per approved QAP / NDE procedure

2.2.35 Fabrication of Plate Fabricated Nozzles **including Rolling** as per drawings including 100% RT

2.2.36 **For nozzles with dia. less than 6" only**, rolling of the plates to form Nozzles will be done in BHEL-HPVP shop. However, fit-up, assembly, welding of L-seams & C-seams, NDT etc. are to be carried out by the Vendor.

2.2.37 Fabrication of Nozzle Sub-assemblies involving Fit-up & Welding of C-seams of Pipes, Elbows, Flanges, Nozzles including DPT of Weld Edges after root run & final weld and RT on C-seam welds as per approved drawings & QAP

2.2.38 Marking & Opening of Nozzles and Access / Man way openings on Shell & Dished end as per approved drawings & QAP

2.2.39 Fit-up & Welding of Nozzles / Sub-Assemblies on Shell & Dished Ends including PT on Weld Edges, on Root Run & on Final Welds and 100% RT on Lip type C-seam welds as per approved drawings & QAP

2.2.40 100% UT on the seam of Nozzle to Shell, Dished Ends

2.2.41 Fabrication of RF pads, Assembly & Welding with the Vessel and Pneumatic Test as per approved drawings & approved QAP

2.2.42 Fabrication of Saddles, Assembly, Fit-up & Welding with Vessel as per drawings including 100% DPT on welds & NDE as per approved QAP

2.2.43 Fabrication of Temporary Saddles as per drawings, if required, for Stress Relieving of Vessel in Sections

2.2.44 Fabrication of Externals like Compression & Base Rings, Trailing Lugs, Anchor Chairs, Lifting Trunnions, Stiffener Rings, Insert Plates, Earthing Lugs, Ladders, Man Way Davit, Pipe Davit, Level Taps, Inlet Deflector Baffle, Wear Plate, Insulation Supports, Cleats, Thermocouple / Instrument Tapings, Platform & Ladder Clips, etc., and Assembly & Welding of the same with the Vessels as per the approved drawings including NDE (Spot PT) as per approved QAP

2.2.45 Fabrication of CS / LAS / SS Internals like Strainer, Vertex Breaker including Drilling of Holes on CS / SS pipe, Steam Coil Arrangement including pre-heating of joints, Ladder Rungs, Internal Pipe & Guide Supports, Inlet Deflector Baffles, Nozzle Internal Connections, Pipe Support Clips etc., Assembly & Welding of the same with the Vessel as per the drawings including NDE as per approved QAP

2.2.46 100 % UT on Pressure Retaining Welds after PWHT / Stress Relieving of the Vessels as per Approved QAP

2.2.47 Spot PT on internal and external welds as per Approved QAP

2.2.48 All NDT activities like DPT, MPT, RT, UT, etc. shall be carried out by the Vendor as per the approved QAP by NDT personnel qualified by BHEL / AIA as per BHEL Procedure No. BHEL: NDE: WP01 for qualification of NDE personnel.

2.2.49 NDT agency engaged by fabrication contractors shall have to ensure that their NDE personnel are qualified by BHEL in advance before start of the job.

2.2.50 PWHT will be carried out by a separate Specialised Agency engaged by HPVP. The method of PWHT i.e. (1) Internally by diesel Firing (2) Electrical Resistance method (3) External firing by Box Furnace is yet to be finalised. However, any assistance required for the Stress Relieving of the Vessels like preparation & fixing of Bulk Heads, Handling, Shifting & Placing the Vessels on Saddles, Rotation of the equipment, Welding of Thermocouples etc. as per the requirements of SR Agency are to be carried out by the vendor.

2.2.51 UT and Hardness Test after SR but before Hydro test as per approved drawings / QAP

2.2.52 Testing of Water Samples at NABL approved laboratory for its suitability for Hydro test

2.2.53 Hydro-testing of Vessel followed by Drying & Cleaning

2.2.54 Arranging of all the accessories required for the Hydro-test like Filling Pump, Pressurizing Pump, Calibrated Pressure Gauges including fabrication of Stems for Fixing of Pressure Gauges, Non-Return Valves etc.

2.2.55 Spot PT after Hydro Testing of Vessel as per Approved QAP

2.2.56 Surface preparation by Blast Cleaning to Specification SSPC-SP-10 and Coating of Primer & Finish Paints as per approved Painting Schedule. All tests like Salt Contamination Test, Profile Gauge Check, Tape Adhesion Test, Holiday Check, Peel Off Test etc. required as per Project Specifications and BHEL Painting Procedure No**. SIP:H: PP:22**, Rev.0. shall be carried out by a qualified agency for testing of painting and obtaining stage wise inspection clearance from HPVP (QC) / AIA / LTHE as per the approved QAP.

2.2.57 Painting is to be carried out only by Painters qualified by HPVP as per Doc. No. SIP:H:PP:22

2.2.58 Fabrication of Structural Platforms & Spreader Beams for lifting beams as per the Drawings

2.2.59 Hydra Cranes up to 14 MT capacity required for fabrication, unloading & loading at Lovagarden Site

2.2.60 Handing over of Production Test Coupons to SR agency for PWHT / SR along with the Vessel

2.2.61 Production Test Coupons after RT & PWHT shall be handed over to BHEL QC Laboratory for testing.

2.2.62 Offering for stage wise / final inspection and obtaining Clearance as per the approved QAP from HPVP (QC)/ AIA / LTHE

2.2.63 Loading of Finished equipment onto the trailer using BHEL cranes by providing necessary manpower, tools & tackles and welding of all temporary supports required for transportation of vessel.

2.2.64 Submission of economic Cutting Plans for all the plate materials, pipes, tubes and sections issued by BHEL and approval must be obtained from competent authority before taking up of fabrication.

2.2.65 Wherever fabrication is done without proper approved cutting plans, any loss of materials arising due to the same will be recovered as per BHEL recovery rates.

2.2.66 Free issue items cleared by QC shall be collected within 5 working days from the date of intimation by OS dept. without any failure. Any delay beyond 5 working days shall be considered for levying of LD.

2.2.67 Sufficient no. of Technically Qualified Engineers, Safety Supervisors, Quality Control Engineers, NDT Evaluation Engineer (Level-II) & Fabrication Supervisors shall be deployed for smooth execution & proper co-ordination of the job.

2.2.68 Welding is to be carried out by ASME qualified welders only. Qualification of welders shall be carried out by the vendor at HPVP under supervision of BHEL / WT dept. at their own cost. However, Test Coupons shall be provided by BHEL as free issue.

2.2.69 Sufficient No. of Rollers & Idlers required for fabrication of Vessel in sections have to be arranged by the vendor at their cost.

2.2.70 All indirect materials, consumables **(except Welding consumables)** like gases, grinding wheels etc. required for fabrication to be arranged by the vendor at their cost.

2.2.71 **All Welding electrodes including Filler Wire required for the job shall be free issue from BHEL - HPVP.** Any wastage or excess usage beyond BHEL assessed quantity shall be justified by the Vendor. Otherwise, the same shall be charged to the vendor's account at BHEL recovery rates.

2.2.72 Vendor shall have to engage sufficient skilled manpower for fabrication of the ordered equipment simultaneously to meet the committed delivery schedules.

2.2.73 Vendor shall deploy sufficient no. of Calibrated Welding Machines, Main Ovens & Portable Ovens required for baking of electrodes, etc., at the site. All relevant documents shall also be made available for verification & approval by BHEL - HPVP (QC) / AIA.

2.2.74 Duly calibrated tools & tackles like Measuring instruments, Thermal Chalks / Pyrometer, etc. shall be made available whenever required.

2.2.75 Vessel may require fabrication of Sections in Vertical position. All the Scaffolding materials like Pipes, Clamps, Jallies etc. for temporary platform works are to be arranged by the Vendor at their cost.

2.2.76 Equipment details shall be hard stamped by encircling with paint and stenciled in a specific format with details of Project name, Customer No., Work Order No., PGMA No., Weight etc., for identification and dispatch as per the instructions of the Outsourcing department officials.

2.2.77 Nozzles blanking & N2 filling, Name plate fixing, punching and rub off

2.2.78 Any modification work due to revision of drawings during fabrication is to be carried out by the vendor without any extra cost.

2.2.79 Vendor shall have to return the excess / balance materials including off-cuts and total scrap available with the vendors exclusive of process allowance & invisible wastage to HPVP Stores after material reconciliation but before submission of their final bill. In case the same are not returned by the vendors, Recovery shall be made as per BHEL Rates / MSTC rates plus applicable taxes, prevailing at the time of processing of the final bills.

2.2.80 Though not mentioned specifically, any activity which is required for completion of the work is deemed to be included in the scope of work of Vendor.

3. <u>BHEL SCOPE</u>:

3.1 BHEL – HPVP shall provide the following as free issue:

3.1.1 Approved Drawings, GMS, QAP, WPS, Painting Schedule, applicable Standards & Specifications etc.

3.1.2 Free Issue Raw materials like Plates (full/off-cuts), Pipes/Tubes, Round Bars, Structural items etc., in running meters and BOC like Fittings, Nozzles, Flanges, Fasteners, Gaskets etc. as per GMS from HPVP stores

3.1.3 Rolling of clad plates of Shell segments including Marking, Cutting, Clad Removal and Edge Preparation at HPVP shops

3.1.4 Blind Flanges, Gaskets & Fasteners required for Hydro test

3.1.5 Dished End Petals & Crown in Pressed Condition, trial assembled and dismantled after Match marking

3.1.6 Section Bending wherever required

3.1.7 Pressing of Insert Plates > 50mm thickness shall be carried out at HPVP production shops. However transportation of the Insert Plates from Lovagarden site to HPVP shops and back to Lovagarden site after pressing is in Vendor scope.

3.1.8 Bore Cladding of Nozzles including C-Seam welding for Long Nozzles, if any

3.1.9 Step Machining of Raised Face, Raised Face Weld Deposition, Machining & Turning of Nozzle Flanges for Cladded Vessels

3.1.10 Templates / Gauge plates for match marking of holes in compression rings & base plates

3.1.11 All Welding Electrodes & Filler Wire as per requirement. Any wastage or excess usage beyond BHEL assessed quantity shall be justified by the Vendor. Otherwise the same shall be charged to the vendor's account at BHEL recovery rates.

3.1.12 Higher capacity Slings required for handling the vessel

3.1.13 Wooden Sleepers, if any required for Hydro test, shall be provided by BHEL on returnable basis

3.1.14 Stress Relieving of the total vessel in sections along with Production Test Coupons shall be carried out by a specialised agency engaged by HPVP separately. However, assistance is to be provided by the fabrication vendor for Stress Relieving of the vessel in Handling of shell sections, Placement on Saddles / Supports, Fabrication, Assembly & Welding of Bulk Heads, Welding of Thermocouples etc.

3.1.15 Testing of Production Test Coupons in HPVP - QC laboratory

3.1.16 300 MT & 75 MT crane along with operator and fuel will be provided by BHEL free of charge for fabrication. Maintenance of the crane including spares shall also be in the scope of BHEL. However, Riggers / Helpers required for handling the job shall have to be provided by the vendor.

3.1.17 All Paints as per requirement

3.1.18 Area required for fabrication, site office and Stores at Lovagarden site will be provided free of charge.

3.1.19 Power & Water shall also be provided free of charge at one point inside the fabrication yard but further distribution to the desired location is in Vendor's scope only. Test for Suitability of the Water for carrying out the Hydro Test is to be arranged by vendor at his cost.

Vendor's scope includes arranging Distribution Board with required capacity of Switch Fuse unit as incomer, all outgoings with necessary safe trips as per the industrial safety norms and their installation, all outgoing cables from Distribution Board, termination at the distribution board, Working Area Lighting etc.

4. INSPECTION:

4.1 Inspection shall be carried out by M/s. BHEL – Vizag / BHEL Authorized Inspection Agency (AIA) / LTHE / PMC / Customer as per approved QAP. Contractor shall have to offer for Stage wise and Final inspection as per the approved QAP and obtain necessary inspection clearances before proceeding for further operations.

4.2 Fabrication Vendor shall be solely responsible for preparation and submission of all Inspection Reports & documents duly certified by Inspection Authority along with the finished equipments.

4.3 All the documentation related to inspection clearance of M/s. BHEL / TPI / Customer, Generation of Inspection Reports, Preparation of Final Documents as per BHEL standard formats etc., are included in the scope of vendor and scanned copy as well as hard copy of the same shall be submitted to BHEL-QA.

5. DELIVERY:

5.1 Finished items along with inspection documents and all other certificates are to be handed over to HPVP as per the following schedule:

Within 8 months from the date of issue of First consignment of free issue materials or 6 weeks from the date of issue of Last consignment of materials, whichever is later.

Notes:

i) For intermediate operations like SR, the time period from the date of handing over of the job to date of taking over of the same will be excluded from the delivery period for the purpose of computation of LD.

ii) In case the delivery period offered by the bidder is more than the tender delivery period, Price quoted by the bidder shall be loaded for the additional period @1/2 % per week or part thereof for the purpose of evaluation of Bidder's status.

6. SITE MOBILISATION:

6.1 Successful bidders shall have to complete site mobilization within 15 days from the date of receipt of order or from the date of intimation for the same by Outsourcing dept**.,** whichever is later.

7. PRICE:

7.1 The price shall be quoted as per the Schedule of Rates enclosed at Annexure – I for the detailed scope of work and the quoted price shall be inclusive of all applicable taxes & duties **except GST**.

7.2 The prices shall be fixed & firm without any escalation during the entire period of contract and till completion of the work.

7.3 GST shall be reimbursable to the vendor as per the applicable guidelines.

7.4 Income tax will be deducted at applicable rates from RA & Final bills.

8. PAYMENT TERMS:

8.1 Payment shall be made against RA Bills for **90% of the order value** for the following stages of fabrication:

a) After Completion of L-Seams of shell sections including NDE - 10%
b) After Completion of C-seams of shell sections including NDE - 20%
c) After Completion of SR Assistance, Hydro Testing - 30%
d) After Completion of Blasting & Painting - 15%
e) After completion of Loading of finished equipment - 15%

8.2 Balance 10% payment shall be made after completion of the job in all respects including material reconciliation and handing over of the balance materials & returnable items, if any and submission of total documentation to BHEL (QC).

8.3 The weights indicated in the tender are tentative and may subject to increase or decrease after completion of the detailed engineering. Hence, payment shall be made for the actual weights executed as per approved engineering drawings and documents.

This clause shall be read in conjunction with the clause 17.0 of Annexure – III i.e. General Terms & Conditions.

9. GOODS & SERVICES TAX (GST):

9.1 Bidders shall make a note of the following points of GST before submission of their offer:

a) Bidders shall have to mention their GSTIN no. (15 Digits) in their Technical Bid. If any specific exemption is available, a declaration with due supporting documents need to be furnished for considering the offer.

b) Semi-finished goods are to be delivered by the Vendor in BHEL, HPVP premises / site within a maximum period of one year from the date of issue of the material, failing which the whole transaction will be considered as Supply and Sale and GST is required to be paid along with interest (calculated @ SBI Base Rate + 6%) along with penalty, if any, from the date of Challan on the whole value of materials. Hence vendors shall have to ensure that materials issued to them are returned within 365 days.

c) After fabrication, the vendors shall have to deliver the semi-finished Goods by fulfilling the following formalities:

i) GST invoice should be raised by the vendor by paying GST on job work charges at applicable rates and by incorporating the HPVP GSTIN no. in the invoice for availing the reimbursement of GST from HPVP.

ii) The vendor shall also have to enter in their GST Return -1 (GSTR-1) the details of invoice raised for payment of GST so as to enable HPVP to avail input credit.

10. REVERSE AUCTION:

10.1 BHEL shall be resorting to Reverse Auction (RA) for this tender. RA shall be conducted among the techno-commercially qualified bidders. Guidelines for RA are available on *www.bhel.com* and bidders are requested to go through the same before submission of their offer.

10.2 Sealed envelope / Electronic Price bids of all the techno-commercially qualified bidders shall be opened and the same shall be considered as initial bids of the bidders in RA. In case any bidder(s) do(es) not participate in online Reverse Auction, their sealed envelope price bid along with applicable loading, if any, shall be considered for ranking.

10.3 BHEL will inform to bidders the details of service provider who will provide business rules, all necessary training and assistance before commencement of online bidding. The bidders participating in the Reverse Auction shall have to necessarily submit **'Process Compliance Form'** (PCF) to the designated Service Provider.

10.4 Bidders are advised to read the 'Business Rules' (Annexure – V) indicating details of RA event carefully, before start of the reverse auction event.

11. Other Terms & Conditions, whichever applicable, shall be as per Annexure – III enclosed.

12. RISK PURCHASE:

In case the vendor fails to execute the work within the scheduled time or due to any other reasons, BHEL - HPVP reserves the right to get the same completed through some other party at the risk & cost of the vendor and any additional expenditure incurred due to the same shall be charged to the vendor**.**

13. VALIDITY OF OFFER:

The offer shall be valid for a period of **3 months** from the date of Reverse Auction.

14. GENERAL:

14.1 The bidder shall study the tender documents, drawings, quality documents and all other relevant documents in detail for understanding the scope of work and the processes involved before submission of their offer. Bidders shall get clarifications, if any, from concerned officials on the scope of work or any other details of the tender document, over phone between 09:00 AM and 04:30 PM on any working day or through e-mail.

14.2 Drawings, QAP, WPS, other reference documents etc., shall be sent to vendor's e-mail address on e-mail request by the bidder.

14.3 Bidder shall confirm their acceptance to all the terms & conditions of the tender enquiry. **Conditional Price Bids** and any other deviations to the tender terms & conditions are not acceptable and BHEL reserves the right to reject such offers without further correspondence.

14.4 BHEL reserves the right to modify or cancel the tender enquiry at any stage without assigning any reasons thereof.

14.5 The General Terms & Conditions, if any, contradicting with the specific terms & conditions given in the tender, then specific terms & conditions shall only be considered.

15 The following documents shall form part of the tender enquiry:

i) Schedule of Rates : Annexure – I
ii) Details of Vessel to be fabricated : Annexure – II (A)
iii) List of Reference Drawings & Documents : Annexure – II (B)
iv) General Terms & Conditions : Annexure – III
v) Acceptance to tender terms & conditions : Annexure – IV
vi) Business Rules for Reverse Auction : Annexure – V
vii) GST Compliance for Indigenous Suppliers : Annexure – GST
viii) Applicable Drawings as per Annexure - II (B)
ix) Tentative ITP / QAP, WPS as per Annexure - II (B)
x) Painting Schedule and Painting Procedure as per Annexure - II (B)

(Drawings, QAP, WPS, Painting Schedule, etc. shall be sent by e-mail to vendor's e-mail address on request)

16 TENDER SUBMISSION (Through E - Mail):

16.1 Techno-commercial bid including the tender document duly signed & stamped by the bidder on all pages along with a covering letter on Company's Letter Head addressed to DGM (Outsourcing), BHEL –HPVP, Visakhapatnam shall be sent through an e-mail to **technicalbid-hpvp@bhel.in**

16.2 **Tentative List of Man Power, Machinery, Tools & Tackles to be engaged by the vendor shall also be attached to the Techno-Commercial Bid.**

16.3 Price bid (i.e., Annexure – I) shall also be sent separately through e-mail to another e-mail ID **pricebid-hpvp@bhel.in**

16.4 Offers completed in all respects along with the supporting documents shall be sent through the above e-mails only **latest by 14.00 Hrs. on 01.05.2021** duly mentioning the Name of Work, Tender Ref. No. & Date and Technical Bid / Price Bid in the subject of the e-mail.

16.5 Bidder shall ensure correctness of the e-mail addresses while submitting their offer. There shall be no other e-mail address at the receiving end while submission of the above bids otherwise the system will reject such mails. Bidder shall be solely responsible for non-receiving of such mails at the above mentioned e-mail addresses and no communication in this regard will be entertained.

16.6 **TENDERS RECEIVED AFTER THE DUE DATE & TIME ARE NOT ACCEPTABLE.**

16.7 **OFFERS SENT IN ANY OTHER FORM WILL BE TREATED AS INVALID AND WILL BE SUMMARILY REJECTED.**

17. <u>TENDER OPENING</u>:

17.1 Techno-commercial Bids will be opened **at 14.00 Hrs. on 01.05.2021.** The bidders may depute their representatives at the time of opening of techno-commercial bids.

17.2 After evaluation of the techno-commercial bids, intimation regarding date & procedure of conducting reverse auction shall be given by the service provider to all the eligible techno-commercially qualified bidders through an e-mail in advance at an appropriate time.

For Bharat Heavy Electricals Limited,

17/04/2021

D. N. MURTHY
Dy. Manager (OS)
Bharat Heavy Electricals Ltd.
BHEL, Visakhapatnam-530 012

ANNEXURE - I

SCHEDULE OF RATES

Ref: OS/21-22/2438/LAS PV/32/004 **Date: 17.04.2021**

Sub : Fabrication of HP Flare K.O. Drum (LAS with SS Clad) Vessel against S.O. 2438 at HPVP-Lovagarden site, Visakhapatnam.

Item No.	S.O. No.	Description of Work	Unit	Qty.	Unit Rate (Rs.)	Total Amount (Rs.)
		Complete Fabrication of HP Flare K.O. Drum (SA387GR22CL2 with SS 347 Clad) with rolled shell segments, free issue materials, fabricated components, Dished End Petals & Crown, BOC, etc. including NDT, Hydrotesting, Blasting & Painting as per the Drawings, Specifications, QAP, WPS & Painting Schedule and including Collection of rolled shell segments, Free Issue Materials from HPVP stores / shops, Transportation to Lova Garden site, Assistance to PWHT / SR, Loading of Finished equipments on to the trailers at Lova Garden site etc., complete in all respects as per the detailed scope of work mentioned in the tender document.				
1	**2438**	**HT FLARE K.O. DRUM - Eqpt. Tag No. 504-V-805A - 1 No.**	**MT**	**191**		
Total Amount in words:						

Notes :

1) The quoted price shall be inclusive of all applicable taxes & duties except GST. Income Tax shall be deducted at applicable rates from RA & Final Bills and GST shall be reimbursable to the vendor as per applicable guidelines.

2) The prices shall be fixed & firm without any escalation during the entire period of contract and till completion of work.

3) The quantity and weights indicated above are approximate and may vary on both sides subject to revision or addition or deletion of drawings. However, payment shall be made for the actual weights as per the applicable drawings / BOM.

4) The bidders are advised to go through all the drawings & documents before quoting the tender.

5) The evaluation currency for this tender shall be **INR**.

6) Tenderer should quote the amount in figures & words. It may be noted that corrections, overwriting etc. are not allowed. If there is a discrepancy between amount in figures & words, the amount in words shall prevail unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail. If there is an error in the total corresponding to the addition or subtraction of sub-totals, the sub-totals shall prevail and total shall be corrected accordingly.

   In case of mismatch between rate and amount in figures, rate in figures shall be taken into consideration for further evaluation and processing.

Signature of the Bidder with Stamp

ANNEXURE-II (A)

Ref : OS/21-22/2438/LAS PV/32/004 **Date: 17.04.2021**

Details of Vessel to be fabricated at Lovagarden Site, Visakhapatnam

Sub : Fabrication of HP Flare K.O. Drum (LAS with SS Clad) Vessel against S.O. 2438 at HPVP-Lovagarden site, Visakhapatnam

Sl. No.	S.O.	PGMA	Equipment No.	Equipment Description	Qty. (No.)	Approx. Wt. (MT)	Eqpt. ID (mm)	Eqpt. Ht. / Length - TL to TL (mm)	Main Shell		Clad Thk. (mm)	Dished Ends				Saddles (Sliding / Fixed)
									Thk. (mm)	Matl Spec.		Qty. (No.)	Nom. Thk. (mm)	Min. Thk. (mm)	Matl. Spec.	
1	**2438**	**PV-180**	**504-V-805 A**	**HT FLARE K.O. DRUM**	1	191	6500	20000	**30**	SA387GR22 CL2	**3 (SS 347)**	2	30+3	26+3	SA 387 GR.22 CL2 + SS 347 CLAD	2 Nos.
				TOTAL	**1**	**191**										

Note : Dimensions & Weight indicated above are purely tentative and may be subject to revisions due to incorporation of comments of the approving authority in the drawings. Hence the approved drawings & documents issued to the vendor after ordering shall only be followed for execution & inspection of the job.

ANNEXURE - II (B)

Ref: OS/21-22/2438/LAS PV/32/004 **Date: 17.04.2021**

LIST OF REFERENCE DRAWINGS & DOCUMENTS

Sub : Fabrication of HP Flare K.O. Drum (LAS with SS Clad) Vessel against S.O. 2438 at HPVP-Lovagarden site, Visakhapatnam

Sl. No.	S.O. No.	PGMA	Eqpt. Name	Description of Drawings / Documents	Drawing / Document No.	Rev. No.	No. of Sheets
01	2438	PV-180	HT FLARE KO DRUM (Eqpt. Tag No. 504-V-805A)	General Assembly of HT Flare Knock Out Drum	1-PV-180-U0119	02	01
02				Assembly Details of HT Flare Knock Out Drum	1-PV-180-U0120	01	01
03				Insulation Support Details of HT Flare Knock Out Drum	1-PV-180-U0122	00	01
04				Assembly details of HT Flare KO Drum (Internal Layout for Coils)	1-PV-180-U0142	01	01
05				Shell Assembly Details of HT Flare Knock Out Drum	1-PV-180-U0145	01	01
06				Saddle & Trunion Assembly Details of HT Flare Knock Out Drum	1-PV-180-U0148	01	01
07				Details of Dished Ends	3-PV-010-U0102	03	01
08				Internal Pipe Details of HT Flare Knock Out Drum	3-PV-180-U0053	01	01
09				General Notes for HT Flare Knock Out Drum	3-PV-180-U0190	02	01
10				Details of Strainer & Vortex Breaker Assembly at Nozzle -3 for HT Flare Knock Out Drum	3-PV-180-U0226	01	01
11				Assembly Details of HT Flare Knock Out Drum	3-PV-180-U0239	00	01
12				QAP for Eqpt. No. 504-V-805A (Code-1)	B016-RUF-LT-504-QC-QD-BHEL(1)-02006	02	24
13	-	-	-	Painting Schedule	HPVP-2438-Paint-01	01	03
14	-	-	-	Painting Procedure	HPVP-2438-Paint-01	01	08
15	-	-	-	Procedure for Qualification & Certification of Non- Destructive Examination Personnel	BHEL:NDE:WP01	01	15
16	-	-	-	Procedure for Liquid Penetrant Examination	BHE-NDT-PT-07026	02	09
17	-	-	-	Procedure For Magnetic Particle Examination	BHE-NDT-MT-07024	02	13
18	-	-	-	Procedure for Ultrasonic Examination	BHE-NDT-UT-07025	02	10
19	-	-	-	Procedure for Radiographic Examination	BHE-NDT-RT-07023	02	18

Note : Drawings & Documents indicated above are purely tentative and may be subject to revisions due to incorporation of comments of the approving authority. Hence the approved drawings and documents issued to the vendor after ordering shall only be followed for execution & inspection of the job.

ANNEXURE - III

GENERAL TERMS & CONDITIONS

1. TECHNICAL DELIVERY CONDITIONS:

The work should conform to the technical data given in our drawings, GMS, Shipping List Specifications, QAP, WPS etc.

2. PARTY'S SCOPE:

The scope of the party shall be as follows: -

a) All welding equipments, baking oven, tools, jigs and fixtures, measuring instruments duly calibrated, handling facilities, testing facilities etc.

b) All materials other than those mentioned under ñFree Issue Materials", which are required for completion of the work.

c) All consumables such as electrodes, gases, grinding wheels etc.

Note: Electrodes of specification mentioned in the drawings / WPS and of BHEL approved brands only shall be used and MTCs of the same shall be submitted to BHEL for verification before use.

3. REVISION OF DRAWINGS:

There may be minor changes in the drawings during execution. In such a case, party should accommodate the same without any extra claim.

4. WELDING QUALIFICATION: Qualification of required number of Welders is partyôs responsibility at their cost.

5. X–RAY:

All welding shall be of X-ray quality where specified on drawings. Inspection would specify the quantum of X-ray based on drawings / code requirement. Party should strictly follow the WPS and QAP issued by BHEL during welding. Getting the welds radiographed and getting them cleared by inspection is the responsibility of the party.

6. RECTIFICATIONS / REJECTIONS:

Any rectification due to defective work, if required, shall be done by the party free of charge with a suitable technology approved before hand by BHEL in writing. The cost of material, if any used for rectification work / rejection work, will be estimated by BHEL and the same shall be debited to party's account. In case any rectification / rework is to be carried out due to defective material supplied by BHEL, the replacement material and consumables will be supplied by BHEL free of Cost.

7. SECURITY DEPOSIT:

Vendors shall have to submit a Bank Guarantee for **10%** of the order value in case of **HPVP site** or **25%** of the material cost in case of Vendor works towards Security Deposit and safe custody of materials within one week from the date of issue of Order. The BG shall be valid for the contract period with a claim period of 12 months. This Bank Guarantee shall be released to the contractor after completion of work and on acceptance of the same by BHEL / Owner and on submission of Performance BG (claim period of 12 months) for 10 % of the order value covering for the defects liability period. If PBG is not submitted, 10% of the order value shall be deducted towards PBG from the final bill and shall be refundable after performance guarantee period, if no defects are found during this period.

8. RAW MATERIALS ISSUE:

Raw materials shall be issued with appropriate processing allowance and invisible wastage over the theoretical requirement of raw materials **(Plates, Sheets, Sections and Pipes).**

9. TRANSFER / RETURN OF LEFT OVER MATERIALS:

Party should maintain proper records for receipt & use of all free issue materials. The left over materials & scrap as per the material accounting statement shall be returned to HPVP stores along with finished job. Material Transfer Vouchers (MTV) from one order to another or from one vendor to another and Material Return Vouchers should be submitted immediately after transfer / return. The material reconciliation statement shall be submitted by the contractor after verification and certification by BHEL along with the final bill **within 30 days from the date of completion of work**. Otherwise, recovery for the balance materials shall be made from any of their pending bills without further intimation.

10. MATERIAL RECONCILIATION:

Orders issued to the vendors have to be completed in all respects including Material Accounting within a maximum of **180 days** from the **date of issue of the first material** from BHEL - HPVP stores.

Maximum of 0.5 % on the requirement of materials **(Plates, Sections and Pipes)** is admitted towards **process allowance and invisible wastage**.

Scrap quantity is permissible up to a **maximum of 1% on Structurals (Beams, Channels, Angles, Rods, Pipes etc.), 2% on Sheets, 3% for Plates** on the theoretical requirement of materials.

If wastage and scrap is beyond the above limits, it should be fully justified with cutting diagrams etc. which are to be approved in advance by BHEL. **Otherwise, the cost of raw materials beyond approved limits will be recovered from the contractor as per BHEL recovery rates including applicable taxes & duties**.

Material reconciliation including return of balance materials, off-cuts is to be completed within 20 days from the date of completion of the order. The material reconciliation statement shall be submitted by the contractor after verification and certification by BHEL-HPVP along with the final bill **within 30 days from the date of completion of work**. Otherwise, recovery for the balance materials shall be made from any of their pending bills without further intimation,

Repeated occurrence of inordinate delays in returning and settling the material accounting will entail BHEL the right to terminate the contract forthwith or impose a temporary suspension on further loading at the discretion of BHEL.

11. SCRAP & OFF-CUT NORMS:

Sl. No.	Description	Scrap Size (in mm)	Off-Cut (in MM)
1.	CS/AS Sheets & Plates	Below 500 × 250	500 × 250 & above
2.	Rolled sections Rod, angles etc. (other than -tubes, pipes)	Below 1000	1000 & above
3.	Tubes & Pipes	Below 500	500 & above
4.	Universal column	Below 1000	1000 & Above
5.	SS Sheets & Plates	Below 500 × 250	500 × 250 & above
6.	SS Structural, Rods, Tubes, Pipes	Below 250	250 & above
7.	Non – ferrous: sheets & plates, rods & tubes	Below 500 × 250 (S & PL), Below 250 (Rods & Tubes)	500 × 250 & above, 250 & above
8.	Big size Scrap	(2500 & above) × (150 to 249)	-

12. INSPECTION:

Party shall contact our Quality Control Dept. for stages of inspection before commencement of job and should strictly follow the stages of inspection as per QAP.

13. WORKMANSHIP GUARANTEE:

The vendors should give workmanship guarantee for fabricated items for a period of 18 months from the date of last delivery of the order. Any defects due to incomplete work, faulty workmanship found in the fabricated items after delivery during the defects liability period shall be rectified / replaced by the vendor free of cost. Otherwise, the expenditure incurred towards the same will be recovered from the pending bills of vendors.

14. WORK PROGRESS:

The fabricator shall furnish a weekly report on the progress of work along with the status of availability of free issue materials and requirement of further materials, if any.

Outsourcing dept. personnel will visit vendorôs works from time to time to assess and review the work progress. Free access shall be provided to BHEL or its inspection agency at all reasonable times of the day / night.

In case the progress is not satisfactory or supplies are delayed abnormally beyond the contractual delivery date, BHEL-HPVP, Visakhapatnam reserves the right to cancel the order in part or full or get the balance job in as is where is condition completed elsewhere by another agency at the risk and cost of Fabricator. The value of the work carried out by the party will be assessed by BHEL and the same shall be final. No compensation will be given to the fabricator in case of cancellation of order or diversion of balance job even if the jobs have been processed partly.

15. DELIVERY:

Finished items should be handed over to BHEL-HPVP on party's delivery challans along with Job completion certificate / Final Inspection Report from inspection agency / HPVP-QC department.

16. PENALTY:

If delivery exceeds the stipulated delivery schedule, penalty 1/2 % of the total value of order per week or part there of subject to a maximum of 10% on the total value of the order will be levied. However, time taken for the following will not be considered as delay on the part of the Sub-Contractor.

1) Intermediate operations, if any, carried out by BHEL.
2) Waiting time for BHEL / Third party Inspection beyond a normal time of 3 days.

17. PAYMENT TERMS:

Payment shall be made against RA Bills within 45 days from the date of submission of Bill.

90% payment will be made after handing over of the finished equipments along with all inspection documents to HPVP shops / Logistics dept. / ADM site / Lova Garden site, duly inspected & cleared by Inspection authority. Balance 10% payment shall be made along with the Final Bill against completion of total order in all respects including documentation.

Vendors shall have to submit the bills in the formats specified by HPVP-Outsourcing and the bills submitted in the specified format along with necessary supporting documents are only admitted for processing. The following documents shall be submitted along with the Final Bill: -

1. No Claim Certificate from the contractor
2. No Dues Certificate from BHEL
3. Work Completion Certificate from BHEL
4. Material Reconciliation Statement submitted by the Contractor and certified by concerned authority of BHEL (if applicable)
5. Workmanship Guarantee certificate from the contractor

18. SECRECY:

All the documents of BHEL inclusive of Drawings, GMS and Standards made available to the fabricator should be kept in strict confidence and under no circumstance be made available to others or allow others to make use of them. Such documents shall be returned to BHEL on demand after completion of the job. This secrecy clause is binding on the employees of the fabricators also. Violation of the same may lead to suspension of business with the vendor and necessary legal action.

19. SUB-LETTING:

In general, sub-letting of jobs will not be permitted. But in special circumstances, this may be allowed. In such case, the party should obtain written approval from BHEL-HPVP, Visakhapatnam before sub-letting.

20. FACTORY RULES AND REGULATIONS:

Party shall abide by all the rules and statutory regulations in force from time to time as per factories act. It shall be partyøs responsibility to ensure the safety of their workmen and fulfilling the ESI, PF and other relevant statutory regulations.

21. SAFETY:

a) Contractor shall adhere to safe construction practices, guard against hazardous & unsafe working conditions and shall comply with the safety rules of BHEL and local authorities. He shall maintain First Aid facilities for all his employees and labour. Contractorøs responsibility includes supply of welder kit, all safety items such as safety belts, white and colour glasses, goggles, safety helmets, safety shoes etc.

b) *Contractor and his employees shall follow all fire & safety, security regulations of BHEL.*

22. **HOUSE KEEPING**:

During execution of work, the contractor at all times keep the working place and storage area clean and free from accumulation of waste materials, rubbish etc.,

23. **ACCIDENT / DAMAGE / CONDUCT ETC.:**

Contractor will be held responsible for any disorderly conduct / misconduct, indiscipline, theft, smoking etc., on the part of his men. He will ensure summarily eviction of such men from his premises failing which BHEL would remove them from the factory on his responsibility. Any damage to and or loss of equipment, machinery, building etc., to BHEL or BHEL employees, visitors or other contractors resulting from his own or any of his men's negligence shall be liable to be made good by him. Contractor shall be solely responsible for any accident in which you or your men or your equipment may be involved during the execution of contract on account of any reason what so ever.

24. **TERMINATION OF CONTRACT:**

In the event of any failure on the part of the contractor, BHEL reserves the right to terminate the contract by giving a notice of 2 weeks for any of the following lapses and contractual violations: -

a) Failure to make labour payments in time as per the rules
b) Failure to progress the job according to the agreed schedule
c) Failure to mobilize adequate man power, tools & tackles and consumables in time
d) Failure to adhere to Quality Standards of BHEL
e) Refused to co-operate with other agencies working in the same area
f) Failure to resolve labour disputes like strikes etc., within 7 days of occurrence
g) Failure to comply with statutory regulations applicable at BHEL

BHEL shall also be free to intervene and take necessary remedial measures. All costs incurred with interest and overheads shall be recovered from contractor by such foreclosing or off-loading any part of the contract work.

25. DISPUTES:

Head of BHEL- HPVP Unit will be the final authority for any disputes arising out of this contract. The disputes / arbitration / settlement of contractual or legal issues shall be under the Jurisdiction of Visakhapatnam Court.

26. For this procurement, Public Procurement (Preference to Make in India), Order 2017 dated 15.06.2017 & 28.05.2018 and subsequent Orders issued by the respective Nodal Ministry shall be applicable even if issued after issue of this NIT but before finalization of Contract / PO / WO against this NIT.

In the event of any Nodal Ministry prescribing higher or lower percentage of purchase preference and / or local content in respect of this procurement, same shall be applicable**.**

27. The Bidder declares that they will not enter into any illegal or undisclosed agreement or understanding, whether formal or informal with other Bidder(s). This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

In case, the Bidder is found having indulged in above activities, suitable action shall be taken by BHEL as per extant policies/ guidelines.

Signature of the Bidder with Stamp

ANNEXURE – IV

Acceptance to Tender Terms & Conditions

I / We hereby confirm that the Tender documents, Drawings, Quality documents etc. have been studied in detail and we have fully understood the scope of work.

I / We accept to all the Terms and Conditions of the Tender Enquiry and the prices quoted are in accordance with the same.

I / We give our acceptance to participate in reverse auction for this tender.

Tender documents duly signed on all the pages by the Owner / authorized representative of the bidder are attached herewith.

Signature of the Bidder with Stamp

ANNEXURE – V

BUSINESS RULES FOR REVERSE AUCTION (RA)

This has reference to tender no. **OS/21-22/2438/LAS PV/32/004, dated 17.04.2021**. BHEL shall finalize the Rates for **Fabrication of Structure against S.O. No. 7906 at ADM site of BHEL-HPVP, Visakhapatnam** through Reverse Auction mode. BHEL has made an arrangement with an authorized Service provider (details will be shared before reverse auction) for conducting RA. Bidders should go through the instructions given below and submit acceptance of the same.

The technical & commercial terms are as per (a) BHEL Tender Enq. No. **OS/21-22/2438/LAS PV/32/004, dated 17.04.2021**, (b) Bidders' technical & commercial bid (in case of two-part bid) and (c) subsequent correspondences between BHEL and the bidders, if any.

1. **Procedure of Reverse Auctioning:**
   i) Price bids of all techno-commercially qualified bidders shall be opened.
   ii) **Reverse Auction**: The 'bid decrement' will be decided by BHEL.
   iii) The lowest bidder in sealed envelope price bid shall be shown as current L1 automatically by the system and no acceptance of that price is required. System shall have the provision to indicate this bid as current L1.
   iv) Bidders by offering a minimum bid decrement or the multiples thereof can displace a standing lowest bid and become "L1" and this continues as an iterative process. However, no bidder shall be allowed to lower its bid below the current L1 by more than 5 decrements at one go.
   v) After the completion of the reverse auction, the Closing Price shall be available for further processing.
   vi) Wherever the evaluation is done on total cost basis, after Reverse Auction, prices of individual line items shall be reduced on pro-rata basis.
2. **Schedule for reverse auction:** The Reverse Auction schedule will be intimated to the techno-commercially qualified bidders at a later stage.
3. **Auction extension time:** If a bidder places a bid in the last {…} minutes of closing of the Reverse Auction and if that bid gets accepted, then the auction's duration shall get extended automatically for another {…} minutes, for the entire auction (i.e. for all the items in the auction), from the time that bid comes in. Please note that the auto-extension will take place only if a bid comes in those last {…} minutes and if that bid gets accepted as the lowest bid. If the bid does not get accepted as the lowest bid, the auto-extension will not take place even if that bid might have come in the last {…} minutes. In case, there is no bid in the last {…} minutes of closing of Reverse Auction, the auction shall get closed automatically without any extension. However, bidders are advised not to wait till the last minute or last few seconds to enter their bid during the auto-extension period to avoid complications related with internet connectivity, network problems, system crash down, power failure, etc.
   The above process will continue till completion of Reverse Auction.
   Complaints/ Grievances, if any, regarding denial of service or any related issue should be given in writing thru e-mail/ fax to M/s. {Service provider} with a copy to BHEL within 15 minutes prior to initial closing time of Reverse Auction.
4. **Bid price:** The Bidder has to quote the {……} Price inclusive of Packing & Forwarding charges, all the routine & type tests as per tender scope, taxes, duties, freight and insurance as specified in tender document including loading (if indicated by BHEL due to deviations in technical/ commercial terms) for the Items specified. Details are as shown in Excel Sheet for calculation of total cost to BHEL (To be specified by Unit as per NIT conditions).
5. **Bidding currency and unit of measurement:** Bidding will be conducted in *Indian Rupees* per *Unit* of the material as per the specifications mentioned in the tender.
   In case of foreign currency bids, exchange rate (TT selling rate of State Bank of India) as on scheduled date of tender opening (Part-I bid) shall be considered for conversion in Indian Rupees. If the relevant day happens to be a Bank holiday, then the forex rate as on the previous bank (SBI) working day shall be taken.
6. **Validity of bids:** Price shall be valid for 3 months from the date of reverse auction. These shall not be subjected to any change whatsoever.

7. **Lowest bid of a bidder**: In case the bidder submits more than one bid, the lowest bid at the end of Reverse Auction will be considered as the bidder's final offer to execute the work.

8. Unique user IDs shall be used by bidders during bidding process. All bids made from the Login ID given to the bidders will be deemed to have been made by the bidders/ bidders' company.

9. **Post auction procedure**: BHEL will proceed with the Lowest Bid in the Reverse Auction for further processing.

10. Any commercial/ technical loading shall be separately intimated to respective bidders prior to RA. The excel sheet provided in this regard shall cover all these aspects. Commercial/ technical loading if any, shall be added by the respective bidder in its price during Reverse Auction.
    Modalities of loading & de-loading shall be separately intimated to the bidders. The responsibility for correctness of total cost to BHEL shall lie with the bidders.

11. Reverse auction shall be conducted by BHEL (through M/s {*Service Provider}*), on pre-specified date, while the bidders shall be quoting from their own offices/ place of their choice. Internet connectivity shall have to be ensured by bidders themselves.

    During the RA process if a bidder is not able to bid and requests for extension of time by FAX/ email/ phone then time extension of additional 15 minutes will be given by the service provider provided such requests come before 5 minutes of auction closing time. However, only one such request per bidder can be entertained.

    In order to ward-off contingent situation of connectivity failure bidders are requested to make all the necessary arrangements/ alternatives whatever required so that they are able to circumvent such situation and still be able to participate in the reverse auction successfully. Failure of power or loss of connectivity at the premises of bidders during the Reverse auction cannot be the cause for not participating in the reverse auction. On account of this, the time for the auction cannot be extended and neither BHEL nor M/s. {*Service provider*} is responsible for such eventualities.

12. Proxy bids: Proxy bidding feature is a pro-bidder feature to safe guard the bidder's interest of any internet failure or to avoid last minute rush. The proxy feature allows bidders to place an automated bid in the system directly in an auction and bid without having to enter a new amount each time a competing bidder submits a new offer. The bid amount that a bidder enters is the minimum that the bidder is willing to offer. Here the software bids on behalf of the bidder. This obviates the need for the bidder participating in the bidding process until the proxy bid amount is decrementally reached by other bidders. When proxy bid amount is reached, the bidder (who has submitted the proxy bid) has an option to start participating in the bidding process.

    The proxy amount is the minimum amount that the bidder is willing to offer. During the course of bidding, the bidder cannot delete or change the amount of a proxy bid.

    Bids are submitted in decrements (decreasing bid amounts). The application automates proxy bidding by processing proxy bids automatically, according to the decrement that the auction originator originally established when creating the auction, submitting offers to the next bid decrement each time a competing bidder bids, regardless of the fact whether the competing bids are submitted as proxy or standard bids. However, it may please be noted that if a manual bid and proxy bid are submitted at the same instant manual bid will be recognized as the L1 at that instant.

    In case of more than one proxy bid, the system shall bid till it crosses the threshold value of 'each lowest proxy bid' and thereafter allow the competition to decide the final L1 price.

    Proxy bids are fed into the system directly by the respective bidders. As such this information is privy only to the respective bidder(s).

13. Bidders are advised to get fully trained and clear all their doubts such as refreshing of Screen, quantity being auctioned, tender value being auctioned etc. from M/s. {*Service provider*}.

14. M/s. {*Service provider}*, shall arrange to demonstrate/ train the bidder or bidder's nominated person(s), without any cost to bidders. M/s. {*Service provider}*, shall also explain the bidders, all the business rules related to the Reverse Auction. Bidders are required to submit their acceptance to the terms/ conditions/ modalities before participating in the Reverse Auction in the process compliance form as enclosed. Without this, the bidder will not be eligible to participate in the event.

15. Successful bidder shall be required to submit the final prices (L1) in prescribed format (Annexure – VI) for price breakup, quoted during the Reverse Auction, duly signed and stamped as token of acceptance without any new condition (other than those already agreed to before start of auction), after the completion of auction to M/s. {*Service provider*} besides BHEL within two working days of Auction without fail.

16. Any variation between the final bid value and that in the confirmatory signed price breakup document will be considered as tampering the tender process and will invite action by BHEL as per extant guidelines for suspension of business dealings (as available on www.bhel.com).

17. Bidders' bid will be taken as an offer to execute the work/ supplies the item as per enquiry no. **OS/21-22/2438/LAS PV/32/004, dated 17.04.2021.** Bids once made by the bidder, cannot be cancelled/ withdrawn and bidder shall be bound to execute the work as mentioned above at bidder's final bid price. Should bidder back out and not execute the contract as per the rates quoted, BHEL shall take action as per extant guidelines for suspension of business dealings (as available on www.bhel.com).

18. Bidders shall be able to view the following on their screen along with the necessary fields during Reverse Auction:
a. Leading (Running Lowest) Bid in the Auction (only total price of package)
b. Bid Placed by the bidder
c. Start Price
d. Decrement value
e. Rank of their own bid during bidding as well as at the close of auction.

19. BHEL's decision on award of contract shall be final and binding on all the Bidders.

20. BHEL reserves the right to extend, reschedule or cancel the Reverse Auction process at any time, before ordering, without assigning any reason, with intimation to bidders.

21. BHEL shall not have any liability to bidders for any interruption or delay in access to the site irrespective of the cause. In such cases, the decision of BHEL shall be binding on the bidders.

22. Other terms and conditions shall be as per bidder's techno-commercial offers and other correspondences, if any, till date.

23. If there is any clash between this business document and the FAQ available, if any, in the website of M/s. {*Service provider},* the terms & conditions given in this business document will supersede the information contained in the FAQs. Any changes made by BHEL/ service provider (due to unforeseen contingencies) after the first posting shall be deemed to have been accepted if the bidder continues to access the portal after that time.

24. Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party. If the Bidder or any of his representatives are found to be involved in Price manipulation/ cartel formation of any kind, directly or indirectly by communicating with other bidders, action *as per extant BHEL guidelines for suspension of business dealings (as available on www.bhel.com)*, shall be initiated by BHEL.

Signature of the Bidder with Stamp

Annexure – GST

GST COMPLIANCE FOR INDIGENOUS SUPPLIERS

1. In Response to Tenders for Indigenous supplier will be entertained only if the vendor has a valid GSTIN which should be clearly mentioned in the offer. If any specific exemption is available, a declaration with due supporting documents need to be furnished for considering the offer.

2. Supplier shall mention their GSTIN in all their invoices and invoices shall be in the format as specified/prescribed under GST laws. Invoices shall necessarily contain Invoice number (in case of multiple numbering system is being followed for billing like SAP invoice no, commercial invoice no etc., then the Invoice No which is linked/uploaded in GSTN network shall be clearly indicated), item description as per P0, Quantity, Rate, Value, applicable taxes with nomenclature (like IGST, SGST, CGST & UTGST) separately, HSN/ SAC Code, etc.

3. All invoices shall bear the HSN Code for each item separately (Harmonized System of Nomenclature)/ SAC code (Services Accounting Code).

4. A declaration to the effect that all invoice particulars are/were uploaded in the GSTN network/ portal & all tax liability as per GST rules and regulations have been and will be discharged, shall be mentioned in the invoice. If not mentioned in the invoice, a separate declaration shall be submitted as per the requirement of BHEL.

5. All documents like Test Certificate, LR copy, Guarantee/Warrantee certificate, work completion certificate, any other document mentioned in PO, shall be sent along with the vehicle/consignment where ever applicable. For all consignments received within the calendar month, input credit will be availed within that month in line with monthly returns filing cycle. In case of any discrepancy in the document or non-submission of documents mentioned in the PO, then BHEL will not be able to accept or account the material, in such case availing of tax credit will be deferred to next month or so.

6. In case of discrepancy in the data uploaded by supplier in the GSTN portal or in case of any shortages or rejection in the supply, then BHEL will not be able to avail the tax credit and will notify the supplier of the same. Supplier has to rectify the data discrepancy in the GSTN portal or issue credit note (details to be uploaded in GSTN portal) for the shortages or rejections in the suppliers, within the calendar month notified by BHEL.

7. For any such delay in availing of tax credit for reasons attributable to supplier (as mentioned above), interest (calculated @ SBI Base Rate + 6%) along with penalty if any will be deducted for the delayed period i.e. from the month of receipt till the month tax credit is availed, from the running bills.

8. Under GST regime, BHEL has to discharge GST liability on LD recovered from suppliers/contractors. Hence applicable GST shall also be recoverable from suppliers/contractors on LD amount. For this Debit note will be issued by BHEL indicating the respective supply invoice number.

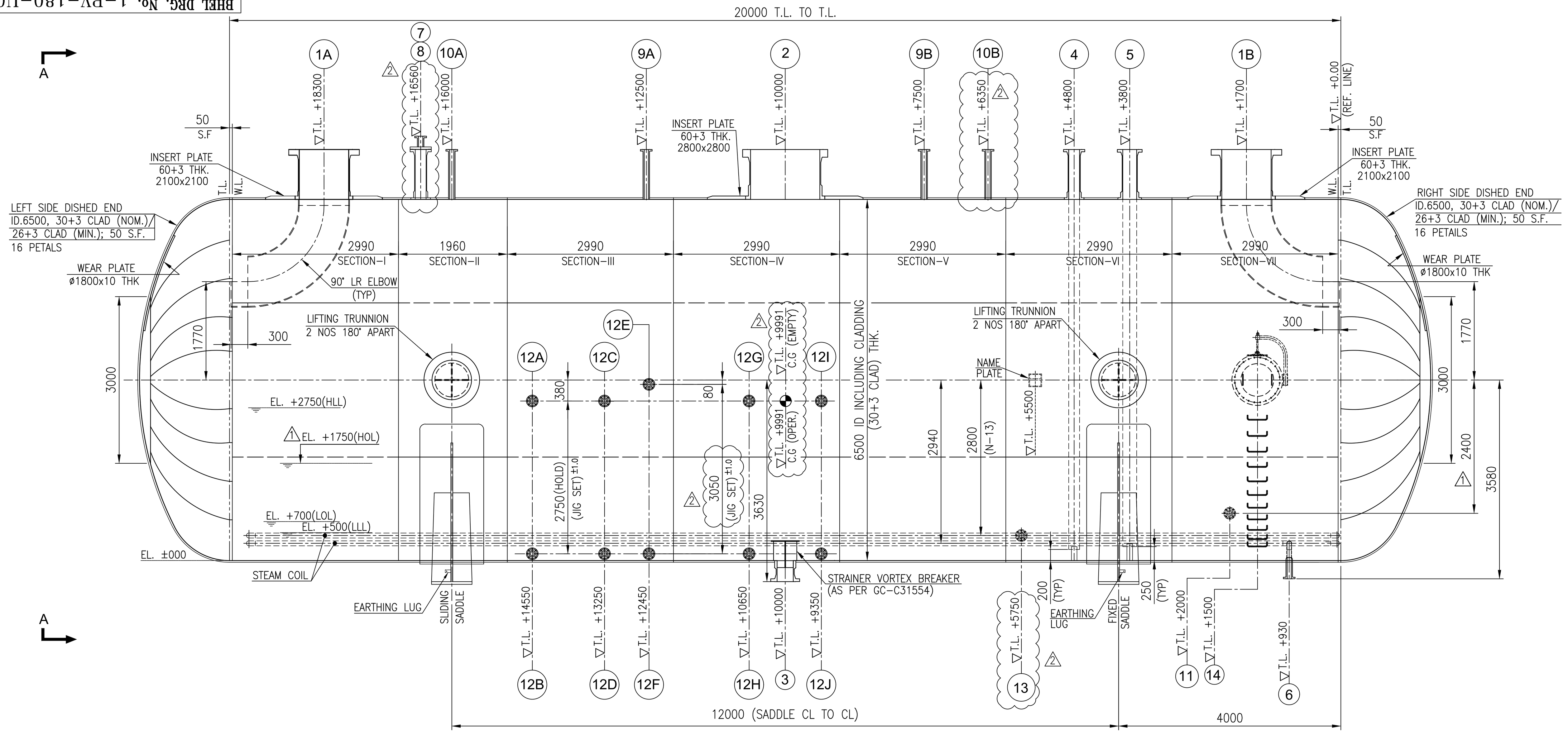
9. This is to inform that GST portion of invoice, shall be released only upon Vendor declaring such invoice in his GSTR-1 and receipt of goods and Tax invoice by BHEL and Confirmation of payment of GST thereon by vendor on GSTN portal. Alternatively, BG of appropriate value may be obtained from vendor which shall be valid At least one month after the confirmation of date of payment of GST by vendor on GSTN portal and receipt of Tax invoice and receipt of goods, whichever is later. Above is subject to receipt of goods/service and tax invoice thereof along with vendor declaring invoice in his return and paying GST within timeline prescribed for availing ITC by BHEL.

10. That in case vendor delays Declaring such invoice in his return and GST credit availed by BHEL is denied or reversed subsequently as per GST law, GST amount paid by BHEL towards such ITC reversal as per GST law shall be recoverable from vendor/contractor along with interest levied/ leviable on BHEL.

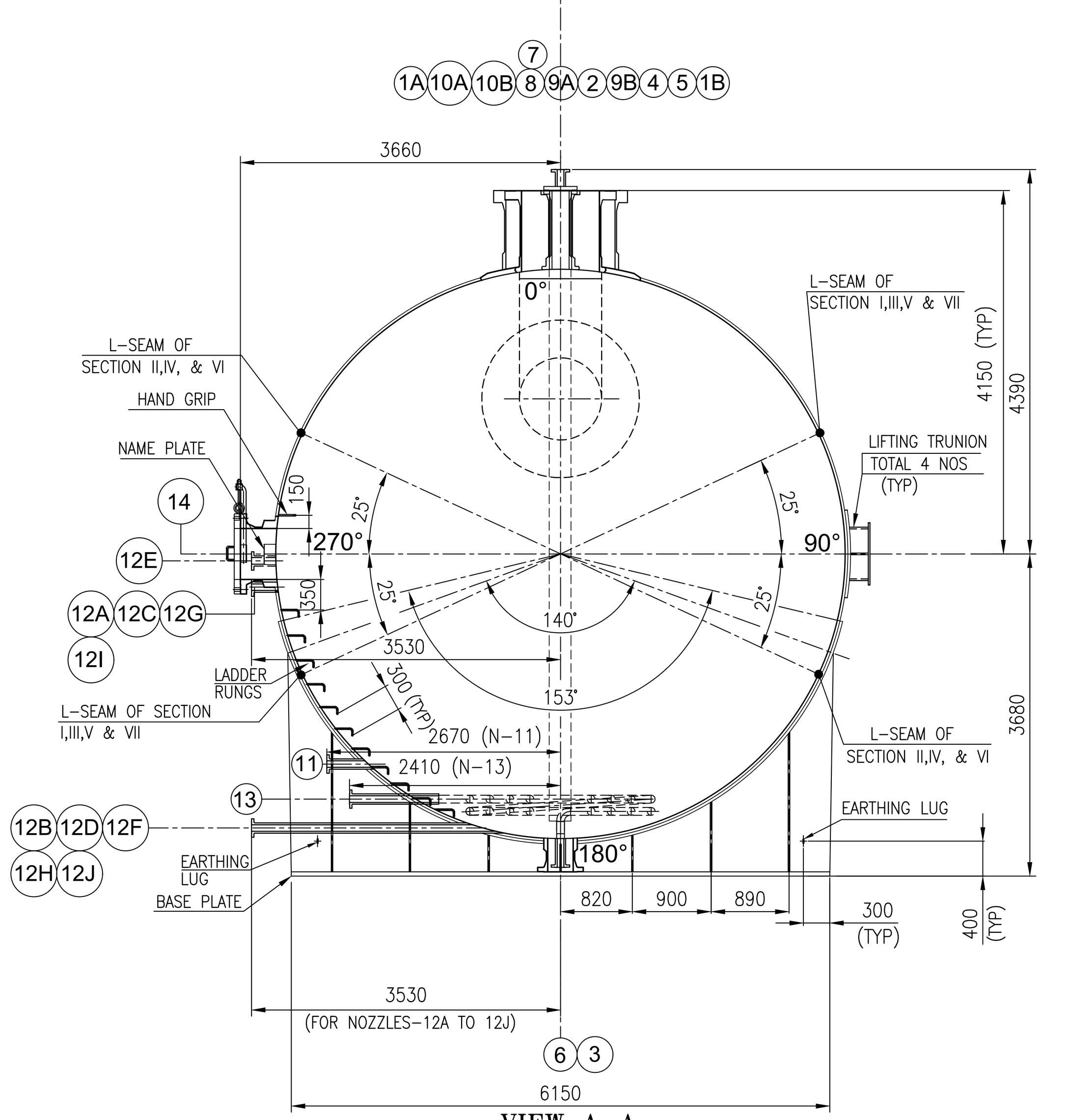
Note: The above will be followed strictly for processing vendor payments to ensure GST Compliance.

Signature of the Bidder with Stamp

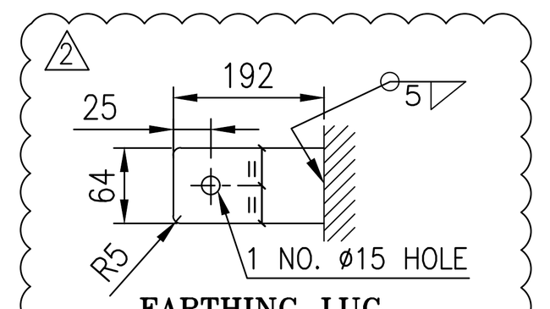
BHEL DRG. No. 1-PV-180-U0119
DWG. NO. B016-RUF-LT-504-MS-GA-BHEL(1)-02651



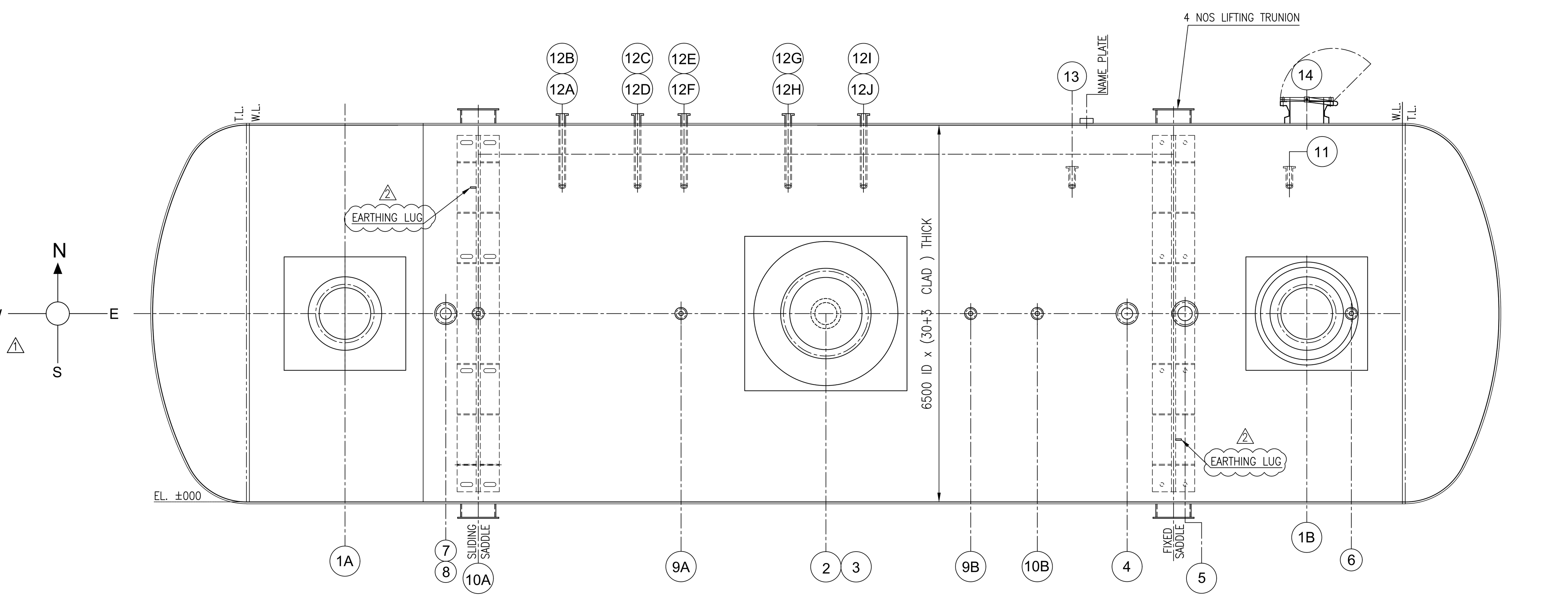
ELEVATION



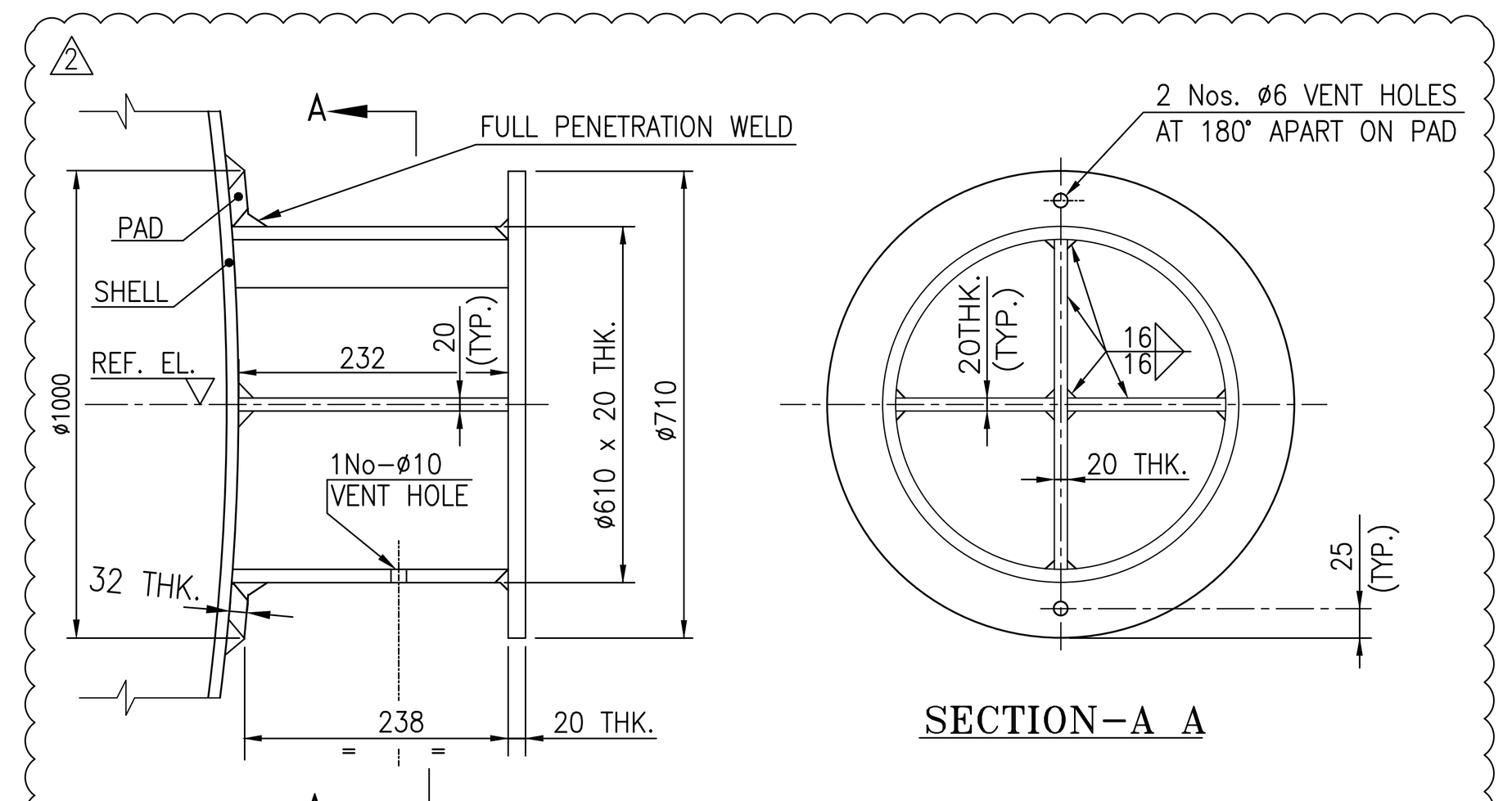
VIEW A-A



EARTHING LUG

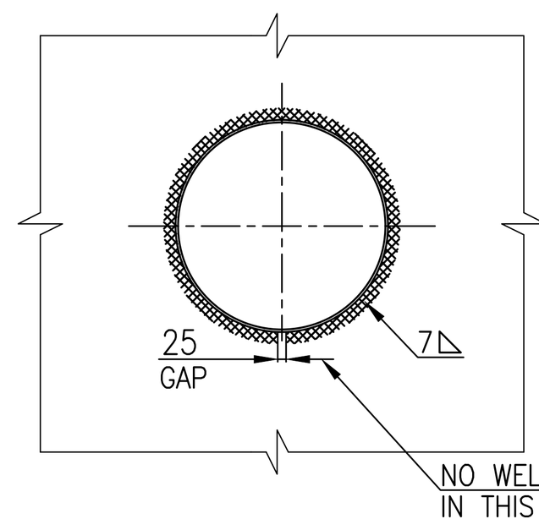


PLAN

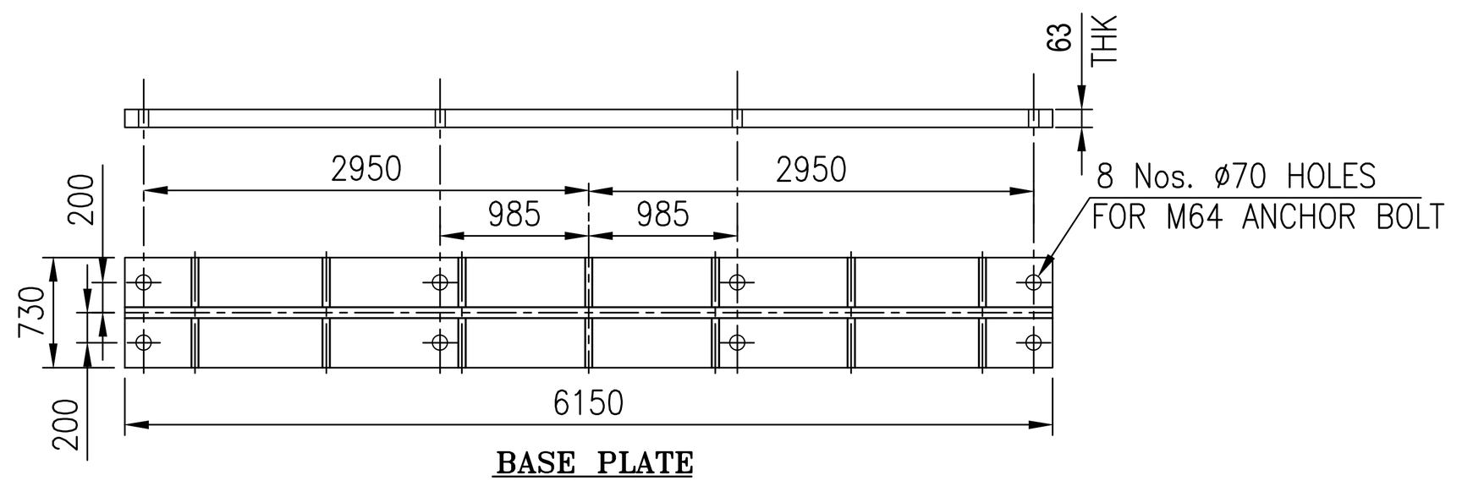


SECTION-A A

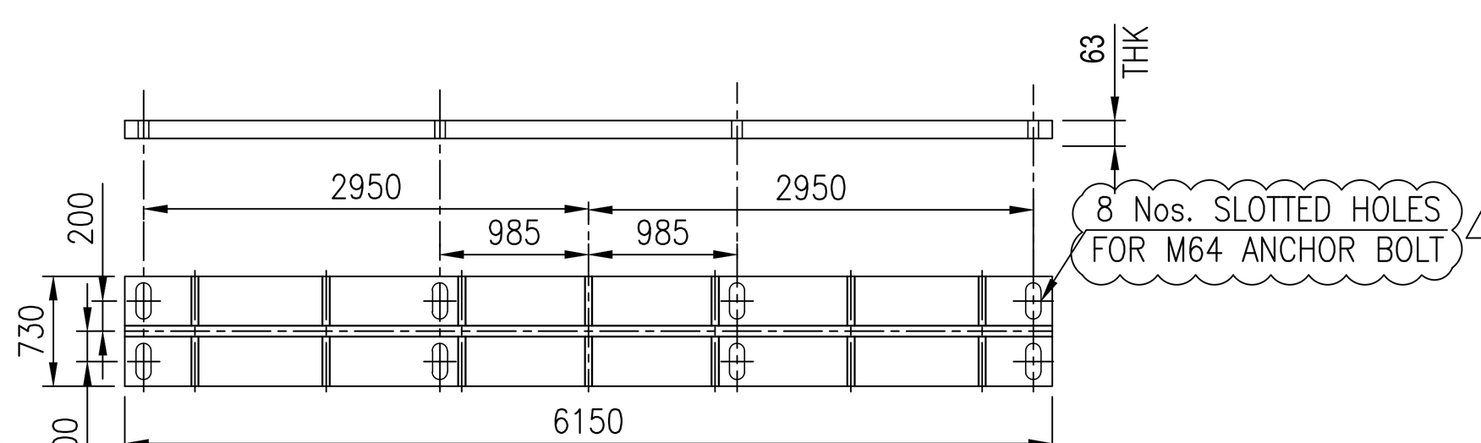
LIFTING TRUNNION



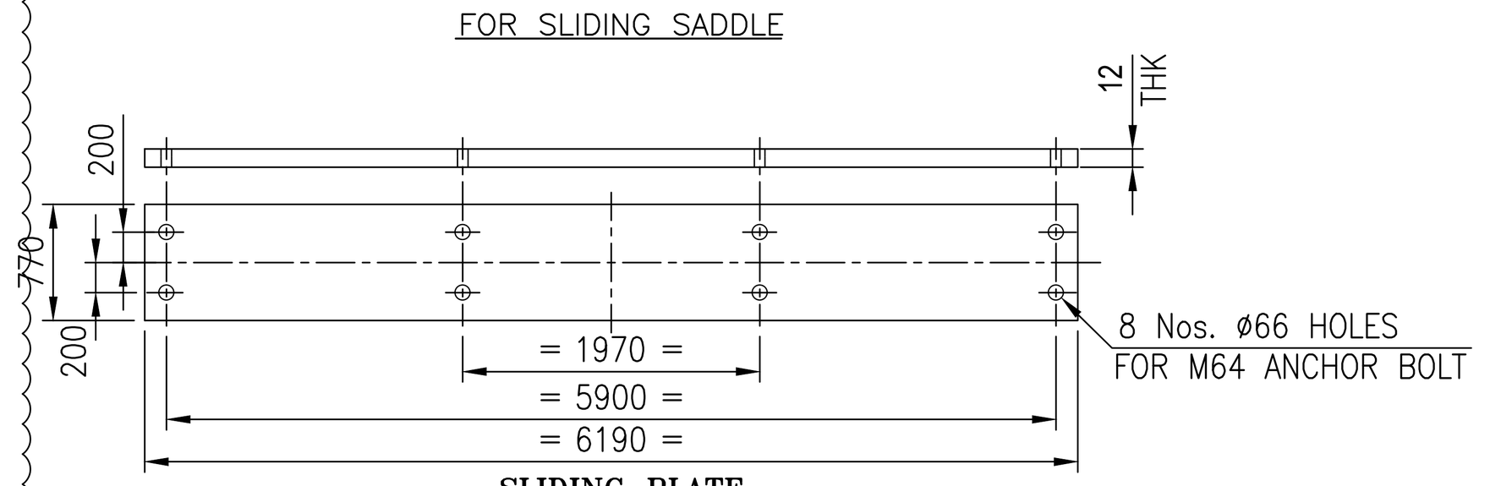
WEAR PL. WELD DETAIL



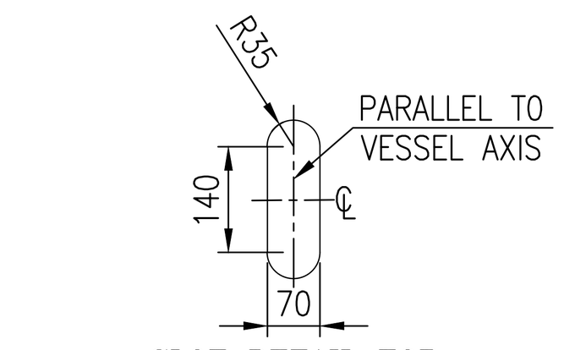
BASE PLATE
FOR FIXED SADDLE



BASE PLATE
FOR SLIDING SADDLE



SLIDING PLATE



SLOT DETAIL FOR
BASE PLATE OF SLIDING SADDLE
(TYP)

DESIGN DATA

SERVICE	HYDRO CARBON
DESIGN PRESSURE (INTL. | EXTERNAL) MPa (kg/cm^2)(g)	0.3432 (3.5) | NIL AT HIGHEST POINT
MAXIMUM ALLOWABLE WORKING PRESSURE MPa (kg/cm^2)(g)	0.3432 (3.5)
MAXIMUM ALLOWABLE PRESSURE MPa (kg/cm^2)(g)	1.3533 (13.8)
MAXIMUM ALLOWABLE EXTERNAL WORKING PRESSURE MPa (kg/cm^2)(g)	0.0601 (0.613)
DESIGN TEMPERATURE (INTL. | EXTERNAL) (°C)	415 | NIL
OPERATING PRESSURE MPa (kg/cm^2)(g)	0.118 (1.2)
OPERATING TEMPERATURE (°C)	310 – 396
STEAM OUT CONDITON MPa (kg/cm^2)(g)	0.05 (0.5) @ 170 °C
STEAM COIL DESIGN PRESSURE (INTL. | EXTERNAL) MPa (kg/cm^2)(g) 0.5394 (5.5) / (FULL VACUUM)| 0.3432 (3.5)	STEAM COIL AREA (m^2):80
STEAM COIL DESIGN TEMPERATURE (INTL. | EXTERNAL)(°C): 190 | 415	STEAM COIL MAWP MPa (kg/cm^2)(g): 0.5394 (5.5)
STEAM COIL HYDRO TEST PRESSURE MPa (kg/cm^2)(g): 0.712 (7.26)	STEAM COIL MAEWP MPa (kg/cm^2)(g): 1.639 (16.713)
PNEUMATIC TEST PRESSURE MPa (kg/cm^2) (g)	–NIL–
HYD.TEST PRESSURE AS PER UG-99(c) (AT SHOP) MPa (kg/cm^2)(g)	1.468 (14.97) AT 16 °C (MIN) / 48 °C(MAX) (AT HIGHEST POINT)
HYD.TEST PRESSURE AS PER UG-99(b) (AT SITE) MPa (kg/cm^2)(g)	0.490 (5.001) AT 16 °C (MIN) / 48 °C(MAX) (AT HIGHEST POINT)
CORROSION ALLOWANCE mm: 1.5 (EXTERNAL) | 3 CLAD/WOL (SHELL & HEAD) | 3 (FIXED INTERNALS) | 1.5 (REMOVABLE INTERNALS)	
MAXIMUM ALLOWABLE CORROSION ALLOWANCE (MACA) mm: 0	
CAPACITY (m^3)	737.935 | CLADDING (mm) 3
RADIOGRAPHY: (RT1) SHELL: 100% | HEAD: 100%	JOINT EFFICIENCY: SHELL: 1.0 | HEAD: 1.0
IMPACT TESTING = EXEMPTED (AS PER NOTE-3 OF FIG. UCS-66)	FABRICATED WEIGHT (Kg.) : ~149230.2
OTHER LOADINGS : YES AS PER UG-22(a), (b), (c), (d), (2), (f), (i), (j)	WEIGHT (EMPTY) (Kg.) : ~190989.7
INSULATION: (THK./HOT): 115 mm/HOT | FIRE PROOFING: NA	OPERATION WEIGHT (Kg.) : ~438824.8
DENSITY OF FLUID: Kg./ m^3 | 835	TEST WEIGHT (Kg.) : ~923613.2
POST WELD HEAT TREATMENT (AS PER UW-2,UCS-56,UCS-68,UCL-34(a)) | YES	SPECIAL SERVICE : NO | CYCLIC SERVICE : NO
MINIMUM DESIGN METAL TEMPERATURE °C | 12.5	VESSEL SL.NO : 26677
CODE STAMP REQUIRED | ☒ YES ☐ NO	CONSIGNMENT SIZE : ODC/~~ORDINARY~~
NB CODE STAMP REQUIRED | ☐ YES ☒ NO	POSITION OF VESSEL : HORIZONTAL
ASME CERTIFICATION MARK: YES WITH 'U' DESIGNATOR	HYDROTEST POSITION : HORIZONTAL IN SHOP
CODE: ASME BPVC.VIII.1: ED–2019	INSPECTION: AUTHORISED INSPECTION: M/s CEIL/TUV/BV one CIS Insurance company
NOZZLE LOAD DATA: APPLICABLE	STAGE WISE & THIRD PARTY INSPCTION: YES
WIND SPEED: 52 M/SEC	NATIONAL BOARD REGISTRATION | NOT REQUIRED
EARTHQUAKE SPECIFICATION: IS 1893 (PART 4)–2015 ED	WIND SPECIFICATION: | IS 875, PART–3: 2015 ED
EQUIMENT CATEGORY=1 & SITE SPECIFIC SEISMIC SPECTRA	WIND ZONE: 6 | RISK FACTOR : 1
IMPORTANCE FACTOR : 2 | SEISMIC ZONE : 3	TERRAIN CATEGORY: 3 | TOPOGRAPHY FACTOR : 1
POST FORMING HEAT TREATMENT	YES, AS PER THE CYCLE GIVEN BELOW*
LOCATION OF INSTALLATION	HPCL–VISAKHAPATNAM, A.P, INDIA

*DISHED ENDS SHALL BE COLD FORMED FOLLOWED BY HEAT TREATMENT CYCLE AS BELOW.

HEAT TREATMENT

Part	Procedure	Loading Temperature (°C)	Holding Temperature (°C)	Heating Rate (°C/hr)	Holding Time (min)	Cooling Rate °C/hr	Remarks
DISHED ENDS (SHELL)	STRESS RELIEVING/PWHT	<400°C	690±15°C	160°C/hr	90 minutes	200°C/hr	Unlaoding at 400°C
COMPLETE EQUIPMENT	STRESS RELIEVING/PWHT	<425°C	690±10°C	110°C/hr	150 minutes	140°C/hr	Unlaoding at 425°C

LIST OF PARTS

SL.NO.	DESCRIPTION	MATERIAL REFERENCE	MATERIAL SPECFICATION
01	SHELL, D'END	LAS PLATE WITH CLADDING	SA 387 GR.22 CL.2 + SS 347
02	NOZZLES WITH INTEGRAL FLANGES	FORGED STEEL + WOL	SA 182 GR.F22 CL.3 + SS 347
03	SADDLE WRAPPER PLATE	BQ PLATE (LAS)	SA 387 GR.22 CL.2
04	SADDLE SUPPORT & TRUNNION BASE PLATE	BQ PLATE (CS)	SA 516 GR.70
05	INTERNALS	STAINLESS STEEL	SA 240 TYP347
06	GASKET	SS 316 SPIRAL WOUND GRAFIL FILED WITH SS316 INNER RING & CS OUTER RING	SS316 SPIRAL WOUND
07	BOLTS & NUTS (EXT.)	ALLOY STEEL	SA 453 GR.660 CL.A
08	BOLTS & NUTS (INT.)	STAINLESS STEEL	SA 193 GR B8CA/ SA 194 GR 8CA
09	PIPE & PIPE FITTINGS (INTERNAL PIPE)	STAINLESS STEEL	SA312TP347, SA403WP347
10	EXTERNAL ATTACHMENTS	BQ PLATE (LAS)	SA387GR.22 CL.2
11	WEAR PLATE & STEAM COIL SUPPORT	STAINLESS STEEL	SA240TYP347
12	STEAM COIL	ALLOY 625	ALLOY 625
13	EARTHING LUG, VORTEX BREAKER	STAINLESS STEEL	SA240 TYP347

FOR GENERAL NOTES & OTHER APPLICABLE STD. PLEASE REFER DRG. NO: B016-RUF-LT-504-MS-FD-BHEL(1)-02660

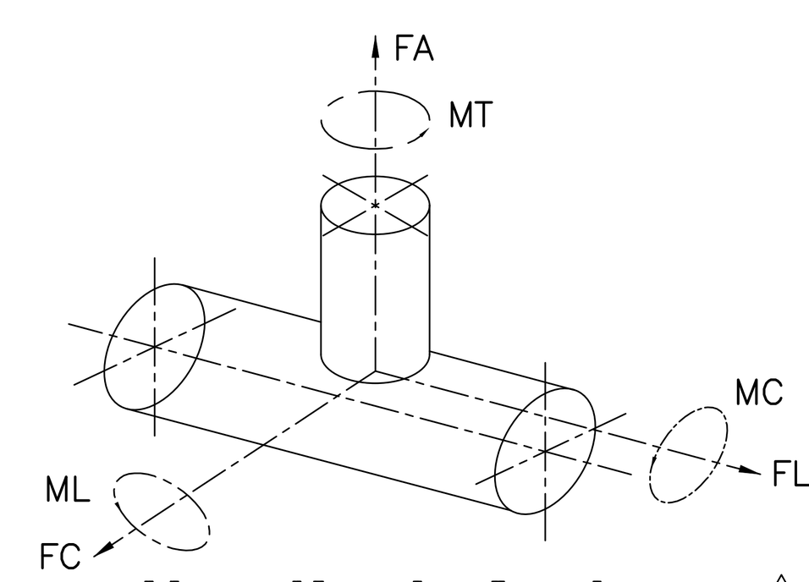
BHEL DRAWING NO.	CLIENT DOCUMENT NO.	DRAWING TITLE	REV.
2-PV-180-U0047	B016-RUF-LT-504-MS-DW-BHEL(1)-02661	TRANSPORTATION ARRANGEMENT DETAILS FOR HT FLARE KO DRUM (504-V-805A)	*
3-PV-180-U0190	B016-RUF-LT-504-MS-FD-BHEL(1)-02660	GENERAL NOTES FOR HT FLARE KO DRUM (504-V-805A)	*
3-PV-180-U0189	B016-RUF-LT-504-MS-FD-BHEL(1)-02659	NAME PLATE DETAILS FOR HT FLARE KO DRUM(504-V-805A)	*
3-PV-180-U0188	B016-RUF-LT-504-MS-FD-BHEL(1)-02658	FOUNDATION TEMPLATE FOR HT FLARE KO DRUM (504-V-805A)	*
3-PV-180-U0187	B016-RUF-LT-504-MS-FD-BHEL(1)-02657	DETAILS OF MANWAY DAVIT FOR HT FLARE KO DRUM (504-V-805A)	*
0-PV-180-U0021	B016-RUF-LT-504-MS-FD-BHEL(1)-02656	SHELL DEVELOPMENT OF HT FLARE KO DRUM (504-V-805A)	*
1-PV-180-U0122	B016-RUF-LT-504-MS-FD-BHEL(1)-02655	INSULATION SUPPORT DETAILS FOR HT FLARE KO DRUM (504-V-805A)	*
1-PV-180-U0121	B016-RUF-LT-504-MS-FD-BHEL(1)-02654	EXTERNAL ATTACHMENTS OF HT FLARE KO DRUM (504-V-805A)	*
1-PV-180-U0120	B016-RUF-LT-504-MS-FD-BHEL(1)-02652	ASSEMBLY DETAILS OF HT FLARE KO DRUM (504-V-805A)	*

REFERENCE DOCUMENT LIST
* REVISION NO. SHALL BE MENTIONED WHILE MAKING THE AS BUILT DRAWING.

MARK NO.	QTY.	SERVICE	NB (N.P.S)	O.D.	SCH. THK.	ID. AFTER CLADDING	R.F.PAD WIDTH x THK.	RATING CLASS	TYPE/ FACE	PROJE. SEE NOTE-3	REMARKS
14	1	MANWAY+B.F.+DAVIT	600 (24")	610	– / 14+W.O	576	LIP TYPE	300	SRN/R.F.	AS PER DRG.	
13	1	STEAM INLET	80 (3")	117	– / 20.4+W.O	70.2	--	300	LWN/R.F.	AS PER DRG.	
12B,D, F,H&J	5	LEVEL TAPS	80 (3")	117	– / 20.4+W.O	70.2	--	300	LWN/R.F.	AS PER DRG.	
12A,C, E,G&I	5	LEVEL TAPS	80 (3")	117	– / 20.4+W.O	70.2	--	300	LWN/R.F.	AS PER DRG.	
11	1	STEAM OUT	80 (3")	117	– / 20.4+W.O	70.2	--	300	LWN/R.F.	AS PER DRG.	
10B	1	TEMPERATURE CONTROL (TI)	80 (3")	117	– / 20.4+W.O	70.2	--	300	LWN/R.F.	AS PER DRG.	
10A	1	TEMPERATURE CONTROL (TI)	80 (3")	117	– / 20.4+W.O	70.2	--	300	LWN/R.F.	AS PER DRG.	
9A & 9B	2	PRESSURE GAUGE (PT/PI)	80 (3")	117	– / 20.4+W.O	70.2	--	300	LWN/R.F.	AS PER DRG.	
8	1	VENTILATION	200 (8")	219.1	– / 12+W.O	189.1	LIP TYPE	300	SRN/R.F.	AS PER DRG.	
7	1	VENT	80 (3")	117	– / 20.4+W.O	70.2	--	300	LWN/R.F.	AS PER DRG.	
6	1	CONDENSATE OUTLET	80 (3")	117	– / 20.4+W.O	70.2	--	300	LWN/R.F.	AS PER DRG.	
5	1	COLD SRVGO	250 (10")	273	– / 12+W.O	243	LIP TYPE	300	SRN/R.F.	AS PER DRG.	
4	1	PUMP MIN. FLOW	200 (8")	219.1	– / 12+W.O	189.1	LIP TYPE	300	SRN/R.F.	AS PER DRG.	
3	1	OIL OUTLET	300 (12")	323.8	– / 16+W.O	285.8	LIP TYPE	600	SRN/R.F.	AS PER DRG.	
2	1	VAPOUR OUTLET	1250 (50")	1277.9	– / 16+W.O	1239.9	LIP TYPE	300	SRN/R.F.	AS PER DRG.	FLANGE AS PER ASME:16.47 SERIES–B
1A & 1B	2	FEED INLET	900 (36")	920.8	– / 16+W.O	882.8	LIP TYPE	300	SRN/R.F.	AS PER DRG.	FLANGE AS PER ASME:16.47 SERIES–B

TABLE OF NOZZLES AND FLANGES

LIST OF HOLDS AS ON DATE
01. PIPE SUPPORT & PLATFORM SUPPORT CLEATS



Max. Nozzle Load

Nozzle Mark	NB	FA (kgf)	FL (kgf)	FC (kgf)	MT (kgf–m)	ML (kgf–m)	MC (kgf–m)
6A,6B,6C,11, 13A,13B,13C	3"	300	300	300	112	90	67
5	10"	1000	1000	1000	1250	1000	2100
4	8"	800	800	800	800	640	480
3	12"	1500	3000	1500	2000	4500	1500
2	50"	19000	10000	14500	92500	25000	29000
1A & 1B	36"	3600	3600	3600	16200	12960	9720

WELD JOINT TOLERANCES

TABLE – 1

Sl.No.	TOLERANCE APPLICABLE	TOLERANCE
01.	BEVEL ANGLE / INCLUDING ANGLE	
	a). > 35°	± 5°
	b). 20° – 35°	± 2°
	c). < 20°	± 1°
02.	ROOT GAP	
	a). ≤ 3	± 1
	b). 1 < ROOT GAP < 3	± 0.5
	c). ≤ 1	+ 0.5 – 0.0

LOAD DATA

SHEAR AT BASE (kgs)	EMPTY	IN OPERATION
DUE TO SEISMIC	–	65548(DBE)/85295(MCE)
DUE TO WIND	–	21811
MOMENT AT BASE (kg–m)		
DUE TO SEISMIC	–	241215(DBE)/ 313884(MCE)
DUE TO WIND	–	80263

APPLICABLE STANDARDS

1. ASME BOILER & PRESSURE VESSEL CODE SEC VIII DIV 1 : ED–2019
2. ASME BOILER & PRESSURE VESSEL CODE SEC II PART A, C & D : ED–2019
3. ASME BOILER & PRESSURE VESSEL CODE SEC V : ED–2019
4. ASME BOILER & PRESSURE VESSEL CODE SEC IX ED–2019
5. ASME B16.5 ED–2013–STANDARD FOR PIPE FLANGES AND FLANGED FITTINGS.
6. ASME B16.47 ED–2017–STANDARD FOR LARGE DIAMETER STANDARD FLANGES
7. ASME B16.11 ED–2016 FORGED STEEL FITTINGS, SOCKET WELDED & THREADED
8. ASME B36.10M ED–2018 WELDED AND SEAMLESS WROUGHT STEEL PIPE
9. ASME B1.20.1 ED–2013 PIPE THREADS, GENERAL PURPOSE (INCH)
10. ASME B16.20 ED–2017 METALLIC GASKETS FOR PIPE FLANGES
11. ASME B36.19M ED–2018 STAINLESS STEEL PIPE

No. OF CIRCUMFERENTIAL SEAMS FOR SHELL: 8
No. OF LONGITUDINAL SEAMS: 2 PER SECTION

L&T - CHIYODA LIMITED

- ☐ REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
- ☐ REVIEW CODE 2 – PROCEED WITH MANUFACTURE/ FABRICATION /CONSTRUCTION AS PER THE COMMENTED DOCUMENT. REVISED DOCUMENT REQUIRED.
- ☐ REVIEW CODE 3 – DOCUMENT DOES NOT CONFORM TO BASIC REQUIREMENTS AS MARKED. RESUBMIT FOR REVIEW.
- ☐ R – DOCUMENT IS RETAINED FOR RECORDS. PROCEED WITH MANUFACTURE / FABRICATION
- ☐ V–VOID

COMMENTED BY	REVIEWED BY	APPROVED BY	DATE

THIS REVIEW / APPROVAL DOES NOT RELIEVE THE VENDOR / MANUFACTURER OF THE FULL RESPONSIBILITY AS TO DESIGN CORRECTNESS OF DIMENSIONS & COMPLIANCE WITHALL APPLICABLE REGULATIONS AND WITH THE REQUIREMENTS MADE IN PURCHASER SPECIFICATIONS.

DRAWING NO.	DRAWING TITLE	REV
XXX.XXXX.XXXX.XXXX	XXX	X

REFERENCE DOCUMENTS / DRAWINGS

DRG. CATEGORY: (USE TICK MARK) [R] [I]
SCH. DATE OF SUBMISSION
EIL REVIEW/APPROVAL CODE:
VPTL NO.:

DOCUMENT STATUS
STATEMENT OF SUB: [1st] [2nd] [3rd]
☐ FINAL FOR CODE–1 ☐ AS BUILT
ISSUED FOR
☐ AS BUILT ☐ INFORMATION
☐ CONSTRUCTION ☐ REVIEW
SIGN: DATE:

- ☐ REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
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- ☐ V–VOID

NAME DICIPLINE SIGN. DATE

REV.	DESCRIPTION	DRN	CHECKED	APPROVED	REVIEWED	APPROVED	DATE
02	COMMENTS ON REV–01 INCORPORATED	MK	AVR	TK			17.10.20
01	COMMENTS OF L&T INCORPORATED	MK	AVR	TK			07.07.20
00	ISSUED FOR APPROVAL	MK	AVR	TK			22.05.20

OWNER: HINDUSTAN PETROLEUM CORPORATION LIMITED
VISAKH REFINERY MODERNIZATION PROJECT
EPCC–03 PACKAGE FOR RESIDUE UP–GRADATION FACILITY (RUF)

PMC: इंजीनियर्स इंडिया लिमिटेड (भारत सरकार का उपक्रम) ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

LSTK CONTRACTOR: L&T Hydrocarbon Engineering

DETAILED ENGINEERING CENTER: L&T - CHIYODA LIMITED

VENDOR: Bharat Heavy Electricals Limited
UNIT: HEAVY PLATES & VESSELS PLANT
VISAKHAPATNAM–530012

VENDOR PO NO: Refinery/75000–66912/NG; DATE:18.03.2020

VENDOR DWG. NO: 1–PV–180–U0119, REV.02

DATE 07.07.20	SCALE 1 : 70
DEPT: HT ENGG.	
DRN BY: MUNAYYA K	
CHK BY: A V RAO	
APP BY: TARAKESH K	

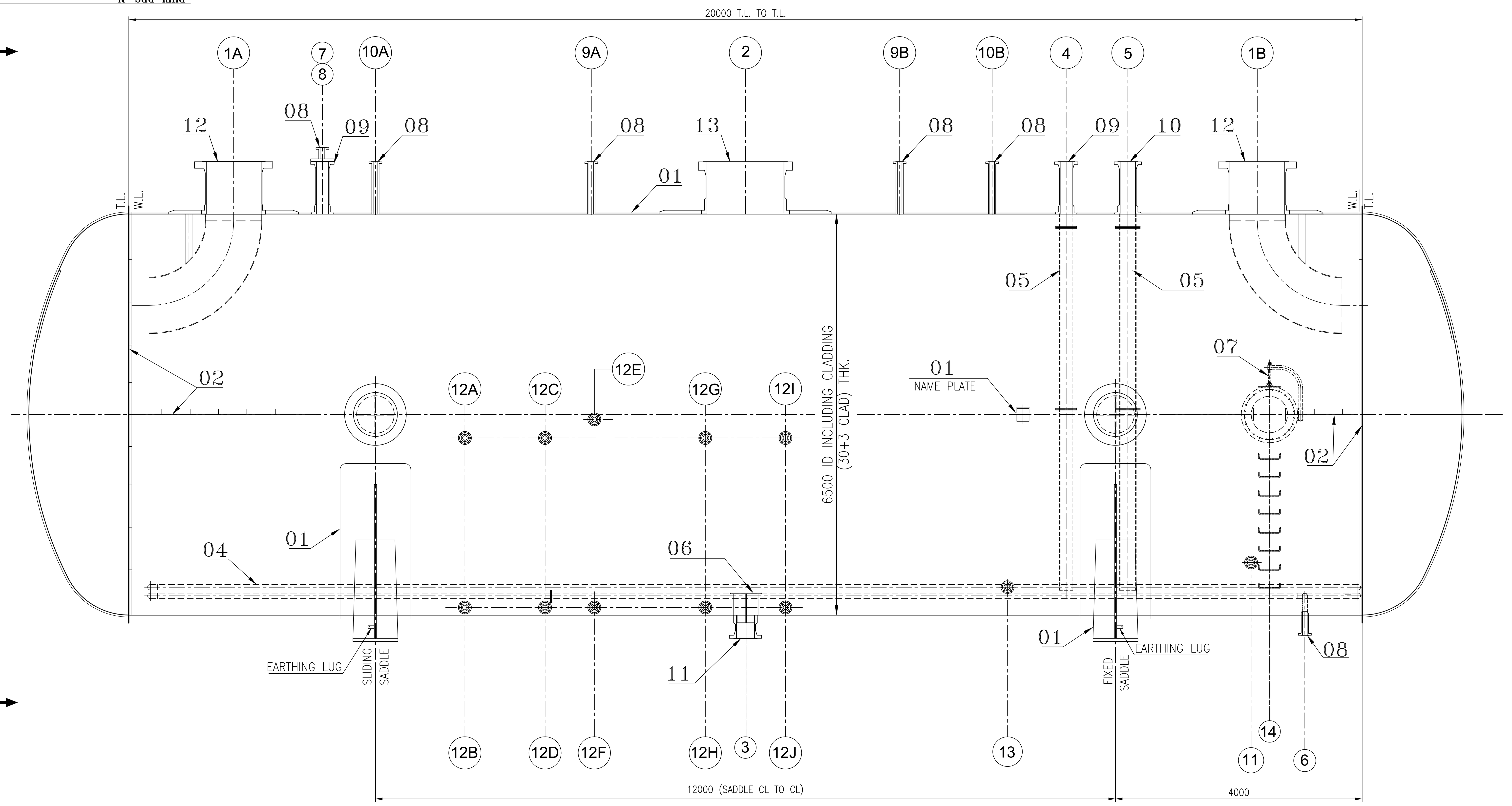
TITLE: GENERAL ASSEMBLY OF HIGH TEMPERATURE FLARE KNOCK OUT DRUM ITEM NO. 504–V–805A

PROJECT:
PWO NO.:
DRG. NO.: B016–RUF–LT–504–MS–GA–BHEL(1)–02651
SH. 01 of 01
REV. 02

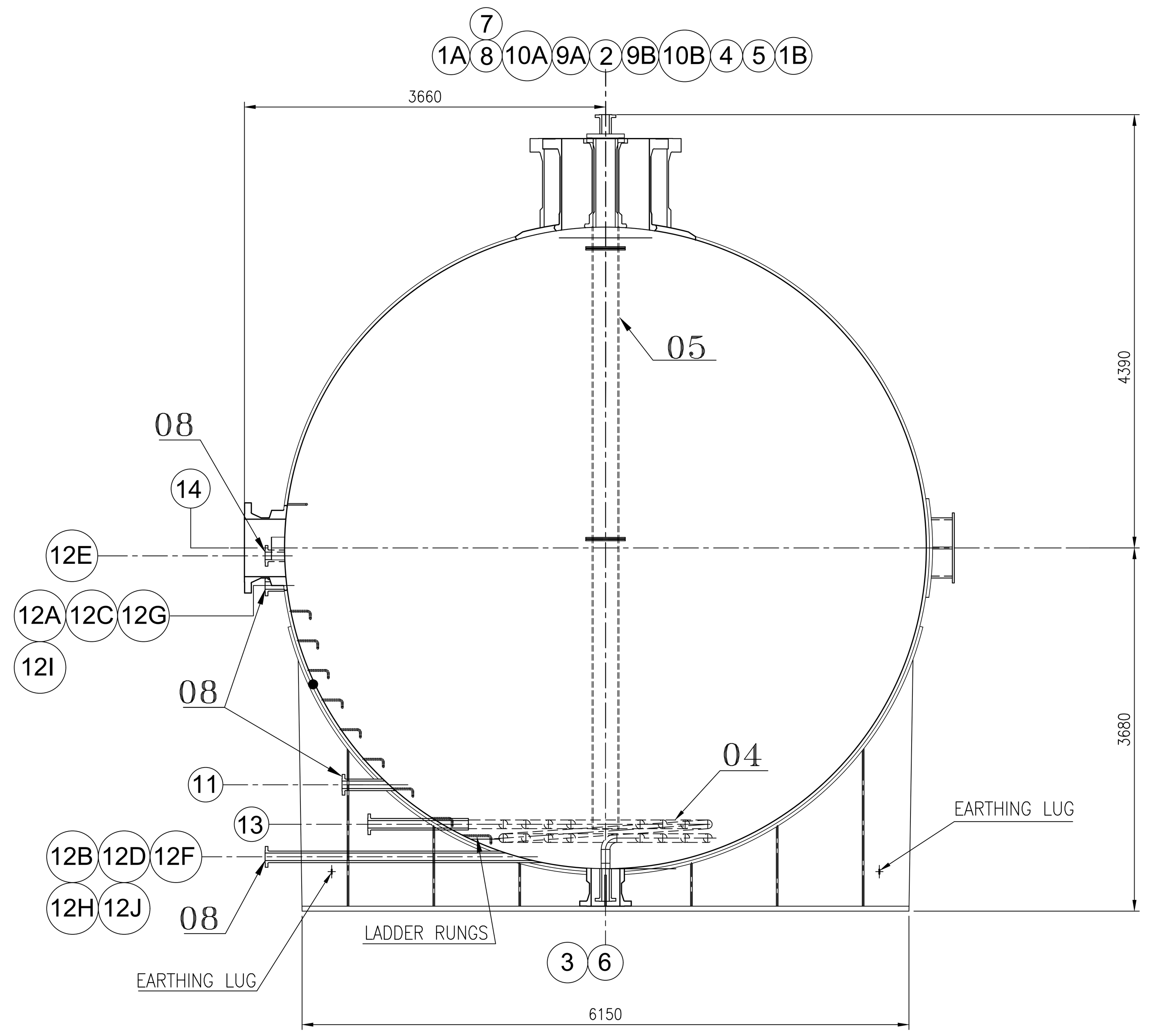
CAD REVISE THIS DRG. USING CAD SYSTEM ONLY FILE:

BHEL DRG. No. 1-PV-180-U0120
DWG. NO. B016-RUF-LT-504-MS-FD-BHEL(1)-02652

SPECIAL NOTE:
BHEL SHALL ENSURE COMPLIANCE OF ALL DIMENSIONS/SKETCHES IN THIS MANUFACTURING ASSEMBLY DRAWING W.R.T GENERAL ASSEMBLY DRAWING: B016-RUF-LT-504-MS-GA-BHEL(1)-02651



ELEVATION



VIEW A-A

BHEL DRAWING NO.	CLIENT DRAWING NO.	DRAWING TITLE	REV
3-PV-180-U0190	B016-RUF-LT-504-MS-FD-BHEL(1)-02660	GENERAL NOTES FOR HT FLARE KO DRUM (504-V-805A)	**
1-PV-180-U0119	B016-RUF-LT-504-MS-GA-BHEL(1)-02651	GENERAL ASSEMBLY OF HT FLARE KO DRUM (504-V-805A)	**

REFERENCE DOCUMENTS / DRAWINGS (** LATEST REVISION No. TO BE UPDATED IN ASBUILT DRAWING)

VARIANT NUMBER	ITEM NUMBER	DESCRIPTION	STD	DRAWING NUMBER	ITEM NO / VAR NO	MATERIAL CODE / MATERIAL SPECIFICATION	A/C/P	UNIT / D1	UNIT WEIGHT / QUANTITY
	13	BLANK FLANGES FOR NOZZLE-2 NPS 50", 300#		3-PV-180-U0239		SA 105 SA 193Gr.B7/SA194Gr.2H		SET	2445.700 1
	12	BLANK FLANGES FOR NOZZLE-1A,1B NPS 36", 300#		3-PV-180-U0239		SA 105 SA 193Gr.B7/SA194Gr.2H		SET	1282.112 2
	11	BLANK FLANGES FOR NOZZLE-3 NPS 12", 600#		3-PV-180-U0239		SA 105 SA 193Gr.B7/SA194Gr.2H		SET	132.690 1
	10	BLANK FLANGES FOR NOZZLE-5 NPS 10", 300#		3-PV-180-U0239		SA 105 SA 193Gr.B7/SA194Gr.2H		SET	77.748 1
	09	BLANK FLANGES FOR NOZZLE-4,8 NPS 8", 300#		3-PV-180-U0239		SA 105 SA 193Gr.B7/SA194Gr.2H		SET	44.760 2
	08	BLANK FLANGES FOR NOZZLES 12A TO 12J,13A,B,C,6A,B,C,9A,B,10A,B,11,7-3" 300#		3-PV-180-U0239		SA 105 SA 193Gr.B7/SA194Gr.2H		SET	4.100 22
	07	DETAILS OF MAN-WAY DAVIT FOR HT FLARE KO DRUM (504-V-805A)		3-PV-180-U0187					495.631 1
	06	STRAINER & VORTEX BREAKER OF ASSLY DETAILS - (504-V-805A)		3-PV-180-U0226					63.302 1
	05	INTERNAL PIPES FOR HT FLARE KO DRUM (504-V-805A)		2-PV-180-U0053					1158.154 1
	04	STEAM COIL AND SUPORTS FOR HT FLARE KO DRUM (504-V-805A)		1-PV-180-U0142					2077.78 1
	03	EXTERNAL ATTACHMENTS OF HT FLARE KO DRUM (504-V-805A)		1-PV-180-U0121					-- 1
	02	INSULATION SUPPORT DETAILS OF HT FLARE KO DRUM (504-V-805A)		1-PV-180-U0122					70.680 1
	01	SHELL ASSEMBLY DETAILS OF HT FLARE KO DRUM (504-V-805A)		1-PV-180-U0145					160697.100 1

DRG. CATEGORY: (USE TICK MARK) R I
SCH. DATE OF SUBMISSION
EIL REVIEW/APPROVAL CODE:
VPTL NO.:

DOCUMENT STATUS
STATEMENT OF SUB: 1st 2nd 3rd
☐ FINAL FOR CODE-1 ☐ AS BUILT
ISSUED FOR
☐ AS BUILT ☐ INFORMATION
☐ CONSTRUCTION ☐ REVIEW
SIGN: DATE:

☐ REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
☐ REVIEW CODE 2 – PROCEED WITH MANUFACTURE / FABRICATION / CONSTRUCTION AS PER THE COMMENTED DOCUMENT. REVISED DOCUMENT REQUIRED.
☐ REVIEW CODE 3 – DOCUMENT DOES NOT CONFORM TO BASIC REQUIREMENTS AS MARKED. RESUBMIT FOR REVIEW.
☐ R – DOCUMENT IS RETAINED FOR RECORDS. PROCEED WITH MANUFACTURE / FABRICATION
☐ V-VOID
NAME DICIPLINE SIGN. DATE

REV.	DESCRIPTION	DRN	CHECKED	APPROVED	REVIEWED	APPROVED	DATE
01	L&T COMMENTS INCORPORATED	MK	AVR	TK			16.10.20
00	ISSUED FOR APPROVAL	MK	AVR	TK			07.07.20

OWNER: HINDUSTAN PETROLEUM CORPORATION LIMITED
VISAKH REFINERY MODERNIZATION PROJECT
EPCC-03 PACKAGE FOR RESIDUE UP-GRADATION FACILITY (RUF)

PMC: इंजीनियर्स इंडिया लिमिटेड (भारत सरकार का उपक्रम) ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

LSTK CONTRACTOR: L&T Hydrocarbon Engineering

DETAILED ENGINEERING CENTER: L&T - CHIYODA LIMITED

L&T - CHIYODA LIMITED

☐ REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
☐ REVIEW CODE 2 – PROCEED WITH MANUFACTURE/ FABRICATION /CONSTRUCTION AS PER THE COMMENTED DOCUMENT. REVISED DOCUMENT REQUIRED.
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☐ R – DOCUMENT IS RETAINED FOR RECORDS. PROCEED WITH MANUFACTURE / FABRICATION
☐ V-VOID

COMMENTED BY	REVIEWED BY	APPROVED BY	DATE

THIS REVIEW / APPROVAL DOES NOT RELIEVE THE VENDOR / MANUFACTURER OF THE FULL RESPONSIBILITY AS TO DESIGN CORRECTNESS OF DIMENSIONS & COMPLIANCE WITHALL APPLICABLE REGULATIONS AND WITH THE REQUIREMENTS MADE IN PURCHASER SPECIFICATIONS.

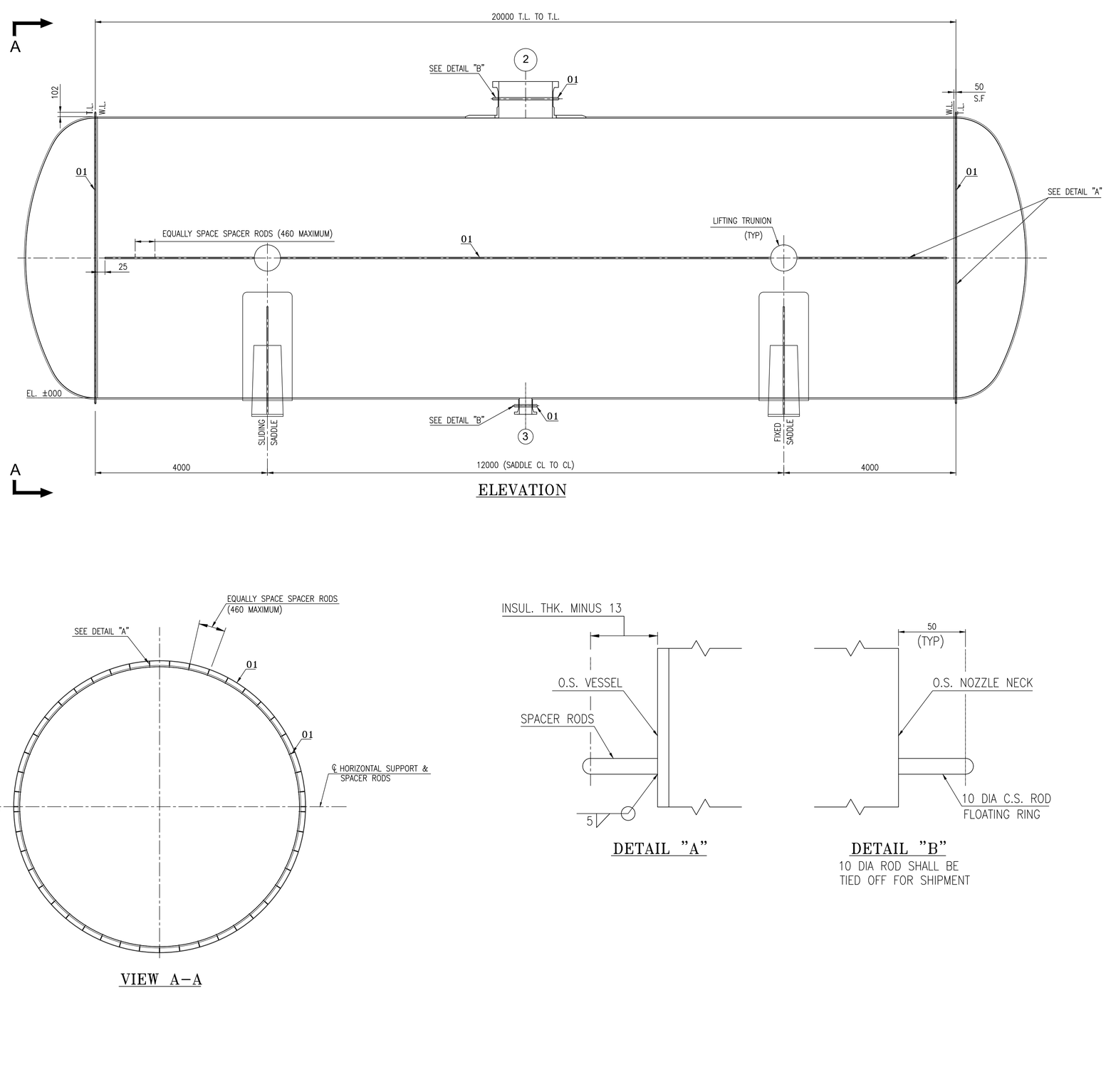
VENDOR: बीएचईएल BHEL
Bharat Heavy Electricals Limited
UNIT: HEAVY PLATES & VESSELS PLANT
VISAKHAPATNAM-530012

VENDOR PO NO: Refinery/75000-66912/NG; DATE:18.03.2020
VENDOR DWG. NO: 1-PV-180-U0120, REV.01

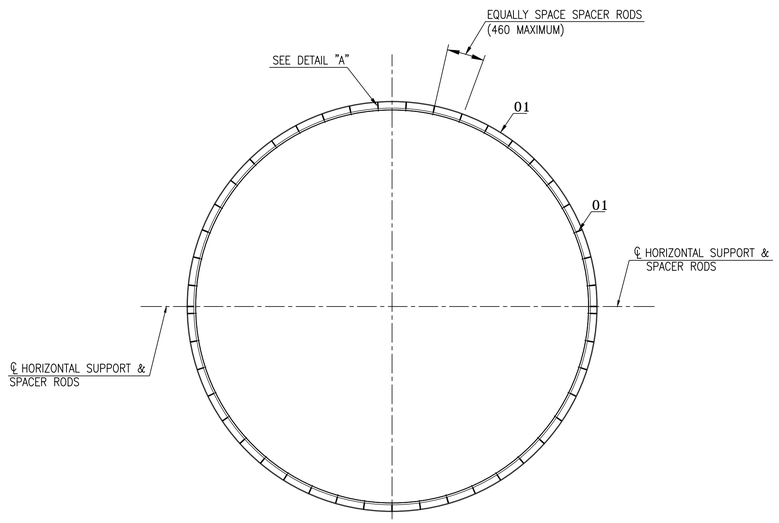
DATE: 07.07.20 SCALE: 1 : 70
TITLE: ASSEMBLY DETAILS OF HT FLARE KO DRUM ITEM NO. 504-V-805A
DEPT: HT ENGG.
DRN BY: MUNAYYA K
CHK BY: A V RAO
APP BY: TARAKESH K
PROJECT:
PWO NO.:
DRG. NO.: B016-RUF-LT-504-MS-FD-BHEL(1)-02652
SH. 01 of 08
REV. 01
CAD REVISE THIS DRG. USING CAD SYSTEM ONLY FILE:

A1

BHEL DRG. No. 1-PV-180-U0122
DMC. NO. B016-RUF-LT-504-MS-FD-BHEL(1)-02655



ELEVATION



VIEW A–A

DETAIL "A"

DETAIL "B"
10 DIA ROD SHALL BE
TIED OFF FOR SHIPMENT

VARIANT NUMBER	ITEM NUMBER	DESCRIPTION	NO.	DRAWING NUMBER	ITEM NO / VAR NO	MATERIAL CODE / MATERIAL SPECIFICATION	A/C/S	MARK	UNIT WEIGHT / QUANTITY
	01	10 DIA ROD 114 M				SA 182 F22 CL.3			70.68 / 1

3-PV-180-U0190	B016-RUF-LT-504-MS-FD-BHEL(1)-02660	GENERAL NOTES FOR HT FLARE KO DRUM (504-V-805A)	**
1-80-180-U0119	B016-RUF-LT-504-MS-GA-BHEL(1)-02651	GENERAL ASSEMBLY OF HT FLARE KO DRUM (504-V-805A)	**
BHEL DRAWING NO.	CLIENT DRAWING NO.	DRAWING TITLE	REV. No.

REFERENCE DOCUMENTS / DRAWINGS ** SHALL BE UPDATED AT AS-BUILT STAGE

DRG. CATEGORY: (USE TICK MARK) R 1
SCH. DATE OF SUBMISSION
EIL REVIEW/APPROVAL
VPTL NO.:
CODE:

DOCUMENT STATUS
STATEMENT OF SUB: 1st 2nd 3rd
☐ FINAL FOR CODE-1 ☐ AS BUILT

ISSUED FOR
☐ AS BUILT ☐ INFORMATION
☐ CONSTRUCTION ☐ REVIEW

SIGN: DATE:

- ☐ REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
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- ☐ V–VOID

	NAME	DICIPLINE	SIGN.	DATE
☐ V–VOID				

REV.	DESCRIPTION	DRN	CHECKED	APPROVED	REVIEWED	APPROVED	DATE
00	ISSUED FOR APPROVAL	MK	AVR	TK			05.08.20

OWNER: HINDUSTAN PETROLEUM CORPORATION LIMITED
VISAKH REFINERY MODERNIZATION PROJECT
EPCC-03 PACKAGE FOR RESIDUE UP-GRADATION FACILITY (RUF)

PMC: इंजीनियर्स इंडिया लिमिटेड ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

LSTK CONTRACTOR: L&T Hydrocarbon Engineering

DETAILED ENGINEERING CENTER: L&T - CHIYODA LIMITED

VENDOR: Bharat Heavy Electricals Limited
UNIT: HEAVY PLATES & VESSELS PLANT
VISAKHAPATNAM-530012

VENDOR PO NO: Refinery/75000-66912/NG; DATE:18.03.2020

VENDOR DWG. NO: 1-PV-180-U0122, REV.00

DATE 05.08.20 | SCALE 1 : 50

TITLE: INSULATION SUPPORT DETAILS FOR HT FLARE KO DRUM (504-V-805A)

DEPT: HT ENGG.
DRN BY: MUNAYYA K
CHK BY: A V RAO
APP BY: TARAKESH K

PROJECT:
DRG. NO.: B016-RUF-LT-504-MS-FD-BHEL(1)-02655
SH. 01 of 01
REV. 00
PWO NO.:

CAD REFER THIS DRG. USING CAD SYSTEM ONLY FILE:

L&T - CHIYODA LIMITED

- ☐ REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
- ☐ REVIEW CODE 2 – PROCEED WITH MANUFACTURE/ FABRICATION /CONSTRUCTION AS PER THE COMMENTED DOCUMENT. REVISED DOCUMENT REQUIRED.
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- ☐ V–VOID

COMMENTED BY	REVIEWED BY	APPROVED BY	DATE

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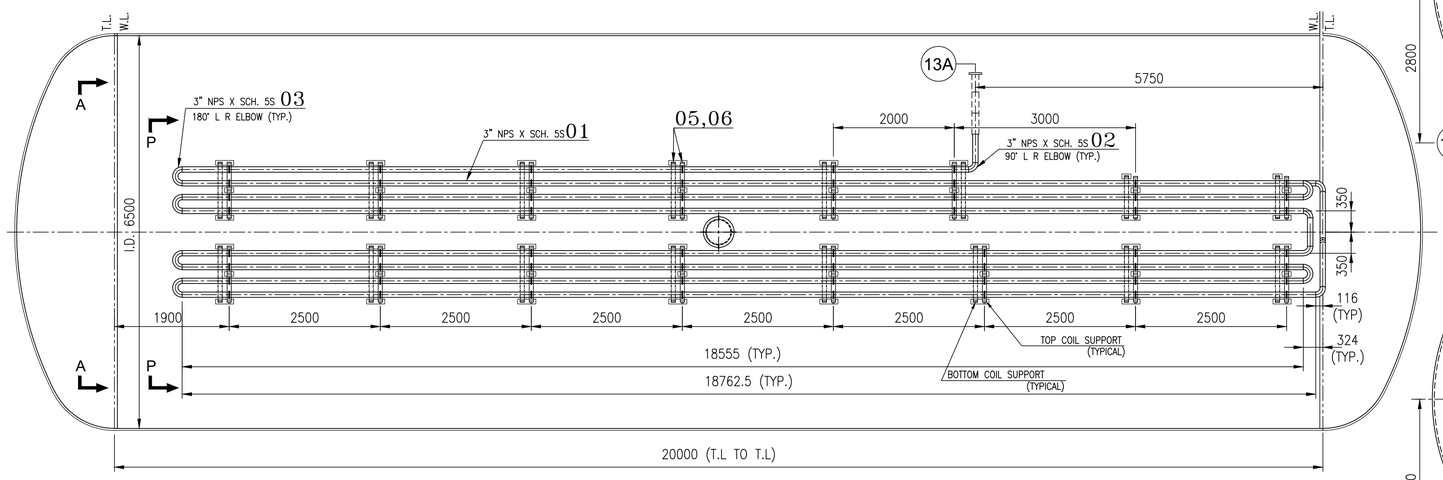
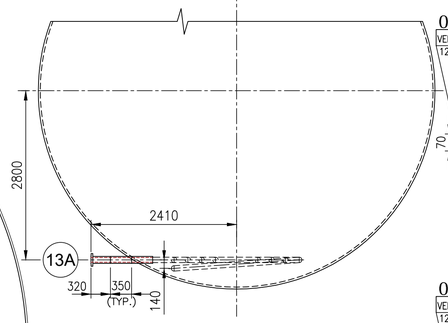
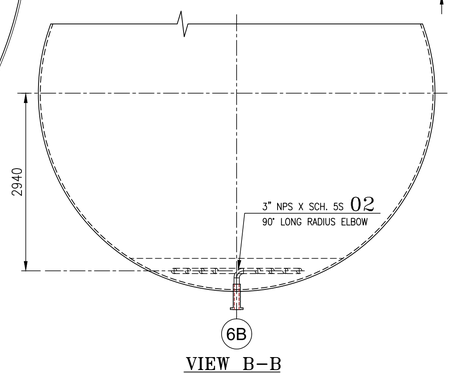
BHEL DRG. No. 1-PV-180-U01442
DMC. NO. B016-RUF-LT-504-MS-FD-BHEL(1)-02652



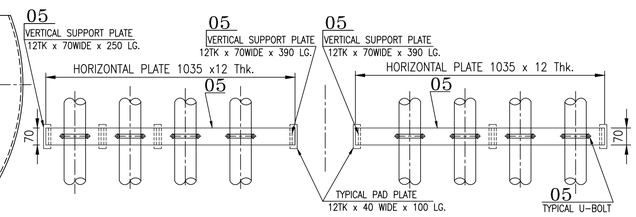
INTERNAL LAYOUT FOR TOP COIL



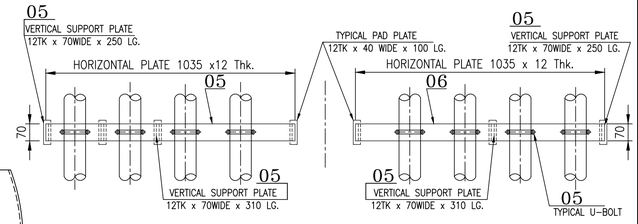
VIEW A–A



VIEW B–B

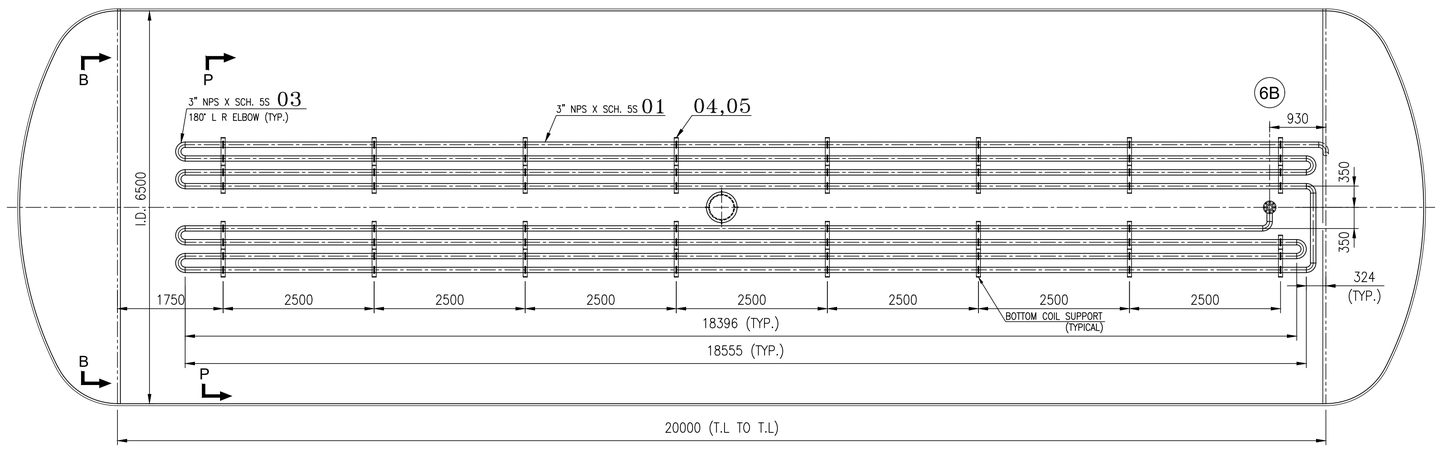


TYPICAL SUPPORT DETAILS FOR TOP COIL
(PLAN)



TYPICAL SUPPORT DETAILS FOR MIDDLE COIL
(PLAN)

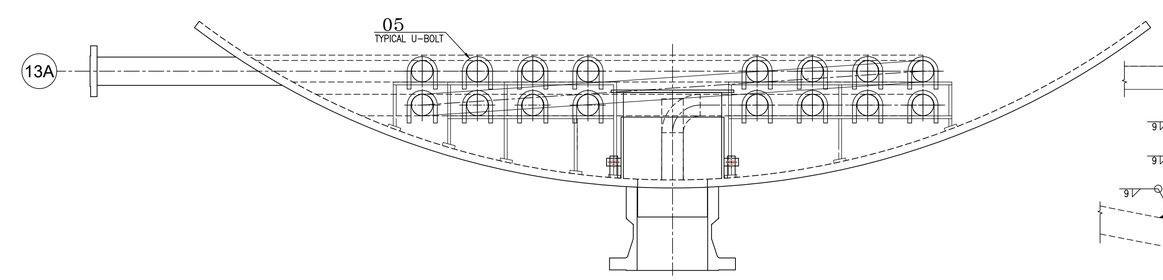
Total Weight: 2077.78Kgs.



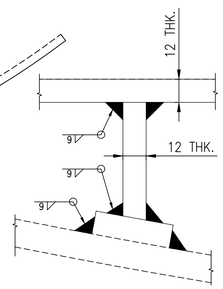
INTERNAL LAYOUT FOR BOTTOM COIL

282.0Mts.

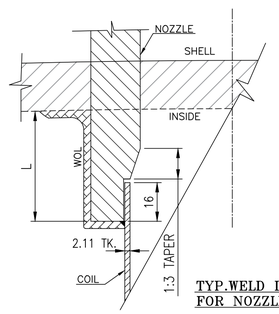
VARIANT NUMBER	ITEM NUMBER	DESCRIPTION	STD	DRAWING NUMBER	ITEM NO / VAR NO	MATERIAL CODE / MATERIAL SPECIFICATION	A/C/P	UNIT / QTY	UNIT WEIGHT / QUANTITY
	06								
	05	12TK x 2000 x 1500 – PLATE				SA 240 TP 347			284.04 02
	04	80NB U–CLAMPS WITH 4 HEX NUTS				SA182 F347/SA194 Gr.8CA			0.650 135
	03	LR 180° ELBOW OD 88.9 X 2.11 THK				SB366 (UNS NO6625)			3.260 12
	02	LR 90° ELBOW OD 88.9 X 2.11 THK				SB366 (UNS NO6625)			1.630 09
	01	PIPE OD 88.9 x 2.11 THK. 300 Mts.				SB444 (UNS NO6625)			1362.00 01



TYPICAL SUPPORT DETAILS FOR COIL
VIEW P–P (ELEVATION)

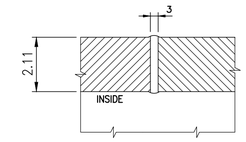


TYP. FILLET WELD DETAIL FOR SUPPORT PLATES



TYP.WELD DETAIL OF C–SEAM FOR NOZZLE TO PIPE / ELBOW

NOZZLE MARK NO.	L
6A	90
6B	90
6C	48
13A	156
13B	332
13C	194



TYP.WELD DETAIL OF C–SEAM FOR PIPE TO PIPE / ELBOW

SPECIAL NOTE:
BHEL SHALL ENSURE COMPLIANCE OF ALL DIMENSIONS/SKETCHES IN THIS MANUFACTURING ASSEMBLY DRAWING W.R.T GENERAL ASSEMBLY DRAWING: B016–RUF–LT–504–MS–GA–BHEL(1)–02651

L&T - CHIYODA LIMITED

- ☐ REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
- ☐ REVIEW CODE 2 – PROCEED WITH MANUFACTURE/ FABRICATION /CONSTRUCTION AS PER THE COMMENTED DOCUMENT. REVISED DOCUMENT REQUIRED.
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- ☐ R – DOCUMENT IS RETAINED FOR RECORDS. PROCEED WITH MANUFACTURE / FABRICATION
- ☐ V–VOID

COMMENTED BY	REVIEWED BY	APPROVED BY	DATE

THIS REVIEW / APPROVAL DOES NOT RELIEVE THE VENDOR / MANUFACTURER OF THE FULL RESPONSIBILITY AS TO DESIGN CORRECTNESS OF DIMENSIONS & COMPLIANCE WITHALL APPLICABLE REGULATIONS AND WITH THE REQUIREMENTS MADE IN PURCHASER SPECIFICATIONS.

DRG. CATEGORY: (USE TICK MARK) [R] [I]
SCH. DATE OF SUBMISSION
DOCUMENT STATUS
STATEMENT OF SUB: [1st] [2nd] [3rd]
☐ FINAL FOR CODE–1 ☐ AS BUILT
ISSUED FOR
☐ AS BUILT ☐ INFORMATION
☐ CONSTRUCTION ☐ REVIEW
SIGN: DATE:

EIL REVIEW/APPROVAL CODE: VPTL NO.:

- ☐ REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
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- ☐ V–VOID

NAME DICIPLINE SIGN. DATE

REV.	DESCRIPTION	DRN	CHECKED	APPROVED	REVIEWED	APPROVED	DATE
00	ISSUED FOR APPROVAL	MK	AVR	TK			16.10.20

OWNER: HINDUSTAN PETROLEUM CORPORATION LIMITED
VISAKH REFINERY MODERNIZATION PROJECT
EPCC–03 PACKAGE FOR RESIDUE UP–GRADATION FACILITY (RUF)

PMC : ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

LSTK CONTRACTOR: L&T Hydrocarbon Engineering

DETAILED ENGINEERING CENTER: L&T - CHIYODA LIMITED

VENDOR : Bharat Heavy Electricals Limited
UNIT: HEAVY PLATES & VESSELS PLANT
VISAKHAPTNAM–530012

VENDOR PO NO: Refinery/75000–66912/NG; DATE:18.03.2020
VENDOR DWG. NO: 1–PV–180–U0142, REV.01

DATE 16.10.20 SCALE 1 : 70
DEPT: HT ENGG.
DRN BY: MUNAYYA K
CHK BY: A V RAO
APP BY: TARAKESH K

TITLE: ASSEMBLY DETAILS OF HT FLARE KO DRUM ITEM NO. 504–V–805A

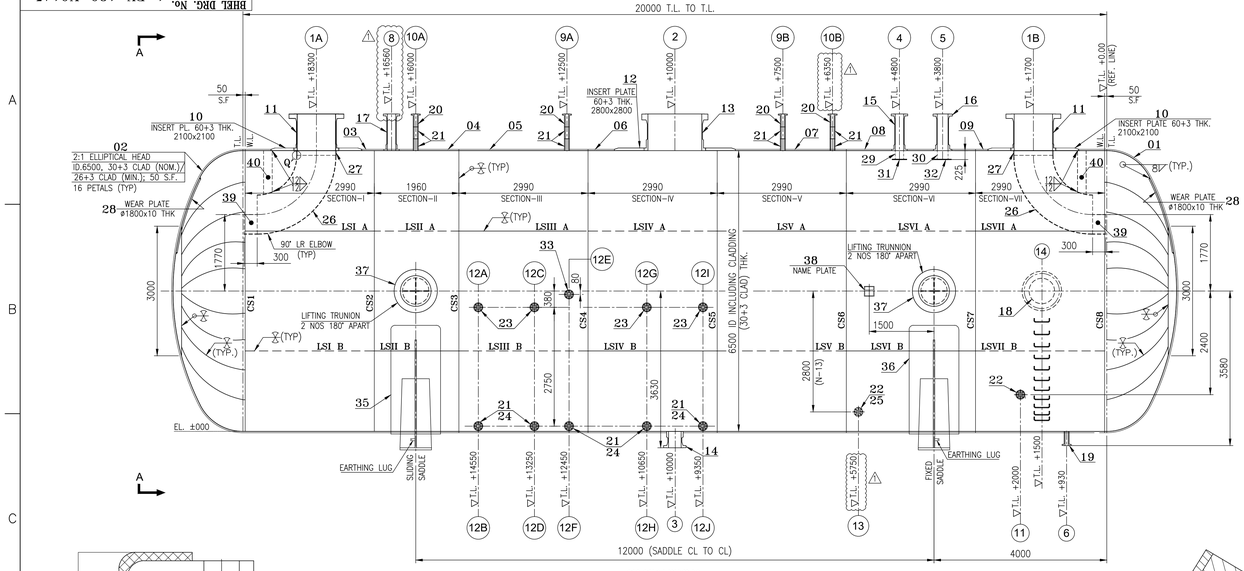
PROJECT:
DRG. NO.: B016–RUF–LT–504–MS–FD–BHEL(1)–02652
SH. 05 of 08
PWO NO.:
REV. 01

CAD HERE THIS DRG. USING CAD SYSTEM ONLY FILE:

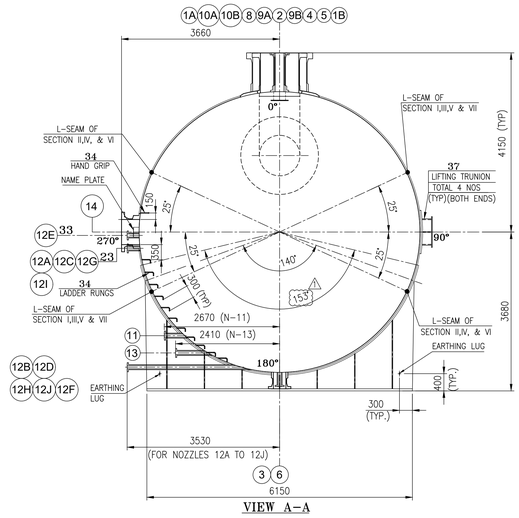
BHEL DRG. No. 1-PV-180-U0145

DWG. NO. B016-RUF-LT-504-MS-FD-BHEL(1)-02652

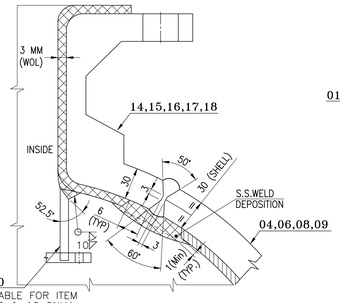
SPECIAL NOTE:
BHEL SHALL ENSURE COMPLIANCE OF ALL DIMENSIONS/SKETCHES IN THIS MANUFACTURING ASSEMBLY DRAWING W.R.T GENERAL ASSEMBLY DRAWING: B016-RUF-LT-504-MS-GA-BHEL(1)-02651



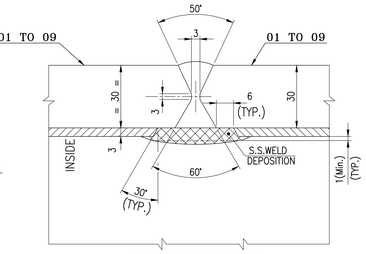
ELEVATION



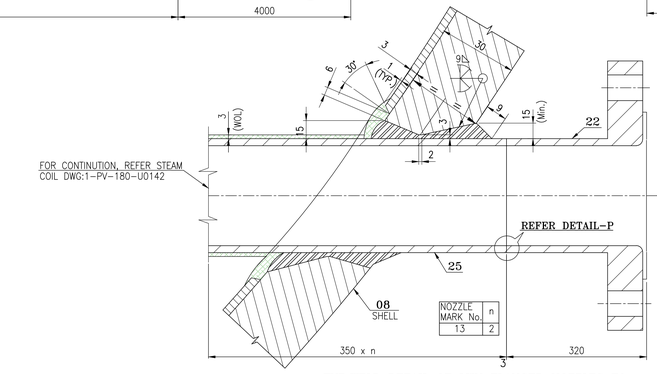
VIEW A-A



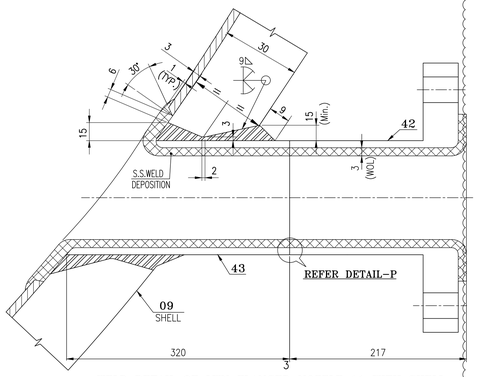
TYP.WELD DETAIL OF SR NOZZLE (LIP TYPE) TO SHELL
(FOR NOZZLE MARK Nos. 3,4,5,8,& 14)



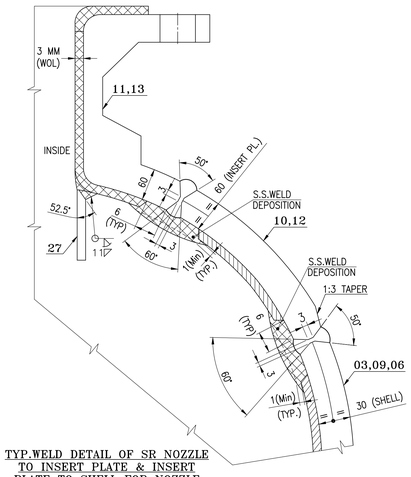
TYP.WELD DETAIL OF L-SEAM/C-SEAM FOR SHELL SECS. I TO VII & PETAL JOINTS OF LEFT & RIGHT DISHED ENDS



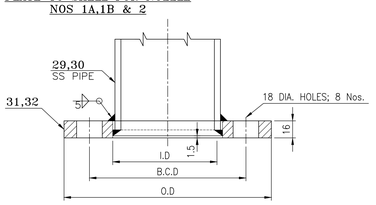
TYP.WELD DETAIL OF LWN FLANGED NOZZLES TO SHELL FOR NOZZLE NO. 13



WELD DETAIL OF LWN FLANGED NOZZLE 11 WITH SHELL

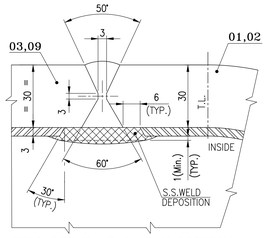


TYP.WELD DETAIL OF SR NOZZLE TO INSERT PLATE & INSERT PLATE TO SHELL FOR NOZZLE NOS 1A,1B & 2

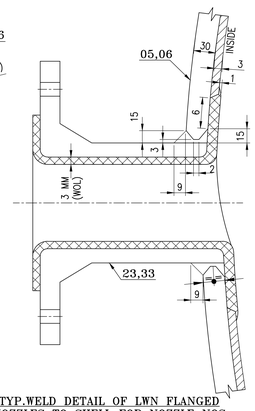


INTERNAL PIPE-FLANGE DETAIL FOR NOZZLE-1A,1B,4 & 5

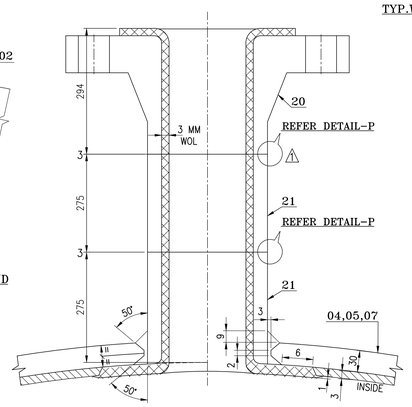
ITEM NO.	PIPE SIZE	I.D	B.C.D	O.D
31	200NB	222	290	340
32	250NB	276	350	400



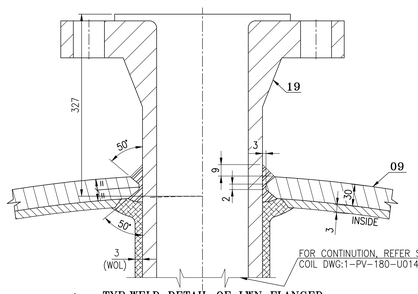
WELD DETAIL OF C-SEAM BETWEEN SHELL SEC.-I & LEFT DISHED END AND SHELL SEC.-VII & RIGHT DISHED END



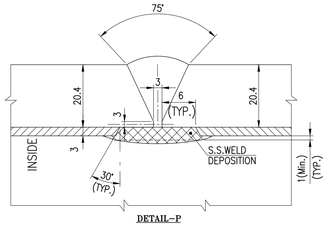
TYP.WELD DETAIL OF LWN FLANGED NOZZLES TO SHELL FOR NOZZLE NOS 12A,12C,12E,12G & 12I
(ITEM No.23 SHALL BE CUT SUITABLY TO ACHIEVE THE DESIRED PROJECTION LENGTH FOR DIFFERENT NOZZLES)



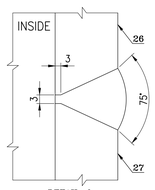
TYP.WELD DETAIL OF LWN FLANGED NOZZLES TO SHELL FOR NOZZLE NOS 9A,9B,10A, & 10B



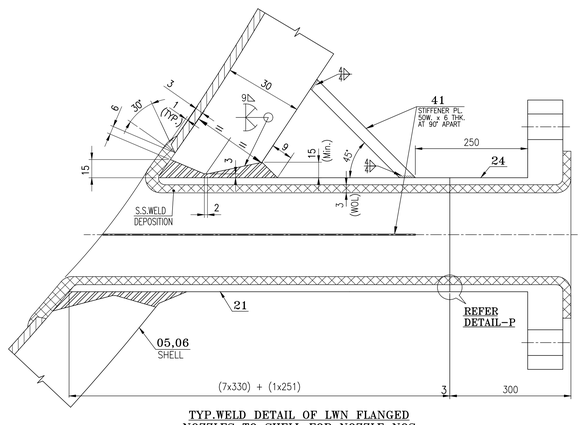
⚠ TYP.WELD DETAIL OF LWN FLANGED NOZZLES TO SHELL FOR NOZZLE No.6



DETAIL-P



DETAIL-Q



TYP.WELD DETAIL OF LWN FLANGED NOZZLES TO SHELL FOR NOZZLE NOS 12B,12D,12F,12H & 12J
(ITEM No. 24 & 33 SHALL BE CUT SUITABLY TO ACHIEVE THE DESIRED PROJECTION LENGTH FOR DIFFERENT NOZZLES)

TOTAL WEIGHT: 160697.1

	ITEM NUMBER	DESCRIPTION	SHD	DRAWING NUMBER	ITEM-NO / VAR-NO	MATERIAL CODE / MATERIAL SPECIFICATION	P. UNIT / QTY	UNIT WEIGHT / QUANTITY
	43	SPOOL FOR LWN NOZZLE – 11 OD. 117x20.4; L=CUT SUITABLY				SA182Gr.F22CL.3+3mm UNS S34700 WOL		17.175 1
	42	LWN NOZZLE – 11 NPS 3" x 300# RF; L=CUT SUITABLY				A243 81PV 1800 1011 SA182Gr.F22CL.3+3mm UNS S34700 WOL		20.815 1
	41	STIFFENER PL. FOR NOZ–12B,12D,12F,12H & 12J; 50 x 6 THK. ; 30 METRE				SA 387 GR.22 CL.2		70.650 1
	40	SUPPORT PL. FOR FEED INLET ELBOW 16 THK. x 200 x 1010				SA 312 TP 347		25.856 2
	39	HALF PIPE (PL. FORMED) OD.914 x 16 THK. ; L=300 mm				SA 312 TP 347		56.097 2
⚠	38	NAME PLATE BRACKET	3–PV–180–U0189			WELDMENT		8.522 1
⚠	37	LIFTING TRUNNION	1–PV–180–U0148			WELDMENT		301.118 4
⚠	36	FIXED SADDLE SUPPORT ASSEMBLY	1–PV–180–U0148			WELDMENT		6908.055 1
⚠	35	SLIDING SADDLE SUPPORT ASSEMBLY	1–PV–180–U0148			WELDMENT		7324.220 1
⚠	34	LADDER RUNGS & HAND GRIP	1–PV–180–U0148					22.024 1
⚠	33	LWN NOZZLE – 12E NPS 3" x 300# RF; L=280 (CUT SUITABLY)				A243 81PV 1800 1014 SA182Gr.F22CL.3+3mm UNS S34700 WOL		18.852 1
⚠	32	INTERNAL FLANGE FOR PIPE 250NB ID: 276 x OD: 400 x 16 THK.				SA 240 TP 347		8.427 1
⚠	31	INTERNAL FLANGE FOR PIPE 200NB ID: 222 x OD: 340 x 16 THK.				SA 240 TP 347		6.667 1
⚠	30	PIPE OD 273 x 15.09 THK. 250 LG.				SA 312 TP 347		21.526 1
⚠	29	PIPE OD 219.1 x 15.09 THK 250 LG.				SA 312 TP 347		17.022 1
⚠	28	WEAR PLATES ø1800 x 10THK				SA 240 TP 347		203.575 2
⚠	27	PL. FORMED PIPE OD 914x16 THK. 108 LG.				SA 240 TP 347		40.390 2
⚠	26	90° LR ELBOW; OD.914x15.88 THK.				SA 403 WP 347		795.000 2
⚠	25	LWN SPOOL – 13 OD. 117x20.4; L=CUT SUITABLY				SA182Gr.F22CL.3+3mm UNS S34700 WOL		17.175 2
⚠	24	LWN NOZZLE – 12B,12D,12F,12H & 12J NPS 3" x 300# RF; L=300 (CUT SUITABLY)				A243 81PV 1800 1013 SA182Gr.F22CL.3+3mm UNS S34700 WOL		12.891 5
⚠	23	LWN NOZZLE – 12A,12C,12G & 12I NPS 3" x 300# RF; L=307 (CUT SUITABLY)				A243 81PV 1800 1012 SA182Gr.F22CL.3+3mm UNS S34700 WOL		20.177 4
⚠	22	LWN NOZZLE – 13A,13B,13C NPS 3" x 300# RF; L=320				A243 81PV 1800 1011 SA182Gr.F22CL.3+3mm UNS S34700 WOL		20.815 3
⚠	21	LWN SPOOL – OD.117x20.4 THK 12B,12D,12F,12H & 12J; L=(CUT AS PER DWG.) 9A, 9B, 10A & 10B; L=275 (CUT SUITABLY)				A243 81PV 1800 1014 SA182Gr.F22CL.3+3mm UNS S34700 WOL		14.108 53
⚠	20	LWN NOZZLE – 9A,9B,10A & 10B NPS 3"x300# RF; L=CUT SUITABLY				A243 81PV 1800 1010 SA182Gr.F22CL.3+3mm UNS S34700 WOL		19.834 4
⚠	19	LWN NOZZLE – 6 NPS 3"x300# RF; L=CUT SUITABLY				A243 81PV 1800 1008 SA182Gr.F22CL.3+3mm UNS S34700 WOL		21.160 1
	18	SR NOZZLE – 14 NPS 24" x 300#; RF LIP				A243 81PV 1800 1007 SA182Gr.F22CL.3+3mm UNS S34700 WOL		530.000 1
	17	SR NOZZLE – 8 NPS 8" x 300#; RF LIP				A243 81PV 1800 1006 SA182Gr.F22CL.3+3mm UNS S34700 WOL		109.116 1
	16	SR NOZZLE – 5 NPS 10" x 300#; RF LIP				A243 81PV 1800 1005 SA182Gr.F22CL.3+3mm UNS S34700 WOL		152.500 1
	15	SR NOZZLE – 4 NPS 8" x 300#; RF LIP				A243 81PV 1800 1004 SA182Gr.F22CL.3+3mm UNS S34700 WOL		108.100 1
⚠	14	SR NOZZLE – 3 NPS 12" x 600#; RF LIP ⚠				A243 81PV 1800 1003 SA182Gr.F22CL.3+3mm UNS S34700 WOL		149.000 1
	13	SR NOZZLE – 2 NPS 50" x 300#; RF LIP				A243 81PV 1800 1002 SA182Gr.F22CL.3+3mm UNS S34700 WOL		1441.000 1
	12	INSERT PLATE FOR NOZZLE–2 (60+3 CLAD) x 2800 x 2800				1560 1897 0000 SA 387 GR.22 CL2+UNS S34700		3071.847 2
	11	SR NOZZLE – 1A & 1B NPS 36" x 300#; RF LIP				A243 81PV 1800 1001 SA182Gr.F22CL.3+3mm UNS S34700 WOL		933.000 2
	10	INSERT PLATE FOR NOZZLE 1A&1B (60+3 CLAD) x 2100 x 2100				1560 1897 0000 SA 387 GR.22 CL2+UNS S34700		1759.270 2
	09	SHELL SECTION–VII (30+3 CLAD) x 2990 x 10262				1560 2087 0000 SA 387 GR.22 CL2+UNS S34700		7948.530 2
	08	SHELL SECTION–VI (30+3 CLAD) x 2990 x 10262				1560 2087 0000 SA 387 GR.22 CL2+UNS S34700		7948.530 2
	07	SHELL SECTION–V (30+3 CLAD) x 2990 x 10262				1560 2087 0000 SA 387 GR.22 CL2+UNS S34700		7948.530 2
	06	SHELL SECTION–IV (30+3 CLAD) x 2990 x 10262				1560 2087 0000 SA 387 GR.22 CL2+UNS S34700		7948.530 2
	05	SHELL SECTION–III (30+3 CLAD) x 2990 x 10262				1560 2087 0000 SA 387 GR.22 CL2+UNS S34700		7948.530 2
	04	SHELL SECTION–II (30+3 CLAD) x 1960 x 10262				1560 2087 0000 SA 387 GR.22 CL2+UNS S34700		5210.410 2
	03	SHELL SECTION–I (30+3 CLAD) x 2990 x 10262				1560 2087 0000 SA 387 GR.22 CL2+UNS S34700		7948.530 2
	02	LEFT SIDE DISHED END (30+3 CLAD)	3–PV–010–U0102			1560 2087 0000 SA 387 GR.22 CL2+UNS S34700		12411.000 1
	01	RIGHT SIDE DISHED END (30+3 CLAD)	3–PV–010–U0102			1560 2087 0000 SA 387 GR.22 CL2+UNS S34700		12411.000 1

						XXX.XXXX.XXXX.XXXX	XXX	X
						DRAWING NO.	DRAWING TITLE	REV

REFERENCE DOCUMENTS / DRAWINGS

DRG. CATEGORY: (USE. TICK MARK) [R] [I]
SCH. DATE OF SUBMISSION
EIL REVIEW/APPROVAL CODE:
VPTL NO.:

DOCUMENT STATUS
STATEMENT OF SUB: [1st] [2nd] [3rd]
[ ] FINAL FOR CODE–1 [ ] AS BUILT
ISSUED FOR
[ ] AS BUILT [ ] INFORMATION
[ ] CONSTRUCTION [ ] REVIEW

[ ] REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
[ ] REVIEW CODE 2 – PROCEED WITH MANUFACTURE / FABRICATION / CONSTRUCTION AS PER THE COMMENTED DOCUMENT. REVISED DOCUMENT REQUIRED.
[ ] REVIEW CODE 3 – DOCUMENT DOES NOT CONFORM TO BASIC REQUIREMENTS AS MARKED. RESUBMIT FOR REVIEW.
[ ] R – DOCUMENT IS RETAINED FOR RECORDS. PROCEED WITH MANUFACTURE / FABRICATION
[ ] V–VOID

SIGN: DATE:

NAME DICIPLINE SIGN. DATE

REV.	DESCRIPTION	DRN	CHECKED	APPROVED	REVIEWED	APPROVED	DATE
01	COMMENTS OF L&T INCORPORATED	MK	AVR	TK			16.10.20
00	ISSUED FOR APPROVAL	MK	AVR	TK			07.07.20

OWNER: HINDUSTAN PETROLEUM CORPORATION LIMITED
VISAKH REFINERY MODERNIZATION PROJECT
EPCC–03 PACKAGE FOR RESIDUE UP–GRADATION FACILITY (RUF)

PMC: ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

LSTK CONTRACTOR: L&T Hydrocarbon Engineering

DETAILED ENGINEERING CENTER: L&T - CHIYODA LIMITED

L&T - CHIYODA LIMITED

[ ] REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
[ ] REVIEW CODE 2 – PROCEED WITH MANUFACTURE/ FABRICATION /CONSTRUCTION AS PER THE COMMENTED DOCUMENT. REVISED DOCUMENT REQUIRED.
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[ ] R – DOCUMENT IS RETAINED FOR RECORDS. PROCEED WITH MANUFACTURE / FABRICATION
[ ] V–VOID

COMMENTED BY	REVIEWED BY	APPROVED BY	DATE

THIS REVIEW / APPROVAL DOES NOT RELIEVE THE VENDOR / MANUFACTURER OF THE FULL RESPONSIBILITY AS TO DESIGN CORRECTNESS OF DIMENSIONS & COMPLIANCE WITHALL APPLICABLE REGULATIONS AND WITH THE REQUIREMENTS MADE IN PURCHASER SPECIFICATIONS.

VENDOR: Bharat Heavy Electricals Limited
UNIT: HEAVY PLATES & VESSELS PLANT
VISAKHAPATNAM–530012

VENDOR PO NO: Refinery/75000–66912/NG; DATE:18.03.2020
VENDOR DWG. NO: 1–PV–180–U0145, REV.01

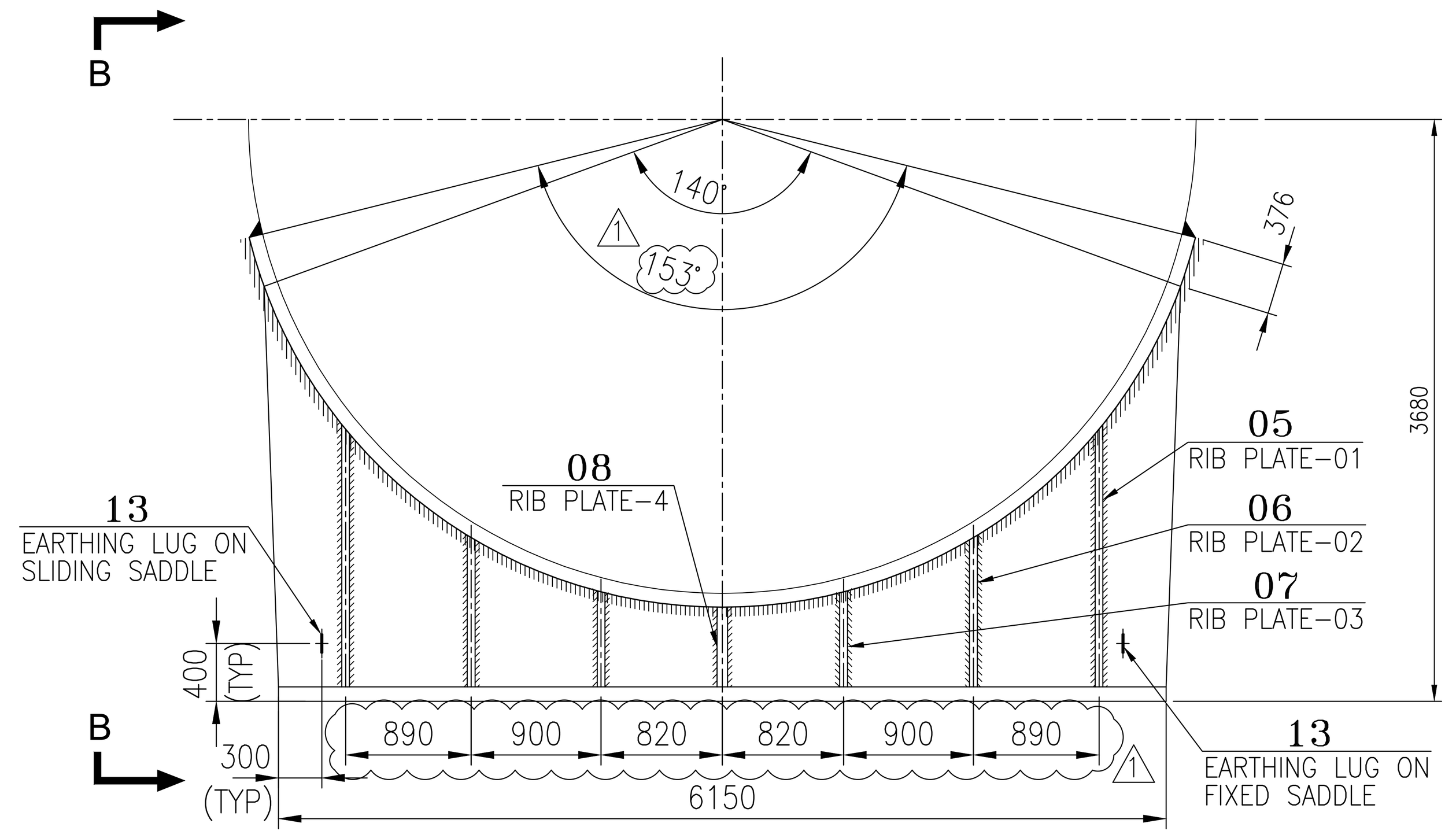
DATE 07.07.20 | SCALE 1 : 70
DEPT: HT ENGG.
DRN BY: MUNAYYA K
CHK BY: A V RAO
APP BY: TARAKESH K

TITLE: SHELL ASSEMBLY DETAILS OF HT FLARE KO DRUM ITEM NO. 504–V–805A

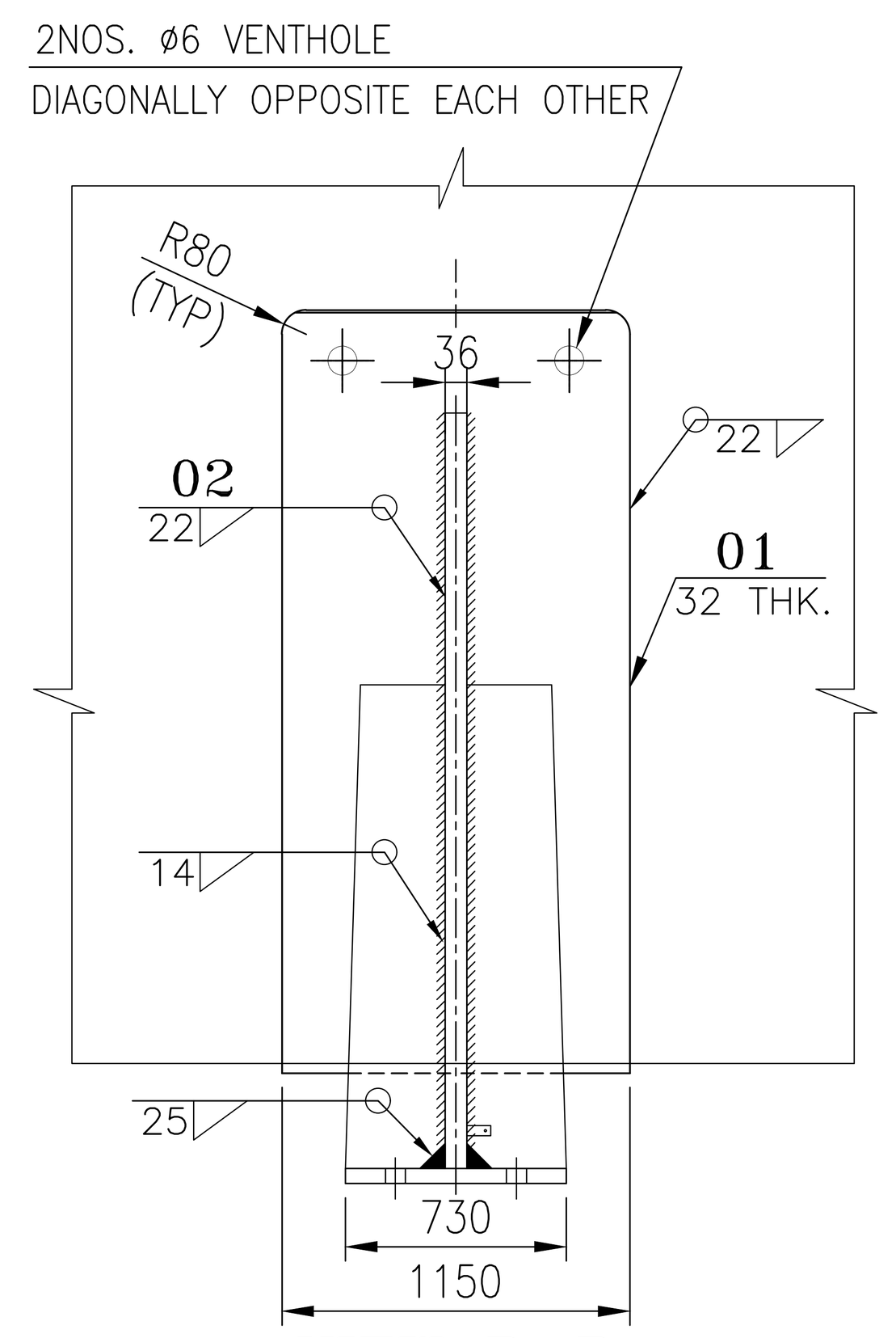
PROJECT:
CUSTOMER REFERENCE DRG. NO.: B016–RUF–LT–504–MS–FD–BHEL(1)–02652
SH. 02 of 07
PWO NO.:
REV. 01

CAD REFER THIS DRG. USING CAD SYSTEM ONLY FILE:

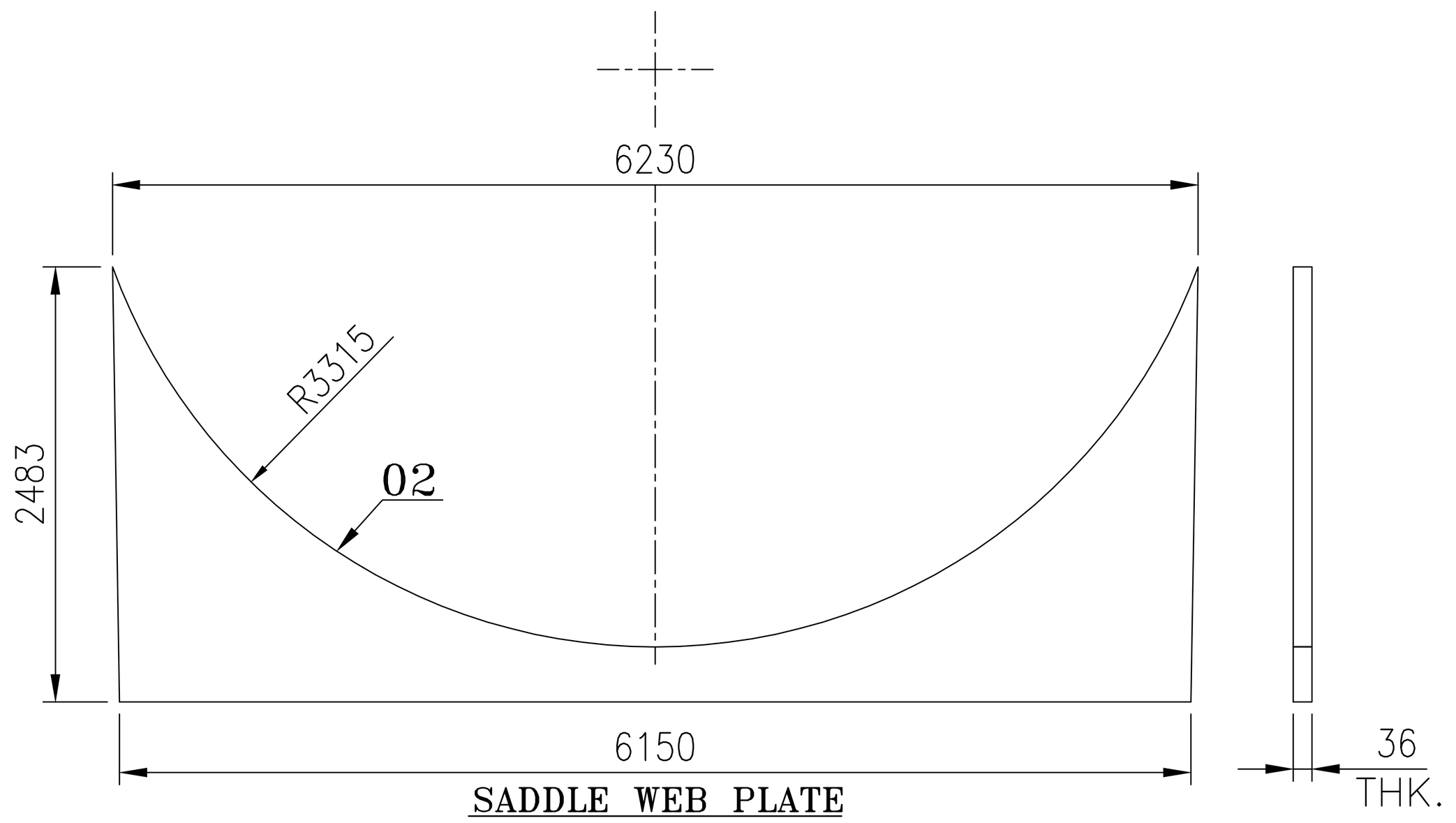
SPECIAL NOTE:
BHEL SHALL ENSURE COMPLIANCE OF ALL DIMENSIONS/SKETCHES IN THIS MANUFACTURING ASSEMBLY DRAWING W.R.T GENERAL ASSEMBLY DRAWING: B016-RUF-LT-504-MS-GA-BHEL(1)-02651



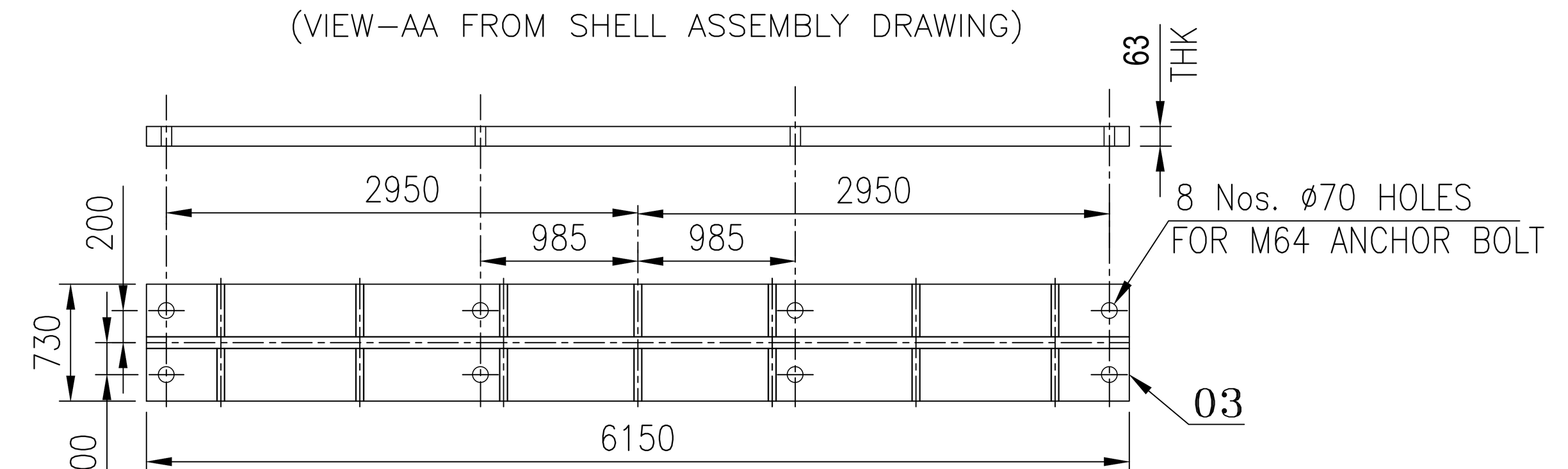
SADDLE SUPPORT ASSEMBLY
(VIEW-AA FROM SHELL ASSEMBLY DRAWING)



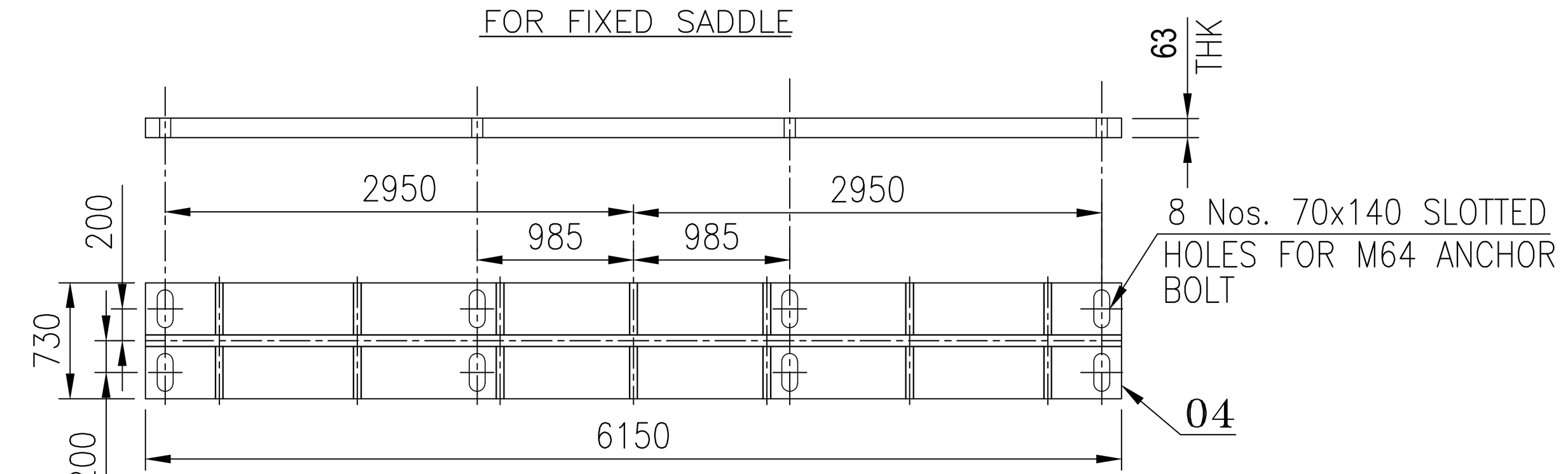
VIEW B-B



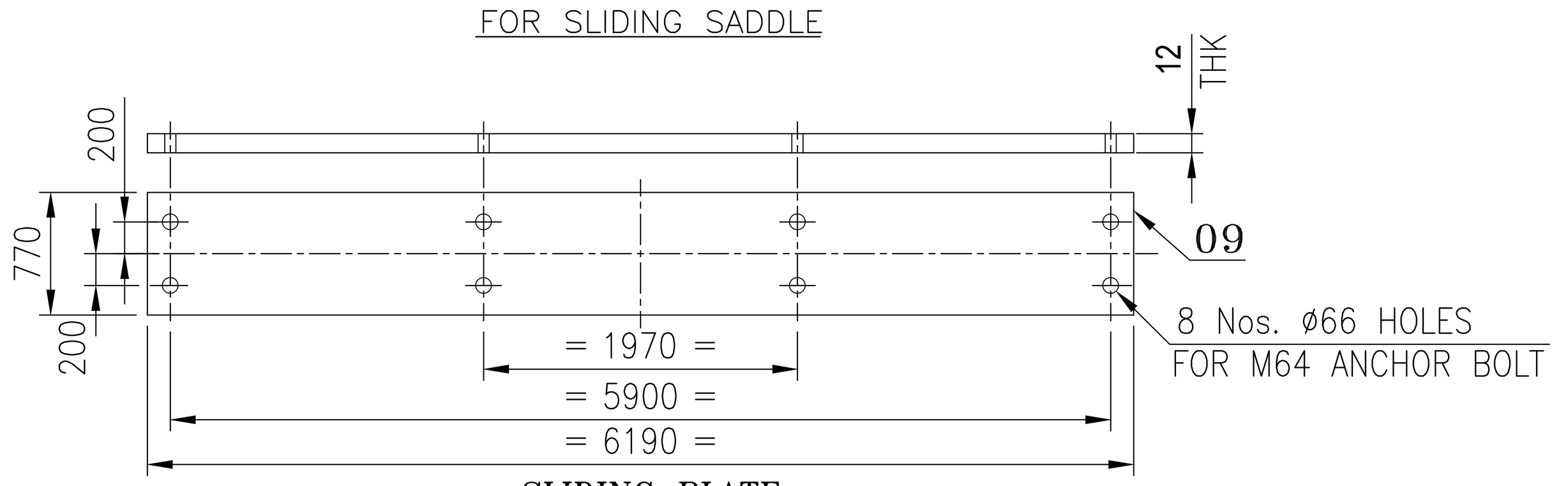
SADDLE WEB PLATE
(2 NOS.)



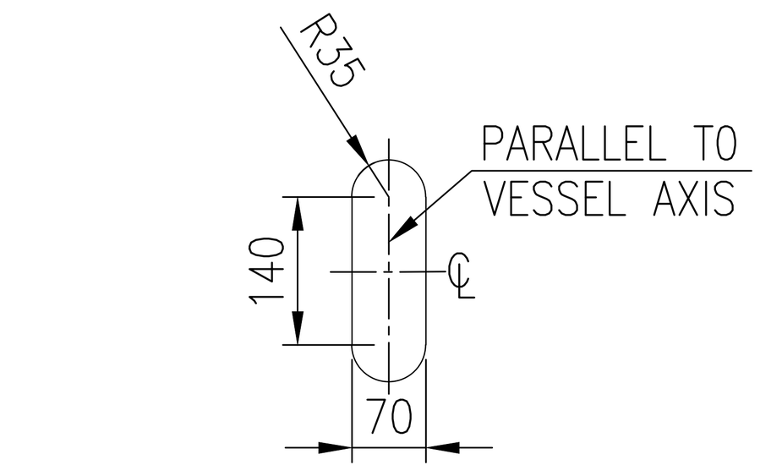
BASE PLATE
FOR FIXED SADDLE



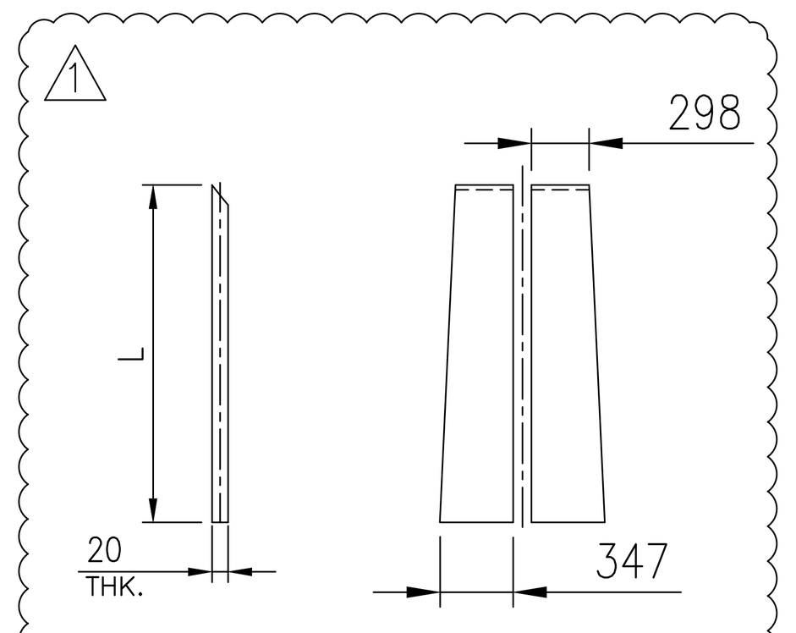
BASE PLATE
FOR SLIDING SADDLE



SLIDING PLATE

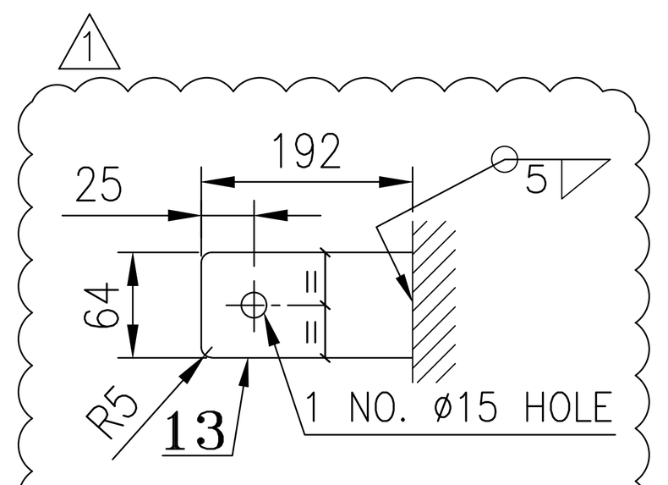


SLOT DETAIL FOR
BASE PLATE OF SLIDING SADDLE
(TYP)



RIB PLATE

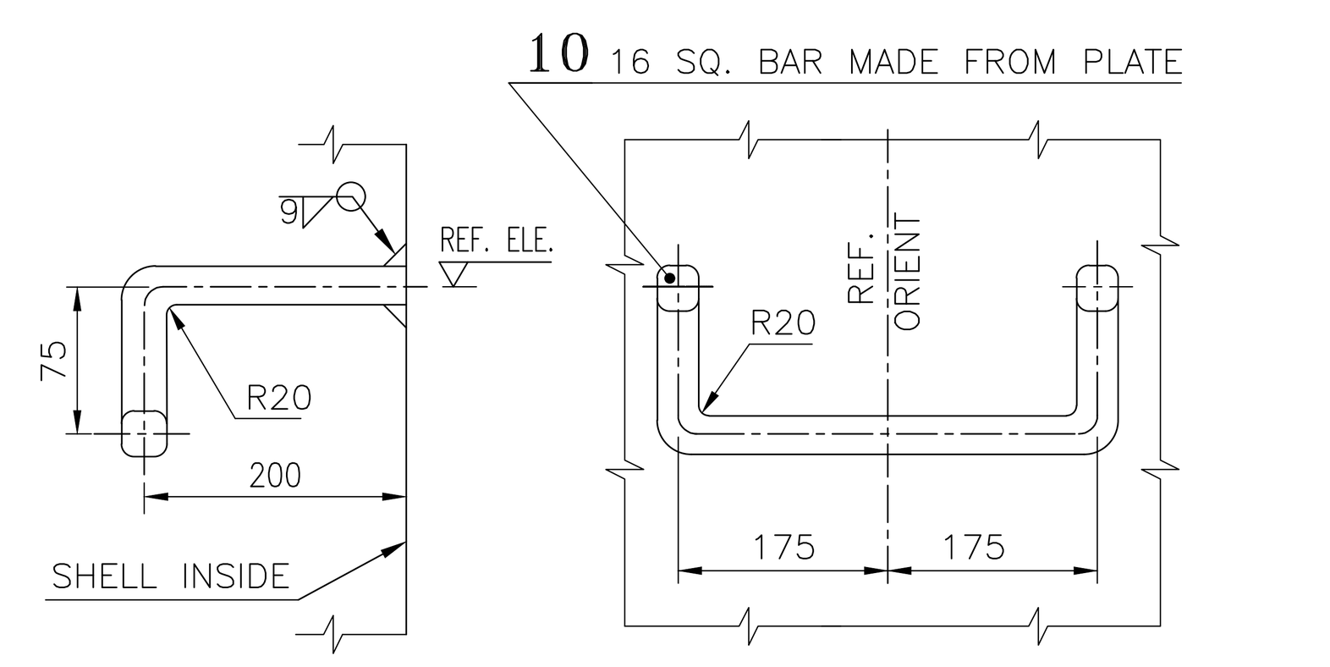
RIB PLATE	L	QUANTITY
RIB PLATE-01	1586	4 SETS
RIB PLATE-02	789	4 SETS
RIB PLATE-03	407	4 SETS
RIB PLATE-04	302	2 SETS



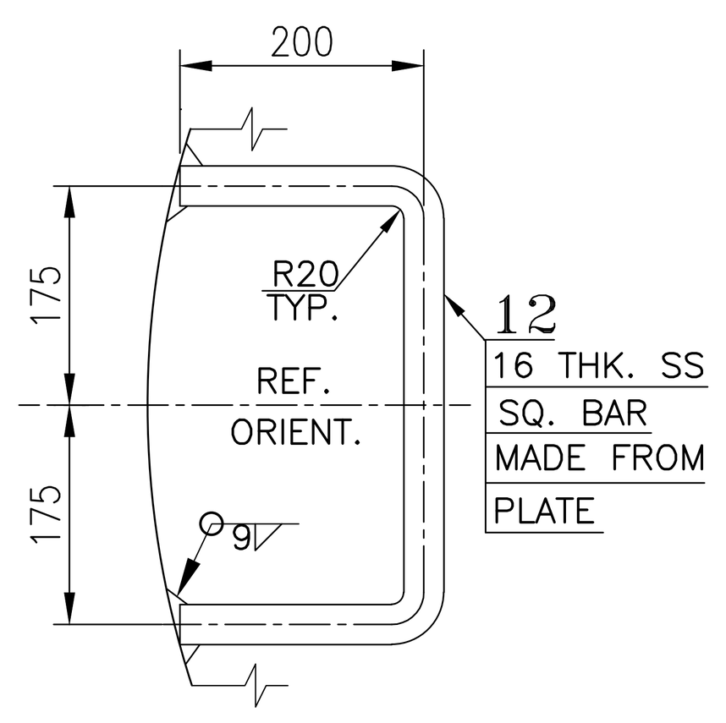
EARTHING LUG

VARIANT NUMBER	ITEM NUMBER	DESCRIPTION	STD	DRAWING NUMBER	ITEM NO / VAR NO	MATERIAL CODE / MATERIAL SPECIFICATION	A/C/P	UNIT / D1	UNIT WEIGHT / QUANTITY
	18	RIBS – LIFTING TRUNION 20 THK. x 275 x 232				SA 516 GR.70			10.017 / 8
	17	RIB – LIFTING TRUNION 20 THK. x 570 x 244				SA 516 GR.70			21.836 / 4
	16	COVER – LIFTING TRUNION ø710 x 20THK.				SA 516 GR.70			62.200 / 4
	15	LIFTING TRUNION PIPE 20 THK. x 246 x 1853.5 LG.				SA 387 GR.22 CL.2			71.586 / 4
	14	PAD – LIFTING TRUNION ø1004 x 32 THK.				SA 387 GR.22 CL.2			125.458 / 4
	13	EARTHING LUG 6 THK. x 65 x 192				SA 240 TP 304			0.592 / 2
	12	HAND GRIP 16 SQ. – 750 Lg.				SA 240 TP 347			1.536 / 1
	11	LADDER RUNG 16 SQ. – 1000 Lg.				SA 240 TP 347			2.048 / 1
	10	LADDER RUNG 16 SQ. – 900 Lg.				SA 240 TP 347			1.844 / 10
	09	SADDLE SLIDING PLATE 770 X 6190 X 12 THK.				SA 240 TYP 304			454.937 / 1
	08	RIB PLATE–4 ; 302 X 20 THK.				SA 516 GR.70			15.291 / 4
	07	RIB PLATE–3; 407 X 20 THK.				SA 516 GR.70			20.912 / 8
	06	RIB PLATE–2; 789 X 20 THK.				SA 516 GR.70			40.557 / 8
	05	RIB PLATE–1; 1586 X 20 THK.				SA 516 GR.70			80.304 / 8
	04	BASE PLATE FOR SLIDING SADDLE 730 X 6150 X 63 THK.				SA 516 GR.70			2166.284 / 1
	03	BASE PLATE FOR FIXED SADDLE 730 X 6150 X 63 THK.				SA 516 GR.70			2205.056 / 1
	02	SADDLE WEB PLATE 2483 X 6230 X 36 THK.				SA 516 GR.70			1547.870 / 2
	01	WRAPPER PLATE 1150 X 8853 X 32 THK.				SA 387 GR.22 CL.2			2557.455 / 2

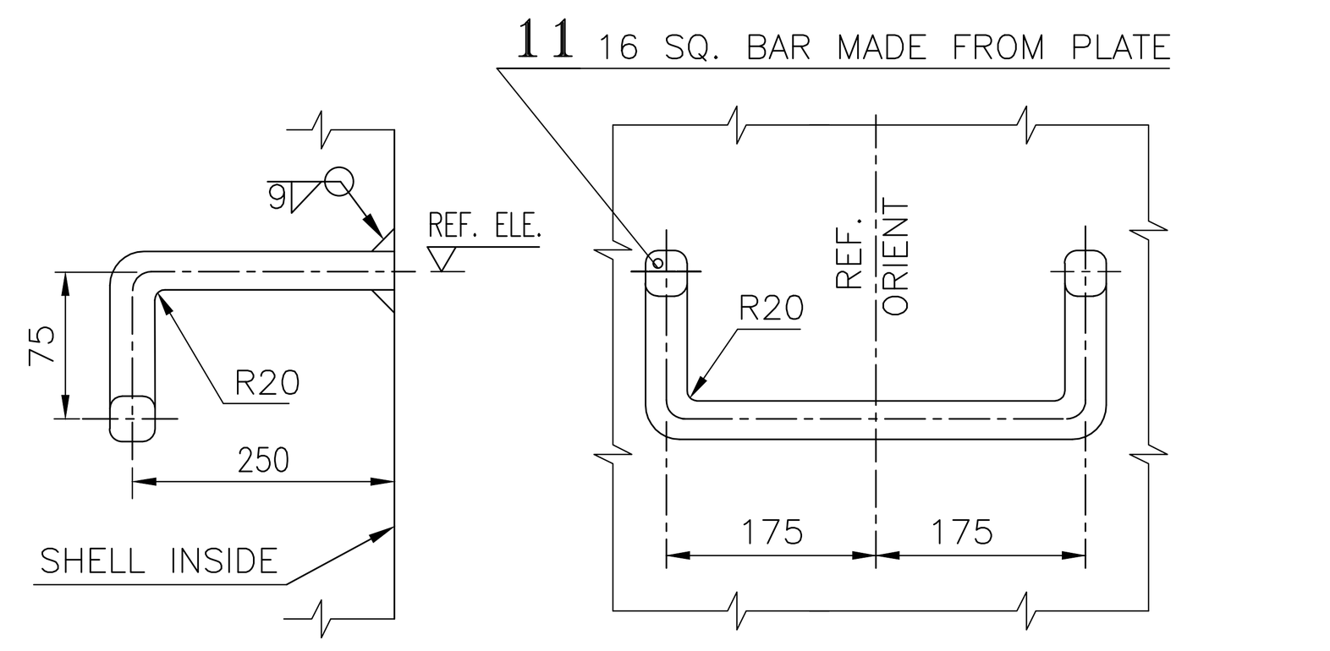
REFERENCE DOCUMENTS / DRAWINGS



DETAIL OF LADDER RUNG
SHARP CORNERS ARE TO BE ROUNDED OFF



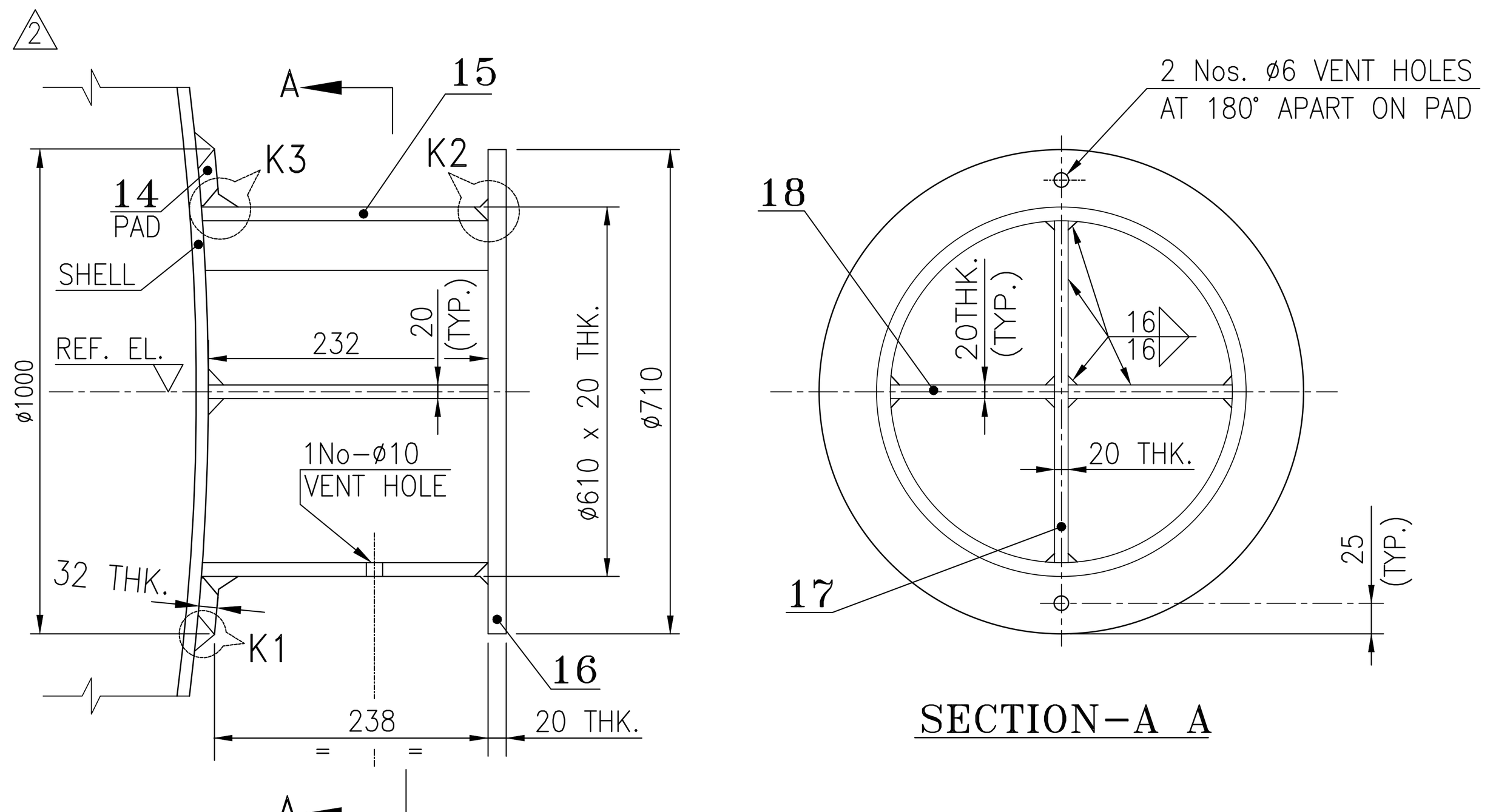
DETAIL OF HAND GRIP



DETAIL OF LADDER RUNG
(LAST RUNG NEAR BOTTOM OF THE VESSEL)
SHARP CORNERS TO BE ROUNDED OFF

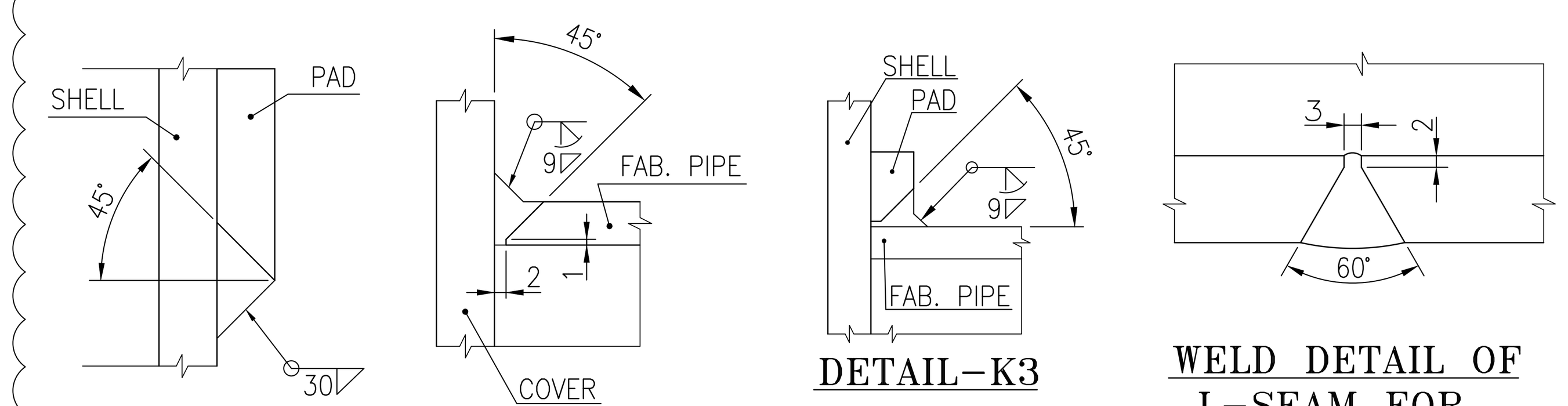
LADDER RUNGS FOR NOZZLE-14

NOTE: FOR LADDER RUNG LOCATIONS REFER SHELL ASSEMBLY DETAILS OF HT FLARE KO DRUM (DRAWING:1-PV-180-U0145)



SECTION-A A

LIFTING TRUNNION



DETAIL-K1 DETAIL-K2 DETAIL-K3 WELD DETAIL OF L-SEAM FOR TRUNNION FAB. PIPE

DRG. CATEGORY: (USE TICK MARK)	R I	EIL REVIEW/APPROVAL CODE:	VPTL NO.:
SCH. DATE OF SUBMISSION			

DOCUMENT STATUS
STATEMENT OF SUB: 1st 2nd 3rd
☐ FINAL FOR CODE-1 ☐ AS BUILT
ISSUED FOR
☐ AS BUILT ☐ INFORMATION
☐ CONSTRUCTION ☐ REVIEW
SIGN: DATE:

☐ REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
☐ REVIEW CODE 2 – PROCEED WITH MANUFACTURE / FABRICATION / CONSTRUCTION AS PER THE COMMENTED DOCUMENT. REVISED DOCUMENT REQUIRED.
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☐ V-VOID
NAME DICIPLINE SIGN. DATE

REV.	DESCRIPTION	DRN	CHECKED	APPROVED	REVIEWED	APPROVED	DATE
01	COMMENTS OF L&T INCORPORATED	MK	AVR	TK			16.10.20
00	ISSUED FOR APPROVAL	MK	AVR	TK			07.07.20

OWNER: HINDUSTAN PETROLEUM CORPORATION LIMITED
VISAKH REFINERY MODERNIZATION PROJECT
EPCC-03 PACKAGE FOR RESIDUE UP-GRADATION FACILITY (RUF)

PMC : ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

LSTK CONTRACTOR: L&T Hydrocarbon Engineering

DETAILED ENGINEERING CENTER: L&T - CHIYODA LIMITED

L&T - CHIYODA LIMITED

☐ REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
☐ REVIEW CODE 2 – PROCEED WITH MANUFACTURE/ FABRICATION /CONSTRUCTION AS PER THE COMMENTED DOCUMENT. REVISED DOCUMENT REQUIRED.
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☐ R – DOCUMENT IS RETAINED FOR RECORDS. PROCEED WITH MANUFACTURE / FABRICATION
☐ V-VOID

COMMENTED BY	REVIEWED BY	APPROVED BY	DATE

THIS REVIEW / APPROVAL DOES NOT RELIEVE THE VENDOR / MANUFACTURER OF THE FULL RESPONSIBILITY AS TO DESIGN CORRECTNESS OF DIMENSIONS & COMPLIANCE WITHALL APPLICABLE REGULATIONS AND WITH THE REQUIREMENTS MADE IN PURCHASER SPECIFICATIONS.

VENDOR : BHEL
Bharat Heavy Electricals Limited
UNIT: HEAVY PLATES & VESSELS PLANT
VISAKHAPATNAM-530012

VENDOR PO NO: Refinery/75000-66912/NG; DATE:18.03.2020

VENDOR DWG. NO: 1-PV-180-U0148, REV.01

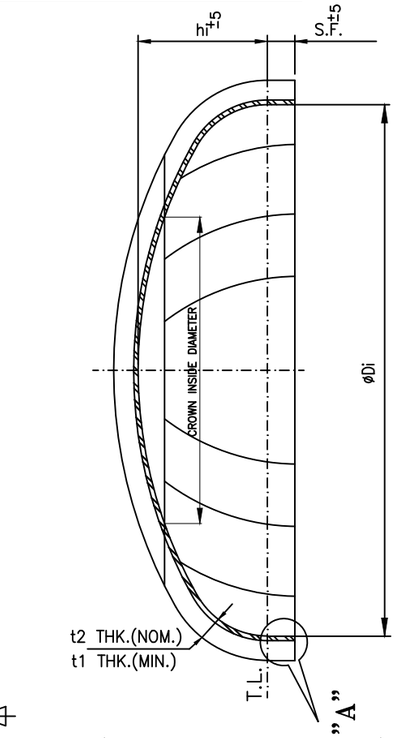
DATE: 07.07.20	SCALE: 1 : 50
DEPT: HT ENGG.	
DRN BY: MUNAYYA K	
CHK BY: A V RAO	
APP BY: TARAKESH K	

TITLE: SADDLE & TRUNNION ASSEMBLY DETAILS OF HT FLARE KO DRUM ITEM NO. 504-V-805A

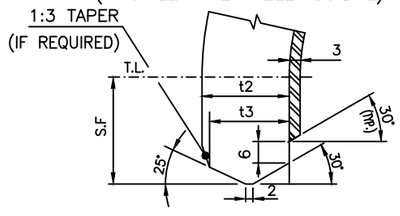
PROJECT:
PWO NO.:
CUSTOMER REFERENCE DRG. NO.: B016-RUF-LT-504-MS-FD-BHEL(1)-02652
SH. 04 of 08
REV. 01

CAD REVISE THIS DRG. USING CAD SYSTEM ONLY FILE:

DRAWING NO: 3-PV-010-U0102



(PROFILE – 2:1 ELLIPSOIDAL)

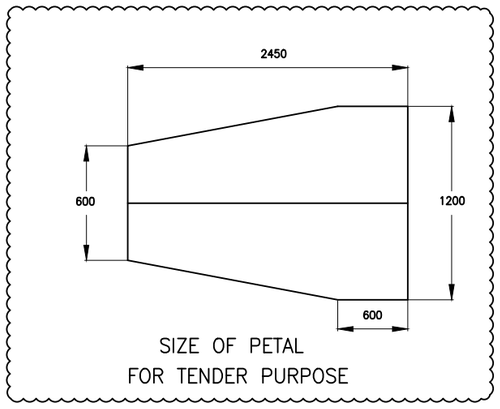


DETAIL–"A"

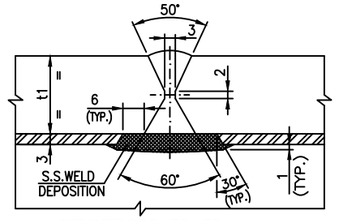
CROWN I.D: 2750 MM

NO. OF PETALS: 16 NO.

2



SIZE OF PETAL
FOR TENDER PURPOSE



SECTION X–X
(WELD DETAIL OF CHORDAL JOINT)

NOTES:–

1. MATERIAL TO BE SA 264 (SA 387 Gr 22+SS 347 clad) OF ASME SEC–II PART–A; 2019 (SHALL COMPLY WITH TDC:PV–PL–TDC–011).
2. DISHED END TO BE PREPARED USING COLD FORMED PETALS WITH FOLLOWING SCOPE OF WORK.

[A] AT THE WORKS OF BHEL : PLATE TO BE SUPPLIED TO DISHED END VENDOR IN RECTANGULAR FORM (SUFFICIENT FOR MAKING THE PETALS). BLANK IN CIRCULAR FORM (INCLUDING WELDING IF ANY) FOR MAKING THE TOP DISH (i.e. CROWN) ALSO TO BE SUPPLIED TO DISHED END VENDOR.

[B] AT THE WORKS OF DISHED END VENDOR :

(a) DETAIL DRAWING SHOWING THE DEVELOPMENT OF EACH PETAL, TOP DISH AND OTHER DETAILS INCLUDING ALL ASSOCIATED DIMENSIONS (MEETING THE END DIMENSION) TO BE FURNISHED TO BHEL FOR APPROVAL BEFORE PROCEEDING FOR MANUFACTURING. SKETCH OF PETAL AS SHOWN HERE IS FOR REFERENCE ONLY. BUT NO. OF PETALS AND CROWN DIA OF TOP DISHED END TO BE KEPT SAME AS ALREADY SHOWN.

(b) PROCEDURE DULY APPROVED BY BHEL TO BE REFERRED FOR MATERIAL HANDLING, MARKING, MATERIAL CUTTING AND CLAD STRIP BACK, PROTECTION WHILE FORMATION OF PETALS / DISH. PROCEDURE SHALL REQUIRE TO BE PREPARED MEETING ALL REQUIREMENTS AS MENTIONED IN SPECIFICATION PVM–SU–1322–H.1

(c) CUTTING OF PETALS FROM THE RECTANGULAR PLATES (AS RECEIVED FROM BHEL), FORMING OF PETALS & TOP DISH BY COLD FORMING.

(d) REMOVAL OF SS CLAD AS SHOWN IN X–X INCLUDING WELD EDGE PREPARATION (FOR PETAL ENDS & TOP DISH), FOLLOWING ACTIVITIES NEED TO BE DONE.
(1) UT AS PER LEVEL–C OF SA578 TO BE DONE WITHIN 1 TIMES THE COMPOSITE CLADDED PLATE THICKNESS FROM THE CLAD PLATE EDGE.
(2) WELD EDGE PREPARATION OF BASE PLATE TO BE DP TESTED.

(e) AFTER FORMING, ALL PETALS & TOP DISH TO BE 100% UT AS PER SA 578 LEVEL–C.

(f) TRIAL ASSEMBLY TO CHECK THE FINISHED DIMENSIONS. INSPECTION REPORT SHOULD INDICATE THE PETAL IDENTIFICATION NOS. (SERIAL WISE) INCLUDING TOP DISH FOR A PARTICULAR DISHED END

(g) AFTER SUCCESSFUL TRIAL ASSEMBLY, EACH PETALS & TOP DISH TO BE IDENTIFIED WITH UNIQUE IDENTIFICATION NO. SO AS TO AVOID ANY AMBIGUITY AFTER GETTING IT RECEIPT AT BHEL FOR PROCESSING FURTHER (i.e. WELDING OF PETALS) TO MEET THE END DIMENSION.

[C] AT THE WORKS OF BHEL : CHEVRON SPEC. PVM–SU–1322–H.1 TO BE COMPLIED.

(a) ARRANGING OF PETALS IN SEQUENCE INCLUSIVE OF TOP DISH TO MEET THE END DIMENSION.

(b) WELDING OF PETALS & TOP DISH BY ASME QUALIFIED WELDERS USING WPS AND PQR (DULY ENDORSED BY AI) AND GROUND FLUSH THE WELD.

(c) D.P TEST OF WELD FOR BASE PLATE OF PETALS & TOP DISH TO BE CARRIED OUT FOLLOWED BY 100% RT.

(d) WELD OVERLAY TO BE DONE AS SHOWN USING SS ELECTRODE IN LINE WITH THE WPS AND PQR (DULY ENDORSED BY AI) MEETING CLAD CHEMISTRY. MAXIMUM 02 WELD LAYERS IS PERMITTED AND DILUTION LAYER SHOULD NOT BE MORE THAN 1MM FROM EACH SIDE OF THE MATING SURFACE.

(e) EACH OVER LAY DEPOSIT TO BE CHECKED BY D.P TEST.

(f) TO ENSURE PROPER BONDING OF SS OVERLAY WITH BASE PLATE, ULTRASONIC EXAMINATION TO BE DONE. ACCEPTANCE LEVEL SHALL BE DECIDED BY AI (INLINE WITH THE CONTRACT SPECIFICATION).

(g) FERROXYL TEST OF WELD OVERLAY (AS PER BHEL APPROVED PROCEDURE) TO BE CARRIED OUT TO CHECK THE IRON CONTAMINATION ON THE WELD OVER LAY.

(h) PMI TEST SHALL ALSO REQUIRED TO BE CARRIED OUT TO ENSURE CHEMICAL PROPERTIES OF THE WELD.

(i) FERRITE CONTENT OF THE WELD METAL SHALL BE LIMITED TO 3 TO 10 FN AND TO BE CHECKED BY MAGNETIC INSTRUMENT (DULY CALIBRATED ACCORDING TO AWS A4.2).

(j) PERFORMING OF HEAT TREATMENT AS PER THE APPROVED PROCEDURE. SEE NOTE–3 BELOW ALSO.

(k) COMPLETE DISHED END TO BE 100% UT AS PER SA 578 LEVEL–C.

(l) EDGE PREP. AT SF IS REQUIRED AS PER DETAIL 'A' SHOWN.

(m) INSIDE & OUTSIDE OF KNUCKLE AND EDGE PREPARATION TO BE DP TESTED FOLLOWED BY 100% RT FOR WELD SEAM.

3. HEAT TREATMENT :– DISHED END TO BE STRESS RELIEVED AFTER WELDING OF PETALS AS PER THE FOLLOWING CYCLE.
   (a) MAX. RATE OF HEATING – 160 °C/HR ABOVE 400 °C
   (b) MAX. RATE OF COOLING – 205 °C/HR UPTO 400 °C AFTER COMPLETION OF SOAKING PERIOD DISHED END TO BE COOLED IN STILL AIR.
   (c) MIN. SOAKING TIME – MINUTE: 90 FOR COMPOSITE PLATE THICKNESS OF 33 mm.
   (d) SOAKING TEMPERATURE : 690 ± 15 DEGREE CENTIGRADE.

- AFTER COMPLETION OF SOAKING PERIOD DISHED END TO BE COOLED IN STILL AIR.
- DISHED ENDS TO BE PLACED ON BLOCKS IN FURNACE TO ENSURE UNIFORM HEATING AND COOLING.
- NO. OF THERMOCOUPLES SHALL BE AS PER ASME SEC.VIII DIV.1; 2019 ONLY.

4. CENTRAL HOLE IF ANY ON DISHED END TO BE PLUGGED FOLOWED BY 100%RT (TO BE DONE BY BHEL).
5. PAINTING AFTER SURFACE CLEANING FOR PETALS & TOP DISHED END : ONE COAT OF PRIMER TO AA 56101 COLOUR RED ON OUT SIDE SURFACE LEAVING 50 MM FROM EDGE.
6. TOLERANCE : (I) OVALITY SHOULD NOT EXCEED 1.0% OF DISHED END ID. (DIFFERENCE MAX. & MIN. I.D.)
   3 (II) MEASURED CIRCUMFERENCE SHOULD BE $^{-0}_{+15}$ OF CALCULATED CIRCUMFERENCE BASED ON I.D. SPECIFIED(FOR FINISHED DISHED END).
7. CODE OF CONSTRUCTION ASME SECTION VIII DIV. 1; 2019.
8. INSPECTION BY M/S BHEL / BHEL APPOINTED TPIA AND END CUSTOMER (IF ANY).
9. TEMPLATE REQUIREMENT AS PER UG–81 (a). FOR INTERNAL PRESSURE INNER SURFACE OF DISHED END SHALL NOT DEVIATE OUTSIDE OF THE SPECIFIED SHAPE BY MORE THAN 30 mm AND SHALL NOT DEVIATE BY MORE THAN 15 mm INSIDE THE SPECIFIED SHAPE, EXCEPT FOR KNUCKLE RADIUS WHICH SHALL NOT BE LESS THAN THAT SPECIFIED.
10. MATERIAL IDENTIFICATION NO. TO BE MAINTAINED AT D'END SUPPLIER'S END BEFORE DURING & AFTER FORMING OPERATION.
11. DISHED END SUPPLIER TO FURNISH TEST CERTIFICATES INCLUDING (a) METHOD OF FORMING, CARRIED OUT IF ANY, (c) DIMENSIONAL REPORT INCLUDING MINIMUM THICKNESS, (d) NDE REPORTS & (e) RESULTS OF TEMPLATE & TRIAL ASSEMBLY CHECK. QAP DULY APPROVED BY BHEL SHALL ALSO REQUIRED TO BE REFERRED FOR OTHER DOCUMENTS.
12. D'END SUPPLIER SHALL CONFIRM THAT THE PETALS AND THE TOP DISHED (AS SHALL BE SUPPLIED) SHALL MEET THE END DIMENSION AS SHOWN.
13. hi = Di /4
14. DP TEST & RT ALWAYS SHALL BE CARRIED OUT AS PER AS PER APPENDIX–8 & UW–51 RESPECTIVELY OF ASME SECTION VIII DIVISION–I; 2019.

ASME CERTIFICATION WITH 'U' STAMP

FOR TENDER PURPOSE ONLY

TABLE–1:

01	504–V–805A	6500	26+3	30+3	55	30+3	--	--	--	12063	2
S.No	EQUIPMENT NO	ØDi	t1+clad (MIN.)	t2+clad (NOM.)	SF	t3+clad	BLANK DIA (ØX1)	X1	X2	WEIGHT (Kg.)	QTY.

REV NO.	DATE	BRIEF RECORD OF REVISIONS	PPD.	CHD.	APPD.
03	16.10.20	CHANGED TO CROWN & PETAL ARRANGEMENT	IJAZ	ANVK	YP
02	06.06.20	REVISED AS MARKED	IJAZ	ANVK	YP
01	06.05.20	REVISED AS MARKED	IJAZ	ANVK	YP

Bharat Heavy Electrics Ltd
UNIT: HEAVY PLATES & VESSELS PLANT
VISAKHAPATNAM–530012

	NAME	DATE
DRN	SATISH/PRASANNA	06.04.20
CHD	B.SATYESWARA RAO	06.04.20
APPD	S.K BISWAS	06.04.20

DEPT: P.P.ENGG | CODE: 031 | ALL DIMENSIONS ARE IN MM | PROJECTION | SCALE: 1 : 25 | WEIGHT (Kg): XXXX | REF TO ASSY / OLD DWG:

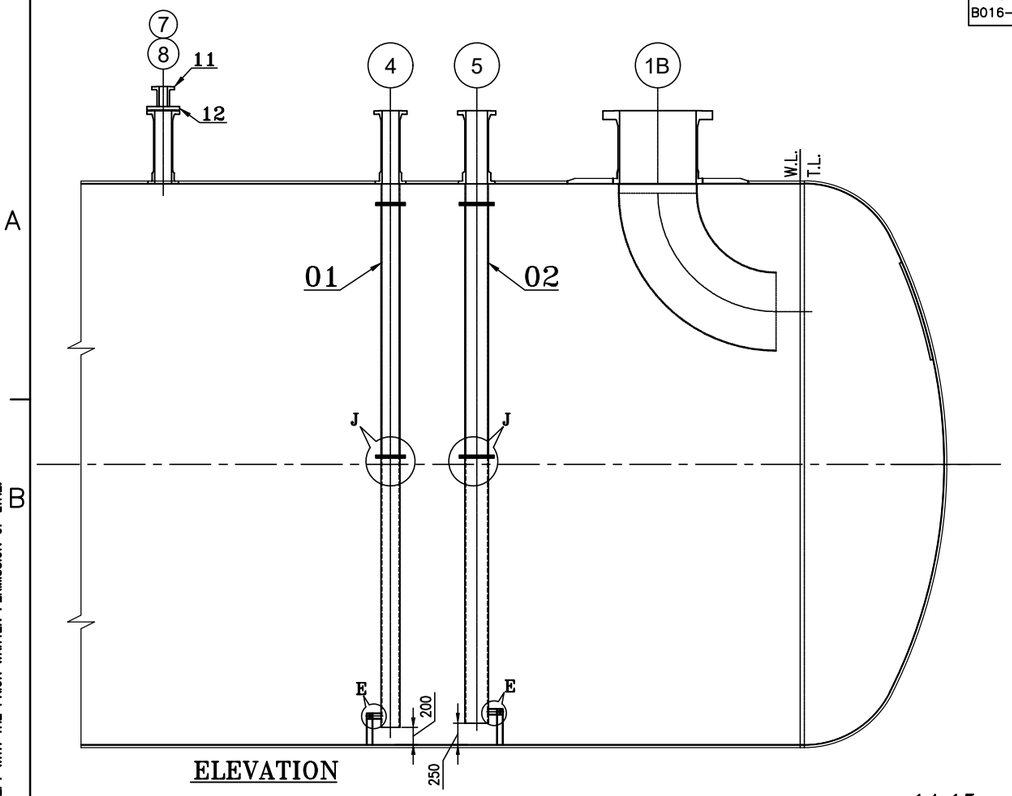
TITLE: DISHED ENDS FOR PRESSING (SA387 Gr 22 Cl2+SS347 clad)

DRAWING NO : 3–PV–010–U0102 | REV: 03

A3 SIZE

DRG. NO. B016-RUF-LT-504-MS-FD-BHEL(1)-02652
BHEL DWG No. 3-PV-180-U0053

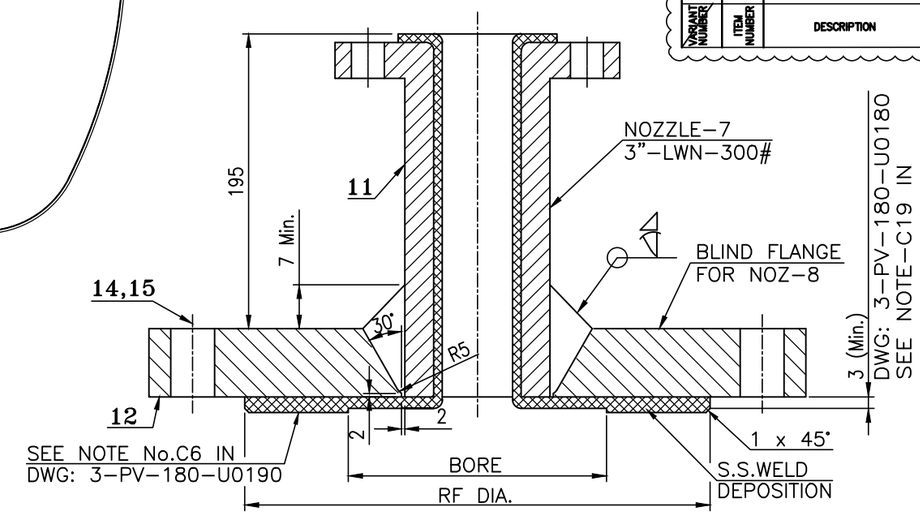
SPECIAL NOTE:
BHEL SHALL ENSURE COMPLIANCE OF ALL DIMENSIONS/SKETCHES IN THIS MANUFACTURING ASSEMBLY DRAWING W.R.T GENERAL ASSEMBLY DRAWING: B016-RUF-LT-504-MS-GA-BHEL(1)-02651



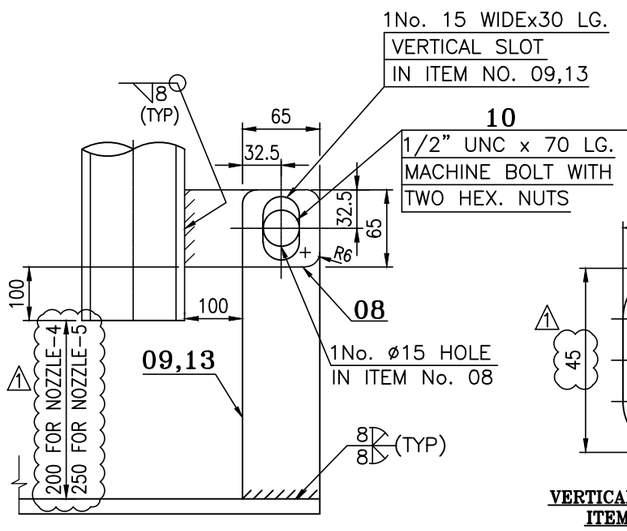
ELEVATION

TOTAL WEIGHT: 1158.154

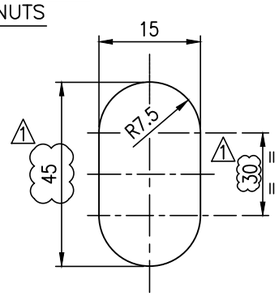
VARIANT NUMBER	ITEM NUMBER	DESCRIPTION	STD	DRAWING NUMBER	ITEM-NO / VAR-NO	MATERIAL CODE / MATERIAL SPECIFICATION	A/C/P DWG	UNIT WEIGHT / QUANTITY
	15	SPIRAL WOUND GASKET NPS 8" x 300#				GRAFIL FILLED WITH SS316 INNER RING AND CS OUTER RING		0.200 1
	14	FULLY THREADED STUD WITH 2 NUTS 7/8" – 9 UNC x 160 LG				SA 453 GR. 660 CL. A		0.682 12
	13	INTERNAL PIPE SUPPORT PLATE FOR NOZ-5; 12 THK. x 65 x 415 LG.				SA 240 TP 347		2.487 1
	12	BLIND FLANGE–NPS 8"–300#;RF				SA 182 F22 CL.3		37.000 1
	11	LW NOZZLE – 7 NPS 3" x 300# RF; L=236				A243 81PV 1800 1009 SA182Gr.F22CL.3+3mm SS347 WOL		16.694 1
	10	MACHINE BOLT WITH TWO HEX. NUTS: 1/2" UNC x 70 LG.				SA193GR.B8CA/SA194GR.8CA		0.124 2
	09	INTERNAL PIPE SUPPORT PLATE FOR NOZ-4; 12 THK. x 65 x 365 LG.				SA 240 TP 347		2.175 1
	08	INTERNAL PIPE SUPPORT PLATE 12 THK. x 65 x 165 LG.				SA 240 TP 347		1.013 2
	07	FULL FACED GASKET SHEET 250NB ID:276; OD:400				CNAF		– 3
	06	FULL FACED GASKET SHEET 200NB ID:222; OD:340				CNAF		– 3
	05	STUD WITH 2 NUTS 5/8" UNC; 90 LONG				SA193GR.B8CA/SA194GR.8CA		0.222 32
	04	INTERNAL FLANGE FOR PIPE 250NB ID:276 x OD:400 x 16 THK.				SA 240 TP 347		8.427 3
	03	INTERNAL FLANGE FOR PIPE 200NB ID:222 x OD:340 x 16 THK.				SA 240 TP 347		6.667 3
	02	PIPE OD 273 x 15.09 THK. 3004 LG.				SA 312 TP 347		288.415 2
	01	PIPE OD 219.1 x 15.09 THK. 3029 LG.				SA 312 TP 347		229.962 2



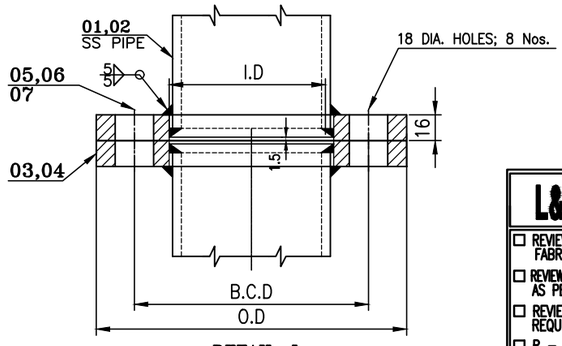
⚠1 WELD DETAIL OF LWN NOZZLE–7 TO BLIND FLANGE FOR NOZZLE–8



DETAIL–E
INTERNAL PIPE SUPPORT FOR NOZZLE 4 & 5



VERTICAL SLOT DETAIL IN ITEM No. 9 & 13



DETAIL–J
INTERNAL PIPE–FLANGE DETAIL FOR NOZZLE – 4 & 5

ITEM NO.	PIPE SIZE	I.D	B.C.D	O.D
03	200NB	222	290	340
04	250NB	276	350	400

L&T - CHIYODA LIMITED

- ☐ REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
- ☐ REVIEW CODE 2 – PROCEED WITH MANUFACTURE/FABRICATION/CONSTRUCTION AS PER THE COMMENTED DOCUMENT. REVISED DOCUMENT REQUIRED.
- ☐ REVIEW CODE 3 – DOCUMENT DOES NOT CONFORM TO BASIC REQUIREMENTS AS MARKED. RESUBMIT FOR REVIEW.
- ☐ R – DOCUMENT IS RETAINED FOR RECORDS. PROCEED WITH MANUFACTURE / FABRICATION
- ☐ V–VOID

COMMENTED BY	REVIEWED BY	APPROVED BY	DATE

THIS REVIEW / APPROVAL DOES NOT RELIEVE THE VENDOR / MANUFACTURER OF THE FULL RESPONSIBILITY AS TO DESIGN CORRECTNESS OF DIMENSIONS & COMPLIANCE WITHALL APPLICABLE REGULATIONS AND WITH THE REQUIREMENTS MADE IN PURCHASER SPECIFICATIONS.

DRAWING NO.	DRAWING TITLE	REV

REFERENCE DOCUMENTS / DRAWINGS

DRG. CATEGORY: (USE TICK MARK) [R] [I]
SCH. DATE OF SUBMISSION
EIL REVIEW/APPROVAL CODE:
VPTL NO.:

DOCUMENT STATUS
STATEMENT OF SUB: [1st] [2nd] [3rd]
☐ FINAL FOR CODE–1 ☐ AS BUILT

ISSUED FOR
☐ AS BUILT ☑ INFORMATION
☐ CONSTRUCTION ☐ REVIEW

SIGN: DATE:

- ☐ REVIEW CODE 1 – NO COMMENTS PROCEED WITH MANUFACTURE / FABRICATION/ CONSTRUCTION AS PER THE DOCUMENT.
- ☐ REVIEW CODE 2 – PROCEED WITH MANUFACTURE / FABRICATION / CONSTRUCTION AS PER THE COMMENTED DOCUMENT. REVISED DOCUMENT REQUIRED.
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- ☐ R – DOCUMENT IS RETAINED FOR RECORDS. PROCEED WITH MANUFACTURE / FABRICATION
- ☐ V–VOID

	NAME	DICIPLINE	SIGN.	DATE

REV.	DESCRIPTION	DRN	CHECKED	APPROVED	REVIEWED	APPROVED	DATE
01	L&T COMMENTS INCORPORATED	MK	AVR	TK			16.10.20
00	ISSUED FOR APPROVAL	MK	AVR	TK			07.07.20

OWNER: HINDUSTAN PETROLEUM CORPORATION LIMITED
VISAKH REFINERY MODERNIZATION PROJECT
EPCC–03 PACKAGE FOR RESIDUE UP–GRADATION FACILITY (RUF)

PMC : इंजीनियर्स इंडिया लिमिटेड (भारत सरकार का उपक्रम) ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

LSTK CONTRACTOR: L&T Hydrocarbon Engineering

DETAILED ENGINEERING CENTER: L&T - CHIYODA LIMITED

VENDOR : Bharat Heavy Electricals Limited
UNIT: HEAVY PLATES & VESSELS PLANT
VISAKHAPATNAM–530012

VENDOR PO NO: Refinery/75000–66912/NG; DATE:18.03.2020

VENDOR DWG. NO: 3–PV–180–U0053, REV.01

DATE	SCALE	TITLE: INTERNAL PIPE DETAILS OF HT FLARE KO DRUM ITEM NO. 504–V–805A	
DEPT: HT ENGG.			
DRN BY: MUNAYYA K	PROJECT:	CUSTOMER REFERENCE DRG. NO.: B016–RUF–LT–504–MS–FD–BHEL(1)–02652	SH. 06 of 08
CHK BY: A V RAO	PWO NO.:		REV. 01
APP BY: TARAKESH K	CAD FILE:		

CAD REVISE THIS DRG. USING CAD SYSTEM ONLY

BHEL DRG. NO.	DRG. NO.
3-PV-180-U0190	B016-RUF-LT-504-MS-FD-BHEL(1)-02660

A. GENERAL:

1. ALL DIMENSIONS & ELEVATIONS ARE IN MM UNLESS OTHERWISE STATED.
2. DESIGN PRESSURE AT BOTTOM INCLUDES TOP DESIGN PRESSURE + OPERATING LIQUID HEAD + PRESSURE DROP ACROSS THE VESSEL.
3. NORTH DIRECTION WHEREVER SHOWN IS WITH RESPECT TO PLAN VIEW.
4. ALL ADDITIONAL INDICATIONS SUCH AS NORTH/EAST/SOUTH/WEST ALONG WITH CG SHALL BE CLEARLY MARKED WITH WHITE PAINT.
5. ALL INTERNAL BOLTS SHALL BE PROVIDED WITH DOUBLE NUTS.
6. ALL STUD / BOLTS SHALL BE FULLY THREADED WITH 2 NOS. OF HEAVY HEXAGONAL NUTS. THREADS SHALL BE UNC ACCORDING TO ASME B1.1 COURSE THREADS FOR STUDS / BOLTS UP TO 1"AND 8UN THREADS PER INCH FOR SIZES LARGER THAN 1".
7. ALL FITTINGS SHALL BE OF SEAMLESS CONSTRUCTION.
2. 8. (ALL STUD BOLTS OF BOLT DIAMETER SIZE 1" AND ABOVE SHALL BE PROVIDED WITH THREE NUTS.)

B. MATERIAL:

1. DIMENSIONS OF FLANGES FOR NOZZLES UPTO 600 NB (24") SHALL BE AS PER ASME B16.5 AND FOR NOZZLE ABOVE 600 NB (24") SHALL BE AS PER ASME B16.47 SERIES 'B' UNLESS SPECIFIED OTHERWISE. FLANGE GASKET FACE SHALL HAVE 3.2 – 6.3 MICRONS (125~250 AARH FINISH.)
2. THE GASKETS USED DURING HYDRAULIC TEST SHALL BE OF SAME SPECIFICATION AS SERVICE GASKETS.
3. IN CLAD FLANGES THE THICKNESS OF FLANGES SHALL BE INCREASED EQUAL TO GROOVE DEPTH. THE W.O.L THICKNESS OF THE FACING SHALL BE MIN. 3MM AFTER MACHINING.
4. ALL MATERIALS WELDED DIRECTLY TO THE PRESSURE-RETAINING ENVELOPE SHALL BE MATERIAL OF THE SAME P NUMBER AND GROUP NUMBER IN THE APPLICABLE TABLE IN ASME CODE, SECTION II, PART D.
2. 5. (FOR CORROSION ALLOWANCE, REFER THE GENERAL ARRANGEMENT DRAWING.)
6. IN CLAD PART OF VESSEL, WELD OVERLAY SHOULD BE MIN. 3mm UNDILUTED MATERIAL HAVING SAME CHEMISTRY AS THAT OF SPECIFIED CLAD MATERIAL.
7. THE WELD OVERLAY SHOULD BE MINIMUM TWO LAYER CONSTRUCTION. THE THICKNESS OF LAYER CONFIRMING TO THE SPECIFIED COMPOSITION, EXCLUDING ANY ALLOWANCE FOR GRINDING OR MACHINING SHALL NOT BE LESS THAN 1.5MM PER LAYER.
8. HARDNESS OF GASKET SHALL BE LESS THAN HARDNESS OF FLANGE.
9. GASKET SHALL BE AS PER ASME B 16.20

C. FABRICATION:

1. THE INDICATED THICKNESS IS MINIMUM ACCEPTABLE AFTER CONSTRUCTION.
2. ALL SHARP CORNERS ARE TO BE ROUNDED OFF.
3. FOR NOZZLES ON SHELL, PROJECTIONS ARE REFERRED FROM VESSEL CENTER LINE TO FLANGE CONTACT FACE AND FOR NOZZLES ON HEAD, PROJECTIONS ARE REFERRED FROM HEAD T.L TO FLANGE CONTACT FACE.
4. ALL FLANGE STUD/BOLT HOLES AND ANCHOR BOLT HOLES TO STRADDLE CENTER LINES AS PER E.I.L.STD.No. 7-12-0015. UNLESS OTHERWISE INDICATED.
5. NOZZLES IN CLADDED SECTION SHALL BE CLADDED / WELD OVERLAYED.
6. GASKET SEATING SURFACE OF ALL EXTERNAL FLANGES SHALL HAVE SMOOTH FINISH TO 125 TO 250 AARH AND ALL INTERNAL FLANGES SHALL HAVE CONCENTRIC SERRATIONS.
7. ALL MAIN WELD SEAMS SHALL BE CLEAR OF NOZZLES, R.F.PADS, INTERNALS AND STIFFENING RINGS BY 50 mm MIN. (WELD EDGE TO WELD EDGE).
   A) IN CASE OF FOULING OF ANY NOZZLE OPENING WITH VESSEL WELD SEAMS (i) GRIND FILLET OF NOZZLE TO SHELL/D'HEAD WELDING TO A SMOOTH CONCAVE RADIUS AND (ii) RE-RADIOGRAPH (100%) THE ADJACENT WELD SEAMS UPTO A DISTANCE OF 300 mm BEYOND EDGE OF NOZZLE ON EACH SIDE BEFORE WELDING THE R.F.PAD.
   B) WHEREVER RF PADS / PADS OF OTHER ATTACHMENTS CROSS OVER WELD SEAMS OF VESSEL, THE WELD SEAM IS TO BE GROUND FLUSH AND FULLY RADIOGRAPHED UPTO 150 mm ON EAITHER SIDE OF PADS BEFORE WELDING THE ATTACHMENTS.
   C) ALL WELDS SHALL BE DYE PENETRATE EXAMINED.
   WHEREVER PADS ARE COMING OVER C-SEAM OF DIFFERENTIAL THICKNESS, BOTTOM SIDE OF PAD SHALL BE GROUND TO SUIT AND WELD OVER THE C-SEAM.
8. ALL WELDS OF PRESSURE PARTS & LOAD BEARING PARTS SHALL BE FULL PENETRATION TYPE.
9. WELD EDGE TO EDGE DISTANCE SHALL BE AS PER CL. 4.7.5 OF GENERAL SPECIFICATION FOR PRESSURE VESSEL 6-12-0001.
10. FILLET WELD SIZES INDICATED SHOWS THE LEG SIZE AND ARE MINIMUM.
11. ALL FILLET WELDS INTERNAL AND EXTERNAL TO PRESSURE CONTAINING COMPONENTS SHALL BE GROUND TO A SMOOTH AND GENEROUS COCAVE CONTOUR.
12. WHEREVER INSULATION SUPPORT RINGS ARE COMING IN WAY OF OTHER ATTACHMENTS, THE INSULATION SUPPORT RING MAY BE SUITABLY MODIFIED.
13. R.F. PAD IS TO BE WELDED TO SHELL SUCH THAT ONE TELL TALE HOLE OF DIA. 8MM WILL BE AT THE BOTTOM OF THE PAD IN THE ASSEMBLED POSITION OF THE VESSEL.
14. NO WELDING IS TO BE DONE ON THE VESSEL AFTER HEAT TREATMENT UNLESS OTHERWISE PERMITTED BY CODE/SPECIFICATION/ APPROVED BY L&T
15. RADIOGRAPH THE WELD ON THE BASE MATERIAL BEFORE CARRYING OUT WELD ON THE CLAD SIDE.
16. COMPLETE EQUIPMENT UP TO WRAPPER PLATE SHALL BE STRESS RELIEVED. HARDNESS OF ALL PLATE, WELDS HAZ AFTER PWHT SHALL BE LIMITED TO 200 BHN. SHALL BE CARRIED BEFORE HYDROTEST.
17. ALL HEAT TREATMENTS SHALL BE AS PER FORMING AND HEAT TREATMENT PROCEDURES DOC. NO. B016-RUF-LT-504-QA-QD-BHEL(1)-02010
18. TELL TALE HOLES SHALL NOT BE PLUGGED AND SHALL BE FILLED WITH HARD GREASE ONLY.
19. IN CLAD FLANGES THE THICKNESS OF FLANGES SHALL BE INCREASED EQUAL TO GROOVE DEPTH. THE W.O.L THICKNESS OF THE FACING SHALL BE MIN. 3MM AFTER MACHINING.

D. TOLERANCE:

1. ALL LEVEL INSTRUMENT NOZZLES SHALL BE JIG SET WITHIN TOLERANCE OF +/- 1.0 MM.
2. THE UPPER & LOWER NOZZLE CONNECTIONS FOR ANY LEVEL INSTRUMENT SHALL BE IN THE SAME PLANE.
3. EQUIPMENT TOLERANCE SHALL BE IN ACCORDANCE WITH EIL STD. 7-12-001 OR GA-C1266 OR DESIGN CODE WHICH EVER IS STRINGENT.
4. TOLERANCES INDICATED IN THE DRAWING ARE NON CUMULATIVE.

E. NDE AND TESTING:

1. ALL INSPECTION REQUIREMENTS SHALL BE AS PER INSPECTION & TEST PLAN DOC. NO. B016-RUF-LT-504-MS-QD-BHEL(1)-02001
2. CLADDED DISHED END SHALL BE ULTRASONICALLY TESTED AFTER FORMING AS PER A 578, LEVEL-C.
3. KNUCKLE PORTION OF DISHED ENDS BOTH INSIDE AND OUTSIDE SHALL BE D.P.CHECKED.
4. ALL WELDED PIPES OF SS 347 MATERIAL SHALL BE 100% DP CHECKED BOTH INSIDE AND OUTSIDE.
5. ON FORMED PIPE OF SS 347 MATERIAL, HARDNESS MEASUREMENT IN BASE METAL AND HAZ SHALL BE CARRIED OUT AFTER WELDING. THE MAXIMUM HARDNESS SHALL BE LIMITED TO 88 RB. OTHERWISE NECCESSARY HEAT TREATMENT SHALL BE CARRIED OUT TO BRING THE HARDNESS WITHIN THE LIMITS. ANNEALING PROCEDURE SHALL BE ESTABLISHED TO CONTROL HARDNESS.
6. ALL NOZZLES FABRICATED FROM PLATE SHALL BE 100% RADIOGRAPHED.
7. WATER USED FOR HYDRAULIC TESTING SHALL BE CLEAN & POTABLE AND HT SHALL BE CARRIED OUT AS PER DOC. NO B016-RUF-LT-504-MS-QD-BHEL(1)-02005.

F. SURFACE PREPARATION & PROTECTION AND PAINTING:

2. 1. SURFACE PREPARATION AND PAINTING SHALL BE AS PER SURFACE PREPARATION & PAINTING PROCEDURE (DOC. NO. B016-RUF-LT-504-MS-QD-BHEL(1)-02004) AND SHALL COMPLY ALL REQUIREMENTS OF B016-000-79-41-PLS-01, REV.1.
2. ALL SS / CLAD SURFACES AND WELDMENTS SHALL BE PICKLED & PASSIVATED AS PER ASTM A-380 AFTER HYDRAULIC TESTING.
3. PROTECT ALL MACHINED SURFACES AND THREADED CONNECTIONS WITH RUST PREVENTIVE IMMEDIATELY AFTER MACHINING. INSTALL WOOD OR STEEL PROTECTORS FOR FITTINGS IMMEDIATELY AFTER TESTING.
4. EARTHING LUGS ARE NOT TO BE PAINTED OR GALVANISED.
2. 5. (STENCILING OF MANWAYS AND NOZZLES SHALL BE CARRIED OUT.)

G. SHIPMENT AND HANDLING:

1. ALL REMOVABLE INTERNALS SHALL BE SIZED SO AS TO PASS THROUGH MANHOLE. (I.D.576 MM)
2. AFTER HYDROTEST, EQUIPMENT SHALL BE THOROUGHLY DRAINED & DRIED OUT, ALL THE NOZZLE OPENINGS SHALL BE CLOSED WITH SUITABLE STEEL COVERS.
3. EQUIPMENT SHALL BE TRANSPORTED TO SITE IN SINGLE PIECE.
4. LIFTING OF EQUIPMENT SHALL BE DONE USING SPREADER BEAM ONLY.

4.

PMC REFERENCE SPECIFICATIONS	STD. NO. :
1. GENERAL SPEC. FOR PRESSURE VESSELS	6-12-0001, REV.5
2. SUPP. SPEC. FOR LAS VESSELS	6-12-0003, REV.4
3. SUPP. SPEC. FOR SS CLAD VESSELS	6-12-0007, REV.4
4. STD. SPEC. FOR BQCS PLATE	6-12-0011, REV.8
5. STD. SPEC. FOR STRUCTURAL QUALITY PLATES	6-12-0014, REV.6
6. STD. SPEC. FOR CLAD PLATES	6-12-0015, REV.4
7. STD. SPEC. FOR 2.25%Cr-1% Mo PLATES	6-12-0018, REV.4
8. STD. SPC. FOR HARDNESS REQU. STATIC EQUIPMENTS	6-15-0091, REV.3
9. HOT INSULATION SPECIFICATION	6-44-0002, REV.5
10. TECHNICAL NOTES FOR GASKETS	6-44-0056, REV.5
11. TECHNICAL NOTES FOR BOLTS & NUTS	6-44-0057, REV.5
12. MATERIAL REQU. FOR CS COMPO.USED IN SOUR SERVICE	6-79-0013, REV.1
13. STD. SPC. FOR PMI AT SUPPLIER'S WORK	6-81-0001, REV.3
14. BASIC ENGINEERING DESIGN BASIS (PART-B)	A758-999-02-41-ODB-1001_BEDB, REV.2
15. ENGINEERING DESIGN BASIS STATIC EQUIPMENT	A758-999-16-46-EDB-1001, Rev.0
16. JOB SPECIFICATION (EQUIPMENT DIVISION)	B016-504-80-43-SP-9509, Rev.D
17. VENDOR DATA REQUIREMENTS	B016-504-80-43-VDR-9509, REV.A
18. MANDATORY SPARES	B016-504-80-43-SL-9509, REV.A
19. SCOPE OF WORK	B016-504-80-43-SOW-9509, REV.C
20. SITE SPECIFIC SEISMIC SPECTRA	B016-000-16-54-DB-0001, Rev.0
21. JOB SPEC. FOR SURFACE PREPARATION & PROTECTIVE COATING	B016-000-79-41-PLS-01, Rev.1

INSPECTION DOCUMENTS	STD. NO. :
1. INSPECTION & TEST PLAN FOR GASKETS	6-81-0008, REV. 3
2. INSPECTION & TEST PLAN FOR PR VESSELS, COLUMNS, REACTORS-LOW ALLOY STEEL	6-81-0012, REV. 3
3. INSPECTION & TEST PLAN PR. VESSEL, COLUMN, REACTORS-SS CLAD	6-81-0013, REV. 3

LICENSOR SPECIFICATIONS	STD. NO. :
1. HYDROPROCESSING REACTORS AND HIGH PRESSURE VESSELS MANUFACTURED FROM 2¼Cr-1Mo AND 2¼Cr-1Mo-¼V LOW-ALLOY STEELS	PVM-SU-5004-I
2. DESIGN AND FAB. OF PRESSURE VESSEL WITH HIGH-ALLOY CLADDING OR OVERLAY	PVM-SU-1322-H.1
3. GENERAL SPECIFICATION FOR MATERIAL OF CONSTRUCTION	BA-175858
4. PROCESS DATA SHEET FOR HIGH TEMPERATURE FLARE KNOCK OUT DRUM (504-V-805A)	B016-RUF-LT-504-PC-DS-0286

PMC REFERENCE STANDARDS	STD. NO. :
1. VESSEL TOLERANCES	7-12-0001, REV.6
2. MANHOLE WITH DAVIT	7-12-0010, REV.7
3. LADDER RUNGS FOR MANHOLE/DEMISTER	7-12-0011, REV.6
4. NOZZLE REINFORCEMENT AND PROJECTION	7-12-0013, REV.6
5. STANDARD BOLT HOLE ORIENTATION	7-12-0015, REV.6
6. ALLOY LINER DETAILS	7-12-0016, REV.6
7. INTERNAL FLANGES	7-12-0018, REV.6
8. EIL NAME PLATE	7-12-0027, REV.6
9. MANUFACTURER NAME PLATE	7-12-0028, REV.6
10. BRACKET FOR NAME PLATE	7-12-0029, REV.6
11. SUPPORTS FOR INTERNAL FEED PIPE	7-12-0032, REV.5

LTC STANDARDS	STD. NO. :
1. TEMPLATE FOR HORIZONTAL EQUIPMENT	LTC-EQ-DOA-038, REV.0
2. ALLOWABLE NOZZLE LOADS	LTC-001

PIP STANDARDS	STD. NO. :
1. HORIZONTAL VESSEL INSULATION SUPPORTS	VEFV-1122
2. VESSEL GROUNDING LUG	VEFV-1103

LICENSOR STANDARDS	STD. NO. :
1. HORIZONTAL VESSEL – FAB. TOLERANCES	GA-C1266, REV.1
2. STRAINER AND VORTEX BREAKER FOR BOTTOM OUTLET NOZZLES	GC-C13354, REV.13
3. STANDARD CONNECTIONS & WELDING DETAILS FOR CLAD STEEL VESSELS	GD-C99663, REV.17
4. STANDARD NOZZLES AND HAND HOLES FOR THICK WALL OR HIGH TEMPERATURE PRESSURE VESSELS	GF-C1030, REV.4
5. GASKET SPECIFICATIONS AND ACCEPTABLE BRANDS	GD-L1264, REV.6

EXTERNAL TEMPLATE	SHELL	HEAD
1. 'e' VALUE	27.75 mm	23.75 mm
2. CHORDAL LENGTH	1543 mm	3020 mm

L&T - CHIYODA LIMITED

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- ☐ V-VOID

COMMENTED BY	REVIEWED BY	APPROVED BY	DATE

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1-PV-180-U0019	B016-RUF-LT-554-MS-GA-BHEL(1)-02651	GENERAL ASSEMBLY OF HT FLARE KO DRUM (504-V-805A)	01
DRAWING NO.	CLIENT DRAWING NO.	DRAWING TITLE	REV. NO.

REFERENCE DOCUMENTS / DRAWINGS

DRG. CATEGORY: (USE TICK MARK) [R] [I]
SCH. DATE OF SUBMISSION
EIL REVIEW/APPROVAL CODE:
VPTL NO.:

DOCUMENT STATUS
STATEMENT OF SUB: [1st] [2nd] [3rd]
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ISSUED FOR
☐ AS BUILT ☐ INFORMATION
☐ CONSTRUCTION ☐ REVIEW

SIGN: DATE:

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- ☐ V-VOID

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REV.	DESCRIPTION	DRN	CHECKED	APPROVED	REVIEWED	APPROVED	DATE
02	REVISED AS PER L&T COMMENTS	VAR	AVR	K.T			21.10.20
01	REVISED AS PER L&T COMMENTS	VAR	AVR	K.T			07.07.20
00	ISSUED FOR APPROVAL	VAR	AVR	K.T			01.06.20

OWNER: HINDUSTAN PETROLEUM CORPORATION LIMITED
VISAKH REFINERY MODERNIZATION PROJECT
EPCC-03 PACKAGE FOR RESIDUE UP-GRADATION FACILITY (RUF)

PMC : ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

LSTK CONTRACTOR: L&T Hydrocarbon Engineering

DETAILED ENGINEERING CENTER: L&T - CHIYODA LIMITED

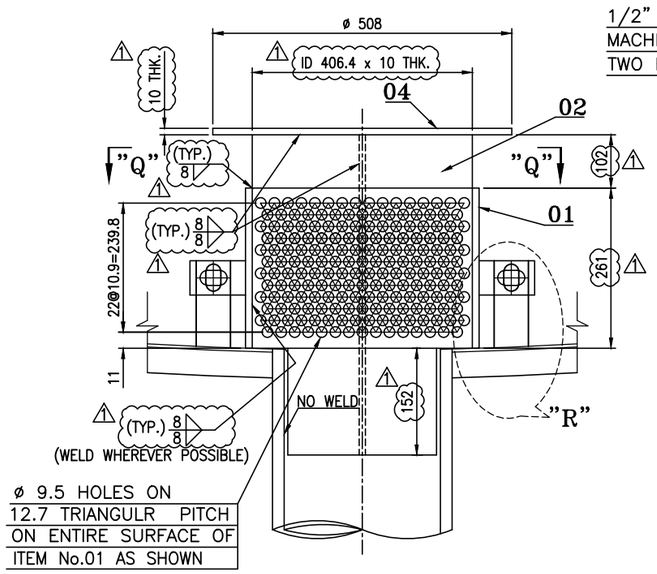
VENDOR : Bharat Heavy Electricals Limited
UNIT: HEAVY PLATES & VESSELS PLANT
VISAKHAPATNAM-530012

VENDOR PO NO: Refinery/75000-66912/NG; DATE:18.03.2020
VENDOR DWG. NO: 3-PV-180-U0190, REV. 02

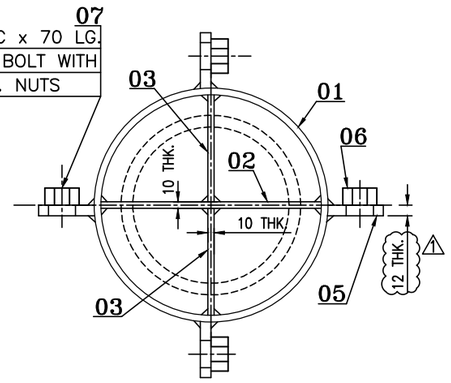
DATE	SCALE	TITLE: GENERAL NOTES FOR HIGH TEMPERATURE FLARE KNOCK OUT DRUM (ITEM NO. 504-V-805A)	
01.06.20	N.T.S		
DEPT: HT ENGG.			
DRN BY: V.A.RAO		PROJECT:	DRG. NO.: B016-RUF-LT-504-MS-FD-BHEL(1)-02660 / SH. 1 OF 1
CHK BY: A.V.RAO		PWO NO.:	REV. 02
APP BY: K.TARAKESH		CAD REWSE THIS DRG. USING CAD SYSTEM ONLY	FILE:

BHEL DRG. NO. 3-PV-180-U0226
DRG. NO. B016-RUF-LT-504-MS-FD-BHEL(1)-02652

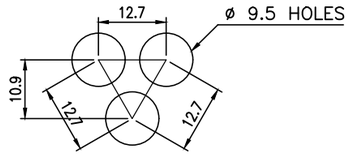
SPECIAL NOTE:
BHEL SHALL ENSURE COMPLIANCE OF ALL DIMENSIONS/SKETCHES IN THIS MANUFACTURING ASSEMBLY DRAWING W.R.T GENERAL ASSEMBLY DRAWING: B016-RUF-LT-504-MS-GA-BHEL(1)-02651



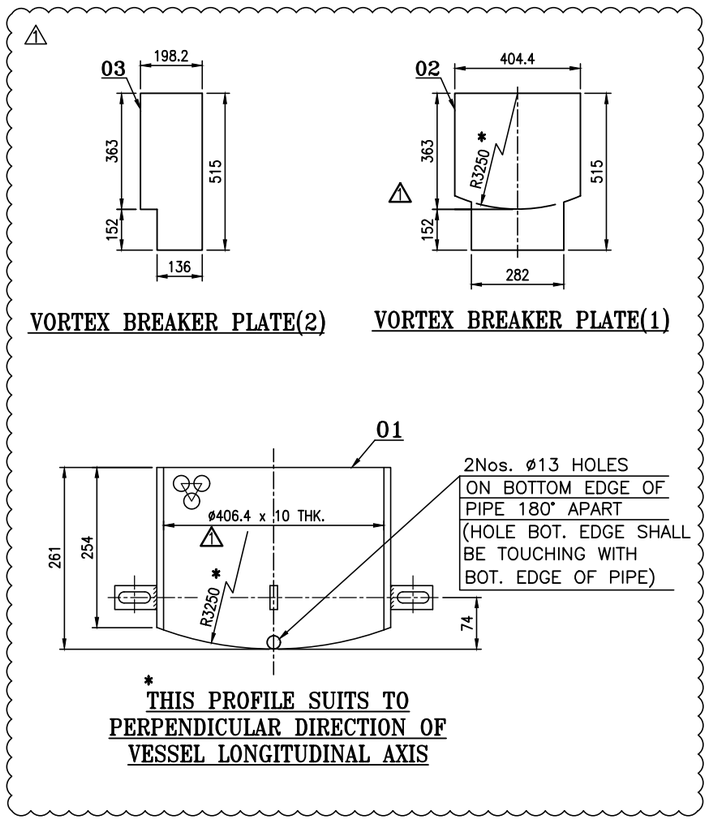
DETAIL OF STRAINER & VORTEX BREAKER AT NOZZLE-3



SECTION- Q Q



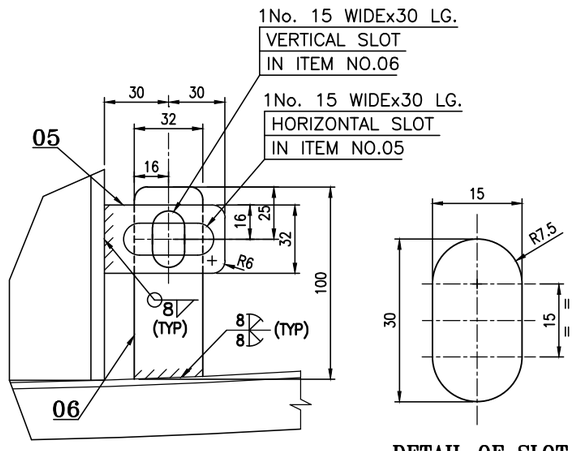
DETAIL OF HOLE PITCH



VORTEX BREAKER PLATE(2)

VORTEX BREAKER PLATE(1)

* THIS PROFILE SUITS TO PERPENDICULAR DIRECTION OF VESSEL LONGITUDINAL AXIS



DETAIL - R (TYP)

DETAIL OF SLOT (TYP)

TOTAL WEIGHT: 63.302

VARIANT NUMBER	ITEM NO.	DESCRIPTION	STD.	DRAWING NUMBER	ITEM NO / VAR NO	MATERIAL CODE / MATERIAL SPECIFICATION	A/C/P	UNIT	UNIT WEIGHT / QUANTITY
	07	MACHINE BOLT WITH TWO HEX. NUTS 1/2" UNC x 70 LG.				SA193Gr.B8CA/SA194Gr.8CA		KG	0.116
								SET	4
	06	VORTEX BREAKER VERT. SUPT. PL. 12 THK. x 32 x 100						KG	0.196
						SA 240 TP 347		NO	4
	05	VORTEX BREAKER HORZ. SUPT. PL. 12 THK. x 32 x 60						KG	0.119
						SA 240 TP 347		NO	4
	04	VORTEX BREAKER TOP PLATE OD 508 x 10 THK.						KG	16.215
						SA 240 TP 347		NO	1
	03	VORTEX BREAKER PLATE(2) 10 THK. x 515 x 198.2 AS PER DRG.						KG	7.341
						SA 240 TP 347		NO	2
	02	VORTEX BREAKER PLATE(1) 10 THK. x 515 x 404.4 AS PER DRG.						KG	15.006
						SA 240 TP 347		NO	1
	01	PIPE FOR STRAINER ID406.4x10TK-261LG. 1308 x 261 x 10TK.						KG	15.675
						SA 240 TP 347		NO	1

DRAWING NO. | DRAWING TITLE

REFERENCE DOCUMENTS / DRAWINGS

DRG. CATEGORY: (USE TICK MARK) [R] [I] | EIL REVIEW/APPROVAL CODE: | VPTL NO.:

SCH. DATE OF SUBMISSION

DOCUMENT STATUS
STATEMENT OF SUB: [1st] [2nd] [3rd]
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☐ V-VOID
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REV.	DESCRIPTION	DRN	CHECKED	APPROVED	REVIEWED	APPROVED	DATE
01	REVISED AS PER CUST. COMMENTS	VAR	AVR	K.T			16.10.20
00	ISSUED FOR APPROVAL	VAR	AVR	K.T			21.05.20

OWNER: HINDUSTAN PETROLEUM CORPORATION LIMITED
VISAKH REFINERY MODERNIZATION PROJECT
EPCC-03 PACKAGE FOR RESIDUE UP-GRADATION FACILITY (RUF)

PMC : इंजीनियर्स इंडिया लिमिटेड ENGINEERS INDIA LIMITED (A Govt. of India Undertaking)

LSTK CONTRACTOR: L&T Hydrocarbon Engineering

DETAILED ENGINEERING CENTER: L&T - CHIYODA LIMITED

VENDOR : Bharat Heavy Electricals Limited, UNIT: HEAVY PLATES & VESSELS PLANT, VISAKHAPATNAM-530012

VENDOR PO NO: HPCL RUF-STA-NGU-0010 DT:18.03.2020

VENDOR DWG. NO: 3-PV-180-U0226, REV. 01

DATE	SCALE
07-07-20	N.T.S

TITLE: ASSEMBLY DETAILS OF HT FLARE KO DRUM (ITEM NO. 504-V-805A) (STRAINER & VORTEX BREAKER ASSEMBLY AT NOZZLE 3)

DEPT: HT ENGG.
DRN BY: K. MUNAYYA
CHK BY: A.V.RAO
APP BY: K.TARAKESH
PROJECT:
PWO NO.:
DRG. NO.: B016-RUF-LT-504-MS-FD-BHEL(1)-02652
SH. 07 OF 08
REV. 01
CAD REVISE THIS DRG. USING CAD SYSTEM ONLY FILE:

L&T - CHIYODA LIMITED

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COMMENTED BY	REVIEWED BY	APPROVED BY	DATE

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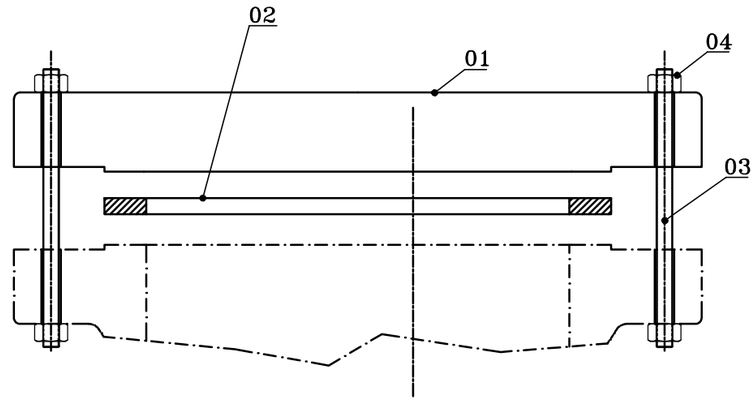
DRG. NO. 3-PV-180-U0239

REF. NO. B016-RUF-LT-504-MS-FD-BHEL(1)-02652

SPECIAL NOTE:
BHEL SHALL ENSURE COMPLIANCE OF ALL DIMENSIONS/SKETCHES IN THIS MANUFACTURING ASSEMBLY DRAWING W.R.T GENERAL ASSEMBLY DRAWING: B016-RUF-LT-504-MS-GA-BHEL(1)-02651



VARIANT NUMBER	ITEM NUMBER	DESCRIPTION	SHT	DRAWING NUMBER	ITEM NO / VAR NO	MATERIAL CODE / MATERIAL SPECN	A/C/P / UNIT	UNIT WEIGHT / QUANTITY	GS
	04	NUT 1 7/8"-8UN				---- / SA194GR.2HM		1.905 / 132	
	03	STUD 1 7/8"-8UNx 440 LG				---- / SA193GR.B7M		4.000 / 44	
	02	GASKET-300#; SPW SS316L GRAF. FILLED INNER RING				---- / SS 316 INNER RING+ CS RING		3.370 / 1	
	01	BLANK FLANGE NPS 50"-300#				---- / SA 105		2014.87 / 1	
07		NOZZLE-50" - 300#				---- / (WELDMENT)		--- /	
	04	NUT 1 5/8"-8UN				---- / SA194GR.2HM		0.736 / 192	
	03	STUD 1 5/8"-8UNx 350 LG				---- / SA193GR.B7M		3.303 / 64	
	02	GASKET-300#; SPW SS316L GRAF. FILLED INNER RING				---- / SS 316 INNER RING+ CS RING		1.250 / 2	
	01	BLANK FLANGE NPS 36"-300#				---- / SA 105		1104.51 / 2	
06		NOZZLE-36" - 300#				---- / (WELDMENT)		--- /	
	04	NUT 1 1/2"-8UN				---- / SA194GR.2HM		0.595 / 72	
	03	STUD 1 1/2"-8UN x 280 LG				---- / SA193GR.B7M		2.170 / 24	
	02	GASKET-300#; SPW SS316L GRAF. FILLED INNER RING				---- / SS 316 INNER RING+ CS RING		1.000 / 1	
	01	BLANK FLANGE NPS 24"-300#				---- / SA 105		342.000 / 1	
05		NOZZLE-24" - 300#				---- / (WELDMENT)		--- /	
	04	NUT 1 1/4"-8UN				---- / SA194GR.2HM		0.357 / 60	
	03	STUD 1 1/4"-8UN x 255 LG				---- / SA193GR.B7M		1.376 / 20	
	02	GASKET-600#; SPW SS316L GRAF. FILLED INNER RING				---- / SS 316 INNER RING+ CS RING		0.750 / 1	
	01	BLANK FLANGE NPS 12"-600#				---- / SA 105		83.000 / 1	
04		NOZZLE-12" - 600#				---- / (WELDMENT)		--- /	
	04	NUT 1"-8UN				---- / SA194GR.2HM		0.193 / 48	
	03	STUD 1"-8UN x 185 LG				---- / SA193GR.B7M		0.624 / 16	
	02	GASKET-300#; SPW SS316L GRAF. FILLED INNER RING				---- / SS 316 INNER RING+ CS RING		0.500 / 1	
	01	BLANK FLANGE NPS 10"-300#				---- / SA 105		58.000 / 1	
03		NOZZLE-10" - 300#				---- / (WELDMENT)		--- /	
	04	NUT 7/8"-9UNC				---- / SA194GR.2HM		0.135 / 48	
	03	STUD 7/8"-9UNC x 160 LG				---- / SA193GR.B7M		0.360 / 24	
	02	GASKET-300#; SPW SS316L GRAF. FILLED INNER RING				---- / SS 316 INNER RING+ CS RING		0.200 / 2	
	01	BLANK FLANGE NPS 8"-300#				---- / SA 105		37.000 / 2	
02		NOZZLE-8" - 300#				---- / (WELDMENT)		--- /	
	04	NUT 3/4"-10UNC				---- / SA194GR.2HM		0.088 / 352	
	03	STUD 3/4"-10UNC x 120 LG				---- / SA193GR.B7M		0.224 / 176	
	02	GASKET-300#; SPW SS316L GRAF. FILLED INNER RING				---- / SS 316 INNER RING+ CS RING		0.200 / 22	
	01	BLANK FLANGE NPS 3"-300#				---- / SA 105		7.000 / 22	
01		NOZZLE-3" - 300#				---- / (WELDMENT)		--- /	

DRAWING NO.	CLIENT DRAWING NO.	DRAWING TITLE	REV

REFERENCE DOCUMENTS / DRAWINGS

DRG. CATEGORY: (USE TICK MARK) [R] [I]
EIL REVIEW/APPROVAL CODE:
VPTL NO.:
SCH. DATE OF SUBMISSION

DOCUMENT STATUS
STATEMENT OF SUB: [1st] [2nd] [3rd]
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REV.	DESCRIPTION	DRN	CHECKED	APPROVED	REVIEWED	APPROVED	DATE
00	ISSUED FOR APPROVAL	KMY	AVR	TK	---	---	07.07.20

L&T - CHIYODA LIMITED

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OWNER: HINDUSTAN PETROLEUM CORPORATION LIMITED
VISAKH REFINERY MODERNIZATION PROJECT
EPCC-03 PACKAGE FOR RESIDUE UP-GRADATION FACILITY (RUF)

PMC : इंजीनियर्स इंडिया लिमिटेड (A Govt. of India Undertaking) ENGINEERS INDIA LIMITED

LSTK CONTRACTOR: L&T Hydrocarbon Engineering

DETAILED ENGINEERING CENTER: L&T - CHIYODA LIMITED

VENDOR : Bharat Heavy Electricals Limited UNIT: HEAVY PLATES & VESSELS PLANT VISAKHAPATNAM-530012

BHEL PO NO: REFINERY/75000-66912/NG; DATE: 18.03.2020
BHEL DWG. NO: 3-PV-180-U0239, REV. 0

DATE	SCALE
07.07.20	N.T.S

TITLE: ASSEMBLY DETAILS FOR HYDRO TEST OF HIGH TEMPERATURE FLARE KNOCK OUT DRUM ITEM NO. 504-V-805A

DEPT: HT ENGG.
DRN BY: MUNAYYA K
CHK BY: A V RAO
APP BY: TARAKESH K
PROJECT:
PWO NO.:
CUSTOMER REF. DRG. NO. : B016-RUF-LT-504-MS-FD-BHEL(1)-02652
SH. 8 OF 8
REV. 00
CAD REVISE THIS DRG. USING CAD SYSTEM ONLY FILE:

A3
CUT TO CLEAR THE ATTACHMENTS.

MANUFACTURER'S NAME & ADDRESS	QUALITY ASSURANCE PLAN	
BHEL-VISAKHAPATNAM or Approved Sub Contractor.	QAP NO: **B016-RUF-LT-504-QC-QD-BHEL(1)-02006** Rev. 2 Date : 04-02-2021 Page 1 of 23 BHEL SO: 2438; Internal CQP No: **2499**	Purchaser : L & T Hydrocarbon Engineering Ltd (LTHE), Vadodara Project Name: VRMP-Visakh Refinery Modernisation Project Customer : Hindustan Petroleum Corporation Limited- Visakhapatnam PMC : Engineers India Limited (EIL) EIL Job No. : B016-504 L & T Job No.& PO No.: RUFV & REFINERY/75000-66912/NG Dt.18-03-2020

Code of Construction: ASME Section VIII Div.1, Edition 2019 with "U" Stamping.

Sl. No.	Item Description	Tag Number
1.	**HT FLARE KO DRUM**	**504-V-805 A**

P. Gopi Kishore Manager/QA/BHEL	A.K. Mandal AGM/Q & BE/BHEL	TUV	AI	LTHE	EIL
Prepared By	Reviewed By	Approved			

Approval/review of this document does not relieve the supplier/manufacturer from contractual bid & specification requirement. Supplier/manufacturer to comply all the requirements of specifications, datasheets & approved drawings.

MANUFACTURER'S NAME & ADDRESS BHEL-VISAKHAPATNAM or Approved Sub Contractor.	**QUALITY ASSURANCE PLAN** QAP NO: **B016-RUF-LT-504-QC-QD-BHEL(1)-02006** Rev.2 Date : 04-02-2021 Page 2 of 23 BHEL SO: 2438; Internal CQP No: 2499	Purchaser : L & T Hydrocarbon Engineering Ltd (LTHE), Vadodara Project Name: VRMP-Visakh Refinery Modernisation Project Customer : Hindustan Petroleum Corporation Limited- Visakhapatnam PMC : Engineers India Limited (EIL) EIL Job No. : B016-504 L & T Job No.& PO No.: RUFV & REFINERY/75000-66912/NG Dt.18-03-2020	

S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
1.0	Design & Drawings approval	Drawings & Design Calculations	ASME Sec VIII Div.1 Ed 2019 & PR Specifications	Drawings & Design Calculations	H	V	R		
2.0	ITP / QAP	Documents & Inspection Stages	ASME Sec VIII Div.1 Ed 2019 & & other specifications as per approved General Assembly drawing	QAP	H	H	R		
3.0	**Procedures**								
3.1	Welding Procedure Specification & WPS/PQR/WPQ	Compliance to ASME Sec IX	ASME Sec VIII Div.1 & Sec IX and CLG and EIL specifications including API RP 934 A	WPS/PQR/WPQ	H	R/W	R		TPIA inspection envisaged for any new WPS or WPQ R- for old PQR W-New PQR to be qualified; Refer Note-6

19.3.2024

MANUFACTURER'S NAME & ADDRESS	QUALITY ASSURANCE PLAN	Purchaser : L & T Hydrocarbon Engineering Ltd (LTHE), Vadodara
BHEL-VISAKHAPATNAM or Approved Sub Contractor.	QAP NO: **B016-RUF-LT-504-QC-QD-BHEL(1)-02006** Rev.2 Date : 04-02-2021 Page 3 of 23 BHEL SO: 2438; Internal CQP No: 2499	Project Name: VRMP-Visakh Refinery Modernisation Project Customer : Hindustan Petroleum Corporation Limited- Visakhapatnam PMC : Engineers India Limited (EIL) EIL Job No. : B016-504 L & T Job No.& PO No.: RUFV & REFINERY/75000-66912/NG Dt.18-03-2020

S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
3.2	All Manufacturing, Test Procedures a) NDT (UT/RT/MT/PT) * b) NDE Plan * c) Surface Preparation & Painting d) Hydro test * e) Ferrite measurement f) PMI g) Hardness test h) Pickling & Passivation i) Heat Treatment * j) Material handling & Protection	Procedure & Acceptance Criteria	ASME Sec VIII Div.1 Ed 2019 & & other specifications as per approved General Assembly drawing	Procedure	H	R	R *		*Review for AI
3.2a	Heat Treatment procedure for Dénd	Procedure & Acceptance Criteria	ASME Sec VIII Div.1 Ed 2019 & PR Specifications including API RP 934 A	Procedure	H	R	R		
4.0	**Raw Materials**								
4.1	Plates, Pipes, Fittings, Forgings, Fasteners, Gaskets etc., (as applicable) at sourcing locations.	PO., Approved Drawings	ASME Section II A, TDC & other specifications as per PR including API RP 934 A	Test Certificates / Check test results	H	R	-		Raw materials will be inspected by BHEL appointed TPIA.

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	MANUFACTURER'S NAME & ADDRESS	QUALITY ASSURANCE PLAN	
बीएच ई एल	BHEL-VISAKHAPATNAM or Approved Sub Contractor.	QAP NO: **B016-RUF-LT-504-QC-QD-BHEL(1)-02006** Rev.2 Date : 04-02-2021 Page 4 of 23 BHEL SO: 2438; Internal CQP No: 2499	Purchaser : L & T Hydrocarbon Engineering Ltd (LTHE), Vadodara Project Name: VRMP-Visakh Refinery Modernisation Project Customer : Hindustan Petroleum Corporation Limited- Visakhapatnam PMC : Engineers India Limited (EIL) EIL Job No. : B016-504 L & T Job No.& PO No.: RUFV & REFINERY/75000-66912/NG Dt.18-03-2020

S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
	Raw Materials after receipt								
4.2 a)	All Pressure parts / Part attached to Pressure part (Plates & Pipes)	PO., Approved Drawings	ASME Section II A, UCS-23 & other specifications as per PR including API RP 934 A	Manufacturer Test Certificates / Check test results	H	H&	RW		&-Material identification for Plates & Pipes (Pressure parts): Review of test certificates, markings, visual & dimensional inspection, identity correlation & transfer of identity for each tag & part no. This is to be followed by TPIA stamping.
4.2 b)	All Pressure parts / Part attached to Pressure part (Nozzle forgings & Flanges)	PO., Approved Drawings	ASME Section II A, UCS-23 & other specifications as per PR including API RP 934 A	Manufacturer Test Certificates / Check test results	H	W	R		
4.3	Non Pressure parts	PO., Approved Drawings	ASME Section II A & other specifications as per PR including API RP 934 A	Manufacturer Test Certificates / Check test results	H	R	-		
4.4	Welding Consumables	PO, TDC	ASME Section II C, CLG PVM-SU-5004-I & other specifications as per PR including API RP 934 A	Manufacturer Test Certificates	H	R	R		
4.5	Fasteners & Gaskets	PO, Drawings	ASME Section II A & other specifications as per PR including API RP 934 A	Manufacturer Test Certificates	H	W	R		PMI of AS, SS Material as applicable.

Engineering Projects

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MANUFACTURER'S NAME & ADDRESS	QUALITY ASSURANCE PLAN	Purchaser : L & T Hydrocarbon Engineering Ltd (LTHE), Vadodara
BHEL-VISAKHAPATNAM or Approved Sub Contractor.	QAP NO: **B016-RUF-LT-504-QC-QD-BHEL(1)-02006** Rev.2 Date : 04-02-2021 Page 5 of 23 BHEL SO: 2438; Internal CQP No: 2499	Project Name: VRMP-Visakh Refinery Modernisation Project Customer : Hindustan Petroleum Corporation Limited- Visakhapatnam PMC : Engineers India Limited (EIL) EIL Job No. : B016-504 L & T Job No.& PO No.: RUFV & REFINERY/75000-66912/NG Dt.18-03-2020

S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
5.0	**Fabrication of Dished Ends along with PTC as applicable**								
5.1	Transfer of Marking and Heat Number	Material Spec & Heat Number	Drawing & TDC, Material identification & transfer of marking procedure	Inspection Report	H	W	R		
5.2	Plate Marking, Cutting, Weld Edge Preparation	Dimensions	Drawing	Inspection Report	H	R	R		9 10
5.3	MPI & UT of Weld Edges & Fit Up Clearance for L-seam	Detection of flaws & Offset	Drawing	Inspection Report	H	RW	-		Refer Note- 10 & 11.
5.4	Fit-up & Welding of L-Seam along with PTC	weld geometry	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	RW	R/W		W by AI, when there is impact test requirement; Refer Note- 11
5.5	MT for back gouging prior to back welding of L-seam & Clearance for back welding	Detection of flaws	ASME Sec VIII Div.1 & Drawing, ASME Sec V Article 7, MPI Procedure	Inspection Report	H	RW	-		Refer Note- 12
5.6	Welding of L-Seam back gouging area	weld geometry	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	R	R/W		
5.7	Weld Visual Inspection before RT	Weld Visual	ASME Sec VIII Div.1, UW-35	Inspection Report	H	R	W		
5.8	100% RT of L-Seam weld before clad restoration	Detection of flaws	ASME Sec VIII Div.1 & Drawing	RT Films & Report	H	R	R		Refer Note- 4

Spot after restoration MT

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S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
5.9	100% PT on prepared surfaces just before clad restoration welding	Detection of flaws	ASME Sec VIII Div.1 & Drawing including API RP 934 A, PT Procedure	Inspection Report	H	W	-		Refer Note- 4
5.10	Clad restoration on L-seam weld	Welding parameters	WPS including API RP 934 A	-	H	R	-		Refer Note-1 & 4
5.11	100% PT on clad restoration each layer	Detection of flaws	ASME Sec VIII Div.1 & Drawing including API RP 934 A	Inspection Report	H	R/ RW	-		RW- for Final Layer
5.12	Chemical Analysis after Clad restoration	Chemical properties	PVM-SU-1322-H.1 Cl. No. 9.3.1.3 (a,b,c) & 9.3.1.4 (a,b,c &d) ; 6-12-0007 Rev.4 Cl. No. 5.6 ; API RP 934 A Cl.No. 7.5.5.1	Inspection Report	H	R#	-		# Chip extraction shall be witnessed by L-TPIA; Refer Note-16
5.13	Forming of Dished End	Dimensional & Template check	As per Drawing including API RP 934 A	Inspection Report	H	R	R		
5.14	Dis bondment check (100% UT) of surface of Knuckle area and Straight face of Dished End	Lack of bonding	ASME Sec VIII Div.1 & Drawing including API RP 934 A	Inspection Report	H	RW	-		Refer Note -5
5.15	Heat Treatment (along with PTC)	Time & Temperature	ASME Sec VIII Div.1 & Drawing	HT Chart / Report	H	R	R		HT procedure duly approved to be followed. ~~(if HT is applicable)~~
5.16	100% MT on Knuckle inside & outside including welds and WEP after forming & heat treatment	Detection of flaws	ASME Sec VIII Div.1 & Drawing, PT Procedure	Inspection Report	H	W	-		Refer Note-14

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MANUFACTURER'S NAME & ADDRESS	QUALITY ASSURANCE PLAN	Purchaser : L & T Hydrocarbon Engineering Ltd (LTHE), Vadodara
BHEL-VISAKHAPATNAM or Approved Sub Contractor.	QAP NO: B016-RUF-LT-504-QC-QD-BHEL(1)-02006 Rev.2 Date : 04-02-2021 Page 7 of 23 BHEL SO: 2438; Internal CQP No: 2499	Project Name: VRMP-Visakh Refinery Modernisation Project Customer : Hindustan Petroleum Corporation Limited- Visakhapatnam PMC : Engineers India Limited (EIL) EIL Job No. : B016-504 L & T Job No.& PO No.: RUFV & REFINERY/75000-66912/NG Dt.18-03-2020

S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
5.17	Dis bondment check (Spot UT) of Dished End	Detection of lack of bond	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	RW	-		Refer Note -5
5.18	Weld Visual Inspection before RT	Weld Visual	ASME Sec VIII Div.1, UW-35	Inspection Report	H	H R.	W W		
5.19	100% RT of weld after forming and heat treatment	Detection of flaws	ASME Sec VIII Div.1 & Drawing	RT Films & Report	H	R	R		
5.20	Final Dimensions (minimum thickness, profile, roundness, ovality etc.,)	Visual & dimensional	ASME Sec VIII Div.1 & Drawing, UG-80, UG-81	Inspection Report	H	H$	W		$ -Trail Assembly & fit up in case of Crown & Petal construction.
5.21	Test Coupon testing	Tensile Strength, Hardness & Impact test	ASME Sec VIII Div.1 & Specifications as per PR including API RP 934 A	Test report	H	H	R#		R # for AI, if heat treatment is Normalising; Refer Cl.No. 10.3 of CLG Spec PVM-SU-5004-I & Cl. No. 7.0 of EIL spec 6-12-0003 Rev.4

QA - QC

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S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
6.0	**Fabrication of Main Shell along with PTC ~~as applicable~~**								
6.1	Plate Marking, Cutting, Weld Edge Preparation	Dimensions	Drawing	Inspection Report	H	R	R		
6.2	Shell rolling	Dimensions	Drawing	Inspection Report	H	-	-		9 & 10
6.3	MPI & UT of Weld Edges & Fit Up Clearance for L-seam	Detection of flaws & Offset	Drawing	Inspection Report	H	RW	-		Refer Note- ~~10~~ & ~~11~~.
6.4	Fit up & Welding of L-Seam along with PTC	weld geometry	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	RW	R/W		W by AI, when there is impact test requirement; Refer Note- ~~12~~ 11
6.5	MT for back gouging prior to back welding of L-seam & Clearance for back weld	Detection of flaws	ASME Sec VIII Div.1 & Drawing, ASME Sec V Article 7, MPI Procedure	Inspection Report	H	RW	-		Refer Note- 12
6.6	Welding of L-Seam back gouging area	weld geometry	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	R	R/W		
6.7	Weld Visual Inspection before RT	Weld Visual	ASME Sec VIII Div.1, UW-35	Inspection Report	H	~~H~~ R.	~~W~~ WRT		
6.8	100% RT of L-Seam weld before clad restoration	Detection of flaws	ASME Sec VIII Div.1 & Drawing	RT Films & Report	H	R	R		Refer Note- 4

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S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
6.9	100% PT on prepared surfaces just before clad restoration welding	Detection of flaws	ASME Sec VIII Div.1 & Drawing, PT Procedure	Inspection Report	H	W	-		Refer Note- 4
6.10	Clad restoration on L-seam weld	Welding parameters	WPS	-	H	R	-		Refer Note-1 & 4
6.11	100% PT on clad restoration each layer	Detection of flaws	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	R/ RW	-		RW- for Final Layer
6.12	Spot RT of L-Seam weld ~~before~~ after clad restoration	Detection of flaws	ASME Sec VIII Div.1 incl UCL-36 & UW-52 & Drawing,	RT Films & Report	H	R	R		
6.13	Chemical Analysis after Clad restoration	Chemical properties	PVM-SU-1322-H.1 Cl. No. 9.3.1.3 (a,b,c) & 9.3.1.4 (a,b,c &d) ; 6-12-0007 Rev.4 Cl. No. 5.6 ; API RP 934 A Cl.No. 7.5.5.1	Inspection Report	H	R#	-		# Chip extraction shall be witnessed by L-TPIA ; Refer Note-16
6.14	Dis bondment check (Spot UT) of rolled sections of clad	Detection of lack of bond	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	RW	-		Refer Note -5

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S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
7.0	**Shell to Shell Circular Seam fabrication**								
7.1	Weld Edge Preparation	Dimensions	Drawing	Inspection Report	H	R	R		9 & 10
7.2	MPI & UT of Weld Edges & Fit Up Clearance for C-seam	Detection of flaws & Offset	Drawing	Inspection Report	H	RW	-		Refer Note- 10 & 11.
7.3	Fit up & Welding of C-Seam	weld geometry	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	R	R/W		
7.4	MT for back gouging prior to back weld of C-seam & Clearance for back welding	Detection of flaws	ASME Sec VIII Div.1 & Drawing, ASME Sec V Article 7, MPI Procedure	Inspection Report	H	RW	-		Refer Note- 12
7.5	Welding of C-Seam back gouging area	weld geometry	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	R	R/W		
7.6	Weld Visual Inspection before RT	Weld Visual	ASME Sec VIII Div.1, UW-35	Inspection Report	H	~~H~~ R	~~W~~ WR		
7.7	100% RT of C-Seam weld	Detection of flaws	ASME Sec VIII Div.1 & Drawing	RT Films & Report	H	R	R		Refer Note- 4
7.8	100% PT on prepared surfaces just before clad restoration welding	Detection of flaws	ASME Sec VIII Div.1 & Drawing, PT Procedure	Inspection Report	H	W	-		Refer Note- 4
7.9	Clad restoration on C-seam weld	Welding parameters	WPS	-	H	R	-		Refer Note-1 & 4

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MANUFACTURER'S NAME & ADDRESS	QUALITY ASSURANCE PLAN	Purchaser : L & T Hydrocarbon Engineering Ltd (LTHE), Vadodara
BHEL-VISAKHAPATNAM or Approved Sub Contractor.	QAP NO: B016-RUF-LT-504-QC-QD-BHEL(1)-02006 Rev.2 Date : 04-02-2021 Page 11 of 23 BHEL SO: 2438; Internal CQP No: 2499	Project Name: VRMP-Visakh Refinery Modernisation Project Customer : Hindustan Petroleum Corporation Limited- Visakhapatnam PMC : Engineers India Limited (EIL) EIL Job No. : B016-504 L & T Job No.& PO No.: RUFV & REFINERY/75000-66912/NG Dt.18-03-2020

S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
7.10	100% PT on clad restoration each layer	Detection of flaws	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	R/ RW	-		RW- for Final Layer
7.11	Spot RT of C-Seam weld	Detection of flaws	ASME Sec VIII Div.1 incl UCL-36 & UW-52 & Drawing,	RT Films & Report	H	R	R		
7.12	Chemical Analysis after Clad restoration	Chemical properties	PVM-SU-1322-H.1 Cl. No. 9.3.1.3 (a,b,c) & 9.3.1.4 (a,b,c &d) ; 6-12-0007 Rev.4 Cl. No. 5.6 ; API RP 934 A Cl.No. 7.5.5.1	Inspection Report	H	R#	-		# Chip extraction shall be witnessed by L-TPIA; Refer Note-16
8.0	**Shell to Dished end Circular Seam fabrication**								
8.1	Weld Edge Preparation	Dimensions	Drawing	Inspection Report	H	R	R		
8.2	MPI & UT of Weld Edges & Fit Up Clearance for C-seam	Detection of flaws & Offset	Drawing	Inspection Report	H	RW	-		Refer Note- 10 & 11.
8.3	Fit up & Welding of C-Seam	weld geometry	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	R	R/W		
8.4	MT for back gouging prior to back welding of C-seam & Clearance for back welding	Detection of flaws	ASME Sec VIII Div.1 & Drawing, ASME Sec V Article 7, MPI Procedure	Inspection Report	H	RW	-		Refer Note- 12
8.5	Welding of C-Seam back gouging area	weld geometry	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	R	R/W		

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S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
8.6	Weld Visual Inspection before RT	Weld Visual	ASME Sec VIII Div.1, UW-35	Inspection Report	H	W WR	W RW		
8.7	100% RT of C-Seam weld before clad restoration	Detection of flaws	ASME Sec VIII Div.1 & Drawing	RT Films & Reports	H	R	R		Refer Note- 4
8.8	100% PT on prepared surfaces just before clad restoration welding	Detection of flaws	ASME Sec VIII Div.1 & Drawing, PT Procedure	Inspection Report	H	W	-		Refer Note- 4
8.9	Clad restoration on C-seam weld	Welding parameters	WPS	-	H	R	-		Refer Note-1 & 4
8.10	100% PT on clad restoration each layer	Detection of flaws	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	R/ RW	-		RW- for Final Layer
8.11	Spot RT of C-Seam weld	Detection of flaws	ASME Sec VIII Div.1 incl UCL-36 & UW-52 & Drawing,	RT Films & Report	H	R	R		
8.12	Chemical Analysis after Clad restoration	Chemical properties	PVM-SU-1322-H.1 Cl. No. 9.3.1.3 (a,b,c) & 9.3.1.4 (a,b,c &d) ; 6-12-0007 Rev.4 Cl. No. 5.6 ; API RP 934 A Cl. No. 7.5.5.1	Inspection Report	H	R#	-		# Chip extraction shall be witnessed by L-TPIA; Refer Note-16

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S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
9.0	**Wed overlay of Nozzles, Pipes, Elbow and blind flanges**								
9.1	Nozzle & Elbows, ID Check and Record up to NPS 3 before overlay with Nozzle identification	Dimensions	Drawing	Inspection Report	H	W	-		
9.2	Weld overlay	Welding parameters	Drawing	-	H	R	-		
9.3	Weld overlay thickness from inside the nozzle (ID Check)	Thickness	Drawing	Inspection Report	H	W	-		
9.4	100% PT on weld overlay each layer	Detection of flaws	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	R/ RW	-		RW- for Final Layer
9.5	Ferrite Number	% delta ferrite	PVM-SU-1322-H.1 Cl.No. 9.3.2	Inspection Report	H	RW	-		It shall be at the time of Final Dimensional Inspection for accessible portion of overlay.

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BHEL-VISAKHAPATNAM or Approved Sub Contractor.	QAP NO: **B016-RUF-LT-504-QC-QD-BHEL(1)-02006** Rev.2 Date : 04-02-2021 Page 14 of 23 BHEL SO: 2438; Internal CQP No: 2499	Project Name: VRMP-Visakh Refinery Modernisation Project Customer : Hindustan Petroleum Corporation Limited- Visakhapatnam PMC : Engineers India Limited (EIL) EIL Job No. : B016-504 L & T Job No.& PO No.: RUFV & REFINERY/75000-66912/NG Dt.18-03-2020

S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
10.0	**Fabrication of Nozzle Assemblies**								
10.1	Weld Edge Preparation	Dimensions	Drawing	Inspection Report	H	R	R		
10.2	DPT of Weld Edges & Fit Up Clearance for C-seam	Detection of flaws & Offset	Drawing	Inspection Report	H	RW	-		
10.3	Welding of C-Seam of pipes /elbows / flanges / nozzle neck etc	weld geometry	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	R	R		Refer Note-13
10.4	Weld Visual Inspection before RT	Weld Visual	ASME Sec VIII Div.1, UW-35	Inspection Report	H	W R.	W		
10.5	100% DPT of Full Weld	Detection of flaws	ASME Sec VIII Div.1 & Drawing, PT Procedure	Inspection Report	H	R	R		
10.6	RT on C-seam weld	Detection of flaws	ASME Sec VIII Div.1 & Drawing, UW-51	RT Films & Reports	H	R	R		
11.0	**Nozzle to Shell / Dished end fabrication**								
11.1	UT of clad plate areas to be cut for nozzle openings	Approved Drawings	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	RW	-		Refer Note-5
11.2	Marking, Cutting, Weld Edge Preparation of Openings for Nozzles on Shell, Dished ends.	Dimensions	Drawing	Inspection Report	H	R	R		
11.3	MPT of Weld Edges & Fit Up Clearance	Detection of flaws & Offset	Drawing ASME Sec VIII Div.1 & Drawing	Inspection Report	H	RW	-		

19.7.21

MANUFACTURER'S NAME & ADDRESS	QUALITY ASSURANCE PLAN	Purchaser : L & T Hydrocarbon Engineering Ltd (LTHE), Vadodara
BHEL-VISAKHAPATNAM or Approved Sub Contractor.	QAP NO: B016-RUF-LT-504-QC-QD-BHEL(1)-02006 Rev.2 Date : 04-02-2021 Page 15 of 23 BHEL SO: 2438; Internal CQP No: 2499	Project Name: VRMP-Visakh Refinery Modernisation Project Customer : Hindustan Petroleum Corporation Limited- Visakhapatnam PMC : Engineers India Limited (EIL) EIL Job No. : B016-504 L & T Job No.& PO No.: RUFV & REFINERY/75000-66912/NG Dt.18-03-2020

S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
11.4	Welding of Seam	weld geometry	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	R	R		
11.5	Intermediate Stress Relieving	Time & Temperature	ASME Sec VIII Div.1 & Drawing	HT Chart / Report	H	R	R		Refer Note-15; HT procedure duly approved to be followed.
11.6	100% MT prior to back welding of seam (In cases where root run is done by GTAW process because of access constraint / limitation in access to weld from both sides, MT will be done for root run)	Detection of flaws	ASME Sec VIII Div.1 & Drawing, ASME Sec V Article 7, MPI Procedure	Inspection Report	H	RW	-		
11.7	Weld Visual Inspection	Weld Visual	ASME Sec VIII Div.1, UW-35	Inspection Report	H	~~W~~ R	W		
11.8	100% RT of C-Seam weld before clad restoration	Detection of flaws	ASME Sec VIII Div.1 & Drawing	RT Films & Reports	H	R	R		Refer Note- 4
11.9	100% PT on prepared surfaces just before clad restoration welding	Detection of flaws	ASME Sec VIII Div.1 & Drawing, PT Procedure	Inspection Report	H	W	-		Refer Note- 4 (for Nozzles other than Lip type)
11.10	Clad restoration on C-seam weld	Welding parameters	WPS	-	H	R	-		Refer Note-1 & 4
11.11	Chemical Analysis after Clad restoration	Chemical properties	PVM-SU-1322-H.1 Cl.No. 9.3.1.3 (a,b,c) AND 9.3.1.4 (a,b,c &d) or 6-12-0007 Rev.4 Cl.No. 5.6	Inspection Report	H	R#	-		# Chip extraction shall be witnessed by L-TPIA.
11.12	100% DPT of Full Weld	Detection of flaws	ASME Sec VIII Div.1 & Drawing, PT Procedure	Inspection Report	H	R	R		

S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
11.13	100% UT on Nozzles to Shell, Dished ends before PWHT as applicable	Detection of flaws	Drawing	Inspection Report	H	W	-		
11.14	100% RT of insert plate to shell and insert plate to SR Nozzles, SR Nozzles to Shell	Detection of flaws	ASME Sec VIII Div.1 & Drawing	RT Films & Report	H	R	R		
12.0	**Fabrication of Internal & External attachments**								
12.1	UT of clad plate areas near load bearing internal attachments to be welded	Approved Drawings	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	RW	-		Refer Note-5
12.2	Welding of Internal & External attachments including insert plate (where applicable)	Location & Dimensions	Drawing	Inspection Report	H	-	-		
12.3	100% DPT for Internal & External attachment welds	Detection of flaws	Drawing	Inspection Report	H	-	-		
12.4	Assembly and Welding of coil to coil joints	Location & Dimensions	Drawing	Inspection Report	H	R	W		
12.5	RT of coil to coil joints	Detection of flaws	ASME Sec VIII Div.1 & Drawing, UW-51	RT Films & Report	H	R	R		
12.6	PMI of parent material & weld area	Approved Drawings	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	RW	-		

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S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
12.7	Hydro testing of coil assembly followed by drying & cleaning as applicable	No pressure drop or leakage	Drawing	Inspection Report	H	H	H@		@ H for AI for Hydrostatic test only.
12.8	Assembly and Welding of coil to nozzle hook-up joint.	Location & Dimensions	Drawing	Inspection Report	H	R	R		
12.9	RT of coil to nozzle hook-up joint.	Detection of flaws	ASME Sec VIII Div.1 & Drawing, UW-51	RT Films & Report	H	R	R		
12.10	Assembly and Welding of coil supporting arrangement to Vessel weld joints	Location & Dimensions	Drawing	Inspection Report	H	R	-		
12.11	NDE of coil supporting arrangement to Vessel weld joints	Detection of flaws	Drawing	Inspection Report	H	-	-		

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MANUFACTURER'S NAME & ADDRESS	QUALITY ASSURANCE PLAN	Purchaser : L & T Hydrocarbon Engineering Ltd (LTHE), Vadodara
BHEL-VISAKHAPATNAM or Approved Sub Contractor.	QAP NO: **B016-RUF-LT-504-QC-QD-BHEL(1)-02006** Rev.2 Date : 04-02-2021 Page 18 of 23 BHEL SO: 2438; Internal CQP No: 2499	Project Name: VRMP-Visakh Refinery Modernisation Project Customer : Hindustan Petroleum Corporation Limited- Visakhapatnam PMC : Engineers India Limited (EIL) EIL Job No. : B016-504 L & T Job No.& PO No.: RUFV & REFINERY/75000-66912/NG Dt.18-03-2020

S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection M	Inspection TUV	Inspection AI	EIL	Remarks
13.0	**Saddle fabrication and Assembly**								
13.1	Fit up and Welding of saddle, saddle with Vessel	Offset & weld geometry	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	R	-		
13.2	100% PT on welds of entire inside surface	Detection of flaws	Drawing	Inspection Report	H	R	-		Refer Note-8
13.3	Dimensional inspection of Saddle	Dimensions	Drawing	Inspection Report	H	R	-		W-During Final Inspection by AI.
14.0	Final Visual & Dimensional inspection before PWHT & clearance for PWHT	Dimensions & orientations	Drawing	Inspection Report	H	H	W		
14.1	PMI Check	Chemical	PVM-SU-1322-H.1 Cl.No. 9.3.1	Inspection Report	H	RW	R		
14.2	Ferrite Number	% delta ferrite	PVM-SU-1322-H.1 Cl.No. 9.3.2	Inspection Report	H	RW	-		
15.0	PWHT of Equipment along with PTC	Time & Temperature	ASME Sec VIII Div.1 & Drawing	HT Chart / Report	H	R	R		PWHT procedure duly approved to be followed
16.0	Test Coupon testing	Tensile Strength, Hardness & Impact test	ASME Sec VIII Div.1 & Specifications as per PR including API RP 934 A	Test report	H	H	R#		R # for AI, if heat treatment is Normalising; Refer Cl .No. 10.3 of CLG Spec PVM-SU-5004-I & Cl. No. 7.0 of EIL spec 6-12-0003 Rev.4

UT of the Cladded parts (shell, dished ends) shall be checked for lack of disbondment after PWHT and same shall be witnessed by TPIA.

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MANUFACTURER'S NAME & ADDRESS	QUALITY ASSURANCE PLAN	
BHEL-VISAKHAPATNAM or Approved Sub Contractor.	QAP NO: **B016-RUF-LT-504-QC-QD-BHEL(1)-02006** Rev.2 Date : 04-02-2021 Page 19 of 23 BHEL SO: 2438; Internal CQP No: 2499	Purchaser : L & T Hydrocarbon Engineering Ltd (LTHE), Vadodara Project Name: VRMP-Visakh Refinery Modernisation Project Customer : Hindustan Petroleum Corporation Limited- Visakhapatnam PMC : Engineers India Limited (EIL) EIL Job No. : B016-504 L & T Job No.& PO No.: RUFV & REFINERY/75000-66912/NG Dt.18-03-2020

S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
17.0	NDE after PWHT – RT of butt weld, 100% UT on pressure retaining weld	Detection of flaws	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	RW	-		Refer Note-2 & 7
18.0	Spot PT on internal & External welds	Detection of flaws	ASME Sec VIII Div.1 & Drawing	Inspection Report	H	RW	-		
19.0	Final Dimensional inspection	Dimensions & orientations	Drawing	Inspection Report	H	H	W		Complete Equipment Visual inspection of both Internal & External
20.0	Hydro static testing followed by drying & cleaning	No pressure drop or leakage	Drawing	Inspection Report	H	H	H@		@ H for AI for Hydrostatic test only.
21.0	Spot PT* after Hydro testing	Detection of flaws	Drawing	Inspection Report	H	W	-		* SPOT PT for weld overlay & MT of LAS welds as per CLG Specification PVM-SU-5004-I Cl. No.: 14.5.1.5
22.0	Pickling & Passivation of inside weld overlays of nozzles, clad surface of shells, dished ends and further cleaning and drying	Dimensions	Drawing	Inspection Report	H	W	-		
23.0	Ferroxyl test after Pickling & Passivation	No iron contamination	Approved procedure	Inspection Report	H	RW	-		

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MANUFACTURER'S NAME & ADDRESS	QUALITY ASSURANCE PLAN	Purchaser : L & T Hydrocarbon Engineering Ltd (LTHE), Vadodara
BHEL-VISAKHAPATNAM or Approved Sub Contractor.	QAP NO: **B016-RUF-LT-504-QC-QD-BHEL(1)-02006** Rev.2 Date : 04-02-2021 Page 20 of 23 BHEL SO: 2438; Internal CQP No: 2499	Project Name: VRMP-Visakh Refinery Modernisation Project Customer : Hindustan Petroleum Corporation Limited- Visakhapatnam PMC : Engineers India Limited (EIL) EIL Job No. : B016-504 L & T Job No.& PO No.: RUFV & REFINERY/75000-66912/NG Dt.18-03-2020

S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		
24.0	Outside Surface Preparation (Blasted Surface Profile & Salt Contamination Tests)	Surface profile & salt contamination	Approved procedure	Inspection Report	H	RW	-		
25.0	Painting	Visual & DFT etc	Drawing, Approved procedure	Inspection Report	H	RW	-		Paint DFT, Adhesion test and Holiday detection (if applicable) check are Random witness point for TPIA
26.0	Nozzles blanking & N2 filling (if specified in drawing)	Physical verification	Drawing		H	W	-		
27.0	Verification of Name Plate	Verification as per drawing	Name plate drawing	Name Plate	H	R	H		
27.1	Stamping of ASME certification mark with "U" designation	Verification as per drawing	Name plate drawing	Name Plate	H	R	H		
28.0	Closing of NCRs (if any)	Closure of NCRs	PR, Drawing, Specification	Closure Reports	H	H	H		
29.0	Name plate fixing, punching and rub off	Visual	Drawing	Inspection Report	H	H	H		
30.0	Inspection of Mandatory & Commissioning spares	Physical Verification	Drawing & approved spares list (as applicable)	Inspection Report	H	H	-		
31.0	Manufacturer's Data Report & Final Documentation	Documentation	Drawings & ITP/QAP	MDR	H	R	H		
32.0	Issue of IRN & clearance for dispatch	Completeness	Drawing, Approved procedure	Inspection Release Note	H	H	-		

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	MANUFACTURER'S NAME & ADDRESS	QUALITY ASSURANCE PLAN	Purchaser : L & T Hydrocarbon Engineering Ltd (LTHE), Vadodara
	BHEL-VISAKHAPATNAM or Approved Sub Contractor.	QAP NO: **B016-RUF-LT-504-QC-QD-BHEL(1)-02006** Rev.2 Date : 04-02-2021 Page 21 of 23 BHEL SO: 2438; Internal CQP No: 2499	Project Name: VRMP-Visakh Refinery Modernisation Project Customer : Hindustan Petroleum Corporation Limited- Visakhapatnam PMC : Engineers India Limited (EIL) EIL Job No. : B016-504 L & T Job No.& PO No.: RUFV & REFINERY/75000-66912/NG Dt.18-03-2020

S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		

Notes:

1) As per PVM-SU-1322-H.1 – 6.3.7: Clad removal (strip back or repairs) shall be verified using copper sulphate to ensure complete removal of the clad before alloy welding.

2) As per PVM-SU-1322-H.1 – 9.1.3: Required radiographic and ultrasonic examinations shall be performed on completed Category A, B, C, and D weld joints after the weld overlay has been applied and any PWHT has been completed.

3) As per PVM-SU-1322-H.1 – 9.1.2: Magnetic particle examination shall be made of the surfaces of Category A, B, C, and D welds that are to be covered by weld overlay at the last stage of fabrication prior to applying the overlay.

4) As per 6-12-0007 Rev. 4 (Supplementary specification for Clad Vessels, Clause No.: 5.3) - Weld joint in the base plate shall be radiographed as specified in engg. Drawing / data sheet for detection of cracks/flows before clad side welding is carried out. Just before clad restoration welding, the prepared surface shall be inspected by 100% dye penetrant testing.

5) As per 6-12-0007 Rev. 4 (Supplementary specification for Clad Vessels, Clause No.: 6.0) – Shell, dished end and tori cones formed from a clad plate shall be ultrasonically examined for lack of bond as detailed below:

   a) 100% of surface of Knuckle area and Straight face of dished ends and tori cones. Other than this, a minimum of 10% of clad surface, not less than one square foot in each 10 square foot or fraction thereof shall be examined for lack of bond after forming.

   b) Dished ends/ tori cones made from clad plate shall be ultrasonically examined after final heat treatment for lack of bond.

   c) 100% Ultrasonic test shall be carried out of areas where attachments are to be welded directly to the cladding. The above areas shall include 50 mm width of adjacent areas on both sides of attachment.

As per PVM-SU-1322-H.1 – 9.2.2: UT according to ASME Code, Section II, SA 578, shall be made of clad plates within 1T (1 × total clad + base material plate thickness) of the edges to be welded, and covering an area extending 1T from load-bearing internal attachments designated on the vessel drawing.

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S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		

6) PQR qualification shall be as per Licensor Specification No.: PVM-SU-5004-I, Clause No.: 8.2 & 11.2.

7) As per PVM-SU-1322-H.1 – 9.3.3.1: The completed vessel bulk weld overlay (primary method of applying the internal corrosion-resistant lining) shall be checked for bond flaw indications after PWHT by UT in accordance with ASME Code, Section II, SA 578).

8) As per PVM-SU-1322-H.1 – 9.3.4.2: Prior to any heat treatment including PWHT, PT of the entire surface shall be performed in accordance with mandatory appendix 8 of ASME Code, Section VIII, Div. 1 or Section VIII, Div. 2, as applicable.

9) As per 6-12-0003 Rev. 4 (Supplementary specification for Low Alloy Steel Vessels, Clause No. 5.4.2): UT shall be carried out within 2t of material thickness(t) of all weld edges prior to welding as per ASTM A 578 with acceptance level-B.

10) As per 6-12-0003 Rev. 4 (Supplementary specification for Low Alloy Steel Vessels, Clause No. 5.4.1): All welding edges shall be checked by Magnetic Particle Examination.

11) It is to be noted that wherever PTC is applicable, it will be as per Doc: B016-RUF-LT-504-QC-QD-BHEL (1)-02022.

12) As per PVM-SU-5004-I – 14.3: MT shall be performed after completion of all welds excluding stainless weld overlay.

    a. This shall include pressure-retaining base metal welds, weld build-up deposits, root passes, and attachment welds.
    b. MT shall also be performed after any gouging or grinding operation including back gouging of root passes.
    c. MT shall be in accordance with Code Division 2, Section 7.5.6. Acceptance criteria shall be as defined in Code Division 2, Section 7.5.6.2.

13) EIL Spec 6-12-0007 Rev 4 Cl. No. 5.1.5: For welding of clad piping components such as pipe to pipe / pipe fitting from single side where approach from clad side is not accessible, shall be done with a welding consumable matching the clad material followed by an intermediate layer of pure iron (ARMCO/KARDO Iron) welding filler material and then by a welding consumable matching the base material.

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S. No	Description	Type of Checks	Reference Documents and Acceptance Criteria	Format of Record	Inspection			EIL	Remarks
					M	TUV	AI		

14) As per 6-12-0003 Rev. 4 (Supplementary specification for Low Alloy Steel Vessels, Clause No. 5.2): Magnetic Particle Examination shall be carried out on the formed knuckle surface (both inside and outside) of dished ends and tori cones for detection of cracks.

15) As per PVM-SU-5004-I – 9.2.2: ISR or DHT shall be conducted on all welded joints in pressure parts prior to allowing the weldment to cool below the preheat temperature

    a. ISR shall be required for all nozzle to shell attachment welds, areas of weld build-up, and other welds having high restraint.

16) As per API RP 934-A Cl. No.7.5.5.1 (API Recommended Practice 934 -A: The chemical composition of the weld overlay should be checked by laboratory chemical analysis of a sample taken at minimum specified thickness. This composition should meet the required chemistry of the specified overlay material (C, Cr, Ni, Nb, Mo, and V, as applicable). At least one analysis for each shell ring and head, and one for each manual welding process for nozzles, should be required.

Legends:

P: Perform	Drawing : Approved Drawing	WPS: Welding procedure specification	DFT: Dry film thickness
A-Approval	Spec : Specification	WPQ; Welder performance Qualification	RT: Radiographic testing
W-Witness Point	IRN: Inspection release note issued by TUV	HT Chart: Heat Treatment chart	UT: Ultrasonic testing manual
RW: Random Witness	M-BHEL or BHEL approved sub-contractor	PR: Purchase Requisition	PT: Dye penetrant testing
H: Hold Point (to inform to concerned and proceed ahead only after their approval)	L-Seam: Longitudinal Seam welding, C-Seam: Circumferential Seam welding	TUV: TUV India Pvt Ltd., (Third party inspection agency appointed by M/s LTHE	MPI: Magnetic particle Inspection
V: Verification of reports/Procedures	R: Review Point		MT: Magnetic testing

L&T Hydrocarbon Engineering OnShore Projects QA-QC

19.3.21

Approved
16.02.2021

Surface Preparation & Painting Scheme(All vessels) for ODC&CrMo Vessels											Doc No:B016-RUF-LT-504-MS-QD-BHEL(1)-02013 (Rev:00)/BHEL Doc No:HPVP-2438-Paint-01(Rev:01)							Date:02-11-2020
S No.	Vessel Tag No.	Vessel Description	Material of Construction(Pressure parts)	PG	MA	Qty	Design Temp ^{0}C	Insulation Reqd	Coating System as per B016-000-79-41-PLS-01 Rev.1	Surface Preparation (Refer note:01)	Primer Coat			Finish Coat				Total DFT µm(min)
											Paint Spec	DFT µm/coat (Refer note:02)	No of coats	Paint Spec	DFT µm/coat(Refer note:02)	No of coats	Paint Shade	
01	504-V-101	VR FEED SURGE DRUM	SA516Gr.70 + 3 mm SS317L Clad	PV	010	1		Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
02	504-V-105	VR MP/HT SEPARATOR	SA387Gr.11CL2 + 3 mm SS347 Clad (NACE + HIC) , SA387Gr.11CL2 + 6 mm SS347 Clad (NACE + HIC)	PV	020	1	454	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
03	504-V-109	DAO MP/HT SEPARATOR	SA387Gr.22CL2+3 mm SS347 Clad (NACE + HIC) , SA387Gr.22CL2+6 mm SS347 Clad (NACE + HIC)	PV	030	1	465	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
04	504-V-110	LC-MAX MP/MT SEPARATOR	SA387Gr.11CL2	PV	040	1	343	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
05	504-V-122	SEAL OIL RESERVOIR	SA516Gr.70+3 MM SS304L Clad (NACE)	PV	050	1	260	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
06	504-V-126	VR BOOSTER FEED DRUM	SA516 Gr.70 +317L Clad	PV	060	1	260	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
07	504-V-201	HOS PRODUCT DRUM	SA516 Gr.70 (NACE+HIC)	PV	070	1	260	No	TABLE-8 of SI. NO.8.1.3	SSPC-SP-10	Inorganic Zinc silicate Paint (F9)	65-75 (No over coating is allowed)	One	Heat Resistant silicone Aluminium Paint (F12), It shall be ambient temperature curing type.	20	Two	Golden yellow IS5- 356	105-115
08	504-V-306	PRODUCT MP/MT SEPARATOR	SA387Gr.22CL2+ 347 Clad (NACE+HIC)	PV	080	1	343	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
09	504-V-313	FRACTION OR FEED DRUM	SA387Gr.22CL2+ 347 Clad (NACE+HIC)	PV	090	1	285	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
10	504-V-315	SULFIDING CHEMICAL DRUM	SA 516 Gr70(NACE)	PV	100	1	260	No	TABLE-8 of SI. NO.8.1.3	SSPC-SP-10	Inorganic Zinc silicate Paint (F9)	65-75 (No over coating is allowed)	One	Heat Resistant silicone Aluminium Paint (F12), It shall be ambient temperature curing type.	20	Two	Golden yellow IS5- 356	105-115
11	504-V-602	CATALYST SLOP OIL DRUM	SA516 Gr70 + 3mm SS316L/410S	PV	110	1	343	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
12	504-V-607A/B/C	CATALYST INVENTORY HOLDING BIN	SA516Gr.70(NACE+WET H2S)	PV	120	3	280	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
13	504-V-703	HOT OIL SURGE DRUM	SA 516 Gr70	PV	130	1	385	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
14	504-V-801	HP FLARE KO DRUM	SA516 Gr.70 (NACE+HIC)	PV	140	1	260	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
15	504-V-802	LP FLARE KO DRUM	SA516 Gr.70 (NACE+HIC)	PV	150	1	275	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60

Surface Preparation & Painting Scheme(All vessels) for ODC&CrMo Vessels											Doc No:B016-RUF-LT-504-MS-QD-BHEL(1)-02013 (Rev:00)/BHEL Doc No:HPVP-2438-Paint-01(Rev:01)							Date:02-11-2020
S No.	Vessel Tag No.	Vessel Description	Material of Construction(Pressure parts)	PG	MA	Qty	Design Temp ^{0}C	Insulation Reqd	Coating System as per B016-000-79-41-PLS-01 Rev.1	Surface Preparation (Refer note:01)	Primer Coat			Finish Coat				Total DFT µm(min)
											Paint Spec	DFT µm/coat (Refer note:02)	No of coats	Paint Spec	DFT µm/coat(Refer note:02)	No of coats	Paint Shade	
16	504-V-803	CLOSED BLOWDOWN DRUM-1	SA516Gr.70	PV	160	1	260	No/Buried	TABLE-10 of SI. NO.10.1.3	SSPC-SP-10	Ambient temperature curing Poly Silixane/inert polymeric Paint (F16)	125	One	Ambient temperature curing Poly Silixane/inert polymeric Paint (F16)	125	One	Aluminium	250
17	504-V-804	AMINE BLOWDOWN DRUM	SA516Gr.70(NACE)	PV	170	1	260	No/Buried	TABLE-10 of SI. NO.10.1.3	SSPC-SP-10	Ambient temperature curing Poly Silixane/inert polymeric Paint (F16)	125	One	Ambient temperature curing Poly Silixane/inert polymeric Paint (F16)	125	One	Aluminium	250
18	504-V-805A	HT FLARE KO DRUM	SA387Gr.22CL2+ 347 Clad (NACE)	PV	180	1	415	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
19	504-V-807	HOT OIL BLOWDOWN DRUM	SA516Gr.70	PV	190	1	260	No/Buried	TABLE-10 of SI. NO.10.1.3	SSPC-SP-10	Ambient temperature curing Poly Silixane/inert polymeric Paint (F16)	125	One	Ambient temperature curing Poly Silixane/inert polymeric Paint (F16)	125	One	Aluminium	250
20	504-V-809	CLOSED BLOWDOWN DRUM-2	SA516Gr.70	PV	200	1	260	No/Buried	TABLE-10 of SI. NO.10.1.3	SSPC-SP-10	Ambient temperature curing Poly Silixane/inert polymeric Paint (F16)	125	One	Ambient temperature curing Poly Silixane/inert polymeric Paint (F16)	125	One	Aluminium	250
21	504-V-811	PITCH SURGE DRUM	SA516 Gr.70 +317L Clad	PV	210	1	365	Yes	TABLE-11 of SI. NO.11.1.2	SSPC-SP-10	Heat Resistant silicone Aluminium Paint (F12)	20	One	Heat Resistant silicone Aluminium Paint (F12)	20	Two	Aluminium	60
22	701-T-113A/B	SOLVENT STORAGE TANK	SA516Gr.70	PV	220	2	115	No	TABLE-6 of SI. NO.6.2	SSPC-SP-10	Inorganic Zinc silicate Paint (F9)	65-75 (No over coating is allowed)	One	Heat Resistant silicone Aluminium Paint (F12)	40	Two	Aluminium	105

Note:

01:**SSPC-SP-10:** A near-white metal blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter. Random staining shall be limited to no more than 5 percent of each unit area of surface (approximately 5,800 mm2 [9.0 in.2] (i.e., a square 76 mm x 76 mm [3.0 in. x 3.0 in.]), and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating.Surface finish shall be ensured by Quality before proceeding for application of Primer.

02:DFT shall be ensured by Quality for both Primer and finish paints.

03:Painting on internal surfaces for pressure retaining components:NIL.Pickling and Passivation is required for Internal surfaces of SS cladded Vessels.

04:THIS PAINTING SCHEME IS APPLICBALE FOR COMPLETE EXTERNAL SURFACES OF VESSELS INCLUDING SUPPORTS (INSIDE/OUTSIDE) & SLIDING PLATE.

05:TOUCH UP PAINT (1 LITRE FOR EACH VESSEL) SHALL BE PROVIDED ALONG VESSELS DURING DISPATCH

References:

01.EIL Specification for Surface preparation and Protective coating VRMP HPCL with ref Document No:B016-000-79-41-PLS-01 Rev.1

02.DSI-G-1.2 Colour code for refinery plants.

1.0 SURFACE PREPARATION

a) General:

Adhesion of the paint film to the surface depends largely on the degree of cleanliness of the metal surface. Proper surface preparation contributes more to the success of the paint protective system. In order to achieve the maximum durability, surface preparation by Abrasive blast cleaning shall be done.

Mill scale, rust, rust scale and foreign matter shall be removed fully to ensure that a clean and dry surface is obtained and it shall be Sa 2-1/2 as per Swedish standard SIS-055900 (latest edition) or SSPC-SP or ISO 8501-01.

Before surface preparation by blast cleaning, the surface shall be degreased by aromatic solvent to remove all grease, oil etc as per SSPC-SP-1.

Blast cleaning shall not be performed where dust can contaminate surfaces undergoing such
cleaning or during humid weather conditions having humidity 85%.

Irrespective of the method of surface preparation, the first coat of primer must be applied by airless spray/ air assisted conventional spray, if recommended by the paint manufacturer, on dry surface.

This should be done immediately and in any case within 4 hours of cleaning of the surface. However, at times of unfavourable weather conditions, BHEL QC-Incharge shall have the liberty to control the time period, at his sole discretion and/or to insist on re-cleaning before primer application is taken up. In general, during unfavourable weather conditions, blasting and painting shall be avoided as far as practicable.

b) Procedure for surface preparation

- **Air blast cleaning with abrasives**

The surfaces shall be blast cleaned using one of the abrasives such as Al2O3 particles, chilled cast iron or steel grit, copper slag or nickel slag at a pressure of 7.0 kg/cm2 and at an appropriate distance & angle depending on nozzle size maintaining constant velocity and pressure.

Chilled cast iron or steel shall be in the form of shot or grit of size in the range of G16 – G42 conforming to SSPC AB1 and S250 grade size of steel shots (maximum) to obtain a desired surface profile of 35-50 microns' trough to peak. For all other abrasives, size shall be in the range of G16 – G24. The combination of steel grits and shots shall be normally in the ratio of 3:1.

The quality of abrasives shall be free from contaminants and impurities and shall meet the requirements of SSPC AB1. The compressed air shall be free from moisture and oil. The blasting nozzles should be venturi style with tungsten carbide or boron carbide as the material for liners. Nozzle orifice may vary from 3/16" to 3/4".

On completion of blasting operation, the blasted surface shall be clean and free from any scale or rust and must show a grey-white metallic luster.

Primer or first coat of paint shall be applied within 4 hours of surface preparation. Blast cleaning shall not be done outdoors in bad weather without adequate protection. If there is dew on the metal surface, it shall be cleaned. The surface profile shall be uniform to provide good adhesion (i.e. 35 to 50 microns) to the paint. If possible, a vacuum collector shall be installed to collect and recycle the abrasives.

- **Mechanical or power tool cleaning**

Power tool cleaning shall be done by mechanical striking tools, chipping hammers, grinding wheels or rotating steel wire- brushes. Excessive burnish of the surface shall be avoided as it can reduce paint adhesion. On completion of cleaning, the detached rust, mill scale etc. shall be removed by clean rags and /or washed by water/steam and thoroughly dried with compressed air jet before application of paint.

Shop primed equipment and surfaces will only be 'spot cleaned' in damaged areas by means of power tool brush cleaning or hand tool cleaning and then spot primed before applying one coat of field primer, if applicable. In case of the shop primer that is applied is not compatible with field primer, then shop coated primer should be completely removed before application of selected paint system for a particular environment.

2.0 COATING PROCEDURE AND APPLICATION

a) General:

All coatings shall be applied by airless spray except for the following special cases, where application can be carried out by brush subject to suitability of the application of the paint product by brush.

- Spot repair
- Stripe coating on edges
- Small bore parts not suitable for spray application

Irregular surfaces such as sharp edges, welds, small brackets, and interstices may stripe coated to ensure specified DFT is achieved. Paint manufacturer recommendation should be followed before deciding for brush application.

Surface shall not be coated in rain, wind or in an environment where injurious airborne elements exist, when the steel surface temperature is less than 5 0F above dew point, when the relative humidity is greater than 85%, when the temperature is below 40oF and when the ambient/substrate temperature is below the paint manufacturers recommended temperature of application and curing. Dehumidifier equipment shall be used to control RH and Dew point. The paint application shall not be done when the wind speed exceeds 20 km per hour.

Blast cleaned surface shall be coated with complete application of primer as soon as practicable but in no case later than 4 hours the same day.

To the maximum extent practicable, each coat of paint shall be applied as a continuous film with uniform thickness and free of probes. Any spots or areas missed in application shall be re-coated and permitted to dry before the next coat is applied. Applied paint should have the desired wet film thickness.

Each coat shall be in proper state of cure or dryness before the application of succeeding coat. Material shall be considered dry for re-coating when an additional coat can be applied without the development of any detrimental film irregularities such as lifting or loss of adhesion of the under coat. Manufacturer's instructions shall be followed for inter coat interval.

When the successive coat of the same colour have been specified, alternate coat shall be tinted, when practical, sufficiently to produce enough contrast to indicate the complete coverage of the surface. The tinting material shall be compatible with the material underneath and shall not be detrimental to its service life and shall be recommended by the original paint manufacturer. Further, all the recommended practises as per Material Safety

Data sheets i.e. PPEs to be used. Minimum safety tools i.e dead man handle, whip arrestor as applicable to be deployed.

Brush application of paint shall be in accordance with the following:

a. Brushes shall be of a style and quality that will enable proper application of paint.
b. Round or oval brushes are most suitable for rivets, bolts, irregular surfaces, and rough/ pitted steel. Wide flat brushes are suitable for large flat areas but they shall not have width over 5 inches.
c. Paint shall be applied into all corners.
d. Any runs or sags shall be brushed out.
e. There shall be a minimum of brush marks left in the applied paint.
f. Surfaces not accessible to brushes shall be painted by spray, daubers, or sheepskin.

b) Drying of coated surfaces

No coat shall be applied until the preceding coat has dried. The material shall be considered dry for re-coating when another coat can be applied without the development of any film irregularities such as lifting or loss of adhesion of undercoats. Drying time of the applied coat should not exceed maximum specified for it as a first coat. If this exceeds, the paint material has possibly deteriorated or mixing is faulty.

No paint shall be force dried under conditions which will cause chalking, wrinkling, blistering formation of pores, or detrimentally affect the conditions of the paint.

No drier shall be added to paint on the job unless specifically called for in the manufacturer specification for the paint.

Paint shall be protected from rain, condensation, contamination, snow and freezing until dried to the fullest extent practicable.

c) Spot repair of damaged primer

Where pre-erection/shop primer has been damaged at isolated localized spots during handling and transportation or after erection / welding, its repair shall be done as given below

Design Temp. in ˚C	Surface Preparation	Coating System	Total DFT in Microns (min.)
-90 to 400	SSPC-SP-3	1 coat of F-9	65-75
401-550	SSPC-SP-3	1 coat of F-12	20

Repair of damaged inorganic zinc silicate pre-erection/pre-fabrication/shop primer (F9) after erection / welding in the design temperature of -90 oC to 400 oC and damaged silicone aluminium (F-12) pre-erection/pre-fabrication/shop primer after erection/welding for design temperature range of 401 to 550 oC.

Surface preparation: Quickly remove the primer from damaged area by mechanical scraping and emery paper conforming to SSPC-SP-3 to expose the white metal. Blast clean the surface, if possible. Feather the primed surface, over the intact adjacent surface surrounding the damaged area, by emery paper.

Primer coating: One coat of F-9 shall be applied wherever damage was observed on pre-erection / pre fabrication or shop primer of inorganic zinc silicate coating (F-9). Similarly, one coat of F-12 shall be applied wherever damage observed on pre erection / pre-fabrication/shop primer of silicone aluminium (F-12).

If damaged areas are found to be extensive and spread over large areas, then entire pre-erection / pre-fabrication / shop primer shall be removed by blasting to achieve SSPC-SP-10 and entire blasted surface shall be primed again with F-9 or F-12, as applicable, for the intended design temperature as per above Table.

d) Paint application

Shop priming/pre-erection priming with F9 or F12 shall be done only on blasted surface (SSPC-SP-10).

Shop priming / pre-erection priming with F9 or F12 shall be done only with airless spray or Air assisted pressure pot.

e) Documentation / records

Daily progress report with details of weather conditions, particular of applications, no. of coats and type of materials applied, anomalies, progress of work versus program.

Results of measurement of temperatures, relative humidity, surface profile, film thickness, holiday detection, adhesion tests with signature of appropriate authority.

Particulars of surface preparation and paint application during trials and during the work.

Details of non-compliance, rejects and repairs.

Type of testing equipment and calibration.

Code and batch numbers of paint materials used.

3.0 QUALITY CONTROL, INSPECTION AND TESTING

a) General:

All painting materials including primers and thinners brought to site for application shall be procured directly from manufactures as per specifications and shall be accompanied by manufacturers" test certificates. Paint formulations without certificates are not acceptable.

The painting work shall be subject to inspection at all times. In particular, following stage-wise inspection will be performed and the work for inspection and approval of every stage before proceeding with the next stage. The record of inspection shall be maintained in the registers. Stages of inspection are as follows:

a) Surface preparation
b) Primer application
c) Each coat of paint

b) Following tests are to be carried out during surface preparation:

- Test for presence of oil/grease and contamination

The steel substrate after degreasing as per SSPC-SP-1 shall be tested as per following procedure to validate absence of oil and grease contamination:

a) Visual inspection - continue degreasing until all visible signs of contamination are removed.

b) Conduct a solvent evaporation test by applying several drops or a small splash of residue-free tri-chloromethane on the suspect area especially pitting, crevice corrosion areas or depressed areas. An evaporation ring formation is indicative of oil and grease contamination. Continue degreasing and inspection till test is passed.

- Tests for surface finish of blasted surface shall be done by visual inspection using SSPC-VIS1. Clear cellophane tape test as per ISO 8502-3 shall be used to confirm absence of dust on blasted surface. Checks shall be done on each component at least once per 200 m2 of blasted surface and a minimum of 3 checks per shift.

- Test for presence of soluble salt as per method ISO 8502-9. Maximum allowable salt content shall be considered 20 mg/m2.Checks shall be done on each component at least once per 200 m2 of blasted surface and minimum of 3 checks per shift. In case salt exceeds specified limit, the contaminated surface shall be cleaned by method as per Annexure-C of IS 12944-4 (water cleaning). After cleaning, surface shall be retested for salt after drying.

c) Primer Application

After surface preparation, the primer should be applied to cover the crevices, corners, sharp edges etc. The shades of successive coats should be slightly different in colour in order to ensure application of individual coats, the thickness of each coat and complete coverage should be checked as per provision of this specification.

d) Final inspection of finished coating shall consist of the following:

1) **Coating dry film thickness check:** DFT measurement shall be as per ISO 2808. Type II electromagnetic gauges should be used for ferrous substrates. DFT gauge calibration, number of measurement shall be as per SSPC-DA-2. Measured DFT shall be within + 10% of the dry film thickness, specified in the specifications.

2) **Adhesion testing**: Adhesion of the primer to the steel substrate and inter-coat adhesion of the subsequent coat(s) after curing for at least a week after application of the topcoat shall be examined by a knife test in accordance with ASTM D6677. For the knife test, if the rating is better than 8, the adhesion is considered acceptable. The adhesion is destructive and tested areas shall be repaired afterward using the spot repair procedure. Alternatively, the applicator may perform the adhesion test on a steel panel coated using the same surface preparation and coating application procedure as the work piece. Adhesion testing shall be carried out for each component at least once per 200 m2 of coated surface

3) **Holiday detection check**: Holiday testing shall be conducted in case the total paint DFT is more than 500 microns in accordance with NACE SP0188. For atmospheric exposure, 10% of coated area which must include weld seams, corners and edges to be holiday tested. Voltage at which test is to be carried out will depend upon DFT of coating being tested and shall be as per NACE SP0188. Any holiday is unacceptable and should be marked and repaired immediately. In case the total paint DFT is less than 500 microns, Pin Hole test will be applicable.

4.0 ENCLOSURES:

1) Painter Qualification Certificate (Annexure I –A)
2) Record of Training & Qualification (Annexure I- B)
3) Painting Certificate: FORMAT NO: QOS/PNT/002

ISSUE NO.: 2

PROCEDURE FOR LIQUID PENETRANT EXAMINATION

Issue No	Rev No	Date of Revision	Brief Records of Revision
1	0	02-02-2015	First Edition
1	1	11-04-2017	Cl no. 3,5,13 revised as per ASME Sec V Edition 2015
2	1	25-04-2018	Cl no. 3,5,6.2,6.4,6.6,7.2.4,7.3,10,15 revised as per ASME Sec V Edition 2017
2	2	15-05-2020	Cl no. 3.1,3.2,6.2,14 revised and Cl no.1,6.1,6.4,8 modified as per ASME Sec V Edition 2019.

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TABLE OF CONTENTS

1. SCOPE:

This Procedure shall be used for the detection of open surface discontinuities in welds, plates, and forgings etc., used in Pressure Vessels., Heat Exchangers, Boilers and parts thereof by visible Liquid Penetrant Examination using solvent removable process for ferrous and non-ferrous materials.

2. POLICY:

2.1. The Liquid Penetrant Examination shall be carried out either as per one of the procedures enumerated in the following pages which are verified and found to be in accordance with ASME SEC V or as per any other applicable referencing code sections and specifications.

2.2. Only personnel qualified in accordance with BHEL HPVP NDE Written Practice shall carry out any Liquid Penetrant examination.

3. APPLICABLE STANDARDS:

3.1 ASME SEC V Edition 2019.

3.2 Construction code sections ASME Sec I, ASME Sec VIII Div 1, ASME Sec VIII Div 2 Edition 2019, ASME B31.1 Edition 2018, NBIC NB 23 Edition 2019, SNT-TC-1A Edition 2016 & ASME SEC V Edition 2019 Art.1.

4. SYSTEM:

All Liquid Penetrant Examination procedures shall be amended and approved as required by NDE Level III taking into consideration of

4.1. Experience gained in various examination procedures.

4.2. Recommendation of Audit Teams.

4.3. Referencing Code sections.

5. WRITTEN PROCEDURE REQUIREMENTS: (As per ASME Sec V Article 6 T-621)

Liquid Penetrant examination shall be performed in accordance with a written procedure, which shall as a minimum contain the essential and non-essential variable as mentioned in the table below. The written procedure shall establish a single value, or range of values, for requirement.

Table T-621.1
Requirements of a Liquid Penetrant Examination Procedure

Requirement	Essential Variable	Nonessential Variable
Identification of and any change in type or family group of penetrant materials including developers, emulsifiers, etc.	X	...
Surface preparation (finishing and cleaning, including type of cleaning solvent)	X	...
Method of applying penetrant	X	...
Method of removing excess surface penetrant	X	...
Hydrophilic or lipophilic emulsifier concentration and dwell time in dip tanks and agitation time for hydrophilic emulsifiers	X	...
Hydrophilic emulsifier concentration in spray applications	X	...
Method of applying developer	X	...
Minimum and maximum time periods between steps and drying aids	X	...
Decrease in penetrant dwell time	X	...
Increase in developer dwell time (Interpretation Time)	X	...
Minimum light intensity	X	...
Surface temperature outside 40°F to 125°F (5°C to 52°C) or as previously qualified	X	...
Performance demonstration, when required	X	...
Personnel qualification requirements	...	X
Materials, shapes, or sizes to be examined and the extent of examination	...	X
Post-examination cleaning technique	...	X

Any change of requirement specified as an essential variable mentioned above shall require requalification of the written procedure.

6. METHOD OF EXAMINATION:

6.1. IDENTIFICATION OF PENETRANT EXAMINATION MATERIALS:

6.1.1. PRADEEP/PMC/MAGNAFLUX brands of PT chemicals be used. Other brands may also be used with the approval of NDE Level-III.

6.1.2. Refer certification of contaminant content for all liquid penetrant materials used.

6.1.3. Ensure manufacturers batch numbers, on the penetrant material containers and Certificate mentioned above are same.

6.2. **MINIMUM LIGHT INTENSITY:**

All following activity shall be done under the illumination of 100 watt 230V incandescent bulb at a maximum distance of 25 cms from test part for ensuring 1076 Lux light intensity at test part surface.

6.3. **SURFACE PREPARATION (FINISHING AND CLEANING, INCLUDING TYPE OF CLEANING SOLVENT) (As per ASME Sec V Edition 2019Article 6 T-642)**

This procedure applies to below mentioned surface preparations.

6.3.1. As welded
6.3.2. As ground
6.3.3. As machined /As Forged/As Plates

6.3.4. SURFACE CLEANING:

6.3.4.1. Ensure Surface examined and all adjacent areas within 1" shall be free of scale, welding flux, weld spatter.
6.3.4.2. Use Organic solvent - Cleaner mentioned above to remove oil, and other extraneous matter.
6.3.4.3. Wait for a minimum of 3 minutes for evaporation of cleaning solvent used above.

6.4. **SURFACE TEMPERATURE (As per ASME Sec V Edition 2019 Article 6 T-652)**

Ensure that the temperature of the penetrant and the surface of the part to be subjected to penetrant testing is between 5 to 52 deg centigrade. For examination between 5- 10 deg Centigrade, the minimum Penetrant dwell time shall be two times than that established for testing between 10 to 52 deg Centigrade.

6.5. **METHOD OF APPLYING PENETRANT**

Use brush or spray for application of penetrant to the surface of the part.

6.6. **PENETRATION (DWELL) TIME**

6.6.1. Allow penetrant on the weld surface for minimum 5 minutes and maximum 10 for welds & Casts.

6.6.2. Allow penetrant on the surface for minimum 10 minutes and maximum 15 minutes and for plates & forgings.

Note: Ensure that penetrant is not dried during dwell time.

6.7. **METHOD OF REMOVING EXCESS SURFACE PENETRANT**

6.7.1. After completion of penetration (dwell) time remove any penetrant remaining on the surface using clean, dry, and lint free cloth.

6.7.2. Remove the remaining traces of penetrant on the weld surface by wiping the surface with clean, lint- free material lightly moistened with the solvent remover. Complete this step within 10 minutes after start of excess penetrant removal.

6.7.3. Do not flush the weld surface with cleaning solvent for removal of excess penetrant.

6.8. **DRYING AFTER EXCESS PENETRANT REMOVAL (AS PER ASME SEC V ARTICLE 6 T-674)**

Wait for a maximum of 2 minutes for evaporation of cleaning solvent used above for Excess Penetrant Removal.

6.9. **METHOD OF APPLYING DEVELOPER**

Apply Developer using aerosol can spray after above step. (i.e. Drying After Excess Penetrant Removal). Maximum time for Developer application is 5 min.

6.10. **DEVELOPER DWELL TIME (INTERPRETATION TIME)**

6.10.1. Developing time for final interpretation begins immediately after developer coating is dry.

6.10.2. Wait for a minimum of 2 minutes after developer spray for developer coating to dry.

6.10.3. Observe closely during application of developer to aid in characterization of indications developed.

6.10.4. Final interpretation shall be made within 10 to 20 min after developer coating is dry.

6.11. **MINIMUM AND MAXIMUM TIME PERIODS BETWEEN STEPS AND DRYING AIDS**

6.11.1. Minimum time between surface cleaning and application of penetrant 3 minutes. Maximum No limit.

6.11.2. Minimum/Maximum time between application of penetrant and start of excess Penetrant removal 5/10 minutes for welds and 10/15 minutes for plates and forgings.

6.11.3. Maximum time between excess penetrant removal and application of Developer 10 minutes.

6.11.4. Final interpretation time minimum 10 and maximum 20 minutes after developer coating is dry.

7. PERSONNEL QUALIFICATION REQUIREMENTS

Personnel qualified and certified to NDE Level III in PT shall demonstrate this procedure to the satisfaction of AI. Application of this procedure on jobs shall be by personnel qualified and certified to NDE Level II / NDE Level III in PT as per the Written Practice.

8. MATERIALS, SHAPES, OR SIZES TO BE EXAMINED AND THE EXTENT OF EXAMINATION

This procedure is applicable to welds, plates, forgings of all shapes and sizes for ferrous and non ferrous materials. The extent of examination shall be as per referred specification or test plan.

9. POST EXAMINATION CLEANING TECHNIQUE:

Using cloth or cotton waste Post-examination cleaning shall be done as soon as practical after Evaluation and Documentation.

10. GENERAL REQUIREMENTS:

10.1. If the surface to be examined is large enough to complete examination within the above established times the examination shall be performed in increments.

10.2. Ensure bleed-out from large indications does not alter the examination results during interpretation time.

10.3. Any change of requirement specified as an essential variable in para 5 shall require requalification of this written procedure.

11. EVALUATION:

All indications shall be evaluated in terms of the acceptance standards Referred below.

12. DOCUMENTATION (AS PER ASME SEC V EDITION 2019ARTICLE 6 T-690):

Recording of Indications shall be done in Liquid Penetrant Examination Requisition cum report format referred in Exhibit 2.

12.1. Non rejectable Indications: Non rejectable indications shall be recorded as specified by the referencing Code Section.

12.2. Rejectable Indications: Rejectable indications shall be recorded.
As a minimum, the type of indications (linear or rounded), location and extent (length or diameter or aligned) shall be recorded.

13. RECORDS:

All the reports of Liquid Penetrant Examination shall be preserved till MDR signed.

14. ACCEPTANCE STANDARDS FOR LIQUID PENETRANT EXAMINATION:

REF: ASME SEC I, ASME SEC VIII Div 1 & Div 2 Edition 2019.

All surfaces to be examined shall be free of

1. Relevant linear indications.
2. Relevant rounded indications greater than 3/16 inch (5mm).

3. Four or more relevant rounded indications in a line separated 1/16 inch (1.5mm) or less (edge to edge).

Notes:

- Only indications with major dimensions greater than 1/16 inch (1.5 mm) shall be considered relevant.
- A linear indication is one having a length greater than three times the width.
- A rounded indication is one of circular or elliptical shape with the lengthy equal to or less than three times the width.
- Any questionable or doubtful indications shall be reexamined to determine whether or not they are relevant.

(For other Codes such as ASME B31.1, NBIC NB23 refer respective current Edition)

ISSUE NO.2

PROCEDURE FOR MAGNETIC PARTICLE EXAMINATION

Issue No	Rev No	Date of Revision	Brief Records of Revision
1	0	02-02-2015	First Edition
1	1	11-04-2017	Cl no. 3,5,8.6,9,14 revised as per ASME Sec V Edition 2015
2	1	25-04-2018	Cl no. 3,5,8.2,19,14 revised as per ASME Sec V Edition 2017
2	2	15-05-2020	Cl. no. 1,6,7.1,7.2 Modified; 13,14,15,16,17,18 renumbered; Cl. no. 3,4,9.2,18 revised; Cl.no.8,10,11,12 added.

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1. SCOPE :

This Procedure shall be applied for detecting of surface and near surface discontinuities in Butt welds, fillet welds, partial penetration welds, Back Gouging welds, Full penetration butt and corner welds, Nozzles of Boiler components, pressure vessels, heat exchangers, power piping and Non pressure parts welds, plates, forgings, etc. of Ferro Magnetic Materials to detect surface and subsurface discontinuities using visible Dry & wet particle Continuous Prod or Yoke technique and Fluorescent Wet Prod or Yoke Techniques.

2. POLICY:

2.1 The Magnetic Particle Examination shall be carried out either as per one of the procedures enumerated in the following pages which are verified and found to be in accordance with ASME SEC V or as per any other applicable referencing code sections and specifications.

2.2 Only personnel qualified to MT NDE Level II / MT NDE Level III in accordance with NDE written practice shall carry out any Magnetic Particle Examination.

3. APPLICABLE STANDARDS:

3.1 ASME SEC V Edition 2019

3.2 Construction code sections ASME Sec I, ASME Sec VIII Div 1, ASME Sec VIII Div 2 Edition 2019, ASME B31.1 Edition 2018, NBIC NB 23 Edition 2019, SNT-TC-1A Edition 2016 & ASME SEC V Edition 2019 Art.1.

4. SYSTEM:

All Magnetic particle examination procedures shall be amended and approved as required by NDE level III taking into consideration of

4.1 Experience gained in various examination procedures

4.2 Recommendation of Audit Teams

4.3 Referencing Code sections.

5. WRITTEN PROCEDURE REQUIREMENTS:

This procedure based on Table T-721 of ASME SEC V Edition 2019 shall contain the requirements listed in the Table below.

It shall establish a single value, or range of values for each requirement. When required performance shall be demonstrated to the inspector. Any change in specified value or range of values of the essential variables mentioned in Table shall require requalification of the written procedure.

Table T-721
Requirements of a Magnetic Particle Examination Procedure

Requirement	Essential Variable	Nonessential Variable
Magnetizing technique	X	...
Magnetizing current type or amperage outside range specified by this Article or as previously qualified	X	...
Surface preparation	X	...
Magnetic particles (fluorescent/ visible, color, particle size, wet/ dry)	X	...
Method of particle application	X	...
Method of excess particle removal	X	...
Minimum light intensity	X	...
Existing coatings, greater than the thickness demonstrated	X	...
Nonmagnetic surface contrast enhancement, when utilized	X	...
Performance demonstration, when required	X	...
Examination part surface temperature outside of the temperature range recommended by the manufacturer of the particles or as previously qualified	X	...
Shape or size of the examination object	...	X
Equipment of the same type	...	X
Temperature (within those specified by manufacturer or as previously qualified)	...	X
Demagnetizing technique	...	X
Post-examination cleaning technique	...	X
Personnel qualification requirements	...	X

6. SURFACE CONDITIONING :

6.1 SURFACE PREPARATION:

6.1.1. Prior to Magnetic Particle Examination, the surface to be examined and all adjacent areas within at least 1” shall be dry and free of all dirt, grease, lint, scale, welding flux & spatter, oil and other extraneous matter that could interfere with examination.

6.1.2. As welded, ground, Machined and Back Gouged conditions are preferable. However, Surface preparation by grinding or machining may be necessary where surface irregularities could mask indications due to discontinuities. This

procedure does not address the testing of parts covered with coatings and / or non magnetic surface contrast enhancement.

6.1.3. The surfaces which are to be examined by Magnetic particle testing shall be free from any external Nonmagnetic coatings. If any nonmagnetic coatings are present, it shall be demonstrated that indications can be detected through the existing maximum coating thickness applied.

6.1.4. Nonmagnetic Surface Contrast Enhancement:

Nonmagnetic surface contrasts may be applied by the examiner to uncoated surfaces, only in amounts sufficient to enhance particle contrast. When nonmagnetic surface contrasts are used, it shall be demonstrated that indications can be detected through the enhancement. Thickness measurement of surface contract enhancement is not required.

6.2 TEMPERATURE OF PART SURFACE:

The surface temperature of the part examined with dry particles shall be within the range of 17 ºC to 315 ºC (within maximum temperature specified by the manufacturer of the particles) and wet particles shall be maximum 57 ºC or temperature specified by the manufacturer of the particles.

7. EQUIPMENT:

7.1 TYPE OF EQUIPMENT:

7.1.1. Portable magnetic particle testing equipments appearing in the current list of NDE Equipments under calibration (230V, single phase, open circuit voltage <25V) provided with stepped / continuous current control, remote control switch for momentarily switching on / off, prods for application of current and capable of generating max 1000A HWDC shall be used for magnetization.

7.1.2. Direct/Alternating current electromagnetic yokes shall be used to detect discontinuities that are open to the surface of the part by longitudinal magnetization method and to examine the surfaces where arcing is not permitted or prod method is not practicable.

7.2 CALIBRATION OF EQUIPMENT:

7.2.1. Each magnetizing equipment with an ammeter shall be calibrated at least once a year, or whenever the equipment has been subjected to major electric repair, periodic overhaul, or damage.

7.2.2. The magnetizing power of yokes shall be verified prior to use on every day the yoke is used. The magnetizing power of yokes shall be verified whenever the yoke has been damaged or repaired.

7.2.3. Each alternating current electromagnetic yoke shall have a lifting power of at least 4.5 kg at the maximum pole spacing that will be used with contact similar to what will be used during the examination.

7.2.4. Each direct current or permanent magnetic yoke shall have a lifting power of at least 18 kg at the maximum pole spacing that will be used with contact similar to what will be used during the examination.

7.2.5. Each weight shall be weighed with a scale from a reputable manufacturer and stencilled with the applicable nominal weight prior to first use. Weight need only be verified again if damaged in a manner that could have caused potential loss of material.

8. EXAMINATION MEDIUM:

8.1 DRY PARTICLES:

Finely divided ferromagnetic dry particles (non-fluorescent free flowing dry particles of colors either red or grey.) supplied by M/s Arora / M/s Pradeep with brand name Automag RD-7 Red or M/s Ferrochem with Brand names Ferrochem grey and Ferrochem Red shall be used.

8.2 WET PARTICLES:

8.2.1. WET PARTICLE CONCENTRATION:

Non fluorescent or fluorescent wet particles will be black or reddish brown in color that provide adequate contrast with the surface being examined.

Wet particles shall be suspended in kerosene or water for application to the test surface by flowing or spraying. Suitable conditioning agents shall be added to the water to provide proper wetting and corrosion protection for the parts being examined.

The bath concentration shall be determined by measuring the settling volume through the use of pear-shaped centrifuge tube with a 1-mL stem (0.05-mL divisions) for fluorescent particle suspensions or a 1.5-mL stem (0.1-mL divisions) for non-fluorescent suspensions. The suspension shall be mixed thoroughly or shall be run through the re-circulating system for at least 30 minutes to ensure thorough mixing of all particles. Take a 100-mL portion of the suspension from the hose or nozzle, demagnetize and allow it to settle for 30 minutes' minimum with water based suspension or 60 minutes' minimum with petroleum distillate suspension before taking the reading.
For fluorescent particles, the required settling volume is from 0.1 mL to 0.4 mL in a 100-mL bath sample and from 1.2 mL to 2.4 mL per 100 mL of vehicle for non-fluorescent particles or as recommended by the manufacturer. Concentration checks shall be made at least every eight hours.

8.2.2. WET PARTICLE CONTAMINATION:

Both fluorescent and non-fluorescent suspensions shall be checked periodically for contaminants such as dirt, scale, oil, lint, loose fluorescent pigment, water (in the case of oil suspensions), and particle agglomerates which can adversely affect the performance of the magnetic particle examination process. The test for contamination shall be performed at least once per week.

8.2.2.1. Carrier Contamination:

For fluorescent baths, the liquid directly above the precipitate should be examined with fluorescent excitation light. The liquid will have a little fluorescence. Its color can be compared with a freshly made-up sample using the same materials or with an unused sample from the original bath that was retained for this purpose. If the "used" sample is noticeably more fluorescent than the comparison standard, the bath shall be replaced.

8.2.2.2. Particle Contamination.

The graduated portion of the tube shall be examined under fluorescent excitation light if the bath is fluorescent and under visible light (for both fluorescent and non-fluorescent particles) for striations or bands, differences in color or appearance. Bands or striations may indicate contamination. If the total volume of the contaminates, including bands or striations exceeds 30% of the volume magnetic particles, or if the liquid is noticeably fluorescent, the bath shall be replaced.

Note: In any case, color of particles used shall have adequate contrast with the surface being examined.

9. EXAMINATION:

9.1 EXAMINATION COVERAGE:

All examinations shall be conducted with sufficient field overlap to ensure 100% coverage at the required sensitivity.

9.2 MINIMUM LIGHT INTENSITY:

9.2.1. Visible Light Intensity

9.2.1.1. The examination area and the accumulation of magnetic particles shall be observed under adequate lighting. An intensity of 1076 lux is adequate. The minimum light intensity shall be 100 fc (1076 lux). The light intensity, natural or supplemental white light source, shall be measured with a white light meter prior to the evaluation of indications or a verified light source shall be used. Verification of light sources is required to be demonstrated only one time, documented, and maintained on file.

All following activity shall be done under the illumination of 100 watt 230V incandescent bulb at a minimum distance of 25 cms from test part for ensuring 1076 Lux light intensity at test part surface.

9.2.2. Black Light (UV-A Light)

9.2.2.1. Black light intensity at the examination surface shall be not less than 1000 micro watt/ cm^2 at a distance of 15 inch.

9.2.2.2. The black light intensity shall be measured at least once in every 8 hrs. and whenever the work station is changed. The UV-A and White Light Meter should be calibrated once in One year.

9.2.2.3. With fluorescent particles, the examination is performed in a darkened area. The Intensity of Ambient visible light in the darkened area shall not exceed 2 fc or 21.5 lux.

9.2.2.4. The examiner shall be in the darkened area for at least 5 minutes prior to performing the examination for eye adaptation. The examiner shall not wear glasses with permanent Tint or Photo Chromic (light sensitive) lenses which change colour in Sunlight.

9.2.2.5. The black light shall be warmed up for a minimum period of 5 minutes prior to use or measurement of the intensity.

Lux meter/Light meter shall be calibrated at least once a year or whenever a meter has been repaired. If meters have not been in use for one year or more, calibration shall be done before being used.

For selection of other light sources vs maximum distances permitted refer Exhibit 1.

9.3 DIRECTION OF MAGNETIZATION:

Two separate examinations shall be performed on each area. During second examination, the lines of magnetic flux shall be approximately perpendicular to those used in the first examination.

10. METHOD OF EXAMINATION:

Examination shall be made by continuous method.

10.1 Dry continuous magnetization method:

The magnetizing current remains on while the examination medium (Brick red Dry particle) is being applied and while the excess of the examination medium is being removed.

10.2 Wet continuous magnetization method:

The magnetizing current shall be turned on after the particles have been applied. Flow of particles shall stop with the application of current. Wet particles applied from aerosol spray cans/pump sprayers may be applied before and/or during magnetizing current application.

11. TECHNIQUES:

11.1 PROD TECHNIQUE:

11.1.1. Magnetizing Procedure:

The prod electrodes are pressed firmly against the surface in the area to be examined. In order to avoid arcing, a remote control switch shall be built into the prod handles, to permit the current to be turned on after the prods have been properly positioned and to be turned off before they are removed. The prods tips shall be kept dressed and cleaned to make satisfactory electrical contact.

11.1.2. Magnetizing Current and Prod Spacing:

Single-phase (half-wave rectified) current HWDC shall be used. The current shall be 100 to 125amps per inch of prod spacing for sections 0.75 inch thick or greater. For sections less than 0.75 inch thick the current shall be 90 to 110 amps per inch of prod spacing. Prod spacing shall not exceed 8 inches and shall not be less than 3 inches.

11.2 YOKE TECHNIQUE:

11.2.1. This technique is primarily intended to cover the region between the poles. The pole spacing shall be between 100 mm to 150 mm. In order to ensure that the region of interest gets 100 % coverage, every region (or segment of the test area, divided according to the pole spacing), shall be tested twice such that the pole space displacements are mutually perpendicular in the former and later cases. For example, in the case of the weld, the pole space orientation can be 45 Deg. and 135 Deg. Respectively with respect to the weld center line orientation, in the first and second attempts.

11.2.2. Pie-Shaped Magnetic Particle Field Indicator shall be used to ensure field adequacy as well as direction of field. It shall be positioned on the surface to be examined with copper-plated side away from the inspected surface.

Suitable field strength is indicated by formation of clearly defined lines of magnetic particles across the copper face of the indicator when the magnetic particles are applied simultaneously with the magnetizing force. When a clearly defined line of particles are not formed in the desired direction, the magnetizing technique shall be changed as needed.

11.3 For inspection of components of Gr 91 material including Gr C12A, prod technique shall not be used. This shall be inspected by Yoke technique using Dry or Wet method.

12. METHOD OF PARTICLE APPLICATION AND EXCESS PARTICLE REMOVAL:

12.1 DRY PARTICLES:

12.1.1. The dry particles shall be applied in such a manner that a light uniform dust-like coating settles on the surface of the area being examined. The application technique shall be such that the particles are suspended in air and reaches the examination surface in a uniform cloud with a minimum force, using hand powder applicators (squeeze bulb) or specially designed mechanical blower or by a spray nozzle.

12.1.2. Dry particles shall not be applied to a wet surface nor when there is excessive wind. The particles shall not be applied by pouring, throwing, or spreading with fingers.

12.1.3. Any excess powder shall be removed while the magnetization current is on and shall be with a gentle air stream by a blower or squeeze bulb without removing or disturbing particles attracted by a leakage field that may prove to be a relevant indication.

12.2 WET PARTICLES:

12.2.1. The application of wet particles involves the bathing of the area to be examined, by spraying or flowing during the application of magnetizing current.

12.2.2. Two or more shots shall be applied, but the last shot shall be applied while the bath still remains on the area to be examined and after the particle flow has been stopped. Care shall be taken to cut off the bath application before

removing the magnetic field, to prevent high-velocity particle flow that may wash away or remove fine or weakly held indications.

13. INTERPRETATION AND EVALUATION :

(a) All indications shall be evaluated in terms of the acceptance standards of the referencing Code Section.
(b) Discontinuities on or near the surface are indicated by retention of the examination medium. However, localized surface irregularities due to machining marks or other surface conditions may produce false indications.
(c) Broad areas of particle accumulation, which might mask indications from discontinuities, are prohibited, and such areas shall be cleaned and reexamined.

All indications shall be evaluated by a NDE Level II or NDE Level III in terms of the acceptance standard of ASME SEC VIII DIV 1, ASME SEC VIII DIV 2, ASME SEC I, ASME B31.1, NBIC NB 23 current Edition.

14. REPORTING :

Interpretation and evaluation shall be reported in the Proforma appended in Exhibit-2.

15. POST-EXAMINATION CLEANING :

The examination surface shall be wiped clean using cloth / cotton waste.

16. DEMAGNETIZATION :

No demagnetization is required unless specifically required by customer. When required one of the following methods (ref. SE-709-95 for detail techniques) shall be used**.**

- Withdrawing from AC coil.
- Decreasing alternating current.
- Demagnetizing with yokes.

17. RECORDS :

All the reports of Magnetic particle test shall be preserved till MDR signed**.**

18. ACCEPTANCE STANDARDS:

(Ref: ASME SEC I, ASME SEC VIII Div 1 & Div 2 Edition 2019)

All surfaces to be examined shall be free of

- Relevant Linear indications
- Relevant rounded indications greater than 5 mm.
- Four or more relevant rounded indications in a line separated by 1.5 mm or less edge to edge.

Notes: Any indication believed to be non relevant shall be confirmed by re-examination using same method or other non destructive examination method and/or by surface conditioning.

1. **Relevant indications**: Indications having any dimension greater than 1.5 mm.
2. **Linear indications:** Relevant Indications having length greater than three times the width.
3. **Rounded indications:** Relevant indications having circular or elliptical shape with a length equal to or less than three times its width**.**

(For other Codes such as ASME B31.1, NBIC NB23 refer respective current Edition)

ISSUE NO. : 2

PROCEDURE FOR RADIOGRAPHIC EXAMINATION

Issue No	Rev No	Date of Revision	Brief Records of Revision
1	0	02-02-2015	First Edition
1	1	11-04-2017	Cl. no. 3,7,10,12,13,15 revised as per ASME Sec V Edition 2015
2	1	25-04-2018	Cl. no. 3,14,15,18 revised as per ASME Sec V Edition 2017
2	2	15-05-2020	Cl. no. 3.1,3.2,9.2,11,12.1,12.4,16.5 revised; Cl. no.1,5,6,9,14,15,16.2 Modified.

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1. SCOPE

This procedure specifies the requirement for radiographic examination of butt welded joints in steel(Carbon Steel, Alloy Steel, Stainless Steel etc.) and non-ferrous materials using x-rays or gamma rays as a source of radiation for detecting and evaluating flaws within the weld and HAZ (heat affected zone). It applies to the welded joints in pressure vessels, heat exchangers, columns and pipes etc. Radiographic technique used to demonstrate that required IQI sensitivity and density requirements are achieved.

2. POLICY

2.1. The radiographic examination be carried out either as or one of the procedures enumerated in the following pages which are verified and found to be in accordance with latest ASME SEC V or as per any other applicable referencing code sections and specifications.

2.2. Only personnel qualified in accordance with BHEL HPVP NDE Written Practice shall carry out any radiographic examination.

3. APPLICABLE STANDARDS

3.1. ASME SEC V Edition 2019.
3.2. Construction code sections ASME Sec I, ASME Sec VIII Div 1, ASME Sec VIII Div 2 Edition 2019, ASME B31.1 Edition 2016, NBIC NB 23 Edition 2019, SNT-TC-1A Edition 2016 & ASME SEC V Edition 2019 Art.1.

4. SYSTEM

All radiographic examination procedures be amended and approved as required by NDE level III taking into consideration of

4.1. Experience gained in various examination procedures.
4.2. Recommendations of audit teams.
4.3. Referencing code sections.

Each page of the document be independently controlled and revision status be indicated on the title page.

5. SURFACE PREPARATION:

The weld ripples or weld surface irregularities on both inside(where accessible) and outside shall be removed by any suitable process to such a degree that the images of surface irregularities cannot mask or be confused with the image of any discontinuity on the resulting radiograph.

The finished surface of all butt-welded joints may be flush with the base material or may have reasonably uniform crones, with reinforcement not to exceed that specified in the referencing code section.

Welds be visually examined to ensure free from surface irregularities which can mask or cause difficulty in detecting discontinuities. If required surface be ground and surface imperfections removed.

6. REINFORCEMENT

The thickness of reinforcement on each side of all butt welded longitudinal and circumferential joints not exceed the limits as given below:

As per ASME Sec-VIII Div 1:

Material thickness (Nominal) (mm)	Permitted Maximum Reinforcement	
	Cat B& C Butt welds (mm)	Other welds (mm)
< 2.4	2.4	0.8
2.4 to 4.8	3.0	1.5
>4.8 to 13	4.0	2.5
>13 to 25	5.0	2.5
>25 to 51	6.0	3.0
>51 to 76	6.0	4.0
>76 to 102	6.0	5.5
>102 to 127	6.0	6.0
>127	8.0	8.0

As per ASME Sec-VIII Div 2:

Material thickness (Nominal) (mm)	Permitted Maximum Reinforcement	
	Circumferential welds in Pipes & Tubes (mm)	Other welds (mm)
< 2.5	2.5	0.8
≥ 2.5 to < 5.0	2.5	1.5
≥ 5.0 to < 13.0	3.0	2.5
≥ 13.0 to < 25.0	4.0	2.5
≥ 25.0 to < 50.0	4.0	3.0
≥ 50.0 to < 76.0	4.0	4.0
≥ 76.0 to < 100.0	5.5	5.5
≥ 100.0 to < 125.0	6.0	6.0
≥ 125.0	8.0	8.0

As per ASME Sec-I:

Material thickness (Nominal) (mm)	Permitted Maximum Reinforcement	
	Circumferential welds in Pipes & Tubes (mm)	Other welds (mm)
< 3.0	2.5	2.5
3.0 to 5.0	3.0	2.5
>5.0 to 13.0	4.0	2.5
>13.0 to 25.0	5.0	2.5
>25.0 to 50.0	6.0	3.0
>50.0 to 75.0	The greater of 6 mm or 1/8 times the width of the Weld (in mm).	4.0
>75.0 to 100.0		5.5
>100.0 to 125.0		6.0
>125.0		8.0

7. SELECTION OF RADIOGRAPH

Either Agfa D4/D7 or Fuji IX 50/100 brand radiographs be used

8. INTENSIFYING SCREENS

For Iridium 192,X-ray(150 KV – 200 KV) 0.15 mm thick, Co-60 0.25 mm thick front and back Lead intensifying screens shall be used.

9. IMAGE QUALITY INDICATIORS (IQI)

9.1. SELECTION :

9.1.1. MATERIAL:

IQI shall be selected from either the same alloy material group or grade as identified in SE-747 for ASTM wire type or SE-1025 for hole type IQI or grade with less radiation absorption than the material being radiographed.

9.1.2. SIZE:

Nominal single wall Thickness of the base metal (thickness of the thinner incase dissimilar thickness base metals are joined) including the estimated allowed weld reinforcement both in ID and OD be considered for IQI selection. The values used for the estimated weld reinforcement thicknesses shall be representative of the weld conditions and shall not exceed the maximums permitted by the referencing code section. Physical measurement of the actual weld reinforcements not required. Backing rings or strips shall not be considered as part of the thickness in IQI selection. Refer Clause. 14 below for the selection of IQI designation.

9.2. PLACEMENT:

IQI(s) be placed on source side of the object unless hand placing of IQI is not feasible. In such case, the IQI be placed on radiograph side of weld with a letter ‘F’ placed adjacent to the IQI.

Wire type IQI’s be placed on the weld so that the lengths of the wires are transverse to the longitudinal axis of the weld and Hole type IQI’s be placed adjacent and parallel to the weld axis, one at each end of the radiography spot..

When weld reinforcement or backing strip is not removed, a shim of material radiographically similar to weld metal be kept under the hole type IQI.

9.3. NUMBER OF IQI's:

For unidirectional exposures, at least one IQI image appears on each radiograph where one or more radiograph holders are used for an exposure. If the density of the radiograph varies by more than –15% or +30% from the density through the body of hole type IQI, or adjacent to the required wire, an additional IQI be used for each exceptional area or areas and the radiograph is retaken.

For cylindrical components where the source is placed on the axis of the component for a single exposure at least three IQI's be placed approximately 120^0 apart.

10. RADIATION ENERGY SELECTION (SOURSE SELECTION):

The selection be such that required IQI sensitivity and density are achieved.

The recommended source for radiography of objects is as below.

a) Iridium 192 – with thickness from 6 to 65 mm.
b) Co-60 – for thickness above 35 mm.
c) X-ray equipments (100 KV – 200 KV) may be used for thickness 12 mm and below to achieve higher sensitivity, if required.

11. BACK-SCATTER RADIATION

A lead symbol 'B' shall be placed within the area of radiograph with minimum dimensions of 11 mm height and 1.5 mm thick be attached on the back side of each radiograph holder to determine if back-scatter radiation is exposing the radiograph.

12. SYSTEM OF IDENTIFICATION:

Each radiograph must be identified uniquely so that there is a permanent correlation between the part radiographed and the radiograph.

A system of permanent identification of the radiograph be provided with the following minimum details.

12.1. HPVP Manufacturer Symbol/Name and NDE Subcontractor's Symbol/Name.
12.2. Work Order Number.
12.3. SAP generated RT number if requisition raised through SAP.
12.4. Welder No. and Part Number for Non SAP Requisitions.
12.5. Equipment number, if any.
12.6. Weld seam number, if any.
12.7. Segment number (location marker).
12.8. Date of radiography.
12.9. Letter 'R1, R2' to indicate first repair, second repair etc. when required.
12.10. Letter 'RT' to indicate retaken radiograph when required.

13. RADIOGRAPH MAKING TECHNIQUES:

Normally a single wall single image (SWSI) radiography technique be used.

For test objects with external diameter less than 89 mm (DWDI) double wall double image Elliptical technique or (DWSI) double wall single image technique or Super imposition technique be used.

(Note: When DWDI technique is used, one exposure be taken unless otherwise specified. The source position be such that two weld images are clearly separated. The maximum separation between two weld images / distance between two weld images be one weld width. IQI be placed on the source side.

In case of DWSI or Super imposition techniques sufficient number of radiography shots ensuring full coverage of the weld seam be used. The IQI be placed close to the radiograph with a lead letter "F")

14. IQI SELECTION: As per Table T-276 of ASME Sec V Edition 2019

Weld thickness (base metal thickness + Estimated allowed reinforcement) (mm)	Source side			Radiograph side		
	Hole Type Designation	Essential hole	Wire-type Essential wire	Hole Type Designation	Essential hole	Wire type Essential wire
Upto 6.4	12	2T	5	10	2T	4
Over 6.4 to9.5	15	2T	6	12	2T	5
Over 9.5 to12.7	17	2T	7	15	2T	6
Over12.7 to19.0	20	2T	8	17	2T	7
Over 19.0 to25.4	25	2T	9	20	2T	8
Over 25.4 to38.1	30	2T	10	25	2T	9
Over 38.1 to50.8	35	2T	11	30	2T	10
Over 50.8to 63.5	40	2T	12	35	2T	11
Over 63.5to 101.6	50	2T	13	40	2T	12
Over 101.6 to 152.4	60	2T	14	50	2T	13

15. GEOMETRIC UNSHARPNESS:

Recommended maximum values of Ug are tabulated below

Material Thickness (mm)	Ug Maximum (mm)
Under 50	0.51
50-75	0.76
75-100	1.01
>100	1.78

$$\text{Exposure Time (Ci minutes)} = \frac{\text{Film factor} * (\text{SFD in Meters})^2 * 2^{(\text{thickness of job/HVT of material})}}{(\text{RHM of Source})} \times 60$$

General requirements:

- Persons working in radiation areas be provided with Personnel monitoring device (TLDs) and Radiation area monitoring devices (Survey meters).

- Personnel Qualification: The minimum qualification of radiography operator be BARC qualified and certified radiographer.

- The minimum Qualification of Radiography Evaluation personnel be ASNT / ISNT Level II.

- Extent of Examination: As per Applicable Drawing / QA plan / NDE plan.

- Marking and identification of the radiograph: Work order no., Joint No., Spot No(s). be permanently marked on the job by stamping. Where stamping is not permitted by code / specification (< 6mm for ferrous plates) sketches be prepared to identify weld joints and radiography spots.

- Location of weld in the radiograph: Set of Markers (arrows or V's) be placed on both sides of the weld at least 5 mm from the edge of the weld. At least two such sets be placed at each end of the radiography spot.

- Alignment of radiation beam: be directed to the centre of the area being radiographed and shall be perpendicular to the object surface at that point.

- Over lap of radiographs: When multiple radiographs are used to cover entire length of weld seams adjacent radiographs overlap at least 25 mm.

- Radiation Exposure times: Exposure charts indicating thickness vs exposure time (Gamma ray-Ir-192) or thickness vs milli Ampere minutes(mA-mts) (X-ray) prepared exclusively for a particular brand / type industrial x-ray radiograph shall be used.

16. EVALUATION:

16.1. FACILITIES FOR RADIOGRAPH VIEWING:

Radiographs shall be viewed in a room with subdued light after dark adaptation of eyes (minimum 5 minutes) using an illuminator of sufficient illumination. The illuminator shall have facility to adjust the illumination level required for the particular radiograph.

16.2. QUALITY OF RADIOGRAPHS:

All radiographs be free from mechanical, chemical or other blemishes to the extent that they cannot mask or be confused with the image of any discontinuity in the area of interest including:

i. Fogging
ii. Processing marks such as streaks, chemical stains, water marks, air bubble marks
iii. Handling marks such as scratches, finger marks, nail marks, static marks, marks due to dirt on lead intensifying screens.
iv. False indications due to defective screens.

16.3. RADIOGRAPHIC DENSITY:

Density estimation / measurement: The Density be estimated either with a calibrated densitometer or with a step wedge comparison radiograph.

Density of a radiograph at adjacent to essential hole/ wire and area of interest shall be from 1.8 minimum for single film viewing with X-Ray and 2.0(minimum) for Gamma Rays. For composite viewing of multiple film exposures, each film of the composite set shall have a minimum density of 1.3. The maximum density shall be 4.0 for single or composite viewing.

The density anywhere through the area of interest be within – 15% and +30% of that density obtained through the body of the hole type IQI adjacent to the essential hole or adjacent to the essential wire of wire-type IQI.

A tolerance of 0.05 in density is allowed for variation between densitometer readings.

When shims are used with hole type IQI(s) the +30% restriction may be exceeded, and the minimum density requirements mentioned above do not apply provided required IQI sensitivity is met.

16.4. EXCESSIVE BACKSCATTER

If a white image of a letter 'B' appears against a darker background, protection from back scatter radiation is needed and the radiograph be retaken by keeping a lead sheet of 1/16" thick at the back of the radiograph cassette.

16.5. IQI SENSITIVITY:

Essential Hole or Essential wire as referred above in "Clause 14" IQI selection be visible. For wire type IQI's the essential wire shall be visible within the area of interest representing the thickness used for determining the essential wire, inclusive of the allowable density variations described in Clause 16.3.

17. DISPOSITION OF WELDS:

Radiography review form shown in Exhibit 1 be used for recording, reporting evaluation and disposition details.

The indications shown on the radiographs which are unacceptable after interpretation and evaluation be repaired by grinding, welding or gouging. Repair welding be performed using qualified procedure and in a manner acceptable to the inspector. The weld repaired areas be re radiographed in accordance with written procedure.

18. PRESERVATION OF RADIOGRAPHS & EVALUATION REPORTS

The complete set of radiographs and radiography evaluation reports be preserved as per the following.

ASME Sec I & B 31.1	…. 5 Years
ASME Sec VIII Div 1	Radiographs-- Till Data Reports are signed by AI RT Reports – 3 Years
ASME Sec VIII Div 2	…. 3 Years
NBIC Part 3	…. 5 Years

RADIOGRAPHY ACCEPTANCE LEVELS

Ref : ASME SEC I , ASME SEC VIII Div 1, ASME SEC VIII Div 2 Edition 2019.

Full Radiography

Imperfection	Maximum permitted size / length
Any indication characterized as a crack or zone of incomplete fusion or penetration	Unacceptable
Elongated indications (also see notes 1. & 2. Below)	(a) 6 mm for t up to19 mm (b) 1⁄3t for t from 19 mm to 57 mm (c) 19 mm for t over 57 mm Where t is the thickness of the weld excluding any allowable reinforcement
Rounded indications	As specified by the acceptance standards given in pages 13 to 16.

Note:

1. For a butt weld joining two members having different thicknesses at the weld, t is the thinner of these two thicknesses. If a full penetration weld includes a fillet weld, the thickness of the throat of the fillet be included in t.
2. Any group of aligned indications that have an aggregate length greater than t in a length of 12t, except when the distance between the successive imperfections exceeds 6L where L is the length of the longest imperfection in the group.

Spot Radiography

Imperfection	Maximum permitted size / length
any indication characterized as a crack or zone of incomplete fusion or penetration	Unacceptable
slag inclusions or cavities	2⁄3t where t is the thickness of the weld excluding any allowable reinforcement.
Rounded indications	Not a factor in the acceptability of welds not required to be fully radiographed.

Note:

- If a full penetration weld includes a fillet weld, the thickness of the throat of the fillet be included in t.
- If several indications within the above limitations exist in line, the welds be judged acceptable if the sum of the longest dimensions of all such indications is not more than t in a length of 6t (or proportionately for radiographs shorter than 6t) and if the longest indications considered are separated by at least 3L of acceptable weld metal where L is the length of the longest indication. The maximum length of acceptable indications be 3⁄4 in.(19 mm). Any such indications shorter than 1⁄4 in. (6 mm) be acceptable for any plate thickness.

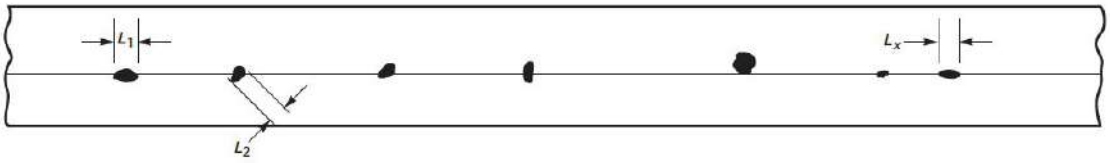
Acceptance Criteria for Rounded Indications

(Ref: Mandatory Appendix 4 ASME SEC I, SEC VIII DIV I Edition 2019)

SI Units

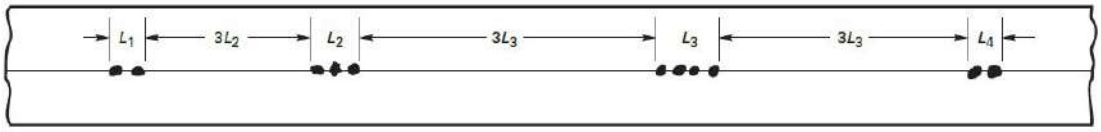
Thickness, t, mm	Maximum Size of Acceptable Rounded Indication, mm		Maximum Size of Nonrelevant Indication, mm
	Random	Isolated	
Less than 3	$\frac{1}{4}\ t$	$\frac{1}{3}\ t$	$\frac{1}{10}\ t$
3	0.79	1.07	0.38
5	1.19	1.60	0.38
6	1.60	2.11	0.38
8	1.98	2.64	0.79
10	2.31	3.18	0.79
11	2.77	3.71	0.79
13	3.18	4.27	0.79
14	3.61	4.78	0.79
16	3.96	5.33	0.79
17	3.96	5.84	0.79
19.0 to 50, incl.	3.96	6.35	0.79
Over 50	3.96	9.53	1.60

Figure 4-1
Aligned Rounded Indications



GENERAL NOTE: Sum of L_1 to L_x shall be less than t in a length of $12t$.

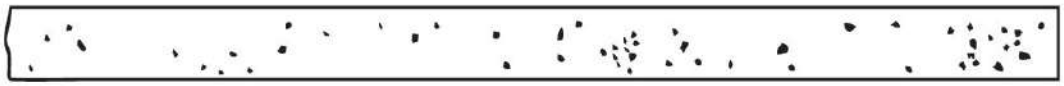
Figure 4-2
Groups of Aligned Rounded Indications



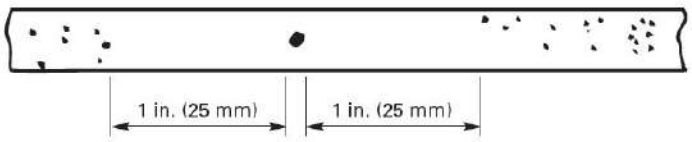
Maximum Group Length	Minimum Group Spacing
L = $1/4$ in. (6 mm) for t less than $3/4$ in. (19 mm) L = $1/3t$ for t $3/4$ in. (19 mm) to $2\,1/4$ in. (57 mm) L = $3/4$ in. (19 mm) for t greater than $2\,1/4$ in. (57 mm)	$3L$ where L is the length of the longest adjacent group being evaluated

GENERAL NOTE: Sum of the group lengths shall be less than t in a length of $12t$.

Figure 4-3
Charts for t Equal to $1/8$ in. to $1/4$ in. (3 mm to 6 mm), Inclusive



(a) Random Rounded Indications [See Note (1)]

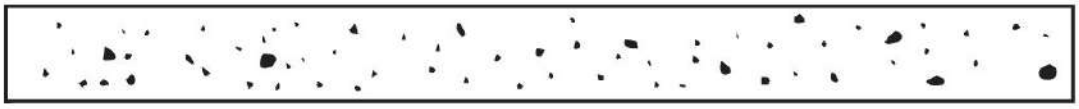


(b) Isolated Indication [See Note (2)]

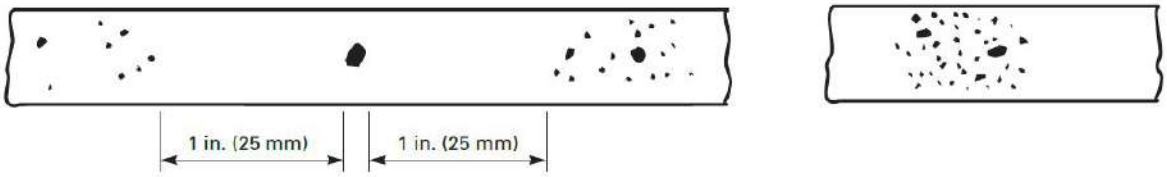
(c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Maximum size per Table 4-1.

Figure 4-4
Charts for t Over $\frac{1}{4}$ in. to $\frac{3}{8}$ in. (6 mm to 10 mm), Inclusive



(a) Random Rounded Indications [See Note (1)]

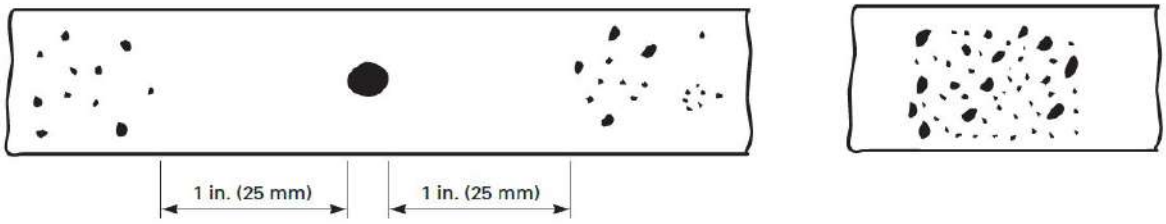


(b) Isolated Indication [See Note (2)] (c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Maximum size per Table 4-1.

Figure 4-5
Charts for t Over $\frac{3}{8}$ in. to $\frac{3}{4}$ in. (10 mm to 19 mm), Inclusive

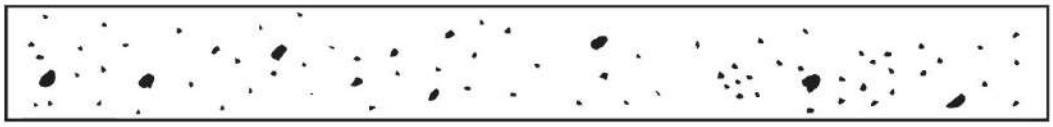
(a) Random Rounded Indications [See Note (1)]



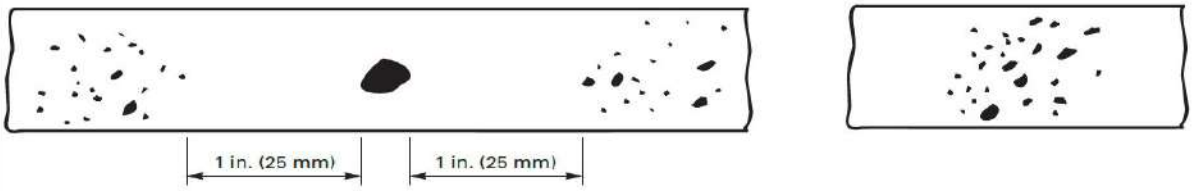
(b) Isolated Indication [See Note (2)] (c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Maximum size per Table 4-1.

Figure 4-6
Charts for *t* Over ¾ in. to 2 in. (19 mm to 50 mm), Inclusive



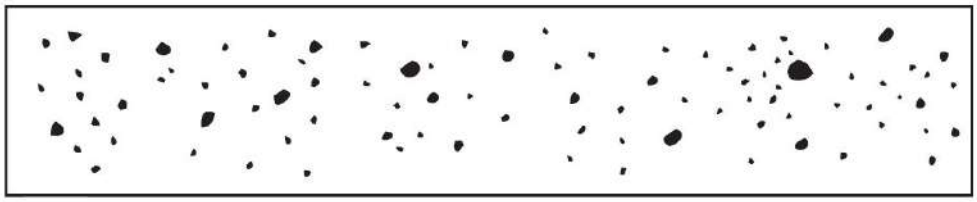
(a) Random Rounded Indications [See Note (1)]



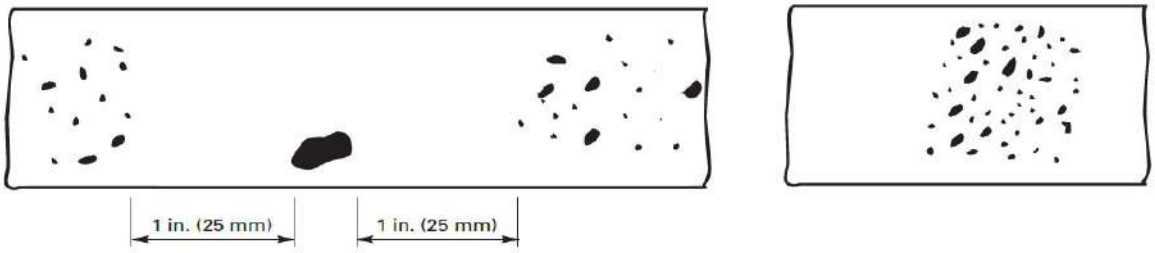
(b) Isolated Indication [See Note (2)] (c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Maximum size per Table 4-1.

Figure 4-7
Charts for *t* Over 2 in. to 4 in. (50 mm to 100 mm), Inclusive



(a) Random Rounded Indications [See Note (1)]



(b) Isolated Indication [See Note (2)] (c) Cluster

NOTES:
(1) Typical concentration and size permitted in any 6 in. (150 mm) length of weld.
(2) Maximum size per Table 4-1.

(For other Codes such as ASME B31.1, NBIC NB23 refer respective current Edition)

ISSUE NO.2

PROCEDURE FOR ULTRASONIC EXAMINATION

Issue No	Rev No	Date of Revision	Brief Records of Revision
1	0	02-02-2015	First Edition
1	1	11-04-2017	Cl no. 2,3,12,13 revised as per ASME Sec V Edition 2015
2	1	25-04-2018	Cl no. 2,3,12,13 revised as per ASME Sec V Edition 2017
2	2	15-05-2020	Cl no. 1,5,7,12 Modified and Cl no. 2.2,2.3,3,12 Revised as per ASME Sec V Edition 2019

Prepared by	Reviewed & Approved by
(K. JANAKI RAMULU) NDE LEVEL- II	VENKATA RAVI CHANDRA M. ASNT NDT LEVEL III-RT,UT,MT,PT CERTIFICATE No. 204694 (M.V. RAVI CHANDRA) NDE LEVEL- III

TABLE OF CONTENTS

1. SCOPE:

This procedure covers Ultrasonic Examination for Ferritic welds (Carbon or Alloy steels) and Claddings by Manual, A-Scan, pulse-echo direct contact method of testing for detection of inclusions(slag) and planar discontinuities (cracks, non-fusion, etc.) and thickness measurement as

a) Full penetration butt welds (double V, single V type), Full penetration corner welded nozzle joints for boiler and pressure vessels of equal to or greater than 10mm thickness.
b) Butt joints in pipes with thickness equal to or greater than 10mm thickness.
c) Claddings.
d) Direct thickness read out by manual Ultrasonic Pulse echo contact method.

2. SYSTEM:

2.1 EXAMINATION PROCEDURE AND APPLICABLE STANDARDS:

All Ultrasonic Examination procedures shall be prepared in accordance with ASME SEC V Edition 2019 by at least NDE Level II and reviewed and approved by NDE Level III.

2.2 REFERENCING CODE SECTION FOR ACCEPTANCE CRITERIA:

ASME SEC I, ASME SEC VIII Div 1, ASME SEC VIII Div 2 Edition 2019, ASME B31.1 Edition 2018 & NBIC NB 23 Edition 2019, SNT-TC-1A Edition 2016 & ASME SEC V Edition 2019 Art.1.

.

2.3 EXAMINATION PERSONNEL AND APPLICABLE STANDARDS:

All NDE Level – I, NDE Level – II and NDE Level III personnel are qualified in accordance with NDE written practice (Based on SNT-TC-1A 2016& ASME Sec V Edition 2019 Art.1) and appearing in Latest List of Qualified NDE Personnel shall carry out any Ultrasonic Examination.

At the appropriate stage, the Ultrasonic Examination shall be carried out as per the requisitions from production shops endorsed by concerned Quality Controls.

3. WRITTEN PROCEDURE REQUIREMENTS:

This procedure based on T-421 of ASME SEC V Edition 2019 shall contain the requirements listed in the Table below of this procedure.

Table T-421
Requirements of an Ultrasonic Examination Procedure

Requirement	Essential Variable	Nonessential Variable
Weld configurations to be examined, including thickness dimensions and base material product form (pipe, plate, etc.)	X	...
The surfaces from which the examination shall be performed	X	...
Technique(s) (straight beam, angle beam, contact, and/or immersion)	X	...
Angle(s) and mode(s) of wave propagation in the material	X	...
Search unit type(s), frequency(ies), and element size(s)/shape(s)	X	...
Special search units, wedges, shoes, or saddles, when used	X	...
Ultrasonic instrument(s)	X	...
Calibration [calibration block(s) and technique(s)]	X	...
Directions and extent of scanning	X	...
Scanning (manual vs. automatic)	X	...
Method for discriminating geometric from flaw indications	X	...
Method for sizing indications	X	...
Computer enhanced data acquisition, when used	X	...
Scan overlap (decrease only)	X	...
Personnel performance requirements, when required	X	...
Personnel qualification requirements	...	X
Surface condition (examination surface, calibration block)	...	X
Couplant: brand name or type	...	X
Post-examination cleaning technique	...	X
Automatic alarm and/or recording equipment, when applicable	...	X
Records, including minimum calibration data to be recorded (e.g., instrument settings)	...	X

It shall establish a single value, or range of values for each requirement. When required performance shall be demonstrated to the inspector. Any change in specified value or range of values of the essential variables mentioned above shall require requalification of the written procedure.

4. SURFACE CONDITION :

4.1 BASE MATERIAL, WELD, CALIBRATION BLOCK:

The base material and weld surface shall be prepared by grinding and sandering. The scanning surfaces of the basic calibration block shall be done by sandering.

4.2 TEMPERATURE DIFFERENCE:(examination surface vs calibration block)

The temperature difference between examination surfaces and the calibration block shall be within +/- 14 deg C (25 deg F) .

5. EQUIPMENT:

5.1 INSTRUMENT:

A Pulse-echo-type of ultrasonic instrument appearing in current list of NDE equipments under calibration and capable of operation at frequencies over the range of 2-4 MHz equipped with 2dB stepped gain control shall be used.

5.2 SEARCH UNITS:

Longitudinal wave Straight beam probe of size 10 mm to 24 mm Ø, 2 - 4 MHz ; Transverse wave angled beam probes 45º, 60º , 70º of nominal size (miniature size) 8 x 9 mm² ; make Modsonic / Olympus / GE with suitable 2mtr long probe cables shall be used.

5.3 COUPLANT:

SAE 30 Hylube machine oil or grease oil mixture shall be used. Calibration shall be carried out using the same couplant to be used in examination of welds.

6. TECHNIQUE (S):

Manual, A-Scan, pulse-echo direct contact using either single or dual element straight beam and angle beam search units.

7. CALIBRATION:

7.1 EQUIPMENT CALIBRATION:

The screen height linearity and amplitude control linearity shall be performed in accordance with Procedure No. 07013 (latest revision) at the beginning of each period of extended use or every 3 months.

7.2 TECHNIQUES FOR STRAIGHT BEAM AND ANGLE BEAM CALIBRATION:

7.2.1. SWEEP RANGE CALIBRATION:

The sweep range shall be adjusted to minimum 2T for straight beam, 3T for 45º angle beam and 4T for 60º using an IIW - V1 or V2 reference block.

7.2.2. SENSITIVITY CALIBRATION:

DAC curve plotted on the CRT screen Using Flat basic calibration block 1.5 inch ASME Block for Both Straight beam and Angle beam.

7.2.3. CALIBRATION VERIFICATION FREQUENCY:

Sweep range and DAC curve shall be calibrated at the beginning of each test and shall be verified at the end of each test,

- Whenever any component of test system is changed,
- Whenever operator is changed,
- At intervals of 4 hours during continuous testing.

7.2.4. CONFIRMATION ACCEPTANCE VALUES:

- If the deviation in distance range points exceeds 10% of the distance reading or 5% of full sweep which ever is greater, correct the distance range calibration, reexamine areas since last calibration and record.
- If the sensitivity decreases by 20% or 2dB of its amplitude correct the sensitivity and reexamine areas since last calibration and record. If the sensitivity increases by 20%

or 2dB of its amplitude correct the sensitivity correct the data sheets since last valid calibration. If the sensitivity varies beyond 20% or 2dB of its amplitude recalibrate and reexamine areas since last valid calibration and record.

7.3 WELD METAL OVERLAY CLADDING CALIBRATION BLOCKS

7.3.1. CALIBRATION BLOCKS FOR TECHNIQUE ONE:

The basic calibration block configuration and reflectors shall be as shown in figure T-434.4.1 of ASME Sec V Article 4. Either a side –drilled hole or flat bottom hole may be used. The thickness of the weld metal overlay cladding shall be at least as thick as that to be examined. The thickness of the base material shall be at least twice the thickness of the weld metal overlay cladding.

7.3.2. ALTERNATE CALIBRATION BLOCKS FOR TECHNIQUE ONE:

Alternately, calibration blocks as shown in figure T-434.4.2.1. or figure T-434.4.2.2. of ASME Sec V Article 4 may be used. The thickness of the weld metal overlay cladding shall be at least as thick as that to be examined. The thickness of the base material shall be at least twice the thickness of the weld metal overlay cladding.

7.3.3. CALIBRATION BLOCK FOR TECHNIQUE TWO:

The basic calibration block configuration and reflectors shall be as shown in the figure T-434.4.3 of ASME Sec V Article 4. A flat bottom hole drilled to the weld /base metal interface shall be used. This hole may be drilled from the base material or weld metal overlay cladding side. The thickness of the weld metal overlay cladding shall be at least as thick as that to be examined. The thickness of the base metal shall be within 1 in. (25mm) of the calibration block thickness when the examination is performed from the base material surface. The thickness of the base material on the calibration block shall be at least twice the thickness of the weld metal overlay cladding when the examination is performed from the weld metal overlay cladding surface.

7.4 CALIBRATION FOR WELD METAL OVERLAY CLADDING

Dished end of clad plates shall be Ultrasonically examined after final heat treatment for lack of bond. 100% UT examination shall be carried out on areas where attachments are to be welded directly to the cladding. Above areas shall include 50mm of adjacent areas on both sides of attachment.

7.4.1. CALIBRATION FOR TECHNIQUE ONE:

Calibrations shall be performed utilizing the calibration block shown in figure T-432.4.1 of ASME Sec V Article 4. The search unit shall be positioned for the maximum response from the calibration reflector. When a side –drilled hole is used for calibration, the plane separating the elements search unit shall be positioned parallel to the axis of the hole. The gain control shall be set so that this response is 80% ± 5% of full screen height. This shall be the primary reference level.

7.4.2. CALIBRATION FOR TECHNIQUE TWO:

Calibrations shall be performed utilizing the calibration block shown in figure T-434.4.3 of ASME Sec V Article 4. The search unit shall be positioned for the maximum response of the first resolvable indication from the bottom of the calibration reflector. The gain shall be set so that this response is 80%± 5% of full screen height. This shall be the primary reference level.

7.4.3. ALTERNATE CALIBRATION FOR TECHNIQUE ONE:

Calibration shall be performed utilizing the calibration blocks shown in figure T-434.4.2.1. or figure T-434.4.2.2 of ASME Sec V Article 4. The calibration shall be performed as follows;

(a) The search unit shall be positioned for the maximum response from the reflector, which gives the highest amplitude.
(b)When the block shown in the figure T-434.4.2.2 is used, the plane separating the elements of the dual elements search unit shall be positioned parallel to the axis of the hole.
(c) The gain shall be set so that this response is 80% ± 5% of full screen height. This shall be the primary reference level. Mark the peak of the indication on the screen.
(d)Without changing the instrument settings, position the search unit for maximum response from each of the other reflectors and mark their peaks on the screen.
(e) Connect the screen marks for each reflector to provide a DAC curve.

Note: When examination for lack of bond and weld metal overlay cladding flaw indications is required, Technique One shall be used. When examination for lack of bond only is required, Technique Two may be used.

8. SCANNING:

8.1 GENERAL:

8.1.1. EXAMINATION SURFACE:
Examination shall be carried out from identity-punched surface.

8.1.2. COVERAGE:
Shall be on both sides of the weld from 0 to 1½ skip.

8.1.3. SCAN OVERLAP:
Each pass of the search unit shall overlap a minimum of 10% of the active transducer (piezoelectric element) dimension perpendicular to the direction of the scan.

8.1.4. SPEED AND SENSITIVITY:
The weld shall be scanned at a speed not exceeding 6" per second at a scanning sensitivity 6 dB above the DAC or primary Reference Level (PRL).

8.2 BASE MATERIAL:

Prior to angle beam examination of weld, adjacent parent material up to a width of 4T on both sides of the weld shall be scanned with a straight beam search unit to find discontinuities that could interfere with interpretation of indications obtained during subsequent angle beam scanning.
Any discontinuity found by straight beam search unit shall be investigated and not be a cause of rejection of element.

8.3 WELD:

Weld shall be scanned with two different angles beam search units for detection of Longitudinal and transverse discontinuities

8.3.1. DIRECTION AND EXTENT OF SCANNING:

8.3.1.1. REFLECTORS PARALLEL TO THE WELD SEAM:

The angle beam shall be directed at approximate right angles to the weld axis from both side of the weld (i.e., is from 2 directions) on the same surface when possible and probe manipulated so as to pass ultrasonic energy thro' the required volume of the weld and adjacent base material.

8.3.1.2. REFLECTORS TRANSVERSE TO THE WELD:

The angle beam shall be directed essentially parallel to the weld axis. The search unit shall be manipulated so that the ultrasonic energy passes thro' the required volume of weld and adjacent base material. Search unit shall be rotated 180 ° and the examination repeated.

9. SIZING:

9.1 METHOD OF SIZING INDICATIONS:

Length dimension of indications shall be measured by half maximum amplitude method.

9.2 CALIBRATION CORRECTION:

The surface finish difference between calibration block &scanning surface shall be compensated by using Transfer Correction.

Calibration correction due to Mode conversion and redirection for planar reflectors perpendicular to the examination surface at or near the opposite surface is carried out as per the following.

Position the search unit for maximum amplitude from the notch on the opposite surface of the basic calibration block and mark the position of peak of the indication on the screen
The opposite surface notch may give an indication 2 to 1 above DAC for a 45º angle beam search unit and ½ DAC for a 60º search unit. Therefore, the indications from the notch must be considered when evaluating reflectors at the opposite surface

10. EVALUATION :

It shall be carried out by at least NDE Level II personnel as per the following.

- All indications exceeding 20% of DAC shall be scanned for their nature and location and recorded. The gain shall be increased an additional amount so that no calibration reflector indication is less than 40% FSH during evaluation.

- The identity, maximum amplitude, location and extent of reflector causing a geometric indication(s) (segregates in the heat-affected zone, surface conditions such as weld root geometry) shall be recorded.

- Following shall be considered for Classifying an indication as geometric or not.
  - Plot and verify the reflector coordinates. Prepare a cross-sectional sketch showing the reflector position and surface discontinuities such as root and counter bore.
  - Review fabrication or weld preparation drawing. Other ultrasonic techniques or nondestructive examination methods may be helpful in determining a reflector's true position, size, and orientation.

11. RECORDING AND REPORTING:

11.1 METHOD OF RECORDING:

- Test data shall be recorded manually in the Proforma appended in exhibit-1 Annexed and reported and Direct thickness read out by manual Ultrasonic pulse echo contact method is recorded in exhibit-2.
- As a minimum all rejectable indications, type of indications (Crack, non-fusion, slag etc.), location and extent (length), depth below surface shall be recorded.
- Non-rejectable indications exceeding 50% of DAC shall be recorded

Report shall contain the following in addition to those mentioned in the table appended next page.

- Procedure identification and revision.
- Instrument reference level gain and, if used, damping and reject settings(s).
- Calibration data (including reference reflector(s) indication amplitude(s), and distance reading(s).
- Identification and location of weld or volume scanned.
- Map or record of rejectable indications detected or areas cleared.
- Areas of restricted access or inaccessible welds;
- Examination personnel identity and, when required by referencing code section qualification level.
- Date of examination.

12. ACCEPTANCE STANDARDS:

As per ASME SEC I, ASME SEC VIII Div 1, ASME SEC VIII Div 2 Edition 2019, ASME B31.1, NBIC NB 23 Latest Edition.

UT on clad plate (Dished ends) shall be performed as per ASME A 578.

ACCEPTANCE-REJECTION STANDARDS:

(Ref: ASME SEC I, ASME SEC VIII Div 1,ASME SEC VIII DIV 2 Edition 2019)

Imperfections recorded as per para 10 above shall be evaluated as below.

1. Indications characterized as cracks, lack of fusion or incomplete penetration are unacceptable regardless of length.

2. Other imperfections are unacceptable if the indications exceed the reference level amplitude and have lengths which exceed 1/3 T - (weld thickness(T) excluding any allowable reinforcement) or 6 mm whichever is greater.

Notes: Butt welds joining two different thicknesses at the weld, T is the thinner of these two thicknesses.

(For other Codes such as ASME B31.1, NBIC NB23 refer respective current Edition)

13. PRESERVATION OF DATA REPORTS:

All the reports of ultrasonic test shall be preserved till MDR signed.

ISSUED TO :	COPY NO:

TITLE PAGE

ISSUE NO:3

WRITTEN PRACTICE FOR QUALIFICATION AND CERTIFICATION OF NONDESTRUCTIVE EXAMINATION PERSONNEL

Issue No	Rev No	Date of Revision	Record of revisions	Approved By	Reviewed By
				NDE Level III	AI
				SIGNATURE	SIGNATURE
1	0	11-05-2015	First Edition	M.V. RAVICHANDRA	BENHAR
1	1	01-09-2016	Clause no. 1.2,7.3.1	M.V. RAVICHANDRA	--
2	1	25-04-2018	Clause no. 1.2	M.V. RAVICHANDRA	N. SAI KIRAN
3	1	15-5-2020	As per SNT-TC-1A 2016 Edition & ASME SEC V Art 1 of 2019 Code Edition	M V RAVI CHANDRA	

PREPARED BY	REVIEWED & APPROVED BY	CERTIFIED BY
15/5/20	15/5/20	
K.JANAKI RAMULU NDE LEVEL II	M.V. RAVICHANDRA NDE LEVEL III	B.ROY HEAD (QUALITY)

VENKATA RAVI CHANDRA M.
ASNT NDT LEVEL III-RT,UT,MT,PT
CERTIFICATE No. 204694.

B. ROY
AGM (Quality)
BHEL - HPVP
Visakhapatnam - 530 012

1. SCOPE

1.1 This document covers all phases of training, qualification and certification of Nondestructive Examination (NDE) personnel; who perform, witness, monitor or evaluate; in accordance with recommended practice SNT-TC-1A 2016 & ASME SEC V-ART 1 of 2019 Code Edition and describes the responsibility of each Level of certification.

1.2 This document is prepared in accordance with the guidelines of recommended practice SNT-TC-1A 2016 & ASME SEC V-ART 1 of 2019 Code Edition qualification and certification of Nondestructive Examination personnel, ASME SEC VIII Division 1&2 Edition 2019, ASME SEC I Edition 2019 & B31.1 Edition 2018 and NBIC Part 3 Edition 2017.

2. DEFINITIONS

Terms included in this document are defined as follows:

2.1. **Certification:** Written testimony of qualification.

2.2. **Certifying Authority:** To sign personnel qualification certificates on behalf of BHEL-HPVP: Head (Q)

2.3. **Certifying agency:** BHEL-HPVP.

2.4. **Closed book examination:** An examination administered without access to reference material except for materials supplied with or in the examination.

2.5. **Comparable:** Being at an equivalent or similar Level of NDE responsibility and difficulty as determined by the BHEL-HPVP's NDE Level III.

2.6. **Documented:** The condition being in written form.

2.7. **Employer:** BHEL-HPVP

2.8. **Experience:** Work activities accomplished in a specific NDE method under the direction of qualified supervision including performance of the NDE method and related activities but not including the time spent in organised training programs.

2.9. **Grading Unit:** Grading units are unflawed or flawed and the percentage of unflawed/flawed grading units required shall be approved by NDE Level III.

2.10. **Limited Certification**: Nondestructive Exam methods may be further subdivided into limited disciplines or techniques to meet specific BHEL-HPVP needs; these are NDE Level II certifications, but to a limited scope.

2.11. **Nondestructive Examination:** A process that involves the inspection, testing or evaluation of materials, components and assemblies for materials' discontinuities, properties and machine problems without further impairing or Destroying the part's serviceability. Throughout this document the term NDE applies equally to the NDE methods used for material inspection and flaw detection.

2.12. **Outside agency:** A company or individual who provides NDE Level III services and whose qualifications to provide these services have been reviewed by the employer engaging company or individual.

2.13. **Qualification:** Demonstrated skill, demonstrated knowledge, documented training, and documented experience required for personnel to properly perform the duties of a specific job.

2.14. **Recommended practice:** A set of guidelines to assist BHEL-HPVP in developing uniform procedures for the qualification and certification of NDE personnel to satisfy BHEL-HPVP's specific requirements.

2.15. **Technique:** A category within an NDE method; for example, Ultrasonic testing.

2.16. **Training:** An organised program developed to impart the knowledge and skills necessary for qualification.

2.17. **Written Practice:** A written procedure developed by BHEL-HPVP that details the req uirements for qualification and certification of their NDE personnel.

Note: For NDE Level II certification, the experience shall consist of time at Level I or equivalent. If a person is being qualified directly to Level II with no time at Level I, the required experience shall consist of the sum of the times required for Level I and Level II and the required training shall consist of sum of the hours required for Level I and Level II.

Training hours shall be as per table 1A and table 1B.

3. NONDESTRUCTIVE EXAMINATION METHODS

This practice shall be applicable to each of the following test methods.

3.1. Radiographic Testing (RT)

3.2. Magnetic Particle Testing (MT)

3.3. Ultrasonic Testing (UT)

3.4. Liquid Penetrant Testing (PT)

4. LEVELS OF QUALIFICATION

4.1. There are three basic Levels of qualification in respect of RT, MT, UT & PT.

4.2. In the process of being initially trained, qualified and certified to either NDE Level –I or Level –II an individual shall be considered a trainee. A trainee shall work with a certified individual and shall not independently conduct, interpret, evaluate or report the results of any Nondestructive Examination.

4.3. The three basic Levels of qualifications are as follows:

4.3.1. **NDE LEVEL I**

An NDE Level I individual shall have sufficient technical knowledge and skills to be qualified to properly perform specific calibrations, specific NDE and specific evaluations for acceptance or rejection determinations according to written instructions and to record results. He shall receive the necessary instructions or supervision from a certified NDE Level II or Level III individual.

4.3.2. **NDE LEVEL II**

An NDE Level II individual shall have sufficient technical knowledge and skills to be qualified to setup and calibrate equipment and to interpret and evaluate results with respect to applicable codes, standards and specifications. He shall be thoroughly familiar with the scope and limitations of the method for which qualified and shall exercise assigned responsibility for on-the-job training and guidance of trainees and NDE Level I personnel. The NDE Level II shall be able to organise and report the results of NDE activities.

4.3.3. **NDE LEVEL III**

An NDE Level III individual shall have sufficient technical knowledge and skills to develop, qualify and approve procedures, establish and approve techniques, interpret codes, standards, specifications and procedures; and designate the NDE methods, techniques and procedures to be used. NDE Level III shall be responsible for the NDE operations for which qualified and assigned and shall be capable of interpreting and evaluating results in terms of existing codes, standards and specifications. NDE Level III shall have sufficient practical background in applicable materials, fabrication and product technology to establish techniques and to assist in establishing acceptance criteria when none are otherwise available. NDE Level III shall have general familiarity with other appropriate NDE methods, as demonstrated by Level III Basic examination or other means. NDE Level III, in the methods in which certified shall have sufficient knowledge and capable of training and examining NDE Level I and Level II personnel for certification in those methods.

5. POLICY

5.1. All NDE personnel considered for initial certification shall be qualified, by training and examination in one or more NDE methods, in accordance with this NDE Written Practice. Personnel qualified and certified to the previous Editions of SNT-TC-1A shall receive applicable training, take applicable examinations and obtain necessary experience, such that they meet new requirements for new techniques are considered to be qualified to

2016 Edition & ASME SEC V ART 1 prior to their next recertification date, in the applicable method. Recertification shall be by re-examination and meet the requirements of SNT-TC-1A 2016 & ASME SEC V ART 1 of 2019 Code Edition.

5.2. Based on ASNT NDE Level-III certificate, Qualifications, Training, Experience, demonstrated abilities and continued satisfactory performance, Head (Q) shall recommend Incharge (NDE) to Head of organisation (BHEL-HPVP) for the appointment of NDE Level-III. NDE Level-III shall recommend certification of other NDE Level-III personnel to Head (Q) when required. The changes will be made to all affected documents including the QCS manual.

6. SYSTEM

This document shall be reviewed, amended as required and approved by NDE Level III and certified by Head (Q) taking into consideration of:

6.1. Experience gained in various Nondestructive examination methods.
6.2. ASME SEC V other referencing code sections of current Edition.
6.3. Construction Code sections such as ASME SEC VIII Division 1 & Division 2, ASME SEC I & ASME B31.1, NBIC Part 3.

7. EDUCATION, TRAINING AND EXPERIENCE REQUIREMENTS FOR INITIAL QUALIFICATION

7.1. Candidates for certification in NDE shall have education, training and experience to ensure qualification in those NDE methods in which they are being considered for certification. Documentation of prior certification shall be used as evidence of qualification for comparable Levels of certification.

7.2. Documented training and/or experience gained in positions and activities comparable to those of Levels I, II and/or III prior to establishment of the Written Practice shall be considered in satisfying the criteria of section 7.3.

7.3. To be considered for certification, a candidate shall satisfy one of the following for the applicable NDE Level.

7.3.1. **NDE LEVELS I & II**

Table 1A lists the recommended training and experience factors to be considered for initial qualifications of NDE Level I and Level II individuals & Table1B lists for recommended training and experience factors for Limited Certification. Table 1C for examination requirements of Limited Certification.

TABLE – 1A (As per Reference Table 6.3.1 A of SNT-TC-1A 2016 Edition and Table II-121-1 of ASME BPVC V-2019 ART 1):

INITIAL TRAINING & EXPERIENCE LEVELS

Educational qualification & Experience	Training Hours							
	RT/DRT*		MT		UT		PT	
	L I	L II	L I	L II	L I	L II	L I	L II
Degree in science or Diploma in Engineering or B.E/B.Tech	40	40	12	8	40	40	4	8
High School Certificate (S.S.C+ Radiographer)	40	40	12	8	40	40	4	8
Minimum experience in Method or Technique (hours)	210	630	70	210	210	630	70	140
Total hours in NDE	400	1200	130	400	400	1200	130	270

DRT*- Digital Radiography Testing

Note:

1. For Level II certification, the experience shall consist of time at Level I or equivalent. If a person is being qualified directly to Level II with no time at Level I, the required experience shall consist of the sum of the times required for Level I and Level II and the required training shall consist of sum of the hours required for Level I and Level II.

2. Training hours shall be as per Table-1A.

TABLE- 1B (As per Reference Table 6.3.18 C of SNT-TC-1A 2016 Edition):

INITIAL TRAINING AND EXPERIENCE REQUIREMENTS FOR LEVEL-II LIMITED CERTIFICATION

EXAMINATION METHOD	LIMITED CERTIFICATION	TECHNICIANS STARTING POINT	FORMAL TRAINING (Hours)	MINIMUM REQUIRED WORK EXPERIENCE IN METHOD (Hours)
Radiographic	Film Interpretation	Non-Radiographer	40	220*
	Film Interpretation	RT Level-I	24	220*
Ultrasonic	Digital Thickness measurement	Trainee	8	40
	A-Scan Thickness measurement	Trainee	24	175

* – Sufficient number of radiographs to demonstrate satisfactory performance to certifying Level III

TABLE-1C (As per Reference Table 6.3.18 C of SNT-TC-1A 2016 Edition):

EXAMINATION REQUIREMENTS FOR LEVEL -II LIMITED CERTIFICATION:

Method	Limited Certification	Minimum No. of Questions	
		General	Specific
Radiographic Testing	Film Interpretation(Non-Radiographer)	40	20
	Film Interpretation(Certified RT Level-I)	20	15
Ultrasonic Testing	Digital Thickness Testing	20	10
	A-Scan Thickness Testing	30	15

7.3.2. **NDE LEVEL III**

7.3.2.1. Have graduated from a minimum four years' college or university curriculum with a degree in engineering or science, plus one additional year of experience beyond the Level II requirements in NDE in an assignment comparable to that of NDE Level II in the applicable NDE method(s), or

7.3.2.2. Have completed with passing grades at least two years of engineering or science study at a university, college or technical school plus two additional years of experience beyond the Level II requirements in NDE Level II in the applicable NDE method(s) or

7.3.2.3. Have four years of experience beyond the Level II requirements in NDE in an assignment at least comparable to that of an NDE Level II in the applicable NDE method(s).

8. TRAINING PROGRAMS

8.1. Personnel being considered for initial certification shall complete sufficient organised training to become thoroughly familiar with the principles and practices of the specified NDE method related to the Level of certification desired and applicable to the processes to be used and the products to be tested.

8.2. The Sufficiently organized training shall be such as to ensure the student is thoroughly familiar with principles and practices of specified NDE method related to the Level of certification desired, and applicable to the processes to be used and the products to be tested.

8.3. The training programme shall include sufficient examinations to ensure understanding of the necessary information to ensure understanding of the necessary information.

8.4. Training course outlines for NDE Level I, Level II and Level III personnel , which may be used as technical source material contained in ASNT CP-105 standards.

8.5. If outside training service is purchased, BHEL-HPVP is responsible for ensuring that such services meet the requirements of this Written Practice.

9. EXAMINATIONS

9.1. Administration and Grading

9.1.1. Qualification examination questions shall be approved by an NDE Level III responsible for the applicable method.

9.1.2. An NDE Level III shall be responsible for the administration and grading of examinations specified in section 9.3 through 9.8 for NDE Level I,II or other NDE Level III personnel. A qualified representative of BHEL-HPVP may perform the actual administration and grading of NDE Level III basic and method examinations specified in 9.8.

9.1.3. For NDE Level I and Level II personnel, a composite grade shall be determined by simple averaging of the results of the general, specific and practical examinations described below. For NDE Level III personnel the composite grade shall be determined by simple averaging of the results of the basic, method and specific examinations described below.

9.1.4. Examinations administered for qualification shall result in a passing composite grade of at least 80%, with no individual examination having a passing grade less than 70%. The practical examination shall have a passing grade of 80%.

9.1.5. When an examination is administered and graded for BHEL-HPVP by an outside agency and the outside agency issues grades of pass or fail only, on a certified report, then BHEL-HPVP may accept the pass grade as 80% for that particular examination.

9.1.6. When BHEL-HPVP purchases outside services, BHEL-HPVP is responsible for ensuring that the examination services are in accordance with the BHEL-HPVP's NDE Written Practice.

9.2. **Vision examinations**

9.2.1. **Near-Vision Acuity:** The examination shall ensure natural or corrected near-distance acuity in at least one eye such that the applicant is capable of reading a minimum of Jaeger Number 1 or equivalent type and size letter at the distance designated on the chart but not less than 12 inches (30cm) on a standard Jaeger test chart. This shall be conducted upon initial certification and at one-year intervals thereafter by NDE Level III. (Refer Annexure I Issue No.1 Rev.0)

9.2.2. **Colour contrast Differentiation:** The colour contrast examination using Ishihara charts for distinguishing and differentiating contrast among colours is required for the personnel qualified and certified in MT and PT. Personnel qualified and certified in RT& MT shall read a minimum 20 correct readings in the chart provided for eye examination for shades of grey. This shall be conducted upon initial certification and at one-year intervals thereafter by NDE Level III. (Refer Annexure I).

9.3. **General (Written – for NDE Level I and II)**

9.3.1. The general examination shall address the basic principles of the applicable method.

9.3.2. In preparing the examinations, the NDE Level III shall select or devise appropriate questions covering the applicable method to the degree required by ASNT Question Bank and example questions in SNT-TC-1A 2016.

9.3.3. The minimum number of questions which shall be given is as follows:
(Ref: Table 8.3.4 of SNT-TC-1A-2016 and Table II-122.1 of ASME BPVC V-2019 ART 1)

Test Method/Technique	Number of Level I questions	Number of Level II questions
PT	40	40
MT	40	40
RT/Digital Radiography Testing	40	40
UT	40	40

9.4. **Specific (Written – for NDE Levels I and II)**

9.4.1. The specific examination shall address the equipment, operating procedures and NDE techniques that the individual may encounter during specific assignments.

9.4.2. The specific examination shall also cover the specifications or codes and acceptance criteria used in the BHEL-HPVP's NDE procedures.

9.4.3. The minimum number of questions which shall be given is as follows
(Ref: Table 8.3.4 of SNT-TC-1A-2016 and Table II-122.1 of ASME BPVC V-2019 ART 1)

Test Method/Technique	Number of Level I questions	Number of Level II questions
PT	20	20
MT	20	20
RT	20	20
Digital Radiography Testing	30	30
UT	20	20

9.5. **Practical (For NDE Level I and Level II)**

9.5.1. The candidate shall demonstrate familiarity with and ability to operate the necessary NDE equipment, record and analyse the resultant information to the degree required.

9.5.2. At least one flawed specimen or component shall be tested and the results of the NDE tests analysed by the candidate.

9.5.3. The description of the specimen, the NDE procedure, including check points and the results of the examination shall be documented.

9.5.4. **NDE Level I Practical Examination:** Proficiency shall be demonstrated in performing the applicable NDE on one or more specimens or machine problems approved by NDE Level III and in evaluating the results to the degree of responsibility as described in this Written Practice. At least 10 different check points requiring an understanding of test variables and BHEL-HPVP's procedural requirements shall be included in this practical examination. The candidate should detect all discontinuities and conditions specified by the NDE Level III.

9.5.5. **NDE Level II Practical examination:** Proficiency shall be demonstrated in selecting and performing the applicable NDE technique within the method and interpreting and evaluating the results on one or more specimens or machine problems approved by NDE Level III. At least ten (10) different check points requiring an understanding of NDE variables and BHEL-HPVP's procedural requirements shall be included in this Practical Examination. The candidate should detect all discontinuities and conditions specified by the NDE Level III.

9.6. The questions for General Examination shall be similar to the standard given in ASNT Question Bank. These questions are intended as examples only and shall not be used verbatim for qualification examinations.

9.7. **Additional Written, Specific and Practical Examination Criteria**

9.7.1. **NDE Level I, II and III Written Examinations**

All NDE Level I, II and III written examinations shall be closed book except that necessary data, such as graphs, tables, specifications, procedures, codes etc., may be provided with or in the examination. Questions utilising such reference materials shall require an understanding of the information rather than merely locating the appropriate answer.

9.8. **NDE Level III Examination**

9.8.1. **Basic Examination**

9.8.1.1. NDE Basic Examinations (required only once when more than one method examination is taken). The minimum number of questions which shall be given as follows.

9.8.1.2. Fifteen (15) relating to understanding the SNT-TC-1A document.

9.8.1.3. Twenty (20) questions relating to applicable materials, fabrication, and product technology.

9.8.1.4. Twenty (20) questions that are similar to published ASNT Level II questions for other appropriate NDE methods.

9.8.2. **Method Examination (for each method)**

9.8.2.1. Thirty (30) questions relating to fundamentals and principles that are similar to published ASNT Level III questions for each method and

9.8.2.2. Fifteen (15) questions relating to application and establishment of techniques and procedures that are similar to the published ASNT NDE Level III questions for each method and

9.8.2.3. Twenty (20) questions relating to capability for interpreting codes, standards and specifications relating to the methods.

9.8.3. **Specific Examination (for each method)**

9.8.3.1. Twenty (20) questions relating to specifications, equipment, techniques and procedures applicable to BHEL-HPVP's product(s) and methods employed and to the administration of the BHEL-HPVP's Written Practice.

9.8.4. A valid endorsement on an ASNT NDE Level III certificate fulfils the examination criteria described in 9.8.1 and 9.8.2 for each applicable NDE method.

9.9. **Re-examination**

Those failing to attain the required grades shall wait at least 30 days or receive suitable additional training as determined by NDE Level III before re-examination.

10. CERTIFICATION

10.1. Certification of all Levels of NDE personnel is the responsibility of BHEL-HPVP. In-charge (NDE) is appointed as NDE Level III by ED/GM I/c BHEL-HPVP by virtue of his educational qualification, experience, demonstrated abilities and achievements. Recommendation to Certification of the other personnel shall be the responsibility of NDE Level III.

10.2. At the option of BHEL-HPVP, an outside agency may be engaged to provide (i) NDE Level III services. In such instances, the final responsibility of certification of the employees shall be retained by BHEL-HPVP.(ii) Level I and Level II qualified personnel as per BHEL-HPVP Written Practice/SNT-TC-1A Code Acceptable Edition.

10.3. Personnel certification records shall be maintained on file by In charge (NDE) till the employee leaves the services of the company or one year of interrupted service and shall include the following. (refer Annexure II-Issue No.1 Rev.0)

10.3.1. Name of certified individual.

10.3.2. Level of certification and NDE method

10.3.3. Educational background and experience of certified individuals.

10.3.4. Statement indicating satisfactory completion of training in accordance with BHEL-HPVP's Written Practice.

10.3.5. Results of the Vision Examination prescribed in 9.2 for the current certification period.

10.3.6. Current examination copy(ies) or evidence of successful completion of examinations.

10.3.7. Composite grade(s) or suitable evidence of grades.

10.3.8. Signature of NDE Level III that verified qualifications of candidate for certification.

10.3.9. Date of certification and/or recertification and the date of assignments to NDE

10.3.10. Certification expiration date.

10.3.11. Signature of the examiner and NDE Level III.

11. TECHNICAL PERFORMANCE EVALUATION

11.1. NDE personnel may be re-examined any time for a cause or at the discretion of NDE Level III. BHEL-HPVP and have their certificates extended or revoked.

11.2. The technical performance of NDE Level I and II personnel shall be evaluated annually (once in every 12 months) and documented by NDE Level III (refer Annexure III Issue No.1 Rev.0). At least 10 check points shall be evaluated for each method. Practical exam shall be conducted as per para 9.5.

11.3. The evaluation and documentation shall follow the format and guidelines described in 9.5.

12. INTERRUPTED SERVICE

The NDE personnel shall be recertified by examination as described in this Written Practice if the interrupted service is more than 6 months' certification of the employees shall be retained by BHEL-HPVP.

13. RE-CERTIFICATION

13.1. All Levels of NDE personnel shall be recertified by re-examination prior to their recertification date. Continuing satisfactory technical performance shall not be utilized for recertification without re-examination.

13.2. Re-examination in those portions of the examination in section 9 deemed necessary by BHEL-HPVP's NDE Level III.

13.3. The maximum recertification intervals shall be 3 years for Level I & II personnel, and 5 years for Level III personnel. Certifications expire from the date of the first examination taken during initial or recertification activities for each method.

13.4. When new techniques are added to the employer's written practice, NDE personnel shall receive applicable training, take applicable examinations and obtain necessary experience, such that they meet requirements or new techniques, prior to their next recertification date.

14. TERMINATION

14.1. BHEL-HPVP's certification shall be deemed revoked when employment is terminated.

14.2. A NDE Level I, Level II, or Level III whose certification has been terminated may be certified to the former NDE Level by BHEL-HPVP based on examination, as described in Para 9, provided all of the following conditions are met:

14.2.1. The employee has proof of prior certification.

14.2.2. The employee was working in the capacity to which certified within six (6) months of termination.

14.2.3. The employee is being recertified within six (6) months of termination.

14.2.4. Level I and Level II personnel shall be recertified by examination as specified above. Level III personnel may be recertified by written method, Specific and practical Examinations and the Demonstration examination. Alternatively, Level III personnel may be recertified using only the written Method and Specific examination, provided the following conditions are met.

14.2.5. Level III candidate was previously certified or recertified using all the written examination and the demonstration examination.

14.2.6. Level III candidate is not being recertified due to interrupted service as defined in the written practice

14.2.6.1. Level III candidate is not being certified by a new Employer.

14.2.6.2. For initial certification, the grades for the Basic, Method, Specific, Practical and Demonstration Examination shall be averaged to determine the overall grade.

For recertification, the grades of applicable examinations shall be averaged to determine the overall grade.

15. REINSTATEMENT

A NDE Level I, NDE Level II or NDE Level III whose certification has been terminated may be reinstated to former NDE Level only by examination.

16. SUB-CONTRACTING OF NDE ACTIVITIES & SERVICES

NDE Level III shall ensure that subcontracted NDE (RT, UT, MT, PT, VT) are performed to meet the requirements of Codes and Quality Control System Manual of BHEL-HPVP. When sub-contracting facility is used, NDE Level III shall ensure that sub-contractor's personnel are trained and certified as per sub-contractor's Written Practice in line with SNT-TC-1A of construction Code accepted Edition Sec V prior to performing NDE.