

BHARAT HEAVY ELECTRICALS LIMITED

MM/RM/PURCHASE/C&F

BHEL / TRICHY-620 014.

ANNEXURE-A-Rev 01**ENQ NO-1402100008**

Date: 04-02-2021

Enquiry Terms & Conditions for Supply of Reactor Header Forgings

Note: This Annexure has to be mandatorily filled & signed by the manufacturer (or) mill and submitted along with Technical bid.

Any deviation to the below mentioned terms shall be stated specifically in the comments column for each term and also in case of acceptance to our terms, it will be construed that the whole term is understood and agreed in totality without any deviation. (If otherwise mentioned).

Sl No	BHEL Requirements	Supplier Comments
01	Material specification: Supply of Reactor Header Forgings shall be made strictly as per Technical Specification TDC-AT:8 Rev 00, Special Condition Annexure A and Drawings as mentioned in the enquiry.	
02	Specification, Size & Quantity: a) All the Reactor Header Forgings are to be supplied fully meeting the Technical Specification TDC-AT:8 Rev 00, Special Condition Annexure A and Drawings. If there is any deviation, the same should be mentioned clearly in the offer itself. b) Supplier has to provide acceptance for the Suggestive Quality plan furnished by BHEL. c) Inspection agency for Indigenous suppliers – BHEL & NPCIL. d) Point wise confirmation for Special Condition Annexure A (Pre-Qualification Criteria), Technical Specification TDC-AT:8 Rev.00, Drawings and Quality Action Plan (QAP) are to be mandatorily filled & signed by the bidder and to be uploaded in NIC portal (https://eprocurebhel.co.in) along with Technical Bid (Part 1 bid). e) Documents to establish previous experience for the supply of reactor headers to nuclear power plants to be submitted along with the bid. f) Suppliers shall quote the Third Party Inspection charges considering the stage wise inspection activities indicated in the Suggestive Quality Plan for one header.	
03	Vendor's confirmation for any terms & conditions should be uniform throughout the offer. Terms agreed in Part-1 Techno commercial Bid is final, Terms mentioned anywhere else by the bidder will not be considered	
04	Bid Submission: a) The tender will be operated on Two part bids basis i.e. Part I -Techno-Commercial Bid & Part II- Price Bid In NIC PORTAL (https://eprocurebhel.co.in) ONLY. b) Part-I Techno-Commercial Bid: It contains Technical details, specifications, commercial terms and conditions, Taxes, delivery terms, delivery schedule, validity of offer, payment terms (except price details), acceptance for LD clause, RP clause etc. as per Annexure-A. c) Part-II Price Bid : It contains the input form for quoting price for all the enquired items in NIC (https://eprocurebhel.co.in). d) This Tender is hosted in EPS portal & offer to be submitted through EPS portal only. You are requested to submit your 2 parts offer before due date & time of the enquiry through NIC (https://eprocurebhel.co.in) only.	
05	Validity: The offers shall be kept open for acceptance for 180 days from the date of Tender opening. Once the tenders are submitted, rates cannot be changed on any grounds.	

06	Delivery: The offer shall clearly indicate delivery period in fixed number of Weeks/Months from the date of Purchase Order.	
07	Goods and Service Tax (GST) Indigenous suppliers: 1. Response to Tenders for Indigenous supplier will be entertained only if the vendor has a valid GST registration No (GSTIN) which should be clearly mentioned in the offer. If the dealer is exempted from GST registration, a declaration with due supporting documents need to be furnished for considering the offer. Dealers under composition scheme should declare that he is a composition dealer supported by the screen shot taken from GST portal. The dealer has to submit necessary documents if there is any change in status under GST. 2. Supplier shall mention their GSTIN in all their invoices (incl. credit Notes, Debit Notes) 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), Billed to party (with GSTIN) & Shipped to party details, item description as per PO, Quantity, Rate, Value, applicable taxes with nomenclature (like IGST, SGST, CGST & UTGST) separately, HSN/ SAC Code, Place of Supply etc. 3. All invoices shall bear the HSN Code for each item separately (Harmonized System of Nomenclature)/ SAC code (Services Accounting Code). 4. Invoices will be processed only upon completion of statutory requirement and further subject to following: a. Vendor declaring such invoice in Form GST ANX-1 b. Receipt of Goods or Services and Tax invoice by BHEL 5. As the continuous uploading of tax invoices in GSTN portal (in GST ANX-1) is available for all (i.e. both Small & Large) tax payers under proposed new GST Return System, all invoices raised on BHEL may be uploaded immediately in GST portal on despatch of material /rendering of services. The supplier shall ensure availability of invoice in GST portal before submission of invoice to BHEL. Invoices will be admitted by BHEL only if the invoices are available in GSTN portal (in BHEL's GST ANX-2). 6. In case of discrepancy in the data uploaded by the 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 or debit note (details also to be uploaded in GSTN portal) for the shortages or rejections in the supplies or additional claims, within the calendar month informed by BHEL. 7. In cases where invoice details have been uploaded by the vendor but failed to remit the GST amount to GST Department (Form PMT-08 or Form GST RET-01 to be submitted) within stipulated time, then GST paid on the invoices pertaining to the month for which GST return not filed by the vendor will be recovered from the vendor along with the applicable interest (currently 24% p.a) and all subsequent bills of the vendor will not be processed till filing of the GST return by the vendor. 8. In case GST credit is denied to BHEL due to non-receipt or delayed receipt of goods and/ or tax invoice or expiry of timeline prescribed in GST law for availing such ITC, or any other reasons not attributable to BHEL, GST amount claimed in the invoice shall be disallowed to the vendor. 9. Where any GST liability arising on BHEL under Reverse Charge (RCM), the vendor has to submit the invoices to BHEL well within the timeline prescribed in GST Law, to enable BHEL to discharge the GST liability. If there is a delay in submission of invoice by the vendor resulting in delayed payment of GST by BHEL along with interest, then such interest payable or paid shall be recovered from the vendor. 10. Under GST regime, BHEL has to discharge GST liability on LD recovered from suppliers/contracts. Hence applicable GST shall also be recoverable from suppliers/contractors on LD amount. For this Tax Invoice will be issued by BHEL indicating the respective supply invoice number. 11. GST TDS will be deducted as per Section 51 of CGST Act 2017 and in line with Notification 50/2018 – Central Tax dated 13.09.2018. GST TDS certificate which will be generated in GST portal subsequent to vendor accepting the TDS deduction in the GST portal, will be issued to the vendor. GST CREDIT: Suppliers are advised to get registered to GSTN portal. Tenderer under "GST credit" shall be preferred. Since GST is implemented, the taxes & duties will prevail as per the government notification/ guidelines. Our Provisional GST registration no. is 33AAACB4146P22L. However, it will be mandatory to confirm from BHEL for this mentioned GST no. Suppliers may quote their GST no with valid proof in the quotation. Also before quoting of tender it is suggested to consider all the factors in line with GST guidelines for input tax credit to arrive ranking of quoted suppliers.	

08	Terms of Delivery: A. INDIGENOUS: a) Bidders should submit their offer on FOR Destination -BHEL Stores, Trichy basis. The quote should be inclusive of all charges, including testing, packing & forwarding, inspection, Insurance etc. (Ex-Works offers will not be considered). b) The soft copies of the invoice, LR copy & Test certificates shall be forwarded to BHEL immediately after dispatch.	
09	Payment terms: Indigenous: BHEL Payment term is 100% direct EFT payment after 60 days from the date of receipt and acceptance of materials.	
10	Liquidated Damages: - Penalty will be levied @ 0.5 % of the undelivered portion per week of delay or part thereof subject to a maximum of 10% of the total order value. - Any deviation from the above LD clause, loading will be applied to the extent to which it is not agreed by the bidder (at offered value). - 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. a) INDIGENOUS: For "FOR Delivery terms", Lorry way bill date will be taken for LD calculation.	
11	Risk Purchase clause: BHEL at its option will be entitled to terminate the contract and to purchase elsewhere at the risk and cost of the seller either the whole of the goods or any part which the supplier has failed to deliver or dispatch within the time stipulated as aforesaid or if the same were not available, the best and the nearest available substitute thereof. The supplier shall be liable for any loss which BHEL may sustain by reason of such risk purchases in addition to LD at the maximum rate mentioned in the LD clause above. Confirm your acceptance. The value under Risk purchase clause shall be calculated as follows: Risk & Cost Amount= [(A-B) + (A x H/100)] Where, i. A= Value of Balance scope of Work/ Supply (*) as per rates of new contract ii. B= Value of Balance scope of Work/ Supply (*) as per rates of old contract being paid to the contractor/ iii. supplier at the time of termination of contract i.e. inclusive of PVC & ORC, if any. iv. H = Overhead Factor shall be taken as 5 v. In case (A-B) is less than 0 (zero), value of (A-B) shall be taken as 0 (zero). vi. Balance scope of work/ supply Difference of Tendered/Contract Quantities and Executed Quantities as on the date of issue of Letter for 'Termination of PO/Contract', shall be taken as balance scope of Supply for calculating risk & cost amount. Note: In case vendor fails to fulfil any of the PO / Contract obligations as per PO/Contract, PO/ contract shall be cancelled and appropriate cost shall be deducted from the vendor's pending bills in BHEL Trichy (or) across the BHEL units.	
12	Performance Bank Guarantee (PBG): The Bidder, in the event of an order, should furnish a bank Guarantee from BHEL's consortium banks (List attached) or counter – guaranty by vendor's bank to BHEL's consortium banks, at no extra cost to BHEL, in a format prescribed by BHEL, provided along with the order, for an amount equivalent to 10% of the contract value. The BG shall be valid for period of 18 months from the date of last shipment or 12 months from the date of receipt / acceptance at BHEL, Trichy whichever is later, with a claim period of two months. PBG shall be strictly as per BHEL format and to be submitted before the dispatch/shipping of the materials. If the supplier agrees for PBG submission and fails to submit PBG during material supply, 10% of the payment will be retained for the PBG period.	

13	Warrantee / Guarantee: Supplier to accept guarantee/warrantee of "18 months from dispatch or 12 months from commissioning, whichever is later". Any deviation to this may lead to rejection of the offer.	
14	Non-Disclosure Agreement(NDA): The bidders shall enter into the Non-disclosure agreement totally voluntarily, with full knowledge of its meaning and without duress. (Format attached).	
15	Patent Right The supplier shall, at all times, indemnify and keep indemnified the purchaser, free of cost, against all claims which may arise in respect of goods & services to be provided by the supplier under the contract for infringement of any intellectual property rights or any other right protected by patent, registration of designs or trademarks. In the event of any such claim in respect of alleged breach of patent, registered designs, trademarks etc. being made against the purchaser, the purchaser shall notify the supplier of the same and the supplier shall, at his own expenses take care of the same for settlement without any liability to the purchaser.	
16	Role of Agents a. BHEL strongly discourages the engagement of Agents in India by foreign principals, to deal with BHEL, in BHEL's tenders. a. BHEL, due to business reasons would ban, would have banned Indian agents from dealing with BHEL. Any foreign principal who engages such a banned agent, or an employee of the banned agency, or any other person connected with the banned agency, at any time during the tender proceedings, would be disqualified from the tender proceedings. The decision of BHEL in this regard shall be final and be binding on the OEM. Hence in their own interests, prospective tenderers may check with BHEL. The list of banned firms is available on BHEL website www.bhel.com. b. In view of the requirement of BHEL, it is strongly suggested that in their own interest, foreign principals may desist from engaging any Indian agent and deal with BHEL directly and it is stressed that any Main producer proposing to deal with BHEL by engaging and through an Indian Agent does so at their own risk. BHEL shall in no way be responsible for any consequences that may arise to the foreign principal on account of the antecedents / actions of their Indian agent.	
17	Evaluation Criteria: The offers of both import vendors and indigenous vendors will be evaluated on total landed cost to BHEL, Trichy. The evaluation details with respect to the import & indigenous vendors is detailed below: I) Indigenous Vendors: Total Landed cost = FOR Rate in INR (A) + Applicable Taxes (B) + Loading for payment term & LD (C) – Applicable input tax credit (D) A. Indigenous vendors submit offers on Free on Road (FOR), Trichy in INR. B. (SGST, CGST, UGST & IGST) on (BASE PRICE+GST) and any other charges quoted by indigenous vendors will be added to the base price. C. Loading for payment terms & non-acceptance of Liquidated Damages (LD) will be added to the FOR value for arriving the landed rate. D. However, input credit is availed for GST taxes, hence the same is excluded for arriving at the landed cost. Note: "In the course of evaluation, if more than one bidder happens to occupy L1 status, effective L1 will be decided by soliciting discounts from the respective L1 bidders. In case more than one bidder happens to occupy the L1 status even after soliciting discounts, the L1 bidder shall be decided by a toss/draw of lots, in the presence of the respective L1 bidders or their representatives. Ranking will be done accordingly. BHEL decision in such situations shall be final and binding".	
18	General condition: a) Bids including all enclosures and supporting documents like catalogues, pamphlets, etc., shall be submitted / uploaded in ENGLISH language only. If the documents submitted have other than English language, translation of the same shall be provided for evaluation. b) Three sets of documents containing Test certificates, Copies of the approved quality documents and test procedures, DCR and Drawings, etc must be provided along with the supply of Raw materials. Dispatch clearance for material shall be given after acceptance of TC's by BHEL & NPCIL. c) Supplier has to submit Quality documents and related test procedures for approval. d) For Indigenous supply, chemical composition and mechanical test are to be carried out in NABL accredited laboratory only e) We required the shipment of forgings to be as per the dates mentioned in the enquiry.	

	f) All the items in the enquiry will be evaluated and ordered on package basis. g) Multiple PO may also be placed considering the applicable duty structure of the respective requirement/Qty. h) No revision of prices will be entertained after the tenders are opened. i) For the evaluation purposes, exchange rate (TT selling rate of SBI) as on schedule date of tender opening (Part I, i.e technical bid, in case of two part bid) shall be considered. j) BHEL will consider the ranking after the loading is applied as referred above wherever deviations are observed. k) Lowest price received against BHEL tenders need not be the technically acceptable one and in that case, BHEL reserves the right not to consider the same. l) BHEL reserves the right to negotiate L1 rate or re-float the tender opened if L1 price is not the lowest acceptable price to them inter-alia other reasons. m) In the event of our customer order covering this tender being cancelled / placed on hold / otherwise modified, BHEL would be constrained to accordingly cancel / hold / modify the tender / your purchase order at any stage of execution. n) Offer will be evaluated based on Landed cost to BHEL- Trichy on package basis. o) No payment will be made for the excess quantity. p) Offer should be submitted only as per the Unit of Measurement (UOM) specified in the enquiry. q) Material shall be physically weighed before stuffing them into container and the same shall be incorporated in BL and packing slip. r) The offers of the bidders who are on the banned list as also the offer of bidders who engage the services of the banned firms, shall be rejected. The list of banned firms is available on the BHEL website -www.bhel.com. s) All documents submitted with the offer shall be signed and stamped in each page by authorized representative of the bidder. t) Documents not signed and stamped by the authorized signatory of the bidder shall not be accepted and considered for registration / evaluation of the bid etc. u) Any additional documents submitted by supplier / bidder, during processing of registration application / tender or after placement of order, shall not be accepted unless it is submitted with forwarding letter and duly signed and stamped as mentioned above. v) The bidder shall submit his response through bid submission to the tender on EPS website at https://eprocurebhel.co.in. The bidder would be required to register on the EPS website at https://eprocurebhel.co.in and submit their bids online. SEALED COVER BIDS / E-MAILS / FAX / MANUAL OFFERS WILL NOT BE ACCEPTED. For any clarification you can contact to rmega@bhel.in, thambi@bhel.in Contact nos. 04312575458 / 04312577492	
19	Fraud Prevention Policy "The bidder along with its associate/collaborators/sub-contractors /consultants/service providers shall strictly adhere to BHEL Fraud prevention policy displayed on BHEL website http://www.bhel.com and shall immediately bring to the notice of BHEL Management about fraud or suspected fraud as soon as it comes to their notice."	
20	Authorization for participation in EPS portal through DSC: E-Tender. Participation requirements: Either Principal or authorized agent shall register their Digital Signature Certificate (DSC) (Class 3- SHA2- 2048 BIT- SIGNING & ENCRYPTION). Suppliers are advised to go through the FAQ available in the web portal (https://eprocurebhel.co.in). DSC shall be registered for the authorized person and all transaction done using that DSC against our tenders shall be taken as valid communication and shall be binding on principal/agent and is valid legally.	
21	Cartel Formation: All the firms should desist from forming cartel as the practice is prohibited under Section 3(3) (a) & (d) of the competition Act 2002. If any such instance is observed during this tender will attract disciplinary action as per BHEL policies.	

22 Suspension of Business Dealings with Suppliers/Contractors:

The offers of the bidders who are under suspension as also the offers of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL web site www.bhel.com.

Integrity commitment, performance of the contract and punitive action thereof:**1. Commitment by BHEL**

BHEL commits to take all measures necessary to prevent corruption in connection with the tender process and execution of the contract. BHEL will during the tender process treat all Bidder(s) in a transparent and fair manner, and with equity.

2. Commitment by Bidder/ Supplier/ Contractor

a. The bidder/ supplier/ contractor commit to take all measures to prevent corruption and will not directly or indirectly influence any decision or benefit which he is not legally entitled to nor will act or omit in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India.

b. The bidder/ supplier/ contractor will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract and shall adhere to relevant guidelines issued from time to time by Govt. of India/ BHEL.

c. The bidder/ supplier/ contractor will perform/ execute the contract as per the contract terms & conditions and will not default without any reasonable cause, which causes loss of business/ money/ reputation, to BHEL.

If any bidder/ supplier/ contractor during pre-tendering/ tendering/ post tendering/ award/ execution/ post-execution stage indulges in mal-practices, cheating, bribery, fraud or and other misconduct or formation of cartel so as to influence the bidding process or influence the price or acts or omits in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India, then, action may be taken against such bidder/ supplier/ contractor as per extant guidelines of the company available on www.bhel.com and/or under applicable legal provisions. Guidelines for suspension of business dealings is available in the webpage: http://www.bhel.com/vendor_registration/vendor.php.

23 Integrity Pact (IP):

Signed Integrity pact (IP) should be furnished along with offer. IP would be signed by authorized official of the bidder/vendor/contractor. Offer without signed Integrity Pact (IP) shall be rejected. Copy of IP should be enclosed. This tender will be monitored by independent external monitor (IEM). For information only.

IP is a tool to ensure that activities and transactions between the Company and its Bidders/ Contractors are handled in a fair, transparent and corruption free manner. Following Independent External Monitors (IEMs) on the present panel have been appointed by BHEL with the approval of CVC to oversee implementation of IP in BHEL.

S.No.	IEM	E Mail
1	Shri Arun Chandra Verma, IPS (Retd.)	acverma1@gmail.com
2	Shri Virendra Bahadur Singh, IPS (Retd.)	vbsinghips@gmail.com

The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory) along with techno-commercial bid (Part-I, in case of two/ three part bid). Only those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this Pact would be a preliminary qualification.

Please refer Section-8 of IP for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to any of the above IEM(s). All correspondence with the IEMs shall be done through email only.

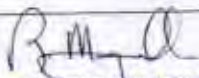
Note:

No routine correspondence shall be addressed to the IEM (phone/ post/ email) regarding the clarifications, time extensions or any other administrative queries, etc on the tender issued. All such clarification/ Issues shall be addressed directly to the tender issuing (procurement) department's officials whose contact details are provided below:

Details of contact person(s):

Name	S Anand Kumar	Meganathan R
Dept	SDGM/MM/Raw materials	Dy. Manager/MM/Purchase-C&F
Address	Bldg No:24, BHEL Trichy	Bldg No:24, BHEL Trichy
Phone	0431 -2575215/ 9442502989	0431 -2575458/ 9488823129
E-Mail	sak@bhel.in	rmega@bhel.in

24	Resolution of Disputes: a. If dispute or difference of any kind shall arise between the Purchaser/Consignee and the supplier in connection with or relating to the contract, the parties shall make every effort to resolve the same amicably by mutual consultations. b. If the parties fail to resolve their dispute or difference by such mutual consultation within 30 days of its occurrence, then, unless otherwise provided in the contract, either the Purchaser/Consignee or the supplier may give notice to the other party of its intention to commence arbitration, as hereinafter provided the applicable arbitration procedure will be as per the Arbitration and Conciliation Act, 1996 of India. In the case of a dispute or difference arising between the Purchaser/Consignee and a domestic Supplier relating to any matter arising out of or connected with the contract, such dispute or difference shall be referred to the sole arbitration of an officer in BHEL Trichy, appointed to be the arbitrator by the General Manager/MM BHEL Trichy. The award of the arbitrator shall be final and binding on the parties to the contract subject to the provision that the Arbitrator shall give reasoned award in case the value of claim in reference exceeds Rupees One lakhs (Rs. 1,00,000/-) c. Venue of Arbitration: The venue of arbitration shall be the place from where the contract has been issued, i.e., BHEL Trichy. d. Jurisdiction of the court will be from the place where the tender enquiry document has been issued, i.e., Trichy, India.	
25	In the event of Force Majeure: a. Notwithstanding the provisions contained in other clauses, the supplier shall not be liable for imposition of any such sanction so long the delay and/or failure of the supplier in fulfilling its obligations under the contract is the result of an event of Force Majeure. For purposes of this clause, Force Majeure means an event beyond the control of the supplier and not involving the supplier's fault or negligence and which is not foreseeable and not brought about at the instance of the party claiming to be affected by such event and which has caused the non – performance or delay in performance. Such events may include, but are not restricted to, wars or revolutions, hostility, acts of public enemy, civil commotion, sabotage, fires, floods, explosions, epidemics, quarantine restrictions, strikes excluding by its employees, lockouts excluding by its management, freight embargoes and Acts of GOD. b. If a Force Majeure situation arises, the supplier shall promptly notify the Purchaser/Consignee in writing of such conditions and the cause thereof within twenty-one days of occurrence of such event. Unless otherwise directed by the Purchaser/Consignee in writing, the supplier shall continue to perform its obligations under the contract as far as reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event. c. If the performance in whole or in part or any obligation under this contract is prevented or delayed by any reason of Force Majeure for a period exceeding sixty days, either party may at its option terminate the contract without any financial repercussion on either side. d. In case due to a Force Majeure event the Purchaser/Consignee is unable to fulfil its contractual commitment and responsibility, the Purchaser/Consignee will notify the supplier accordingly and subsequent actions taken on similar lines described in above sub-paragraphs.	
26	Execution of the order: a. BHEL will have the option to pre-inspect the materials at Supplier's works by BHEL's own inspector or by third party agency appointed by BHEL or BHEL's end customer/s. The mere act of the pre-dispatch inspection (PDI) does not absolve the Supplier from giving the specifications as agreed upon in the Purchase Order. b. In the case of overseas suppliers inspection call for carrying out the inspection shall be given 30 days before the scheduled contract delivery date. The inspection date/s given by the Supplier shall be on firm basis. For local Suppliers the Notice period of inspection shall be 10 working days In the event of any short supply, it shall be the responsibility of the supplier to deliver such short supplied/ missing items on Free-of-Cost basis at BHEL stores, including customs clearances at Indian Ports in the case of foreign suppliers.	
27	Financial Documents: a. Indigenous Suppliers shall submit audited copies of annual reports (Balance Sheets), Profit & Loss statement for last four years (or from date of incorporation whichever is less).	
28	Special Provisions for Micro and Small Enterprises (MSE) bidders registered as per MSME act: (Subject to participating MSE vendors should meet the tender requirements of BHEL) ➤ As per Gazette Notification no. S.O. 2119(E) dated 26.06.2020 issued by Ministry of MSME applicable/existing Micro and small suppliers are requested to get registered with Udyam Registration portal and share us the Udyam registration no along with Udyam registration certificate. ➤ 25% of the tendered quantity is earmarked for MSE suppliers in this tender, subject to participating MSE Vendors should meet the tender requirements of BHEL. In case MSE vendor participating in the tender quotes within the price band of L1 + 15%, they will be allowed to supply the portion of the requirement subject to acceptance of L1 price by MSE vendor. In case of more than one such MSE vendor within the "L1+15% price band", the supply shall be shared proportionately.	

	➤ In the event of Non MSE supplier becoming L1 and MSE supplier quotes within the price band of L1+15% and it is not possible to split the tendered quantity on account of reasons like customer contract requirement/technical requirements, then 100% of the quantity will be offered to MSE suppliers subject to acceptance of L1 price by MSE supplier. ➤ Counter offering of L1 rate will not be made with any MSE vendor whose quoted rate is more than the price band of L1+15%. ➤ Payment to MSE vendor will be as per the applicable provisions of the MSMED Act 2006. ➤ If L1 offer is from a Micro / Small enterprise, the 25% earmarking provision is not applicable. ➤ Out of the 25% tendered quantity reserved for MSE suppliers, 6.25% shall be earmarked for procurement from MSE owned by SC/ST entrepreneurs. Apart from this 3% shall be earmarked for procurement from MSE owned by Women entrepreneurs. ➤ In case of any change in the MSE status of the bidder, it shall be the responsibility of the bidder to notify the change as a part of the bid document. If at a later date it comes to the knowledge of BHEL, that the change in the status has not been intimated by the bidder and the order is obtained under the premise of an MSE then BHEL would cancel the pending order against this tender and take necessary steps for suspension of the business dealing with the bidder as per the procurement policy of BHEL. ➤ MSE suppliers can avail the intended benefits only if they submit along with the offer, Valid EM-II certificate or valid NSIC certificate or UAM certificate along with attested copy of a CA certificate (Format enclosed as below) applicable for the relevant financial year (latest audited). Date to be reckoned for determining the deemed validity will be the date of bid opening (Part 1 in case of two part bid). Non submission of such documents will lead to consideration of their bid at par with other bidders. No benefit shall be applicable for this enquiry if any deficiency in the above required documents are not submitted before price bid opening. Documents should be notarized or attested by a Gazetted officer. However, credentials of all MSE suppliers will be verified before considering the intended benefits for MSE suppliers at the time of tender evaluation. Non submission of such documents will lead to consideration of their bids at par with other bidders and MSE status of such suppliers shall be shifted to Non MSE supplier till the supplier submits these documents.	
29	Preference to Make in India: ➤ For this procurement, the local content to categorize a supplier as a class I local supplier/class II local supplier /Non-local supplier and purchase preference to class I local supplier, is as defined in Public Procurement (Preference to Make in India), Order 2017 dated 04.06.2020 issued by DPIIT. In case of subsequent Orders issued by the respective Nodal Ministry, changing the definition of local content for the items of the NIT, the same shall be applicable even if issued after issue of this NIT, but before opening of part II bids against this NIT.	
30	Restrictions for Procurement from a country sharing its land border with India ➤ For this procurement, Public procurement order dated 23.07.2020 regarding restrictions under rule 144 (xi) of general financial rules 2017 is applicable, Any bidder from a country which shares land border with India will be eligible to participate only if the bidder is registered with the competent authority.	
34	Enclosures: - Enquiry - Technical Specification TDC-AT:8 Rev.00 - Special Condition Annexure A - Drawings	- Suggestive Quality plan - Non-Disclosure agreement. - Integrity Pact - Performance bank guarantee
 R. MEGANATHAN By Manager MM / RM / Purchase / C&F BHEL, TR:CHY - 620 014		SIGNED BY MANUFACTURER / MILL Name of Mill: Designation / Department: Seal & Signature

Annexure C

VENDOR DETAILS

SL NO	DESCRIPTION	To be filled by bidder
1	VENDOR NAME	
2	QUOTATION REFERENCE	
3	QUOTATION DATE	
4	TELE, MOBILE NO	
5	FIRM MAIL ID	
6	CONTACT PERSON	
7	OFFICE ADDRESS	
8	ORDER TO BE PLACED ON	
9	COUNTRY OF ORIGIN	
10	PORT OF LOADING	
11	PORT OF DISCHARGE	

Vendor Seal & Sign

SPECIAL CONDITION ANNEXURE – A

PR No. 127375156

(For manufacture & supply of forgings for Reactor Header)

1. The indented items are required for NPCIL/Reactor Header Assemblies for Primary Heat Transport System for future 700MWe PHWRs (Fleet Mode)
2. There shall be Two Part Tender. Open tender will be floated.
3. End Usage and End User Certificates will not be provided.
4. Supply of forgings conforming to specification SA350 Grade LF2 Class I shall be as per TDCAT:8 Rev 00 & procurement drawings referred against the PR items/sizes specified and suggestive QAP. Supplier shall conform to all these documents.
5. Supplier shall give clause by clause confirmation for all clauses as mentioned in the TDCAT:08 Rev.00. Deviation (if any) shall be mentioned in the offer itself.
6. Notes given in the respective drawings shall be properly read and confirmed by the Supplier.
7. For offer acceptance, supplier shall have the capability and experience to produce the indented items as per specification SA350 Grade LF2 Class I in compliance to ASME Section-III NB and also supplied the indented items for similar applications (i.e. Reactor Headers of Nuclear Power Plants) as per requirement of ASME Section-III NB meeting the requirement of Purchaser's TDC. This is to be established by documentary evidence.
8. The Supplier shall submit the signed Test Certificates (signed by Customer/TPI), Unpriced PO copy & Shipping release document/Supply Invoice Copy/Bill of Lading/Delivery Challan with specifications and details of Customer as a documentary proof of Supplier's experience in manufacturing the indented items along with the offer.
9. The Supplier who doesn't comply to the requirements mentioned in clause nos. 7 & 8 will not be considered for evaluation.
10. The supplier shall ensure to strictly follow the complete process of manufacturing till achieving the final requirements including dimensions as per it's respective drawing and TDC referred against the PR items. Supplier shall not further sub-contract any portion or part thereof the work assigned to them. However, in exceptional cases, the Supplier may further sub contract a part of the work with due approval from BHEL & NPCIL. Supplier shall furnish the details of sub-contracting activities if any in detail during bidding stage itself along with the offer. Final decision will be based on BHEL & NPCIL's acceptance.
11. The Supplier shall submit the offer for all the items since all the items indicated in the PR is proposed to be procured from the same Supplier as a package.

Nil
06/01/2021

Nil
06/01/2021

[Signature]
06.01.2021

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12. Quantity given in the indent may increase or decrease and will depend on the requirements of BHEL & NPCIL. Quantity being procured will be finalized before price bid opening.
13. Due to stringent quality requirements, offers from traders/dealers/distributors/stockist shall not be entertained and will not be considered for evaluation.
14. Offers received will be evaluated by BHEL and NPCIL. Final acceptance of the offers will be based on BHEL and NPCIL recommendation.
15. Supplier has to submit Quality Documents (QAP – Quality Assurance Plan) [in line with the Suggestive Quality Plan: SQP-RH-01], Manufacturing Process Plan and associated procedures, Material Sampling and Testing Plan (MSTP) and related test procedures along with NDE documents (UT, MT & PT Procedures and technique sheets) for approval from BHEL & NPCIL after awarding the contract.
16. Before machining the nozzles on actual job, supplier shall produce mock-up piece of Header Forging with large size & small size nozzle (Sample forgings) with the same material & process that of the Header Forging as per TDCAT:8 and Supplier has to submit Quality documents and related test procedures for approval from BHEL and NPCIL.
17. The actual production of material is permitted only after successful completion and acceptance of Mock-up piece of Header Forging along with large & small size nozzles (Sample forgings) and after the approval of Quality Assurance Plan (QAP), Manufacturing Process Plan (MPP), Material Sampling and Testing Plan (MSTP), Heat Treatment Plan, NDE Procedures, technique sheets and other test procedures by BHEL and NPCIL.
18. Inspection agencies for imports are “BHEL” & “NPCIL/Third party inspection (TPI) agency approved by NPCIL”. Inspection charges for third party inspection are to be quoted separately.
19. Inspection agencies for indigenous supply are BHEL and NPCIL.
20. BHEL & NPCIL or its authorized agency shall have the rights to assess the supplier's or their sub-contractor's premises at all reasonable times and to the extent necessary to assess compliance with the provisions of the said programme and this TDC/Specification.
21. Chemical composition and mechanical/metallurgical tests shall be carried out in Laboratories certified as per ISO/IEC 17025 or NABL/Government Approved Labs.
22. Supplier shall submit Test Certificates of indented items after completion of manufacturing for review by BHEL & NPCIL. Dispatch clearance will be given after acceptance of the test certificates by BHEL & NPCIL.
23. Supplier shall submit- (i.) Test Certificates and Reports, (ii.) copies of the approved quality documents, records and test procedures, (iii.) NCRs/DCRs and (iv.) Drawings etc. in bound volume along with the supply of the indented items. The supplier shall be responsible for preparation and issue of all certificates, reports and documents which shall be certified by “BHEL” & “NPCIL/TPI”. Such certified final documents shall form part of history dockets and shall be

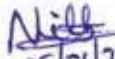
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- * supplied in bound volumes (3 copies) with proper identification. Final documentation shall also be submitted in soft form (pdf format) with proper indexing.

24. Supplier shall submit both technical & commercial bid confirming to all the above applicable points as given in this annexure.

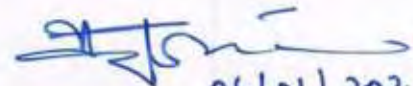

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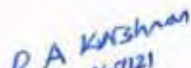
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QUALITY ASSURANCE

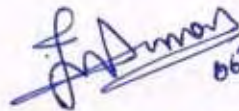

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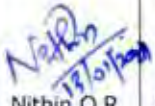
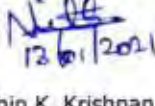
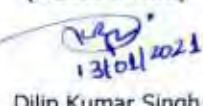
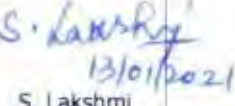

06/01/2021

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Specification for Reactor Header Carbon Steel Forgings

(Fleet mode Order – CMM/FTP/00-33-1-1199/e-PO/43563)

Rev No	Date	Prepared	Reviewed			Approved
		QA	Engg	NDTL	MP	QA
00	24.12.2020	Nithin.O.R	Nithin.K. Krishnan	(Clause 9-NDE) Dilip Kumar Singh	Seikholien Haokip	S. Lakshmi
01	13.01.2021	 Nithin.O.R	 Nithin.K. Krishnan	 Dilip Kumar Singh	 Seikholien Haokip	 S. Lakshmi

Rev 00: First Issue

Rev 01: Clause 5.0 (Chromium Content) modified.



1.0 Scope

- 1.1** This specification establishes minimum requirements for Carbon steel forgings conforming to specification SA350 Grade LF2 Class-1 for Reactor Headers.

Reactor Header is designed, manufacture, tested & examined as a Class I Pressure Vessel in accordance with ASME B&PVC Code Section III Division-1 Sub-section NB. This component is to be manufactured, inspected, tested & delivered as per the requirements of this specification, applicable drawings, governing codes & standards. The position & location of nozzles are very critical and require strict control on the linear and angular dimensional tolerances during manufacturing. The header forging with integral nozzles shall be in single piece as shown in the relevant drawing.

2.0 Applicable Documents

In case of conflict between the codes/standards listed below and this specification, generally this specification will govern. The supplier must obtain necessary clarification from the purchaser in such a case.

- 2.1** ASME Sec IIA: Latest Edition.
2.2 ASME Sec III Division-1: Sub section NB- Class 1 Latest Edition.
2.3 ASME Sec V – Latest Edition.
2.4 ASME Sec IIA: SA20 & SA-370 – Latest Edition.
2.5 ASTM (Latest Edition): E208, E606, E10, E350, E112, E45, E381 & other relevant ASTM Standards.
2.6 Drawing Number (including size and Quantity): As per Enquiry/Purchase Order.

3.0 MATERIALS AND WORKMANSHIP

3.1 General

The Reactor Header forgings shall fully comply with the requirements of ASME Section III-NB for Class I Components as applicable to pressure vessels and also any additional requirements specified in this specification.

All materials, components, processes and workmanship required for fulfilment of this specification which are not specifically designated herein, shall be of high quality and shall comply with the best standards of manufacturing practice pertinent to pressure vessels I equipment for Nuclear Power Plants.

Seamless single piece header forgings, integral with all large nozzles (500 mm NB and 250 mm NB on outlet headers, 450 mm NB and 200 mm NB on inlet headers) & small nozzles (50 mm NB, 65 mm NB and 100 mm NB) and end caps shall be of SA 350 Grade LF 2 Class1 material. The material shall be fully killed, fine grained steel, produced by vacuum treatment followed by electro slag re-melting (ESR). The special requirements and final finished configurations for these headers and caps shall meet the requirements given in the applicable drawings also. The manufacturing process adopted shall ensure cleanliness of the highest order, isotropy of the mechanical, chemical and metallurgical properties, superior fracture toughness and weldability. Each Reactor Unit consists of 4 nos. Reactor Outlet Header (ROH) and 4 nos. Reactor Inlet Header (RIH).

Supply shall include (per reactor unit):-



- i) 4 nos. Reactor Inlet Header forgings. Header forgings shall be in single piece, integral with all large (450 mm NB and 200 mm NB) and small (20 mm NB, 50 mm NB and 65 mm NB) nozzles.
- ii) 4 nos. Reactor Outlet Header forgings. Header forgings shall be in single piece, integral with all large (500 mm NB and 250 mm NB) and small (20 mm NB and 100 mm NB) nozzles.
- iii) 2:1 ellipsoidal end caps - 8 nos. for RIH and 8 nos. for ROH.
- iv) Forged Pipe for Procedure Qualifications: 1 No. each (per Project of 2 Reactor Units) sample of RIH and ROH forgings of 795mm length with small size nozzles for welding procedure qualification etc. during further fabrication of Header assembly at BHEL.
- v) Sample Forgings (Mock up piece of Header Forging): 2 Nos. each (per Project of 2 Reactor Units) sample of RIH and ROH forgings of 1200mm length with large size and small size nozzles for sectioning and verifying the nozzle profiles before start of actual production.
- vi) Reference blocks for ultrasonic examination as per clause No:9

Before machining the nozzles on the actual job, supplier shall produce mock up piece of Header forging along with large size and small size nozzles to verify the nozzle profile and other details and to establish the feasibility of machining these nozzles as per the drawing requirements including ID side corner radius machining. These mock up pieces are to be sectioned at the nozzle center plane in both longitudinal & circumferential planes for inspection by "BHEL" & "NPCIL/TPI". The sectioned pieces and balance material are to be supplied with the main forgings.

All the test/mock up samples mentioned above shall be produced by the same material and process as that of the header forging & shall undergo same NDEs.

3.2 Header Forgings

Reactor Inlet Header forging shall be 457 mm outside diameter x 65 mm minimum wall thickness with all integral nozzles (large & small) and other integral projections.

Reactor Outlet Header forging shall be 508 mm outside diameter x 65 mm minimum wall thickness with all integral nozzles (large & small) and other integral projections.

Around the large integral nozzle openings, the wall thickness is further increased to meet the reinforcement requirements. These large nozzle opening reinforcement and transition shape details as given in the respective drawings are to be strictly adhered.

All header forging ends and nozzle ends shall be weld edge prepared as per applicable drawing. Weld edge preparation at terminal point shall be subject to approval by NPCIL.

3.3 Header End Caps

Forged header end caps shall be of size and dimensions matching with the header ends and the wall thickness at these butt weld ends shall also be not less than 65 mm. The



end caps shall be ellipsoidal (2:1) dished heads with 65 mm min. thickness and 84 mm min. skirt length. All header end caps shall be weld edge prepared as per applicable drawing.

4.0 PROCESS OF MANUFACTURE

4.1 Melting

The steel shall be produced in basic electric arc furnace; vacuum degassed to remove objectionable gases, fully killed and produced to fine grain practice. Vacuum system should be of sufficient capacity to effect a blank-off pressure which is adequately low for sufficiently long duration. The steel shall be subjected to secondary refining by Electro Slag Re-melting (ESR) process.

4.2 Discard

A sufficient discard shall be made to secure freedom from injurious defects and undue segregation.

4.3 Grain size

Grain size shall be measured as per ASTM-E-112 and shall be 6 or finer. The grain size and microstructure shall be determined on a notched bar impact test specimen, obtained from simulated Heat Treated Test Coupons. The examination shall be on all 3 directions. The micrographs for assessing the microstructure shall be made at a magnification allowing unambiguous assessment (as a rule: X 200).

4.4 Forging Process

Each header shall be supplied in a single piece forging with integral nozzles as shown in the applicable drawings. Headers are to be manufactured by hot forging process to work the metal throughout its section. The forging ratios shall not be less than 4. The initial forged piece of header shall be suitably configured to have sufficient material for integral nozzles and test coupons. Material flow shall be such as to favourably resist the stresses encountered in service (Main Working Direction).

4.5 Machining

The initial forged piece may have to undergo suitable stages of machining till the final shape & dimensions are achieved. The supplier shall submit the various stages of manufacture in detail for review & approval by BHEL & NPCIL. The sequence shall include initial forging shape, various machining stages, heat treatment stage, initial, intermediate and final NDE stages, test coupon location details & its removal stage etc.

4.5.1 Header Nozzles - General

The nozzles in the header shall be formed by machining the projected portion/thick wall of the forged shell. The end dimensions of thus formed nozzles shall match the dimensions of connecting pipes/nozzle extensions. The supplier shall qualify his manufacturing procedures to the satisfaction of the purchaser, by production of two samples of each small size nozzle and one sample of large size nozzle. These nozzles shall be made from the same materials and by the same techniques as for the production job. This qualification shall be done separately for RIH and ROH.

4.5.2 500 and 250 mm NB Nozzles in Outlet Header Forging



The 500 and 250 mm NB nozzles in outlet header forging shall be manufactured by machining the protrusion & thick wall of forged shell. At the neck of the nozzles, contour shall be provided as per relevant drawings. The nozzles shall meet the requirements of ASME Sec.III NB.

4.5.3 450 and 200 mm NB Nozzles in Inlet Header Shell

The 450 and 200 mm NB nozzles in inlet header forging shall be manufactured by machining the protrusion & thick wall of forged shell. At the neck of the nozzles, contour shall be provided as per relevant drawings. The nozzles shall meet the requirements of ASME Sec.III NB.

4.5.4 Feeder Nozzles in Header Shell

The 100 mm NB, 65 mm NB and 50 mm NB feeder nozzles in header shell shall be manufactured by machining and boring the thicker wall of forged shell. The dimensions and other details shall be in accordance with the applicable drawings.

4.5.5 Instrumentation Nozzles in Header Shell

The 20 mm NB nozzles for instrumentation connection in the header shell shall be provided by machining the forged shell and by boring in accordance with the applicable drawings.

5.0 CHEMICAL COMPOSITION

In addition to meeting the requirements of SA-350 Gr. LF2 Class I, the material shall also meet supplementary requirements on Chemical composition which are as follows: -

Element	Weight Percentage	Element	Weight Percentage
C	0.30(max.)	Al	0.040(max.)
Mn	0.60-1.35	Sn	0.011 (max.)
Si	0.15-0.30	As	0.025(max.)
Mo	0.12(max.)	Sb	0.007(max.)
Ni	0.40(max.)	P	0.025(max.)
Cr	0.20-0.28	S	0.025(max.)
Cu	0.30(max.)	N	0.013(max.)
V	0.010(max.)	Nb	0.02(max.)
Co	0.020(max.)	---	---

6.0 HEAT TREATMENT

6.1 The forgings shall be supplied in normalized condition.

The uniformity of temperature during heat treatment shall be proved by continuous temperature recording instruments with the help of thermocouples attached to the component.



The supplier shall provide the heat treatment details such as stage at which the heat treatment is carried out, rate of heating & cooling, holding temperature & time and cooling scheme, heat treatment furnace details, temperature control during heating & cooling cycle etc. for approval by BHEL & NPCIL.

6.2 **Simulated Heat Treatment (SHT)**

The simulated heat treatment (SHT) is intended to simulate the heating cycles which the actual component may experience during the course of fabrication. Coupons subjected to such heat treatment are called Simulated Heat Treated Coupons (STC). Test coupons identified as simulated heat treated coupons shall be heated to $610^{\circ}\text{C} \pm 10^{\circ}\text{C}$, held at that temperature for 5 hours and then cooled to room temperature. The rate of heating and cooling shall not exceed 30°C . However, if the supplier envisages any intermediate heat treatment for the purpose of straightening operation etc. such heat treatment shall also to be added to the SHT coupons.

7.0 **MECHANICAL PROPERTIES**

7.1 **Tensile Test**

The mechanical tests shall be conducted as per ASME Section II-A SA-20 and SA-370. Following minimum requirements shall be met in both Normalized and simulated heat treated condition.

Required mechanical properties at room temperature

	At Room Temperature
Tensile Strength (MPa)	485- 655
Yield Strength [0.2% offset] (MPa)	250 (Min.)
% Elongation	22 (Min.)
% Reduction in area	30 (Min.)

7.2 **Notch Toughness**

7.2.1 Fracture Toughness requirement

Fracture toughness of the header material shall be determined as per the requirements of Class I vessels in line with NB-2300 of ASME Section III NB.

The nil-ductility transition temperature (T_{NDT}) as determined by drop weight test in accordance with ASTM-E-208 shall not be higher than -15°C (Minus 15°C).

7.2.2 Reference Nil Ductility Transition Temperature (RT_{NDT})

Three ISO-V specimens shall be tested at $T_{NDT} + 33^{\circ}\text{C}$ for certification of RT_{NDT} . The minimum absorbed energy and lateral expansion shall not be less than 68 J and 0.89 mm respectively, for any of the specimens. The percent shear fracture shall be reported. The RT_{NDT} thus determined shall not be higher than -15°C (Minus 15°C).

7.2.3 ISO-V test specimens shall exhibit the following minimum values at -46°C .

- Average of 3 Specimens: 20 J (Min.)
- Lowest single value: 16 J (permitted for one specimen only per a set of 3)

7.2.4 Cv-Impact Curve



Charpy V-notch impact strength versus temperature curves shall be established. Tests shall be conducted at least at seven different temperatures including -46°C, -15°C and +18°C, to fully define upper and lower energy shelves. The upper energy shelf shall have 100% shear fracture and lower energy shelf a maximum of 10% shear fracture. The test reports shall include absorbed energy, percent shear fracture and lateral expansion, plotted against temperature. The upper shelf energy shall be more than 100 J. The absorbed energy and lateral expansion values at $T_{NDT} + 33^{\circ}\text{C}$ and -46°C shall meet the requirements of 7.2.2 and 7.2.3.

7.3 Fatigue Test

One set of Fatigue test in accordance with ASTM E606 is required to be performed per order for establishing a factor of safety of 2 on S_a (strain amplitude) and 20 on N (cycles) with respect to ASME design fatigue curve.

7.4 Hardness Test

Hardness of each forging shall be measured after normalizing heat treatment before any further processing, along the grid at 120° apart. A minimum of 3 readings are to be taken on the edges followed by at every 1000mm distance on the surface of the header forgings and dished ends to demonstrate uniformity. Tests shall be carried out as per ASTM-E-10 and shall meet the requirement of ASME Section II-A SA-350.

7.5 Bend Test

Bend test shall be performed as per ASME Section II-A SA-20. The specimen shall be cold bent through 180° on a mandrel of 25.4 mm diameter. There shall not be any crack on the outer fiber of the specimen after bending as above.

8.0 TESTS & EXAMINATIONS

8.1 Test Coupons

Raw material Test coupon (RTC) and Simulated Heat Treated Test Coupons (STC) shall be used for Carrying out various tests as per the specification requirements.

8.2 Test Coupon Location

It is essential to demonstrate the homogeneity of material properties across the entire forging in all the 3 directions. Sufficient numbers of test specimens are to be taken from each test location to carry out all the tests indicated in table shown in clause no:8.6. Each end of the Header forging represents either top or bottom end of the ingot. Sufficient material in the form of integrally forged prolongations shall be provided for the purpose of test coupons at each end. Apart from this, test coupons are to be taken from the middle of the forging. Additionally, specimens shall also to be taken from the core of the large and small nozzles and from the adjacent material. Similarly, test coupons shall also be taken from the dished end forgings.

Coupons shall be taken from the adjacent areas at suitable locations of the cross section in the following manner:

- i) Test coupons shall be parted off from the forging prolongations after the final quality heat treatment (normalizing).



ii) Identification of the coupons shall be ensured by suitable methods prior to their separation from the forging and all through the various stages of testing. Sufficient numbers of coupons are to be taken from each end and at other locations as required to accommodate all the test specimens.

iii) Any balance material from the test rings, if in excess of the test requirement shall be kept reserved for any contingency which may arise during the course of testing and surplus material shall be dispatched along with the header forgings.

Supplier shall provide the test ring/ coupon layout and test specimen layout in each test coupons that are to be tested in the supplier's works for the approval of BHEL & NPCIL.

8.3 Test Specimen Location

The test specimens shall be taken in such a way that the test specimens shall have their longitudinal axis at least $1/4 T$ from any surface and with the mid length of the specimens at least $1/2 T$ from any second surface, where 'T' is the maximum heat treated thickness of the forging.

8.4 Specimen Directions

The mechanical properties are to be established along the following three mutually perpendicular directions:

- i) Axial: Parallel to the main working direction
- ii) Tangential: Transverse to the main working direction
- iii) Radial: Parallel to the direction of thickness

8.5 Chemical Analysis

Chemical analysis shall be carried out in accordance with ASTM-E 350 or ASTM E415. If the ingot is made from one heat, only one ladle analysis is required. However, in case of an ingot made from more than one heat, weighted average shall be reported.

For product analysis, samples from each STC shall be analysed. Samples for chemical analysis shall be taken from a depth of $1/4 T$ from any heat treated wall surface and at least at a distance of $1/2 T$ from the heat treated edge of the coupon. Broken mechanical test specimens may be used.

8.6 Mechanical Tests

Mechanical tests shall be conducted on normalized & simulated test coupons as per ASME Section II-A SA-20 and SA-370. The material properties are to be established in all the 3 directions as indicated in clause 8.4 above. Sufficient number of test specimens is to be taken from each test location to carry out all the tests indicated below. The supplier shall submit a detailed proposal of various test specimen layout in various test coupons locations to establish the homogeneity of the material properties across the entire forging for the review and acceptance of BHEL & NPCIL.

For tension test, one specimen shall be tested from a sampling point at room temperature. For impact test, one set of 3 Charpy-V notch specimens shall be tested at given temperatures.



NDT temperature (T_{NDT}) shall be determined using STC Pellini (P2) specimens. The T_{NDT} temperature so determined shall also be confirmed by tests on two additional specimens taken from other locations.

Following tests shall be conducted.

Sl No	Name of Test
1	Product Analysis
2	Micro Structure Evaluation
3	Tensile Test
4	Hardness Test (≤ 197 HB)
5	Impact Test at -46° , $+18^{\circ}\text{C}$
6	FATT(Fracture Appearance Test Temperature) at 7 different temperatures.
7	Determination of T_{NDT} by Drop Weight Test.
8	T_{NDT} verification on samples from other test locations : No break at -10°C (Minus 10°C).
9	Determination of T_{NDT} by ISO V notch impact test at $T_{NDT}+33^{\circ}\text{C}$
10	Fatigue Test
11	Bend Test
12	Grain Size(6 or finer)
13	Inclusion rating Evaluation

Inclusion rating shall be carried out as per ASTM E-45. Total inclusion rating (A+B+C+D) shall be ≤ 4 . Thick series inclusions of stringer type are not acceptable.

8.7 Macro etch Test

Macro etch examination shall be carried out at each end of the forging covering 450 mm^2 area for full thickness at four locations 90° apart as per ASTM E-381. Macro etch photographs are to be included in the final documentation.

8.8 Micrographic Examination

Microstructure examination shall be carried out at each end & at the mid-section of each forging in longitudinal and transverse direction. The examination may be carried out on the broken impact test specimens of simulated heat treated test coupons. Test shall be carried out as per ASTM E-112. Photographs are to be included in the final documentation.

8.9 Inspection of Sample Nozzles

The following paragraph is applicable for RIH and ROD Separately:

Subsequent to the specified non-destructive examinations, out of 3 samples (1 sample for qualification purpose during fabrication at BHEL & 2 samples for mock-ups), nozzle sectioning shall be carried out in two samples which are identified for Mock-ups. Sectioning of large as well as small nozzles in two planes through the nozzle centre-line (through and at right angles to the header centre-line) shall be done to verify nozzle profile before start



of actual production. The sections shall conform to the requirements of applicable drawings. Supplier shall prepare the sectioning plan and submit for approval from BHEL & NPCIL. One sectioned surface from each quadrant shall be polished, etched and inspected. The material shall be free from cracks, tears, injurious inclusions, laminations and other defects. The third sample is allocated for preparation of the nozzle weld qualification etc. at BHEL. The sectioned nozzles and balance materials shall be supplied along with header forgings.

9.0 NON DESCTRUCTIVE EXAMINATION

Non-destructive examination shall be performed with a detailed written and qualified (for all essential variables of ASME Section-V & Section III NB) procedure, which shall, as a minimum contain the requirements of this specification & ASME Section-V, item specific scan plan/technique sheets/instruction sheets, demonstration & demonstration records (for all essential variables), reporting format, equipment calibration & calibration records, personnel qualification/certification details, consumable details & certificate, extent of coverage, drawing & dimensional records of the reference/calibration blocks/specimens/standards, retention & control of standard specimen/blocks.

The examination shall be carried out as per the approved documents as mentioned above. Supplier shall prepare the above component specific documents and obtain the purchaser's (BHEL & NPCIL) approval prior to the commencement of manufacturing. Procedure & scan plan/technique sheet/instruction sheets shall be demonstrated to the satisfaction of the Inspector (BHEL & NPCIL/TPI) as per T-150 Article-1 of the ASME Code Section V.

9.1 Ultrasonic Examination

The header forgings, ellipsoidal end caps and sample forgings shall undergo ultrasonic examination to cover 100% of the metal volume. Ultrasonic examination shall be performed in accordance with the requirements of NB-2500 of section III of ASME Code using procedures and standards such as to ensure consistent detection and discrimination of transverse and longitudinal defects. Since meaningful UT examination may not be possible after final machining due to the geometry of finished headers, this examination has to be carried out during intermediate stages to cover the entire metal volume. While examining at any of the intermediate stages the defect/calibration standards pertaining to final machined nominal wall thickness of the component section/location shall be followed. UT examinations at following stages are suggested:

- I. After initial machining and heat treatment.
- II. Suitable intermediate stage(s).
- III. After machining of nozzles in cylindrical shape.

The above components are to be considered as pressure boundary components of a class-I pressure vessel. Accordingly, ultrasonic testing shall be carried out as per the requirements of ASME Section V Article 5 and NB-2500 of ASME Section III NB (Class -1 component). UT examination shall be carried out by both straight beam and angle beam methods to cover 100% of the metal volume. The angle beam examination shall be carried out in 2 mutually opposite circumferential & 2 mutually opposite axial directions. Straight beam examination of forgings must be performed from both thickness faces, end faces and from the cylindrical surface. The reference standards shall be made from material of same composition, diameter, thickness and surface condition and heat treatment conditions as of



the material which is to be examined. A detailed drawing shall be submitted for all applicable reference/calibration blocks/specimens/standards.

Examination shall be done with specific item wise scan plan in combination with the written procedure, Scan Plan/Technique Sheets/Instruction sheets is a documented examination strategy that provides a standardized and repeatable methodology for examinations. The scan plan shall display cross-sectional geometry of the component, component drawing & dimension during scanning, thickness, surface condition, range of variables, extent of coverage, search unit size(s), type, make, model, angle, near field zone, focal depth (for dual element probe), crystal dimensions and frequency(ies), beam plots of all angles used, test metal distance/beam path, probe technical data sheet with distance amplitude curve), limiting angle for circumferential scan, search unit(s) position in relation to the well-defined reference line/point, schematic calibration positions on the blocks and reference reflectors, search unit mechanical fixturing device (if any), zonal/coverage overlap, acceptance, standard specimen/block details (drawing and dimensional report) etc. A tabulation of all the various stage dimensions (OD, ID, thickness, taper angle etc.) along with ultrasound beam path, calibration etc. shall be also annexed.

9.1.1 Search units (Probe):

on a curved component having a diameter less than 350 mm (at the examination surface location) scanning shall be performed using a contoured wedge, to ensure sufficient ultrasonic coupling is achieved and to limit any potential rocking of the search unit as it is moved along the circumference of the component.

(a) Search units shall be contoured as required by the following equation:

$$D \leq \left[\frac{(A \times A)}{(2.87 \text{ mm})} \right]$$

where A = length of search unit footprint during circumferential scanning or the width when scanning in the axial direction, in mm

D = the component diameter at inspection surface (O.D.), in mm

The footprint is defined as the physical dimension of the search unit in the curved direction of the component. The search unit contoured dimension shall be selected from the table-1, and shall be determined using the same component dimension from which the examination is being performed (O.D.):

Table- 1

Actual Component Outside Diameter, in. (mm)	Allowable Increase in Contour Diameter Over Component O.D., in. (mm)
<4.0 (<100)	<1 (<25)
≥4.0 to 10 (≥100 to 250)	<2 (<50)
>10 (>250)	<4 (<100)

Dual-element transducers shall be used to inspect those regions of a forging where the presence of a bore, taper or other feature prevents scanning the near field region, of the single element transducers used, from the opposite surface. Dual-element transducers shall



be used to inspect areas near the back-wall of forgings where indications caused by noise exceed the reporting requirements.

Over and above the approved documents, other frequencies, search units, method may be used if desirable for evaluating, pinpointing & concluding the doubtful indications (if any observed during inspection).

Complete proposed UT system (procedure, Method, Technique, Search units, Instrument, scan plan etc.) shall be capable of detecting and sizing the applicable reference reflectors & indication throughout the 100% volume of the final forging dimensions with the minimum SNR 3:1. When, at reference level amplification setting, the signal to noise ratio is lesser than 3:1 the forgings shall be examined with the suitable different search units and same shall be mentioned in the procedure/scan plan.

9.1.2 General & Equipment Calibration

Screen Height Linearity and Amplitude Control Linearity shall be met at intervals not to exceed one year, or prior to first use thereafter. The ultrasonic instrument screen high linearity shall be evaluated in accordance with Mandatory Appendix I of ASME BPVC sect. V Article. 4. The ultrasonic instrument amplitude control linearity shall be evaluated in accordance with Mandatory Appendix II of ASME BPVC sect. V Article. 4. Other calibration requirements are as per section V.

Calibrations shall include the complete ultrasonic system and shall be performed prior to use of the system in the thickness range under examination. Any control, which affects instrument linearity (e.g. filters, reject or clipping) shall be at the same position for calibration, calibration checks, instrument linearity checks, and examination. The temperature differential between the calibration block (when used) and examination surfaces shall be within 14 °C.

Calibrations shall be performed from the surface corresponding to the surface of the component from which the examination will be performed, the same couplant to be used during the examination shall be used for calibration. The couplant including additives, shall not be detrimental to the material being examined and shall meet the requirements of Clause 10.0 of this TDC.

The pulse repetition rate shall be small enough to assure that a signal from a reflector located at the maximum distance in the examination volume will arrive back at the search unit before the next pulse is placed on the transducer.

9.1.3 Reference level (Sensitivity Calibration) & calibration/reference block:

- a) For straight beam, reference level shall be Ø2 mm FBH (flat bottom hole) for $T \leq 100$ mm, Ø3 mm FBH (flat bottom hole) for $100\text{mm} \leq T \leq 200\text{mm}$, Ø4 mm FBH (flat bottom hole) for $T \geq 200\text{mm}$. However, for integral nozzles region or nozzles, reference level shall be Ø 0.5 mm CRR (circular reference reflector)/FBH. FBH location shall be at T/4, T/2 and 3T/4 (wherever is possible).
- b) For angle beam scanning: Notch: 3 mm wide x 12 mm long x Depth 2 % of T or 1 mm, whichever is greater. Also, additional scanning in the circumferential directions (two mutually opposite) with 35° angle probes shall be carried out with 1.2 mm CRR and

- notch (U-type notch) dimensions of 1.6 mm max. width and 2.5 mm depth, whichever is stringent (to be proven based on physical block).
- In addition to the above mentioned (a, b) general requirements, the respective locations of the forgings where the integral nozzles/end caps/protrusion will be envisaged, the additional requirements of UT as mentioned in Table-1 shall be also met with.
 - For circumferential scanning, the standard defects/reflectors shall be axial notches on the outside and inside surfaces of the reference specimen/block. For axial scanning in accordance, a transverse (circumferential) notch shall be introduced on the inner and outer surfaces of the reference specimen/block. Dimensions of the transverse notch shall not exceed those of the longitudinal notch. Location of the reflector shall not be closer than T from block edge.
 - Where "T" is final machined nominal wall thickness of the component section/location. In case of multi thickness value, lower value will be considered for the selection of notch depth or FBH, otherwise multiple reference block/specimen shall be made to suite the specific location thickness range of the entire component.
 - The test surface finish on the calibration block shall be comparable but no better than the item to be examined. Item surface finish/condition shall be as per approved drawing.

Table-1 (Additional-Scan)

Locations on the component (as applicable as per the drawing)	Nominal Thickness mm	Scanning probe angles	Scanning Directions	Calibration Standard - Reflectors						
				Angle Beam						
				Axial & Circumferential I SDH (essentially parallel to the examination surface).	Axial ID & OD notch			Circumferential ID & OD notch		
Length ^a	Width ^a	Depth ^a	Length ^a		Width ^a	Depth ^a				
Outlet/Inlet Header Dished end caps and end side of the header	65	45 ^o & 60 ^o	Extent Possible 2 mutually opposite circumferential & 2 mutually opposite axial directions	Ø4.8mm Length 38 mm	12	3	1.3	12	3	1.3
500, 450, 250, 200 NB Integral Nozzles	-	45 ^o & 60 ^o		-	Refer (b) of 9.1.1					
100NB Integral Nozzles	13.5	45 ^o & 70 ^o		-	12	3	0.67	12	3	0.67
65NB Integral Nozzles	10	45 ^o & 70 ^o		-	12	3	0.5	12	3	0.5
50NB Integral Nozzles	9	45 ^o & 70 ^o		-	12	3	0.45	12	3	0.45
20NB Integral Nozzles	5	45 ^o & 70 ^o		-	12	3	0.25	12	3	0.25

- Tolerance and other general details for reference reflectors/block/specimen- shall be based on ASTM E428 & ASME Section V for FBH, and for SDHs ASME Section V & Notches - ASTM specification SE-213. Prior to fabrication, the block material shall be completely examined with a straight beam search unit. Areas that contain an indication exceeding the remaining back-wall reflection shall be excluded from the beam paths required to reach the various calibration reflectors. The same shall be recorded. The standard defects shall be machined by very precise machining process in such a way that the indications of each of them are separate and distinct without any mutual acoustic interface or amplification. The calibration block shall be long enough to simulate the handling of the product being examined through the examination equipment. All upset metal, burrs, etc., adjacent to the reference notches shall be removed. Calibration Standard/Block shall be able to produce minimum SNR value 3:1 in records for all the reflectors with the actual test speed condition. Also, signal from each reflectors have to be clearly distinguishable. Measurements may be made by optical, replicating, or CMM techniques. The all actual dimension of the calibration standard/Block including reflectors shape & size details shall be checked and shall be reported. These dimensions shall be also witnessed & certified (once) by the Inspector (BHEL/NPCIL).



- h) No point on the DAC curve shall be less than 20% of full screen height (FSH). When any portion of the curve will fall below 20% FSH, a split curve shall be used. The first calibration reflector on the second curve shall start at $80\% \pm 5\%$ FSH, when reflector signal-to-noise ratio precludes effective indication evaluation and characterization, a split DAC should not be used (Refer Article 4, No mandatory Appendix Q ASME Section V for example).
- i) All physical reference/standard blocks used in UT examination shall be dispatched along with the component. Apart from above, additional sets as per the Enquiry/P.O shall also be despatched to BHEL (One Set consisting of 6 nos. reference block in each set as per attached drawing no.3_RH1A,1B, 2-5).

9.1.4 Scanning level

The scanning sensitivity level shall be set in a such a way that the detection and evaluation of all indications exceeding 20% of reference sensitivity calibration curve, the gain should be increased an additional amount so that no calibration reflector indication is less than 40% FSH. As an alternate, the scanning sensitivity level may be set at 14 dB higher than the reference level gain setting (This additional gain makes the reference sensitivity calibration curve a 20% sensitivity calibration curve so that indications exceeding 20% sensitivity calibration curve may be easily identified and evaluated). However, evaluation will be done as per required sensitivity level only.

9.1.5 Recording & Evaluation Level

Any indications exceeding 20 % of reference sensitivity level shall be recorded. All ultrasonic indications shall be investigated to determine the indications/defect characteristics such as size, shape, type/nature, location and orientation.

9.1.6 Calibration Confirmation & interim calibration

Calibration confirmation & interim calibration check shall be performed at start and end of 8 hours shift, and when examination personnel, variables are changed and shall meet the requirements of T-467 of ASME Section V.

9.1.7 Acceptance Criteria

- a) Products shall not be accepted if indications of echoes are higher than ($>$) DAC (or reference sensitivity level) for UT examination in straight or angle beam.
- b) A forging shall be unacceptable if the results of straight beam examinations show one or more reflectors which produce indications accompanied by a complete loss of back reflection not associated with or attributable to geometric configurations. Complete loss of back reflection is assumed when the back reflection falls below 5% of full calibration screen height.
- c) A forging shall be unacceptable if the results of the straight beam radial examination show one or more reflectors producing a continuous complete loss of back reflection accompanied by continuous indications on the same plane that cannot be encompassed with a circle whose diameter is 3 in. (75 mm) or one-half of the wall thickness, whichever is greater.
- d) In addition, two or more reflectors smaller than described in (c) above shall be unacceptable unless separated by a minimum distance equal to the greatest diameter of the larger reflector or unless they may be collectively encompassed by the circle described in (c) above.



9.1.8 Documentation & Reports

The results obtained during the ultrasonic examination carried out by supplier form the base line/ reference data for future in inspections to be conducted by the purchaser. Hence, characteristics of all recordable indications within acceptance limits as well as descriptions of ultrasonic procedure, scan plan and equipment etc. shall be documented in detail such that any of those recordable defect indications could be identified and reproduced at a later date and during service life of header assemblies, any changes in characteristics of these defect indications could be monitored and compared with respect to the base line/reference data. The documentation shall include sketches or maps showing the recordable indications sites with respect to well defined reference points on Header forgings/component. Retention & control of standard specimen/blocks shall be mentioned in the procedure.

All documents mentioned under 9.0 shall be properly indexed with proper identification and shall form part of history docket/final documentation also.

A detailed report of the examinations shall be made. The report shall include above records and records indicated in T-590 of Article 5 ASME Section V. A sample report format in line with the above requirement shall be attached with the procedure.

9.2 Magnetic Particle Examination

Each header forging after final machining shall be examined by magnetic particle method (MT) in accordance with ASME Section III, Para NB-2545. The acceptance standards shall be as per para NB-2545.3. The extent of examination shall be 100%. Demagnetization is required after test. Residual magnetism shall be checked, measured and reported for all the examination. Magnetic testing materials used, shall comply with clause 10 of this TDC. Supplier shall submit detailed Magnetic Particle examination procedure and item wise technique/instruction sheets, for review & approval by BHEL & NPCIL.

At least two separate examinations shall be performed on each area, during the second examination, the lines of magnetic flux shall be approximately perpendicular to those used during the first examination. Magnetic particle examination technique shall ensure the detection sensitivity in the sub-surface zone of material which are not examined due to technical limitation in UT (if any).

A technique sketch shall be prepared for each different geometry examined, showing the part geometry, cable arrangement and connections, magnetizing current for each circuit, pole spacing, contact position/grid points, lighting requirement, consumable details and the areas of examination where adequate field strengths are obtained. Parts with repetitive geometries, but different dimensions, may be examined using a single sketch provided that the magnetic field strength is adequate when demonstrated in accordance with T-756.2 ASME Section V.

A detailed report of the examinations shall be made. The report shall include above records and records indicated in T-790 of Article 7 ASME Section V. The documentation shall include sketches or maps showing the recordable indications sites with respect to well



defined reference points on Header forgings/component. A sample report format in line with the above requirement shall be attached with the procedure.

9.2.1 Acceptance standards (Sec. III NB 2545.3)

An indication of a discontinuity may be larger than the discontinuity that causes it; however, the size of the indication and not the size of the discontinuity is the basis of acceptance or rejection.

Any indication in excess of the Acceptance standard below, which is believed to be non-relevant, shall be re-examined other non-destructive examination methods to verify whether or not actual defects are present.

Surface conditioning may precede the re-examination, non-relevant indications which would mask defects are unacceptable.

Only imperfections producing indications with major dimensions greater than 1,5 mm shall be considered relevant imperfections.

Imperfections producing the following relevant indications are unacceptable:

- (a) any linear indications greater than 1,5 mm long for material less than 16 mm thick, greater than 3 mm long for material from 16 mm thick to under 50 mm thick, and 5 mm long for material 50 mm thick and greater;
- (b) rounded indications with dimensions greater than 3 mm for thicknesses less than 16 mm and greater than 5 mm for thicknesses 16 mm and greater;
- (c) four or more relevant rounded indications in a line separated by 1,5 mm or less edge to edge;
- (d) ten or more indications in any 4000 mm² of area whose the major dimension is no more than 150 mm with the dimensions taken in the most unfavourable location relative to the indications being evaluated.

9.3 Dye Penetrant Examination

Dye penetrant examination on all edge preparation and non-accessible (in MT) regions of small size nozzles in accordance with ASME Section III, Para NB-2546. Supplier shall submit detailed Dye Penetrant examination procedure for review & approval by BHEL & NPCIL. Whenever MT is possible, MT shall be preferred over dye penetrant examination, supplier shall indicate such area in the scan plan of MT wherever PT is applicable.

Penetrant testing materials used, shall comply with clause 10 of this TDC.

A detailed report of the examinations shall be made. The report shall include above records and records indicated in T-690 of Article 6 ASME Section V. The documentation shall include sketches or maps showing the recordable indications sites with respect to well defined reference points on Header forgings/component. A sample report format in line with the above requirement shall be attached with the procedure.



10.0 **CLEANING**

Cleaning and surface treatment procedure shall be submitted for approval from BHEL & NPCIL. All chemicals and fluids such as cleaning agents, penetrants, developers, water and paints used for marking shall be free of halogen & sulfur. However, in no case more than 25 ppm of halogen & sulfur shall be permitted. Examination materials, chemicals, fluids or any other materials used for examination, inspection and tests shall be removed from the product to achieve clean dry surface.

11.0 **AXES MARKING ON HEADER FORGINGS**: Axes on the header shall be marked as follows.

Axis Punch marking required on the following axis of the reactor header,

1. 0° Axis
2. 90° Axis
3. 180° Axis
4. 270° Axis
5. 135° Axis
6. 225° Axis

On each of the above axis,

- 2 punches (25mm apart) shall be marked at approximately 100mm from the free end of forging on either side.
- 2 punches (25mm apart) shall be marked at approximately 100mm from the centre reference line of the forging.

Axis marking on the Header Reference line (Centre rib)

1. 2 punches (100mm apart) shall be marked on the Reference line towards 270° axis and 90° axis on perpendicular plane.
2. Single punch mark shall be marked on the Reference line at 45°, 135°, 225°, 315° axis plane.

All the punches shall be identified by Circle or O-punch (low stress punching).

12.0 **DIMENSIONAL CHECK**

Each header forging shall be checked for dimensional compliance with the approved drawings. The actual dimensions shall be recorded in a sketch/drawing and submitted for final acceptance.

13.0 **REPAIRS**

Repair is generally not permitted. Slight surface defects may be smoothly ground and blended without impairing the minimum wall thickness. No other repair shall be carried out without prior approval of BHEL & NPCIL. Repairs involving welding are prohibited.



All non-conformities shall be recorded and reported to BHEL & NPCIL to determine their disposal.

14.0 PROCEDURES, PLANS, REPORTS AND DOCUMENTATION

The manufacturer shall prepare and submit the following documents for approval from BHEL & NPCIL prior to the commencement of manufacture.

- i) Manufacturing Drawings.
- ii) Quality assurance plan (QAP).
- iii) Manufacturing Process Plan (MPP).
- iv) Material Sampling and Testing Plan (MSTP).
- v) Heat Treatment Plan.
- vi) Non Destructive Examination Procedures, report format and Technique sheets/Instruction Sheets/Scan plan etc. as mentioned in clause no. 9.0.
- vii) Cleaning and surface treatment procedure.
- viii) Preservation and Packing Plan.
- ix) Report Formats.
- x) Procedure for axes marking and Inspection.

The manufacturer shall be responsible for preparation and issue of all certificates, reports and documents which shall be certified by "BHEL" & "NPCIL/TPI". Such certified final documents shall form part of history dockets and shall be supplied in bound volumes (3 copies) with proper identification. Final documentation shall also be submitted in soft form (pdf format) with proper indexing.

15.0 QUALITY SURVEILLANCE

The header forgings shall be subjected to quality surveillance by "BHEL" & "NPCIL/TPI" during manufacture. The forgings shall not be shipped until the shipping release is given by BHEL & NPCIL.

16.0 MARKING, PACKING AND SHIPMEN

Each header forging shall be marked with Product Serial Number, Heat number, Material Specification and main working direction.

The forgings shall be protected against corrosion and damage in transit and shall be properly preserved and packed for sea-worthiness. The supplier shall submit the preservation and packing plan for approval by BHEL & NPCIL. Before shipment, suitable rust preventive coating shall be applied on the forgings to ensure sea-worthiness and tropical storage at least for two years.

Supplier's Name , address , logo etc		SUGGESTIVE QUALITY ASSURANCE PLAN for REACTOR HEADER CARBON STEEL FORGINGS							1 of 7				
		ITEM: REACTOR HEADER-CARBON STEEL FORGING SA 350 GR-LF2							QP No: SQP-RH-01 Rev 01 Project : Reactor Header Fleet Order,				
		QAPNO :To be filled by Supplier							P.O No: To be filled by Supplier				
SR.No	COMPONENT /OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									P	W	R	H	
1	2	3	4	5	6	7	8	9	10				11

MAIN JOB FORGING												
1	Review of ladle analysis certificate of ingot used as electrode	Heat analysis & Chemical Composition	CR	Checking of TC, Heat No, Grade, melting practice, etc.	100%	TDCAT:8	TDCAT:8	Raw material certificate report	3	—	2,1	—
2	ESR product analysis	Chemical Composition	CR	Chemical Composition	100%	TDCAT:8	TDCAT:8	TC per Header	3	—	2,1	—
3	Mockup Forging i) Mockup forgings to be manufactured as per Clause 3.1 of TDCAT:08 ii) Forging ratio to be mentioned (Refer Clause no. 4.4 of TDCAT:08)	Profile & Dimensional check	MA	Profile, Dimensional check & NDE	100%	TDCAT:8 & Applicable drawing	TDCAT:8 & Applicable drawing	TC	3	—	2,1	—

N.R.
13/01/2021

Supplier	LEGEND: - 1.NPCIL/TPI 2.BHEL 3. SUPPLIER H: HOLD POINT, "P"PERFORM, "W"WITHNESS AND "R"REVIEW, MA-MAJOR, CR-CRITICAL, MI-MINOR, TC-TEST CERTIFICATE.	BHEL	NPCIL
SEAL & SIGNATURE WITH DATE		SEAL & SIGNATURE WITH DATE	SEAL & SIGNATURE WITH DATE

Supplier's Name , address , logo etc		SUGGESTIVE QUALITY ASSURANCE PLAN for REACTOR HEADER CARBON STEEL FORGINGS							2 of 7				
		ITEM: REACTOR HEADER-CARBON STEEL FORGING SA 350 GR-LF2							QP No: SQP-RH-01 Rev 01 Project : Reactor Header Fleet Order.				
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SR.No	COMPONENT /OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									P	W	R	H	
1	2	3	4	5	6	7	8	9	10				11

4	Forging	Forging process & dimensional check	MA	Profile, Dimensional check	100%	TDCAT:8 & Applicable drawing	TDCAT:8 & Applicable drawing	TC	3	2	1	---	Forging ratio to be mentioned
5	First rough machining	Machining & dimensional check	MA	Profile & Dimensional check	100%	TDCAT:8 & Applicable drawing	TDCAT:8 & Applicable drawing	Record	3	---	2,1	----	---
6	Heat Treatment	Monitoring of temperature and time	CR	Witness of Job loading and at the end of soaking time, review of HT chart,	100%	1) TDCAT:8 & 2)HT Plan Number: <i>(to be submitted by Supplier)</i>	1) TDCAT:8 & 2)HT Plan Number: <i>(to be submitted by Supplier)</i>	HT chart	3	---	---	1,2	HT chart shall be submitted along with TC
7	Straightness & stress relieving (If required)	Stress relieving	MA	Stress relieving	100%	1) TDCAT:8 & 2)HT Plan Number: <i>(to be submitted by Supplier)</i>	1) TDCAT:8 & 2)HT Plan Number: <i>(to be submitted by Supplier)</i>	Record	3	---	2,1	---	----

N.R.
12/01/2021

Supplier	LEGEND: - 1.NPCIL/TPI 2.BHEL 3. SUPPLIER H: HOLD POINT, "P"PERFORM, "W"WITNESS AND "R"REVIEW, MA-MAJOR, CR-CRITICAL, MI-MINOR, TC-TEST CERTIFICATE.	BHEL	NPCIL
SEAL & SIGNATURE WITH DATE		SEAL & SIGNATURE WITH DATE	SEAL & SIGNATURE WITH DATE

Supplier's Name , address , logo etc		SUGGESTIVE QUALITY ASSURANCE PLAN for REACTOR HEADER CARBON STEEL FORGINGS							3 of 7				
		ITEM: REACTOR HEADER-CARBON STEEL FORGING SA 350 GR-LF2							QP No: SQP-RH-01 Rev 01 Project : Reactor Header Fleet Order.				
		QAPNO :To be filled by Supplier							P.O No: To be filled by Supplier				
SR.No	COMPONENT /OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									P	W	R	H	
1	2	3	4	5	6	7	8	9	10				11

8	Second Round machining	Machining& dimensional check	MA	Profile & Dimensional check	100%	TDCAT:8 & Applicable drawing	TDCAT:8 & Applicable drawing	Record	3	--	2,1	---	---
9	Ultrasonic Examination	UTE	MA	Surface & Volumetric Examination	100 %	TDCAT:8 & UTE Procedure No: <i>(to be submitted by Supplier)</i>	TDCAT:8 & UTE Procedure No: <i>(to be submitted by Supplier)</i>	UTE Report	3	--	--	2,1	---
10	Test Coupon identification and cutting for: i) RTC : as supplied condition (i.e. Normalized condition) ii) STC : Simulated HT condition	Identification & stamping	MA	Identification & stamping	100 %	TDCAT:8 & MSTP No: <i>(to be submitted by Supplier)</i>	TDCAT:8 & MSTP No: <i>(to be submitted by Supplier)</i>	TC	3	--	--	2,1	---
11	Simulated Heat Treatment on STC test coupons	Monitoring of temperature and time	CR	Witness of Job loading and at the end of soaking time, review of HT chart ,	100%	1) TDCAT:8 & 2)HT Plan Number: <i>(to be submitted by Supplier)</i>	1) TDCAT:8 & 2)HT Plan Number: <i>(to be submitted by Supplier)</i>	HT chart	3	--	--	2,1	HT chart shall be submitted along with TC

NGP
12/5/2021

Supplier	LEGEND: - 1.NPCIL/TPI 2.BHEL 3. SUPPLIER H: HOLD POINT, "P"PERFORM, "W"WTNESS AND "R"REVIEW, MA-MAJOR, CR-CRITICAL, MI-MINOR. TC-TEST CERTIFICATE.	BHEL	NPCIL
SEAL & SIGNATURE WITH DATE		SEAL & SIGNATURE WITH DATE	SEAL & SIGNATURE WITH DATE

Supplier's Name , address , logo etc		SUGGESTIVE QUALITY ASSURANCE PLAN for REACTOR HEADER CARBON STEEL FORGINGS							4 of 7				
		ITEM: REACTOR HEADER-CARBON STEEL FORGING SA 350 GR-LF2							QP No: SQP-RH-01 Rev 01 Project : Reactor Header Fleet Order.				
		QAPNO :To be filled by Supplier							P.O No: To be filled by Supplier				
SR.No	COMPONENT /OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									P	W	R	H	
1	2	3	4	5	6	7	8	9	10				11

12	Cutting & Machining of test specimen and their identification. All Mechanical & chemical testing shall be done as per TDCAT:8 clause no. 7.0 and 8.0 in normalized & SHT condition	Testing & their identification	MA	Identification & testing witness	100%	1) TDCAT:8 & 2) MSTP Number: (to be submitted by Supplier)	TDCAT:8	TC	3	--	---	2,1	---
13	Third rough machining	Machining& dimensional check	MA	Profile & Dimensional check	100%	TDCAT:8 & Applicable drawing	TDCAT:8 & Applicable drawing	Record	3	--	2,1	--	---

Handwritten signature and date:
13/01/2021

Supplier	LEGEND: - 1. NPCIL/TPJ 2. BHEL 3. SUPPLIER H: HOLD POINT, "P"PERFORM, "W"WITNESS AND "R"REVIEW, MA-MAJOR, CR-CRITICAL, MI-MINOR, TC-TEST CERTIFICATE.	BHEL	NPCIL
SEAL & SIGNATURE WITH DATE		SEAL & SIGNATURE WITH DATE	SEAL & SIGNATURE WITH DATE

Supplier's Name , address , logo etc		SUGGESTIVE QUALITY ASSURANCE PLAN for REACTOR HEADER CARBON STEEL FORGINGS							5 of 7				
		ITEM: REACTOR HEADER-CARBON STEEL FORGING SA 350 GR-LF2							QP No: SQP-RH-01 Rev 01 Project : Reactor Header Fleet Order.				
		QAPNO :To be filled by Supplier							P.O No: To be filled by Supplier				
SR.No	COMPONENT /OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									P	W	R	H	
1	2	3	4	5	6	7	8	9	10				11

14	Ultrasonic Examination of all nozzles (Large & Small) in rough machining condition	UTE	MA	Surface & Volumetric Examination	100%	TDCAT:8 & UTE Procedure No: (to be submitted by Supplier)	TDCAT:8 & UTE Procedure No: (to be submitted by Supplier)	UTE Report	3	—	—	2,1	—
15	Residual Stress Measurement	Residual Stress Measurement	MA	Residual Stress Measurement	100%	TDCAT:8 & Procedure No: (to be submitted by Supplier)	TDCAT:8 & Procedure No: (to be submitted by Supplier)	TC	3	2	1	—	—
16	Stress Relieving (If performed)	Stress Relieving	MA	Stress Relieving	100%	1) TDCAT:8 & 2)HT Plan Number: (to be submitted by Supplier)	1) TDCAT:8 & 2)HT Plan Number: (to be submitted by Supplier)	HT Chart	3	1,2	—	—	HT chart shall be submitted along with TC
17	Final Machining	Machining & Dimensional Check	MA	Profile & Dimensional Check	100%	TDCAT:8 & Applicable drawing	TDCAT:8 & Applicable drawing	TC	3	—	2,1	—	—

N. K. M.
12/01/2017

Supplier	LEGEND: - 1.NPCIL/TPI 2.BHEL 3.SUPPLIER H: HOLD POINT, "P"PERFORM, "W"WITHNESS AND "R"REVIEW, MA-MAJOR, CR-CRITICAL, MI-MINOR, TC-TEST CERTIFICATE.	BHEL	NPCIL
SEAL & SIGNATURE WITH DATE		SEAL & SIGNATURE WITH DATE	SEAL & SIGNATURE WITH DATE

Supplier's Name , address , logo etc		SUGGESTIVE QUALITY ASSURANCE PLAN for REACTOR HEADER CARBON STEEL FORGINGS							6 of 7				
		ITEM: REACTOR HEADER-CARBON STEEL FORGING SA 350 GR-LF2							QP No: SQP-RH-01 Rev 01 Project : Reactor Header Fleet Order.				
		QAPNO :To be filled by Supplier							P.O No: To be filled by Supplier				
SR.No	COMPONENT /OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									P	W	R	H	
1	2	3	4	5	6	7	8	9	10				11

17a	Axes Marking	Axes Marking	MA	Visual , Dimensions	100%	TDCAT:8 & Applicable drawing	TDCAT:8 & Applicable drawing	TC	3	---	1	2	---
18	Dimensional and visual inspection including boroscopic inspection	Dimensional, Visual& UT thickness measurement	MA	Dimensional, Visual &UT thickness measurement	100%	TDCAT:8 & Applicable drawing	TDCAT:8 & Applicable drawing	TC	3	--	---	2,1	---
19	Magnetic Particle Inspection	MPI	MA	Surface & Subsurface Examination	100%	TDCAT:8, MPI Procedure No: <i>(to be submitted by Supplier)</i>	TDCAT:8, MPI Procedure No: <i>(to be submitted by Supplier)</i>	MPI Report	3	--	---	2,1	---
20	Dye Penetrant Examination on all edge preparation and radius portion of all nozzles	DPE	MA	Surface Examination	100%	TDCAT:8, DPE Procedure No: <i>(to be submitted by Supplier)</i>	TDCAT:8, DPE Procedure No: <i>(to be submitted by Supplier)</i>	DPE Report	3	--	---	2,1	---

Supplier	LEGEND: - 1.NPCIL/TPI 2.BHEL 3.SUPPLIER H: HOLD POINT, "P"PERFORM, "W"WTNE SS AND "R"REVIEW, MA-MAJOR, CR-CRITICAL, MI-MINOR, TC-TEST CERTIFICATE.	BHEL	NPCIL
SEAL & SIGNATURE WITH DATE		SEAL & SIGNATURE WITH DATE	SEAL & SIGNATURE WITH DATE

13/01/2021

Supplier's Name , address , logo etc		SUGGESTIVE QUALITY ASSURANCE PLAN for REACTOR HEADER CARBON STEEL FORGINGS							7 of 7				
		ITEM: REACTOR HEADER-CARBON STEEL FORGING SA 350 GR-LF2							QP No: SQP-RH-01 Rev 01 Project : Reactor Header Fleet Order.				
		QAPNO :To be filled by Supplier							P.O No: To be filled by Supplier				
SR.No	COMPONENT /OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									P	W	R	H	
1	2	3	4	5	6	7	8	9	10				11

21	Low Stress Marking	Marking	MA	Verification	100%	TDCAT:8	TDCAT:8	TC	3	2	1	—	—
22	Final Documentation Review	Documentation	MA	Verification	100%	TDCAT:8	TDCAT:8	TC	3	—	—	2,1	—
23	Preservation and Packing	Surface Preservation & Packing Quality	MA	Verification	100%	TDCAT:8	TDCAT:8	TC	3	1,2	—	—	—
24	Shipping Release	Documentation	MA	Verification	100%	TDCAT:8	TDCAT:8	Shipping Release	3	—	—	1,2	—

Notes:

- 1) MPP (Manufacturing Process Plan) , HT(Heat Treatment Plan) , MSTP(Material Sampling and Testing Plan) , UTE procedure , MPE Procedure , DPE Procedure , Format of Test Reports(including NDE reports) shall be submitted for approval (BHEL&NPCIL) by the successful bidder after PO Placement.
- 2) For Drop Weight Test, consumable used for Crack Starter bead shall be qualified as per ASTM E 208.
- 3) MSTP shall contain the details of Test coupons, sketches showing the location of Test coupons in the forging, Main Working Direction (MWD) , Size and Location of the Test coupons, Sketch of the specimens in the Test coupons, Size of the specimens (Tensile , Impact , Drop weight , etc). Applicable standards for tests. Separate MSTPs shall be made for separate type of Products.
- 4) Steel melting route shall be mentioned in MPP.

-Prepared- Nithin 13/01/2021 [NITHIN-O.R.]
 BHEL
 -Reviewed & Approved- S. Lakshmi 13/01/2021 [S. LAKSHMI/DGM/RA]
 NPCIL

Supplier	LEGEND: - 1.NPCIL/TPI 2.BHEL 3. SUPPLIER H: HOLD POINT, "P"PERFORM, "W"WITHNESS AND "R"REVIEW, MA-MAJOR, CR-CRITICAL, MI-MINOR. TC-TEST CERTIFICATE.	BHEL	NPCIL
SEAL & SIGNATURE WITH DATE		SEAL & SIGNATURE WITH DATE	SEAL & SIGNATURE WITH DATE

INTEGRITY PACT

Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi - 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for

_____. The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint Independent External Monitor(s), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1- Commitments of the Principal

1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-

- 1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.
- 1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.
- 1.1.3 The Principal will exclude from the process all known prejudiced persons.
- 1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

Section 2 - Commitments of the Bidder(s)/ Contractor(s)

- 2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.
- 2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he/ she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.
- 2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. 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.
- 2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant Indian Penal Code (IPC) and Prevention of Corruption Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
- 2.1.4 Foreign Bidder(s)/ Contractor(s) shall disclose the name and address of agents and representatives in India and Indian Bidder(s)/ Contractor(s) to disclose their foreign principals or associates. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.
- 2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.
- 2.3 The Bidder(s)/ Contractor(s) shall not approach the Courts while representing the matters to IEMs and will await their decision in the matter.

Section 3 - Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/ Contractor(s) from the tender process or take action as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 4 - Compensation for Damages

- 4.1 If the Principal has disqualified the Bidder from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent Earnest Money Deposit/ Bid Security.
- 4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to

demand and recover from the Contractor liquidated damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit/ Performance Bank Guarantee, whichever is higher.

Section 5 - Previous Transgression

- 5.1 The Bidder declares that no previous transgressions occurred in the last 3 years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.
- 5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

Section 6 - Equal treatment of all Bidders/ Contractors / Sub-contractors

- 6.1 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors. In case of sub-contracting, the Principal contractor shall be responsible for the adoption of IP by his sub-contractors and shall continue to remain responsible for any default by his sub-contractors.
- 6.2 The Principal will disqualify from the tender process all bidders who do not sign this pact or violate its provisions.

Section 7 - Criminal Charges against violating Bidders/ Contractors /Subcontractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 - Independent External Monitor(s)

- 8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.
- 8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.
- 8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality in line with Non- disclosure agreement.
- 8.4 The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

- 8.5 The role of IEMs is advisory, would not be legally binding and it is restricted to resolving issues raised by an intending bidder regarding any aspect of the tender which allegedly restricts competition or bias towards some bidders. At the same time, it must be understood that IEMs are not consultants to the Management. Their role is independent in nature and the advice once tendered would not be subject to review at the request of the organization.
- 8.6 For ensuring the desired transparency and objectivity in dealing with the complaints arising out of any tendering process, the matter should be examined by the full panel of IEMs jointly as far as possible, who would look into the records, conduct an investigation, and submit their joint recommendations to the Management.
- 8.7 The IEMs would examine all complaints received by them and give their recommendations/ views to CMD, BHEL, at the earliest. They may also send their report directly to the CVO and the Commission, in case of suspicion of serious irregularities requiring legal/ administrative action. IEMs will tender their advice on the complaints within 10 days as far as possible.
- 8.8 The CMD, BHEL shall decide the compensation to be paid to the Monitor and its terms and conditions.
- 8.9 IEM should examine the process integrity, they are not expected to concern themselves with fixing of responsibility of officers. Complaints alleging mala fide on the part of any officer of the organization should be looked into by the CVO of the concerned organisation.
- 8.10 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant Indian Penal Code/ Prevention of Corruption Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.
- 8.11 The number of Independent External Monitor(s) shall be decided by the CMD, BHEL.
- 8.12 The word 'Monitor' would include both singular and plural.

Section 9 - Pact Duration

- 9.1 This Pact shall be operative from the date IP is signed by both the parties till the final completion of contract for successful bidder and for all other bidders 6 months after the contract has been awarded. Issues like warranty / guarantee etc. should be outside the purview of IEMs.
- 9.2 If any claim is made/ lodged during currency of IP, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 - Other Provisions

- 10.1 This agreement is subject to Indian Laws and jurisdiction shall be registered office of the Principal, i.e. New Delhi.

- 10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.
- 10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.
- 10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.
- 10.5 Only those bidders / contractors who have entered into this agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

R

Meganathan

Digitally signed by
R Meganathan
Date: 2021.01.07
16:38:12 +05'30'

For & On behalf of the Principal

(Office Seal)

S ANAND
KUMAR

Digitally signed by
S ANAND KUMAR
Date: 2021.01.07
16:40:58 +05'30'

Place

Date

For & On behalf of the Bidder/

Contractor

(Office Seal)

Witness: _____

(Name & Address) _____

Witness: _____

(Name & Address) _____

Clause on IP in the tender**"Integrity Pact (IP)"**

- (a) IP is a tool to ensure that activities and transactions between the Company and its Bidders/ Contractors are handled in a fair, transparent and corruption free manner. Following Independent External Monitors (IEMs) on the present panel have been appointed by BHEL with the approval of CVC to oversee implementation of IP in BHEL.

Sl	IEM	Email
1.	Shri Arun Chandra Verma, IPS (Retd.)	acverma1@gmail.com
2.	Shri Virendra Bahadur Singh, IPS (Retd.)	vbsinghips@gmail.com

- (b) The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory) along with techno-commercial bid (Part-I, in case of two/ three part bid). Only those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this Pact would be a preliminary qualification.
- (c) Please refer Section-8 of IP for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to any of the above IEM(s). All correspondence with the IEMs shall be done through email only.

Note:

No routine correspondence shall be addressed to the IEM (phone/ post/ email) regarding the clarifications, time extensions or any other administrative queries, etc on the tender issued. All such clarification/ issues shall be addressed directly to the tender issuing (procurement) department's officials whose contact details are provided below:

Details of contact person(s):

(1)
 Name: R. Meganathan
 Deptt: Materials Management
 Address: BHEL Trichy
 Phone: (Landline/ Mobile) +91 0431 2575458
 Email: rmeda@bhel.in
 Fax: _____

(2)
 Name: S. Anand Kumar
 Deptt: Materials Management
 Address: BHEL Trichy
 Phone: (Landline/ Mobile) +91 0431 2575215
 Email: _sak@bhel.in
 Fax: _____

BANK GUARANTEE FOR PERFORMANCE SECURITY

(Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s))

Bank Guarantee No:

Date:

To

NAME

& ADDRESSES OF THE BENEFICIARY

IFSC AND MICR CODE

Dear Sirs,

1. In consideration of Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at _____¹ through its Unit at.....(name of the Unit) having awarded to (Name of the Vendor / Contractor / Supplier) (VENDOR CODE) with its registered office at _____² hereinafter referred to as the ' Vendor / Contractor / Supplier ', which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns), a contract Ref No.....dated³ valued at Rs.....⁴ (Rupees -----)/FC.....(in words.....) for⁵ (hereinafter called the 'Contract') and the Vendor / Contractor / Supplier having agreed to provide a Contract Performance Bank Guarantee, equivalent to% (... Percent) of the said value of the Contract to the Employer for the faithful performance of the Contract,

2. we,, (hereinafter referred to as the Bank), having registered/Head office at and inter alia a branch at being the Guarantor under this Guarantee, hereby, irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer any sum or sums upto a maximum amount of Rs -----⁶ (Rupees -----) without any demur, immediately on first demand from the Employer and without any reservation, protest, and recourse and without the Employer needing to prove or demonstrate reasons for its such demand.

3. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____.

4. We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Vendor / Contractor / Supplier in any suit or proceeding pending before any Court or Tribunal, Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

5. The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment thereunder and the Vendor / Contractor / Supplier shall have no claim against us for making such payment.

6. We thebank further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract/satisfactory completion of the performance guarantee period as per the terms of the Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied or discharged.

7. We.....BANK further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said Vendor / Contractor / Supplier from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Vendor / Contractor / Supplier and to forbear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Vendor / Contractor / Supplier or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Vendor / Contractor / Supplier or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

8. The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Vendor / Contractor / Supplier and notwithstanding any security or other guarantee that the Employer may have in relation to the Vendor / Contractor / Supplier's liabilities.

9. This Guarantee shall remain in force upto and including.....⁷ and shall be extended from time to time for such period as may be desired by Employer.

10. This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Vendor / Contractor / Supplier but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof.

11. Unless a demand or claim under this guarantee is made on us in writing on or before the⁸we shall be discharged from all liabilities under this guarantee thereafter.

12. Any claim or dispute arising under the terms of this document shall only be enforced or settled in the Courts at Tiruchirappalli.

13. We..... BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

a) The liability of the Bank under this Guarantee shall not exceed.....⁶

- b) This Guarantee shall be valid up to⁷
- c) Unless the Bank is served a written claim or demand on or before (minimum 3 to 6 months from the expiry date)⁸ all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

14. We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

For and on behalf of
(Name of the Bank)

Dated.....

Place of Issue.....

BANK EMAIL ID:

BANK PHONE NO:

AUTHORISED SIGNATORIES CELL PHONE NO:

BANK FAX NO:

¹ NAME AND ADDRESS OF EMPLOYER I.e Bharat Heavy Electricals Limited

² NAME AND ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER.

³ DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE

⁴ CONTRACT VALUE

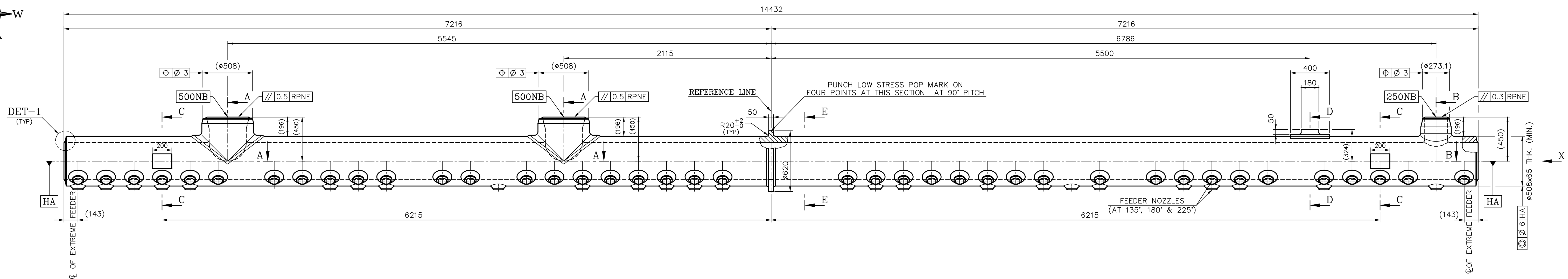
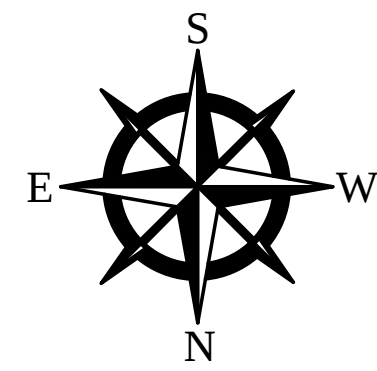
⁵ PROJECT/SUPPLY DETAILS

⁶ BG AMOUNT IN FIGURES AND WORDS

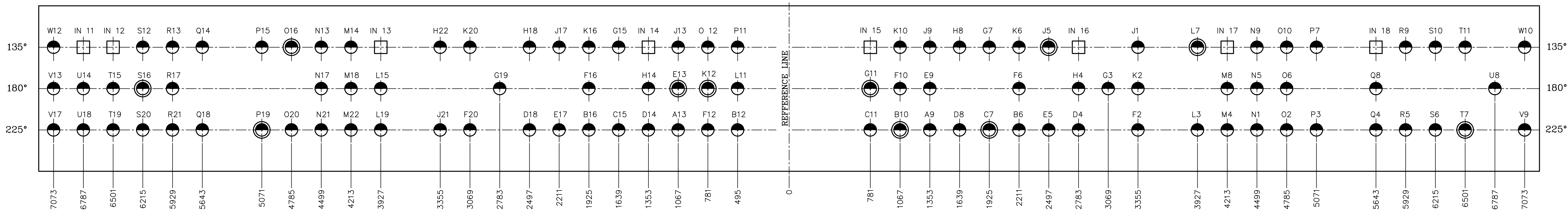
⁷ VALIDITY DATE

⁸ DATE OF EXPIRY OF CLAIM PERIOD

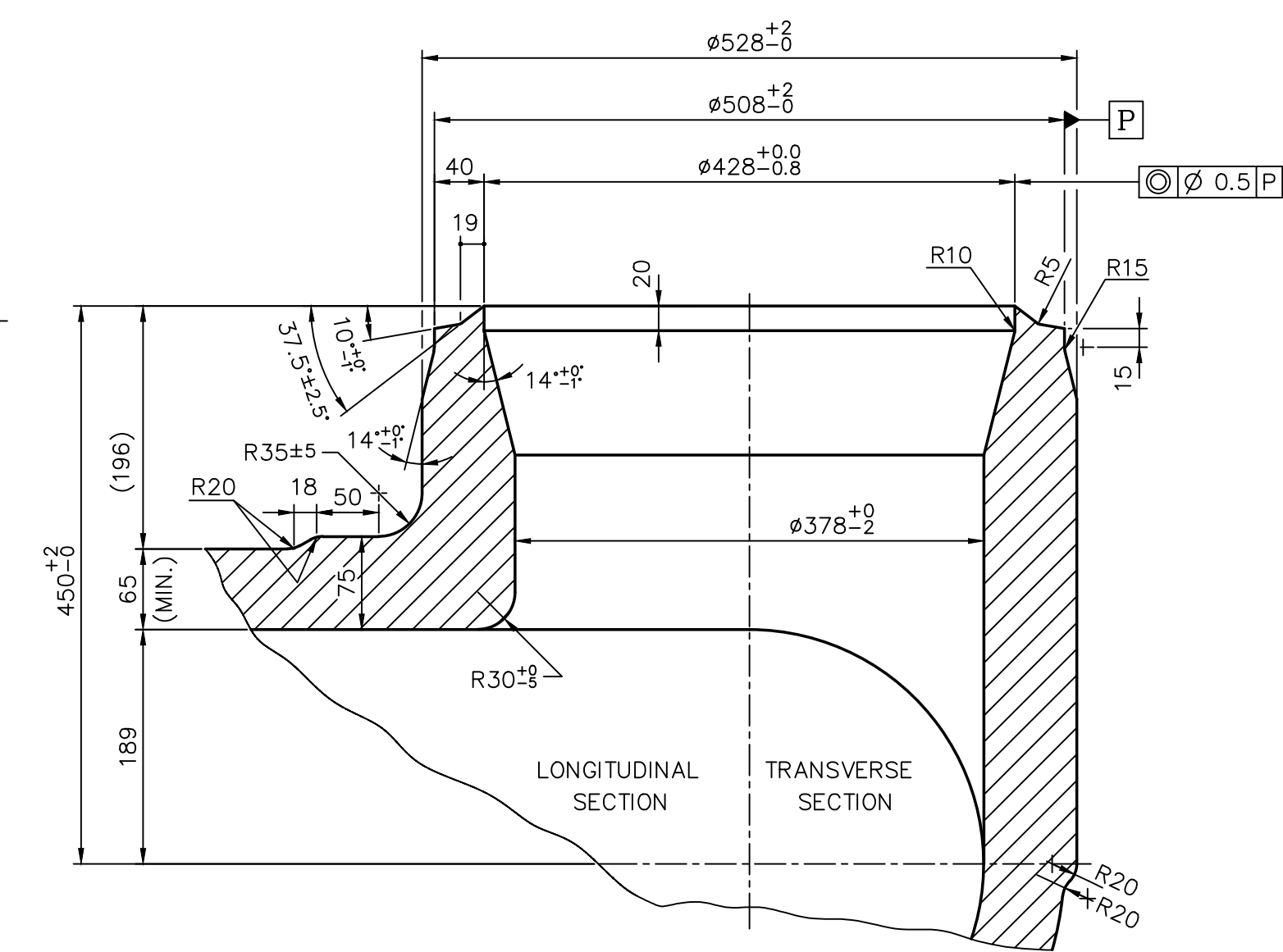
List of Consortium Bank			
	Nationalised Bank		Nationalised Bank
1	Allahabad bank	19	Vijaya Bank
2	Andhra bank		Public Sector Banks
3	Bank of Baroda	20	IDBI
4	Canara Bank		Foreign bank
5	Corporation bank	21	CITI Bank N.A
6	Central bank	22	Deutsche Bank AG
7	Indian Bank	23	The Hongkong and Shanghai Banking Corporation Limited
8	Indian Oversea Bank	24	Standard Chartered Bank
9	Oriental bank of Commerce	25	The Royal Bank of Scotland N.V.
10	Punjab National Bank	26	J P Morgan
11	Punjab & Sindh Bank		Private bank
12	State Bank of India	27	Axis Bank
13	State Bank of Hyderabad	28	The Federal Bank Limited
14	Syndicate Bank	29	HDFC
15	State Bank of Travancore	30	Kotak Mahindra Bank
16	UCO Bank	31	ICICI
17	Union Bank of India	32	Indusind Bank
18	United Bank of India	33	Yes Bank



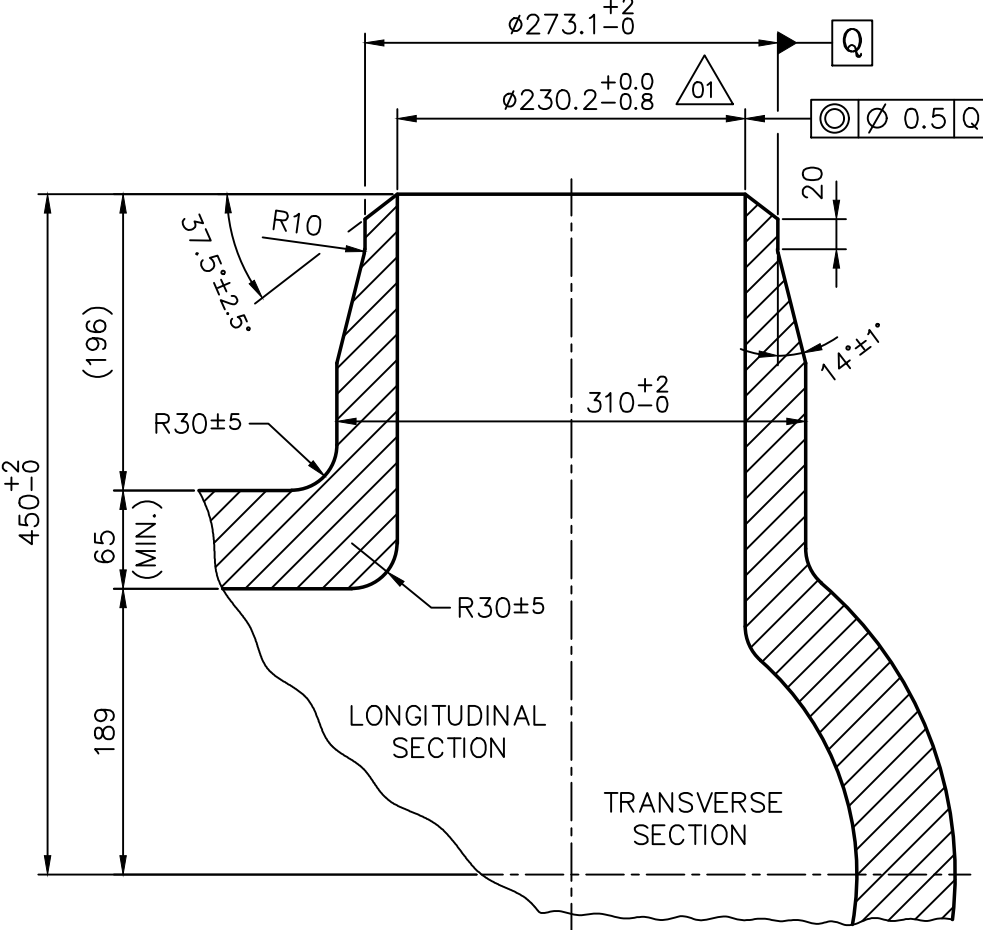
REACTOR OUTLET HEADER (ROH) - H1



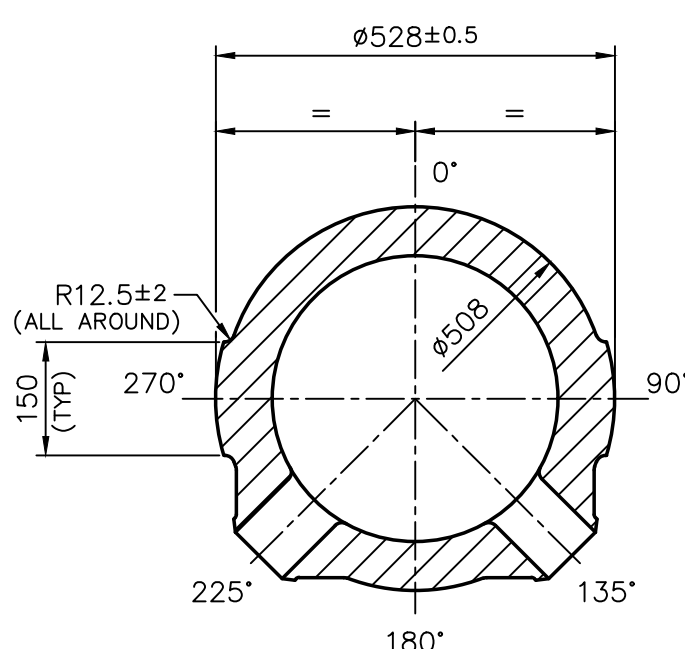
FEEDER PIPE NOZZLE DEVELOPED PLAN FOR (ROH) - H1



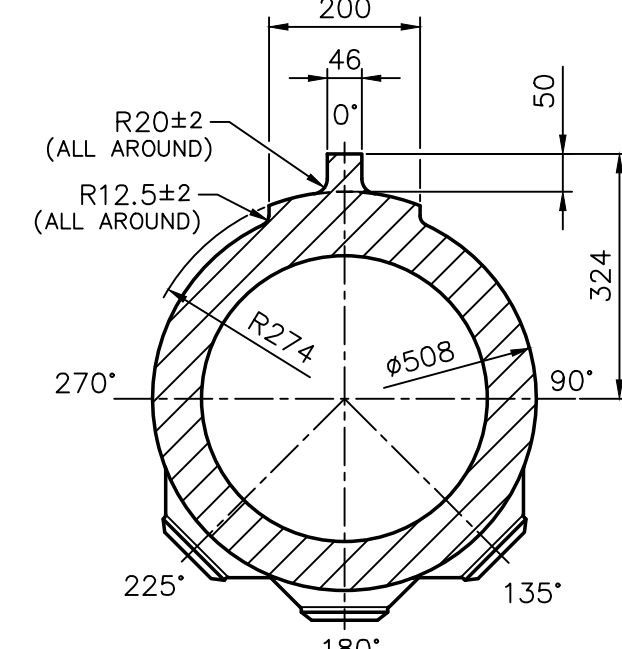
SECTION-AA
(500 NB)
(1:5)



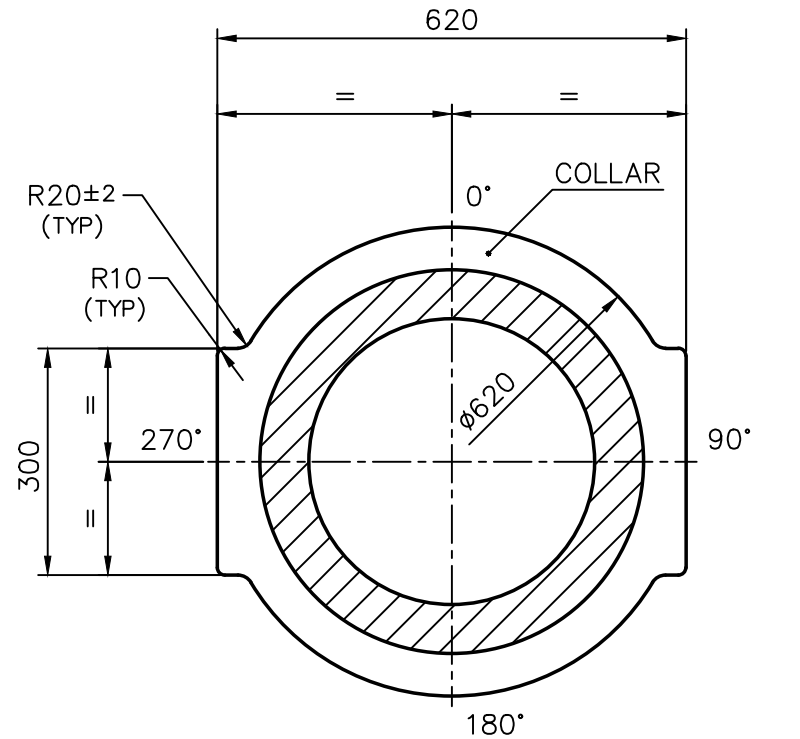
SECTION-BB
(250 NB)
(1:5)



SECTION-CC
(VIEW WITHOUT LARGE SIZE NOZZLE DETAILS)
(1:10)



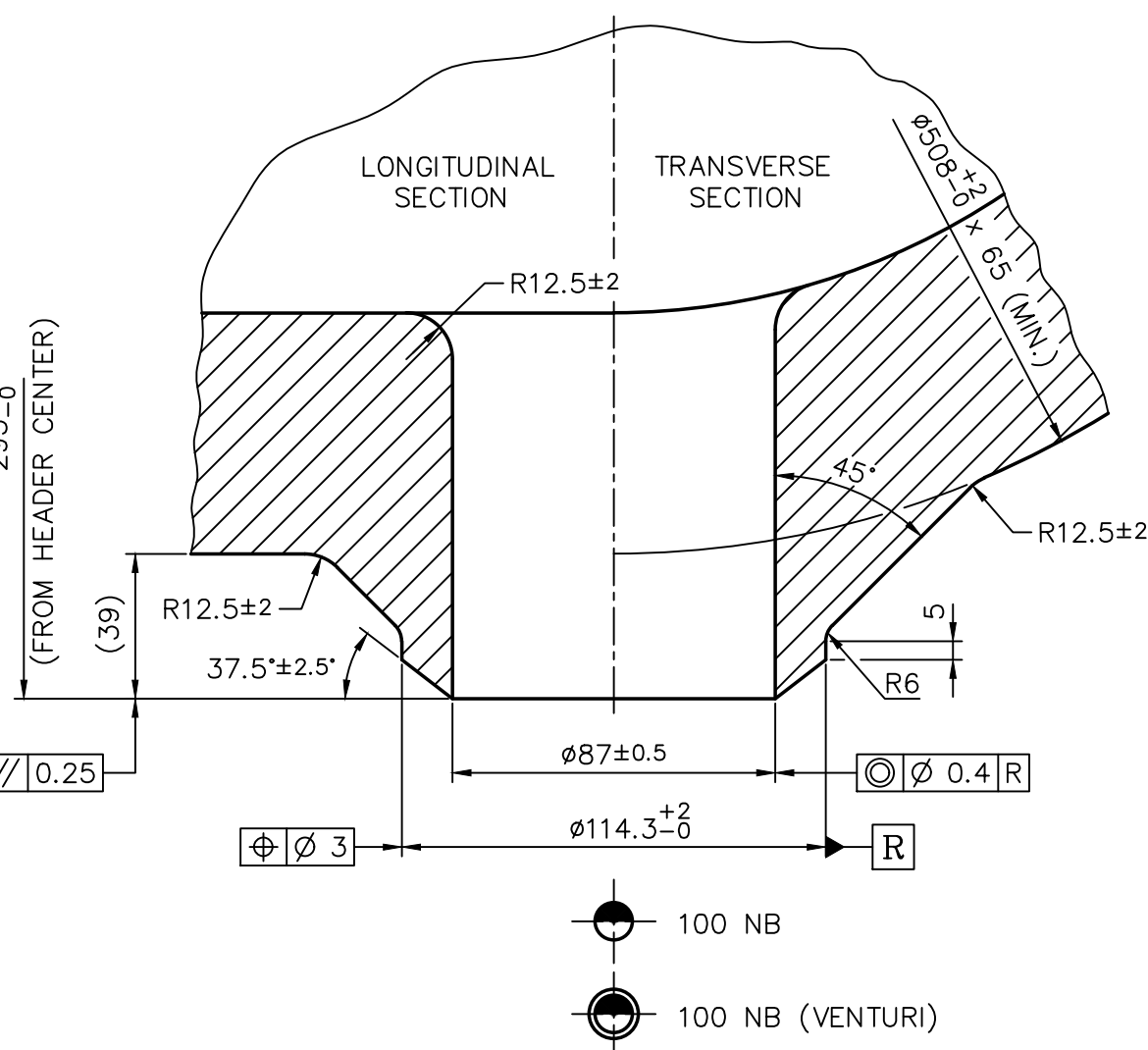
SECTION-DD
(VIEW WITHOUT LARGE SIZE NOZZLE DETAILS)
(1:10)



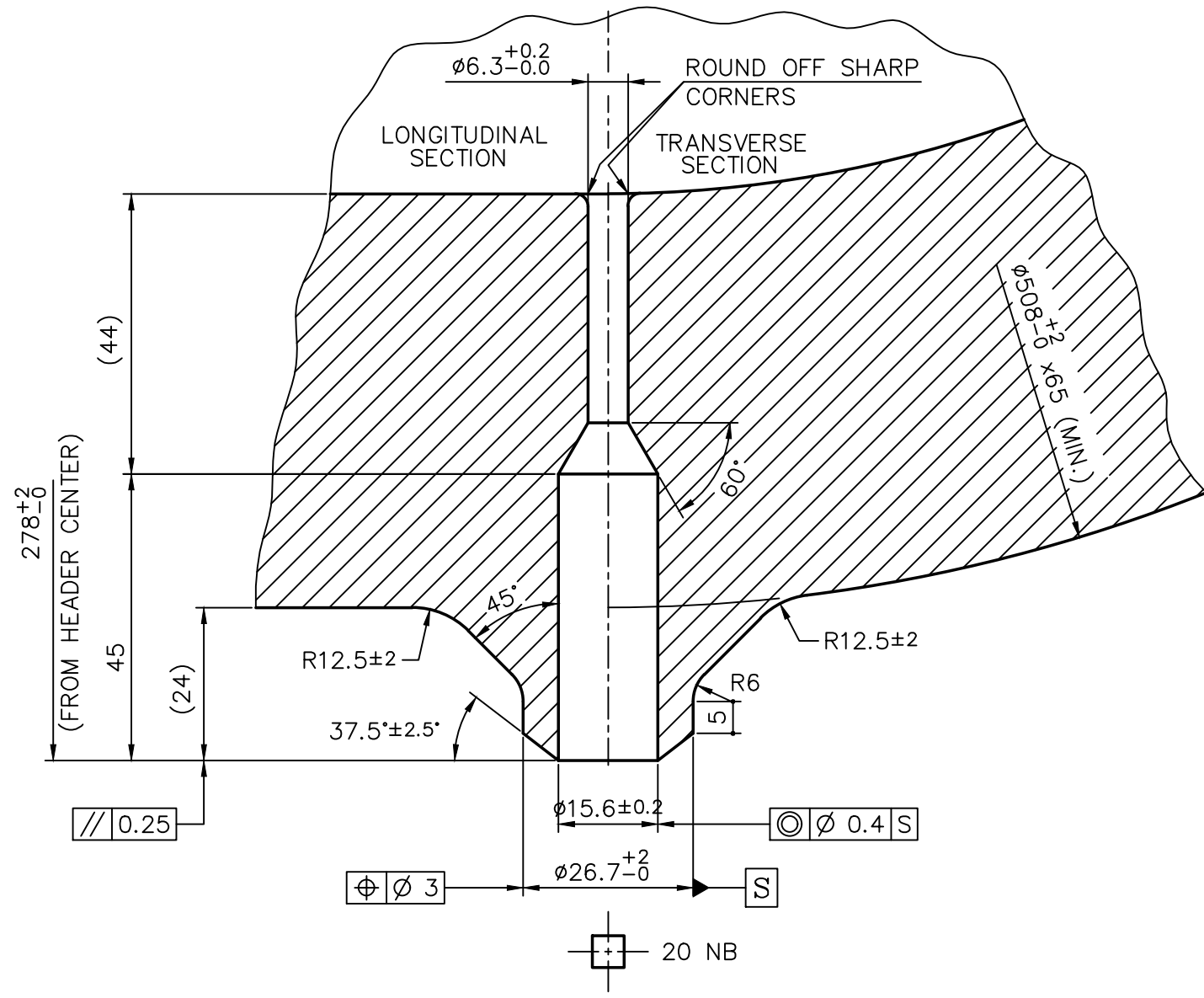
SECTION-EE
(VIEW WITHOUT NOZZLE AND FEEDERS DETAILS)
(1:10)

NOZZLE LEGEND & QUANTITY DETAILS

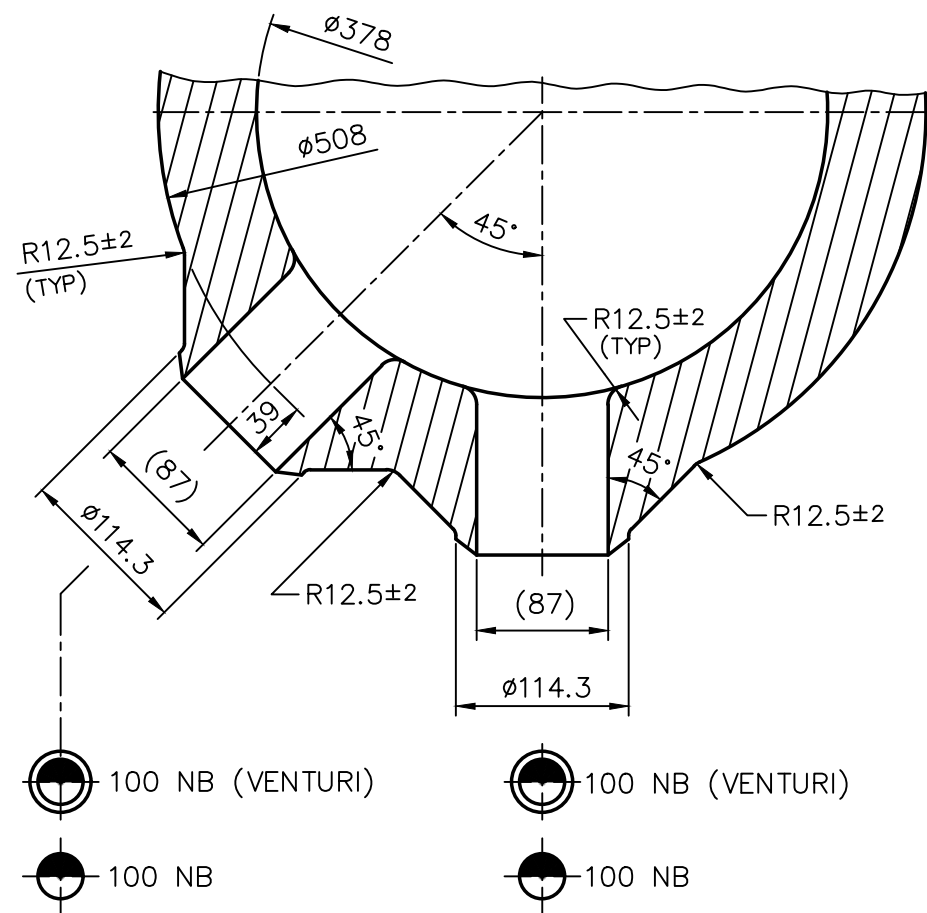
SYMBOL	NOZZLE DESCRIPTION	QUANTITY
	FEEDER PIPE NOZZLE 100NB	87
	FEEDER PIPE NOZZLE 100NB (VENTURI)	11
	INSTRUMENTATION NOZZLE 20NB	8
	250 NB SHUT DOWN COOLING INLET	1
	500 NB STEAM GENERATOR INLET	2



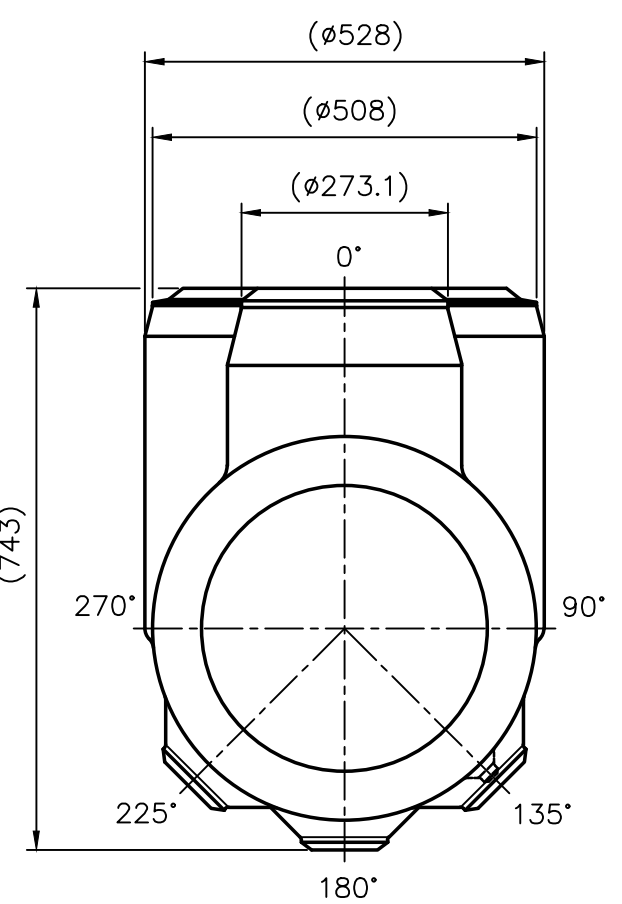
100 NB NOZZLE DETAILS
(1:2)



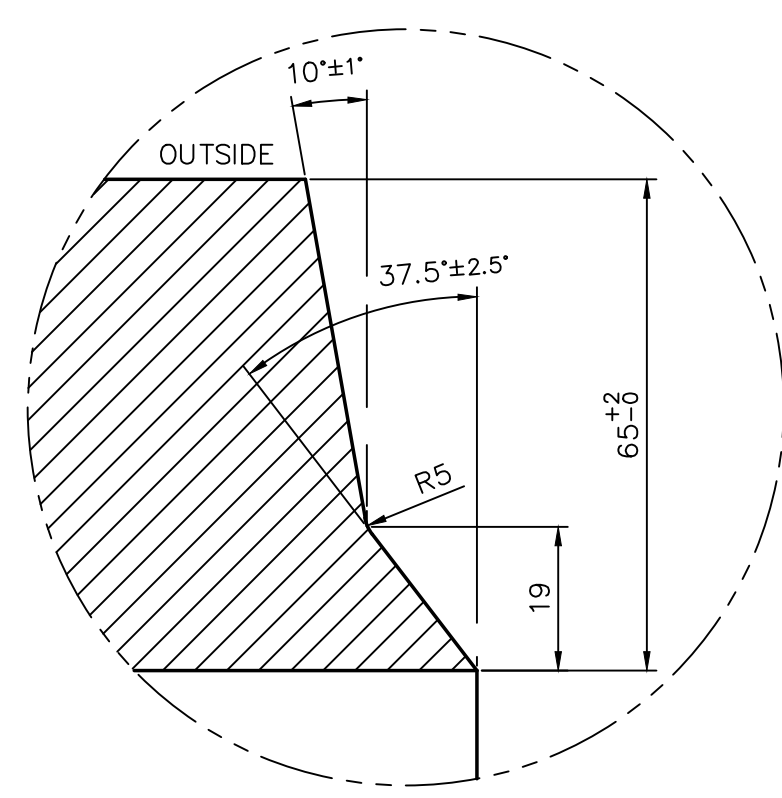
20 NB NOZZLE DETAILS
(1:1)



MERGING DETAILS
(MAJOR NOZZLES)
(1:5)



VIEW-X
(1:10)

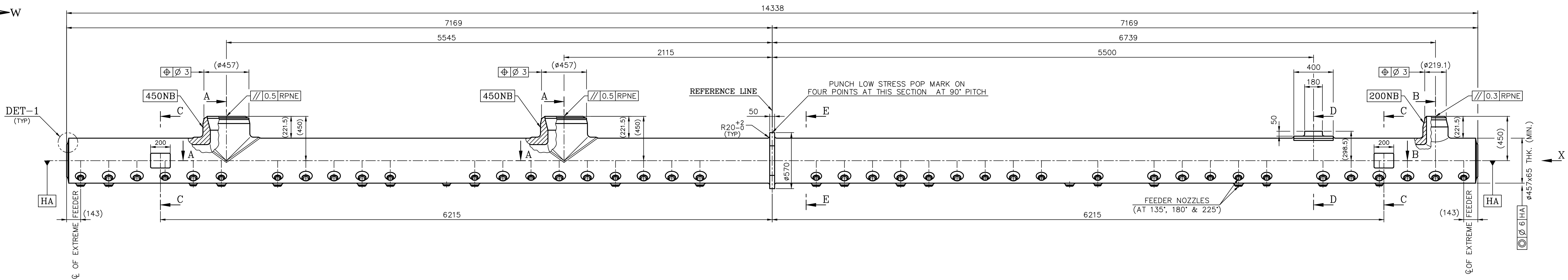
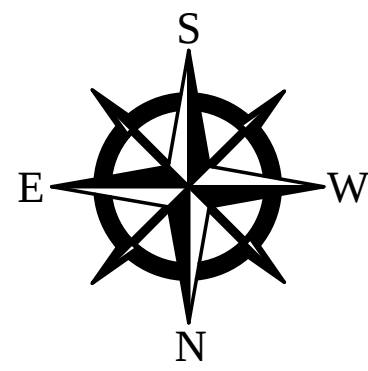


DETAIL-1
(1:1)

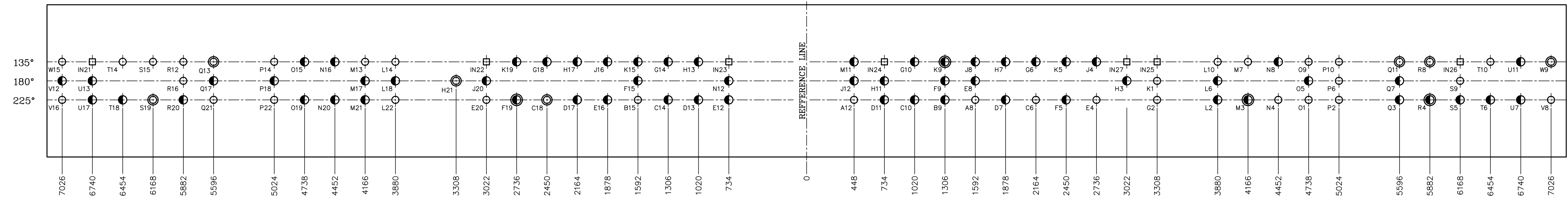
TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)	
LINEAR	ANGULAR
0.5 TO 3 ±0.1	0 TO 10 ±1°
3 TO 6 ±0.1	10 TO 50 ±30'
6 TO 30 ±0.2	50 TO 120 ±20'
30 TO 120 ±0.3	120 TO 400 ±10'
120 TO 400 ±0.5	OVER 400 ±5°

CAUTION: The information on this drawing is the property of Bharat Heavy Electricals Ltd. It must not be disclosed, copied, or used in any form without the written consent of the company.

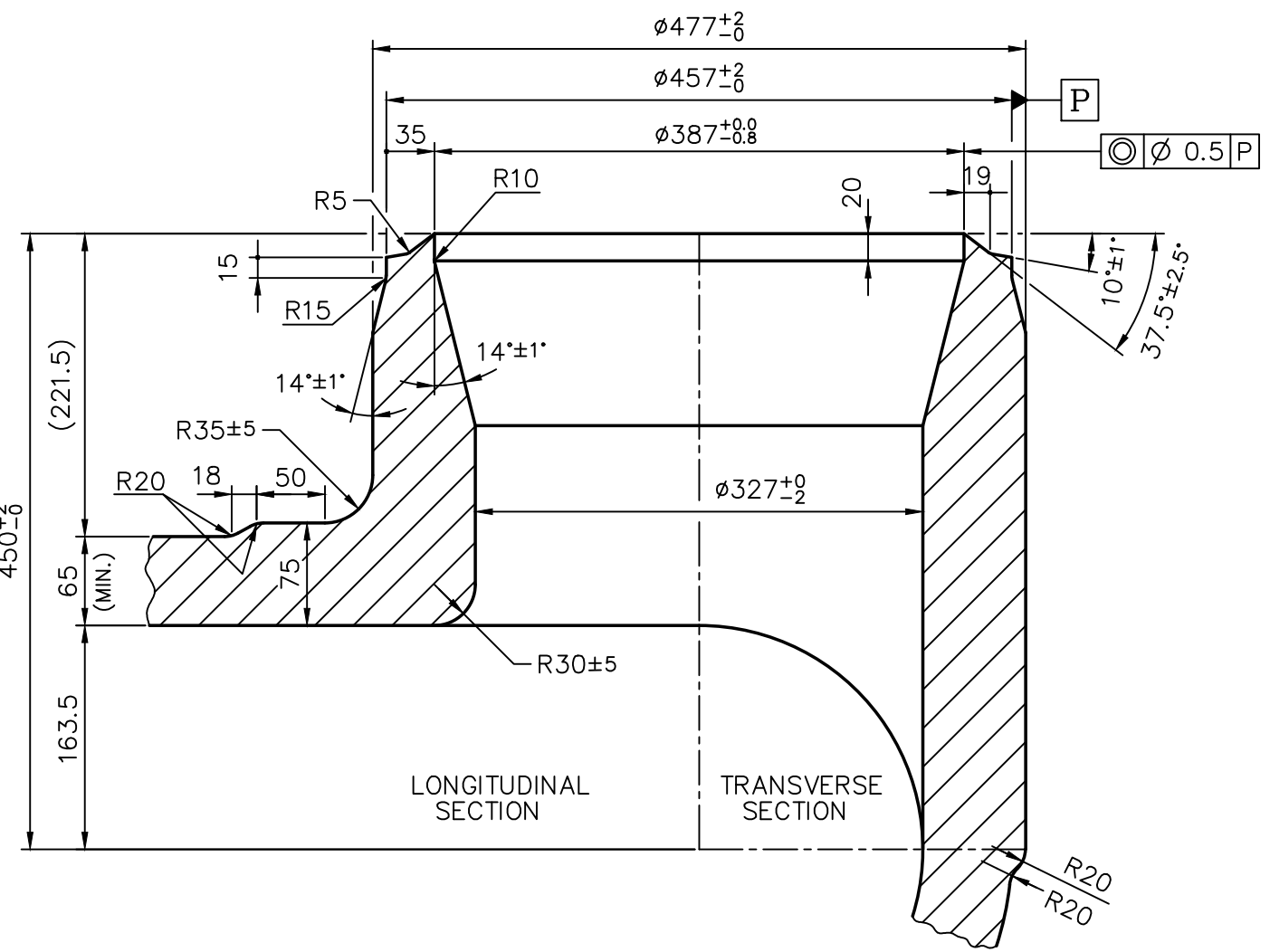
TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700MW REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer DWG.No. 700PLET/33117/2001, 2002 & 2006/DD)	
Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI - 620014		CHK RA KRISHNAN	SIGNATURE [Signature]
DATE 14.12.20	NO. OF VGS	DATE 21.12.20	NO. OF REV
TITLE REACTOR OUTLET HEADER-H1 (FORGING)		DRAWING NO : 0-93-422-05305 01	



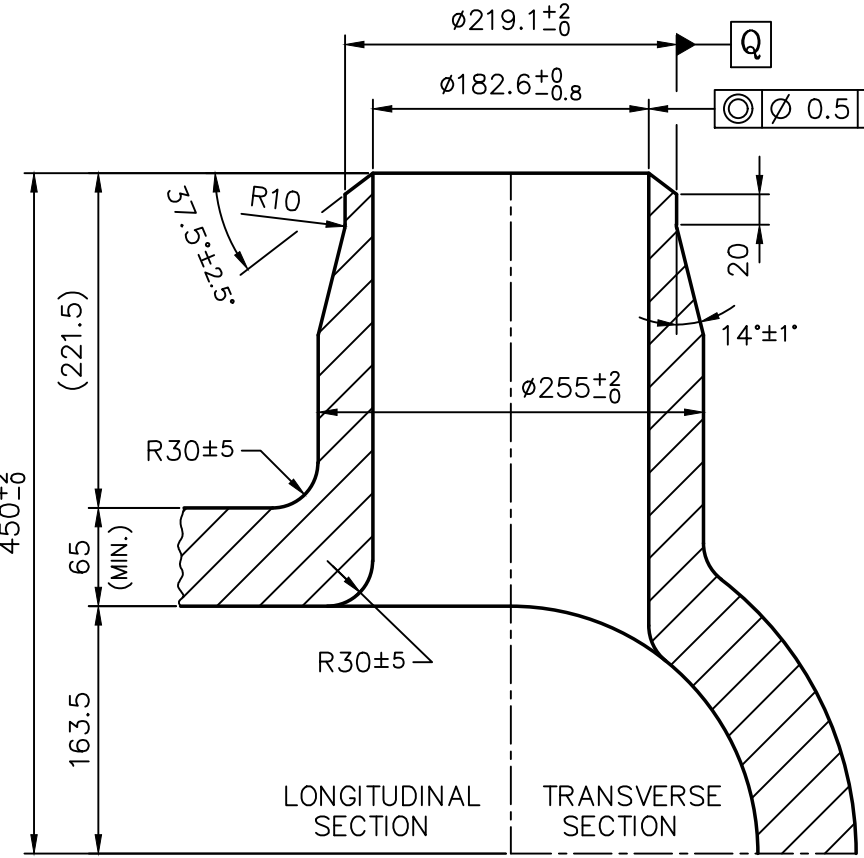
REACTOR INLET HEADER (RIH) - H2



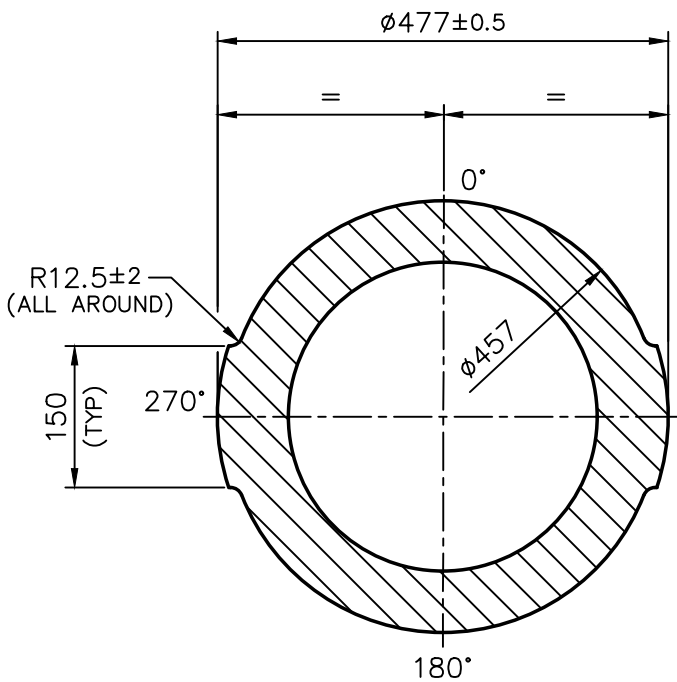
FEEDER PIPE NOZZLE DEVELOPED PLAN FOR (RIH) - H2



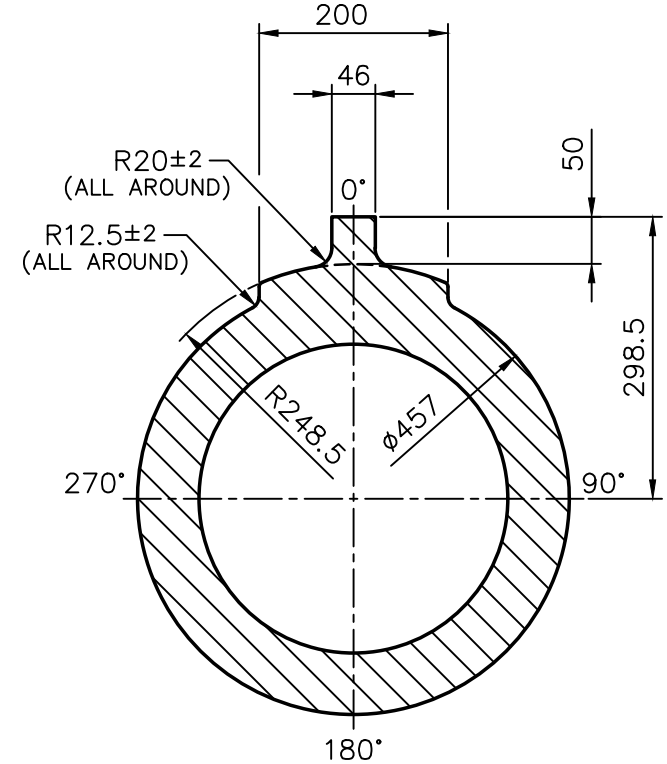
SECTION-AA
(450 NB)
(1:5)



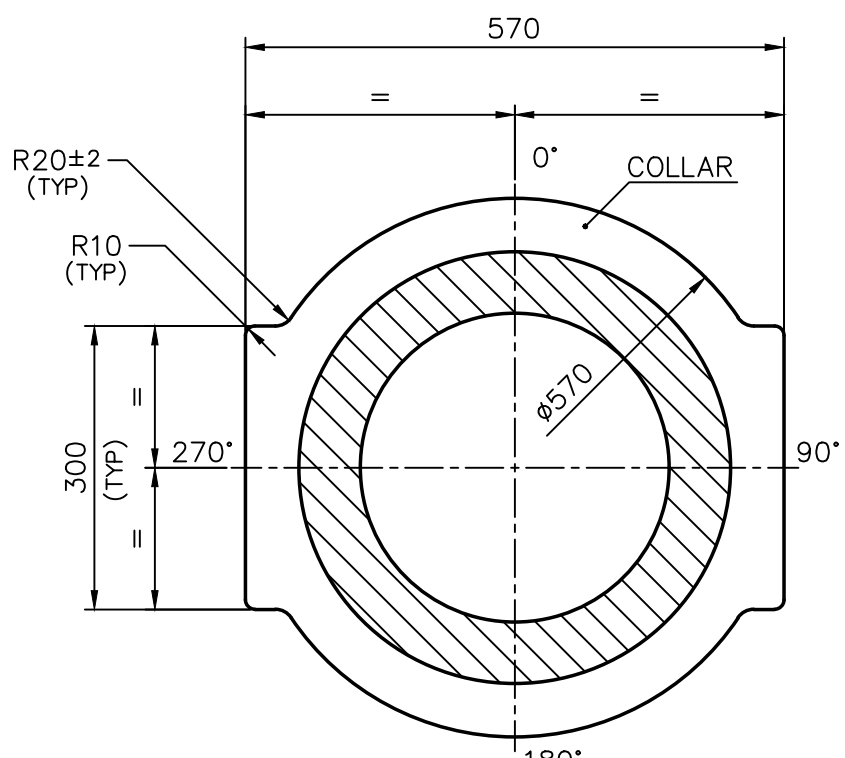
SECTION-BB
(200 NB)
(1:5)



SECTION-CC
(VIEW WITHOUT LARGE SIZE NOZZLE DETAILS)
(1:8)



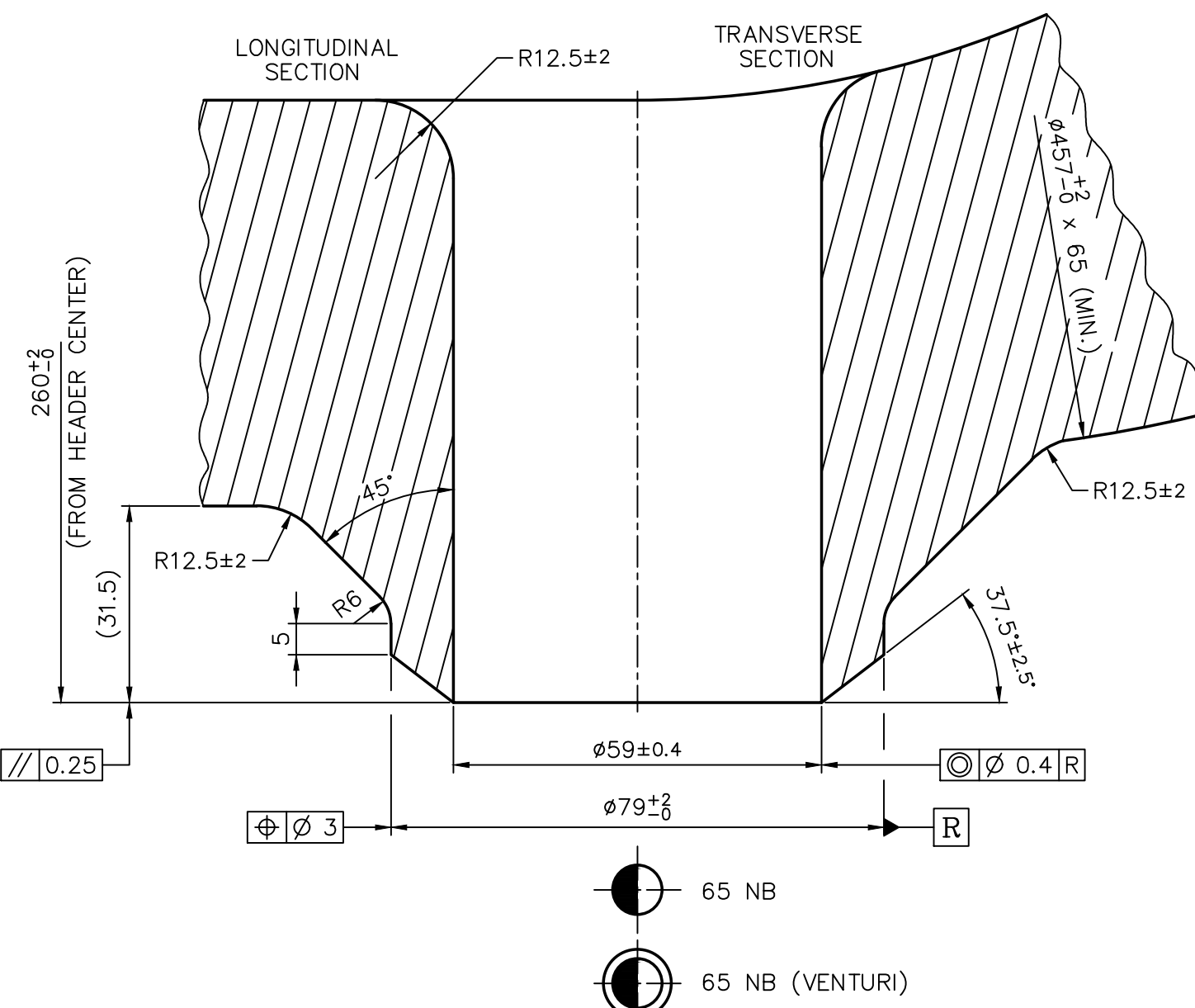
SECTION-DD
(VIEW WITHOUT LARGE SIZE NOZZLE DETAILS)
(1:8)



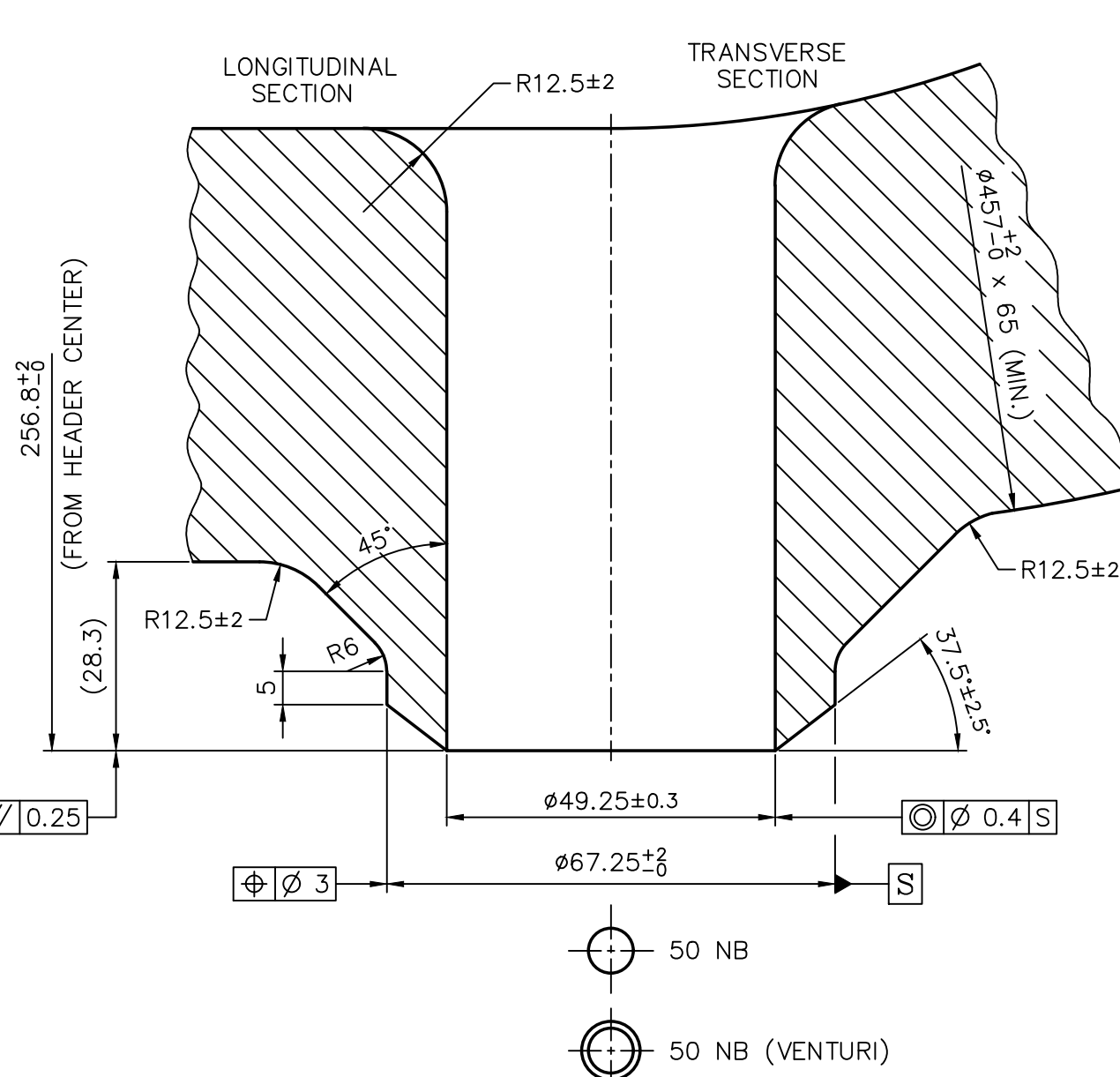
SECTION-EE
(VIEW WITHOUT NOZZLE AND FEEDERS DETAILS)
(1:8)

NOZZLE LEGEND & QUANTITY DETAILS

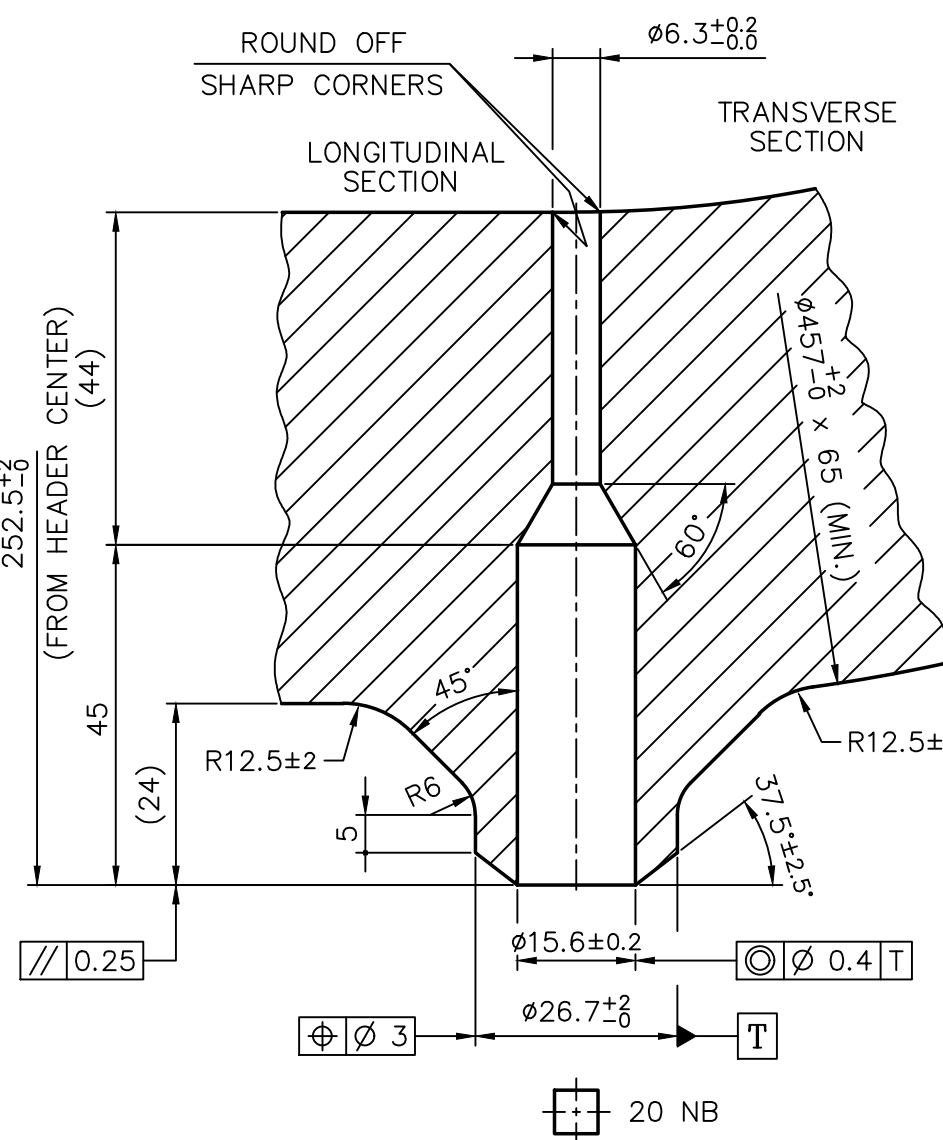
SYMBOL	NOZZLE DESCRIPTION	QUANTITY
	FEEDER PIPE NOZZLE 65NB	56
	FEEDER PIPE NOZZLE 50NB	31
	INSTRUMENTATION NOZZLE 20NB	7
	FEEDER PIPE NOZZLE 65NB (VENTURI)	4
	FEEDER PIPE NOZZLE 50NB (VENTURI)	7
200 NB	SHUT DOWN COOLING OUTLET	1
450 NB	PCP INLET	2



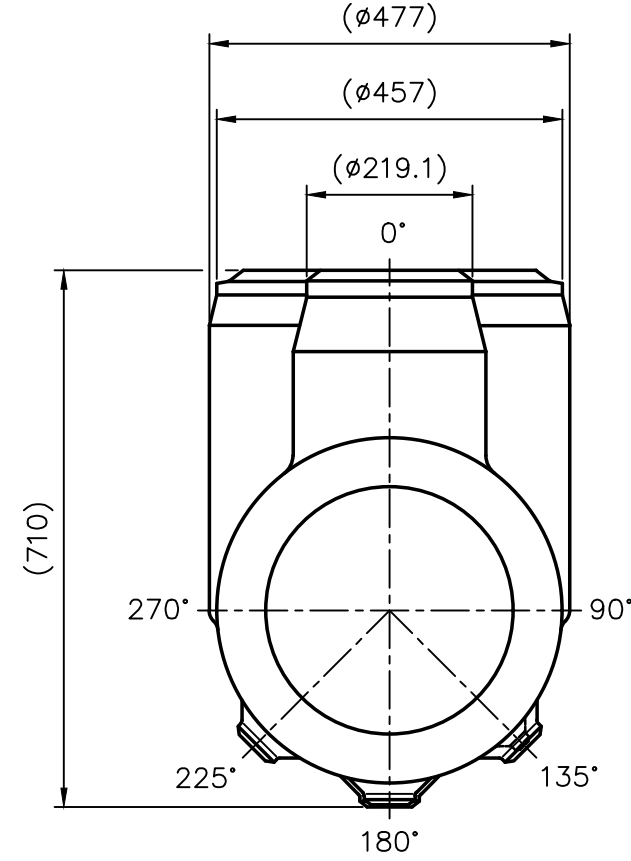
65 NB NOZZLE DETAILS
(1:1)



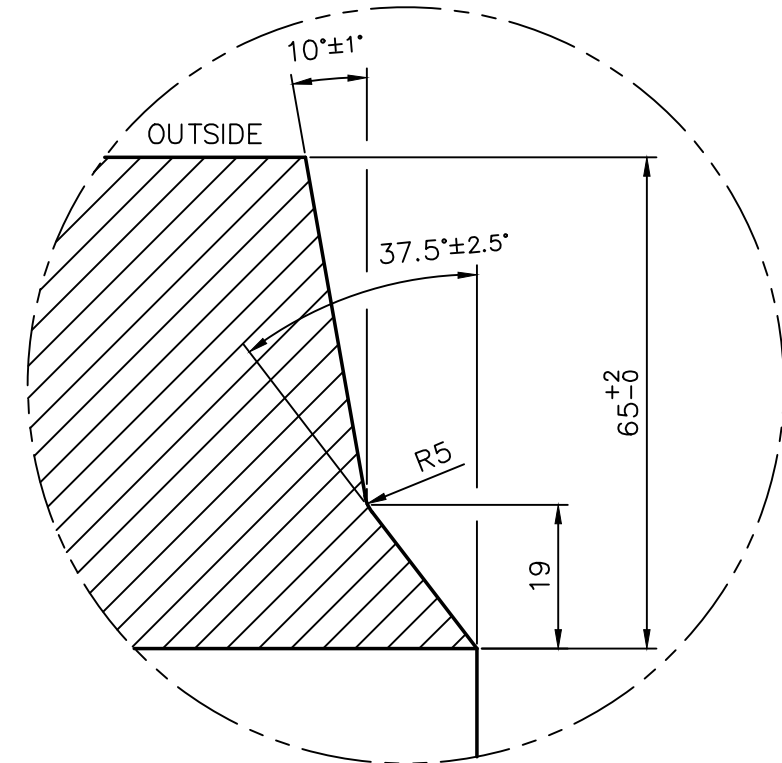
50 NB NOZZLE DETAILS
(1:1)



20 NB NOZZLE DETAILS
(1:1)



VIEW-X
(1:10)

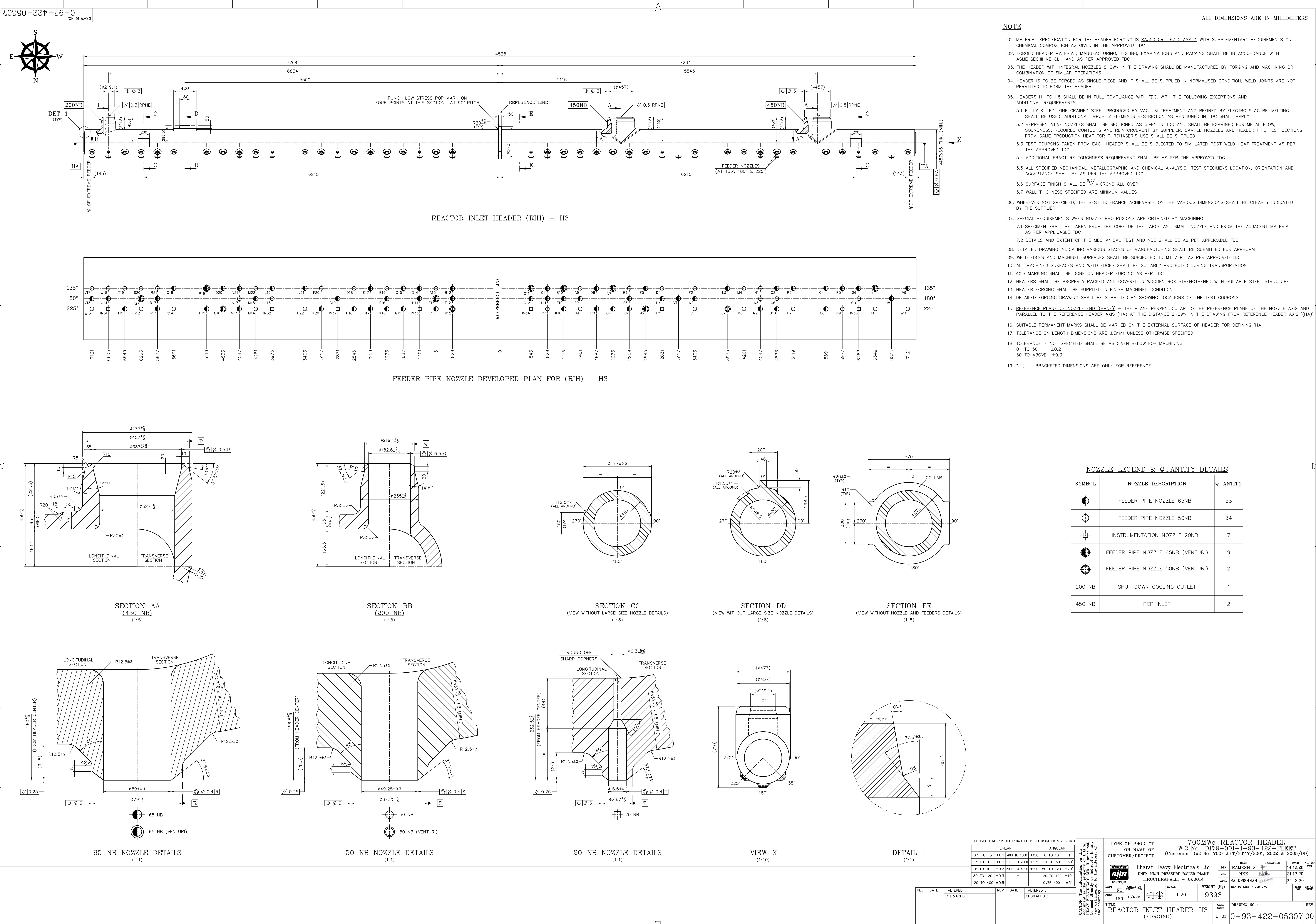


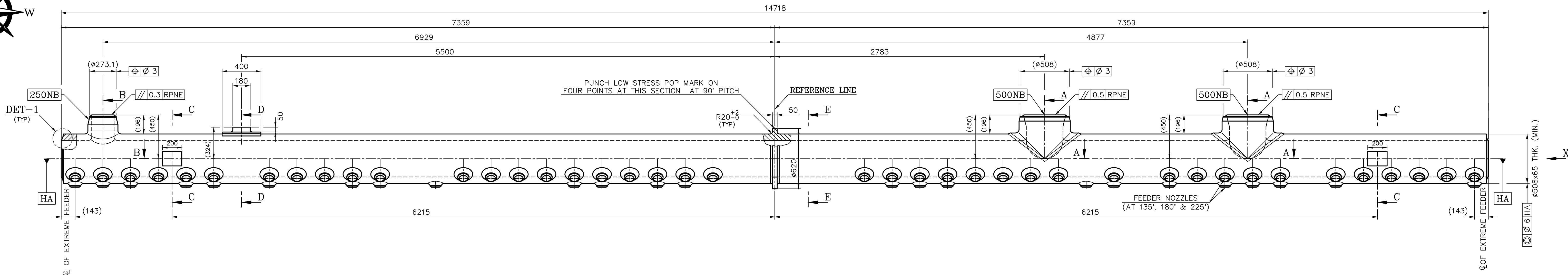
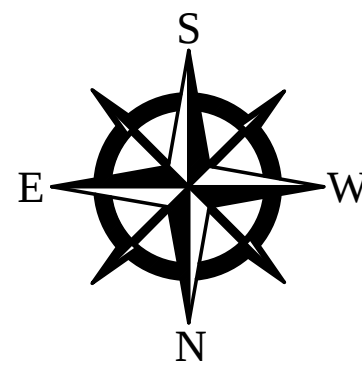
DETAIL-1
(1:1)

TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)	
LINEAR	ANGULAR
0.5 TO 3	±0.1
3 TO 6	±0.2
6 TO 30	±0.3
30 TO 120	±0.4
120 TO 400	±0.5

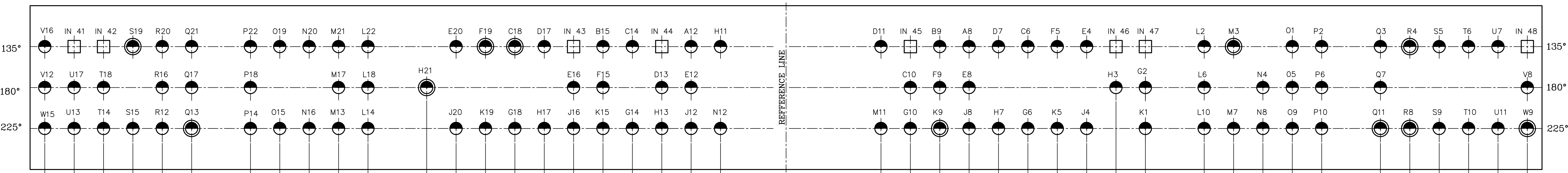
CAUTION: The information on this drawing is the property of Bharat Heavy Electricals Ltd. It must not be used for any purpose other than the intended use without the written consent of the company.

TYPE OF PRODUCT		700MWe REACTOR HEADER	
OR NAME OF CUSTOMER/PROJECT		W.O.No. D179-001-1-93-422-FLEET (Customer DWG.No. 700FLEET/33117/2001, 2002 & 2006/DD)	
	Bharat Heavy Electricals Ltd. UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI - 620014	NAME RAMDISH S	SIGNATURE [Signature]
DEPT CODE	NC 150	SCALE C/M/P	1:20
WGT CODE	9275	REV U 01	0-93-422-05306
DRAWING NO :		REV	

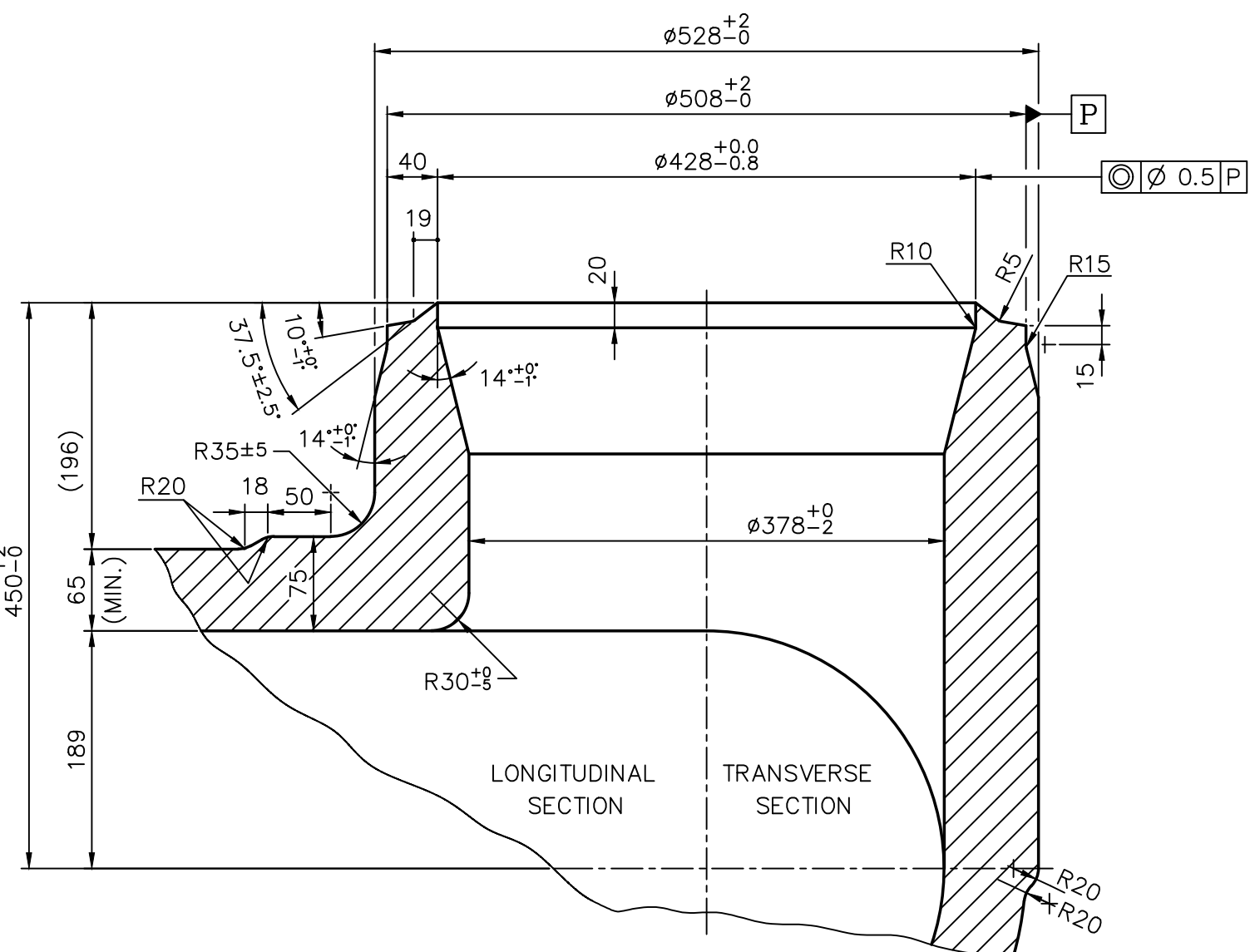




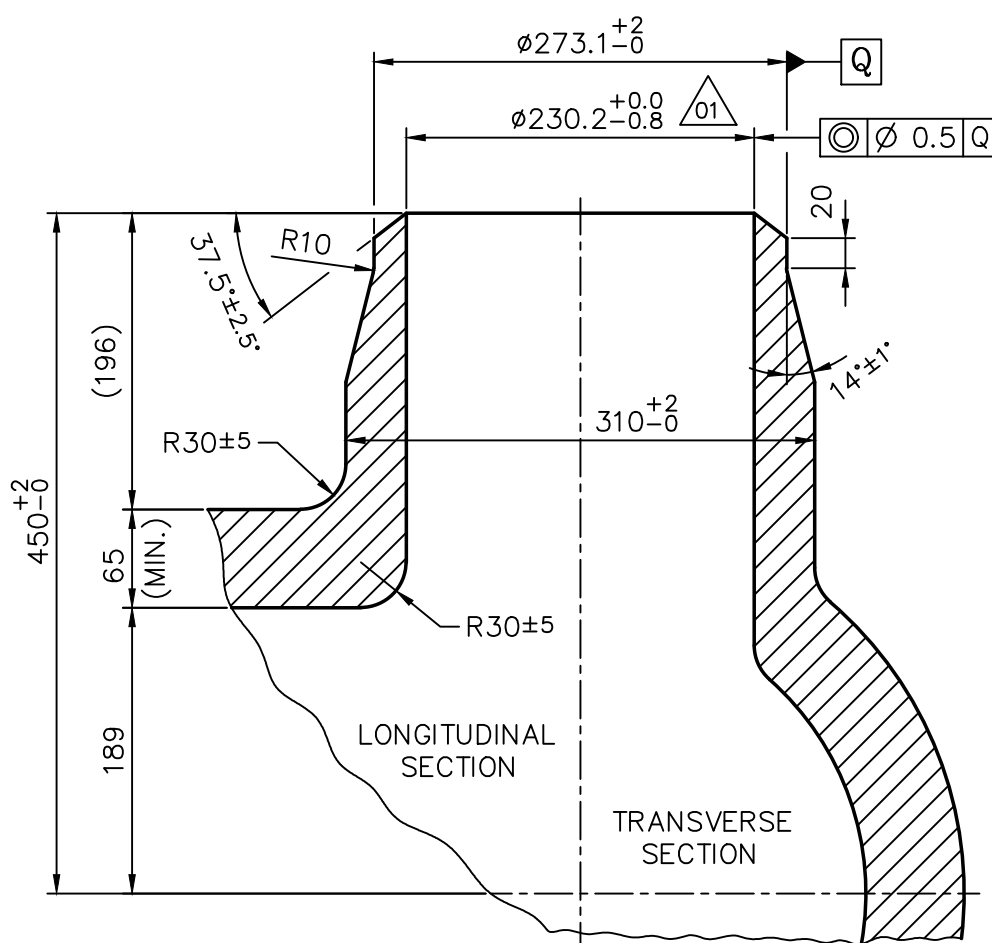
REACTOR OUTLET HEADER (ROH) - H4



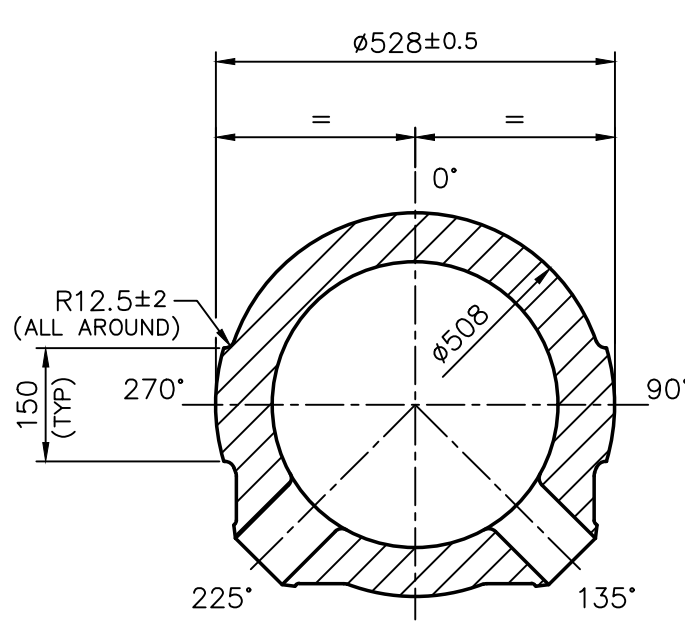
FEEDER PIPE NOZZLE DEVELOPED PLAN FOR (ROH) - H4



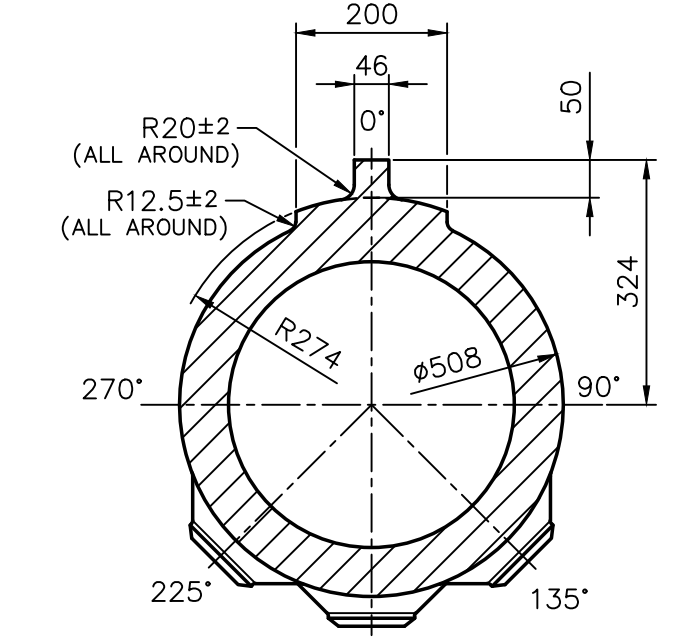
SECTION-AA
(500 NB)
(1:5)



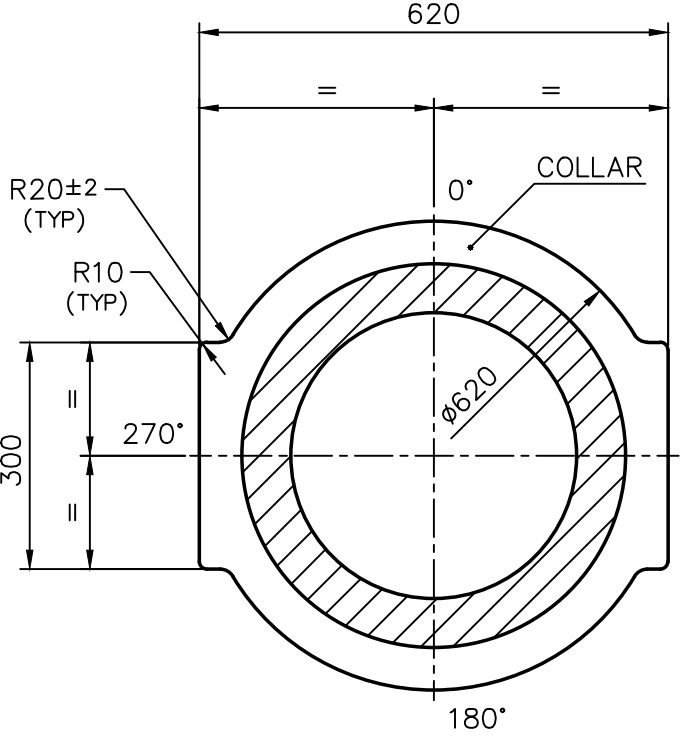
SECTION-BB
(250 NB)
(1:5)



SECTION-CC
(VIEW WITHOUT LARGE SIZE NOZZLE DETAILS)
(1:10)



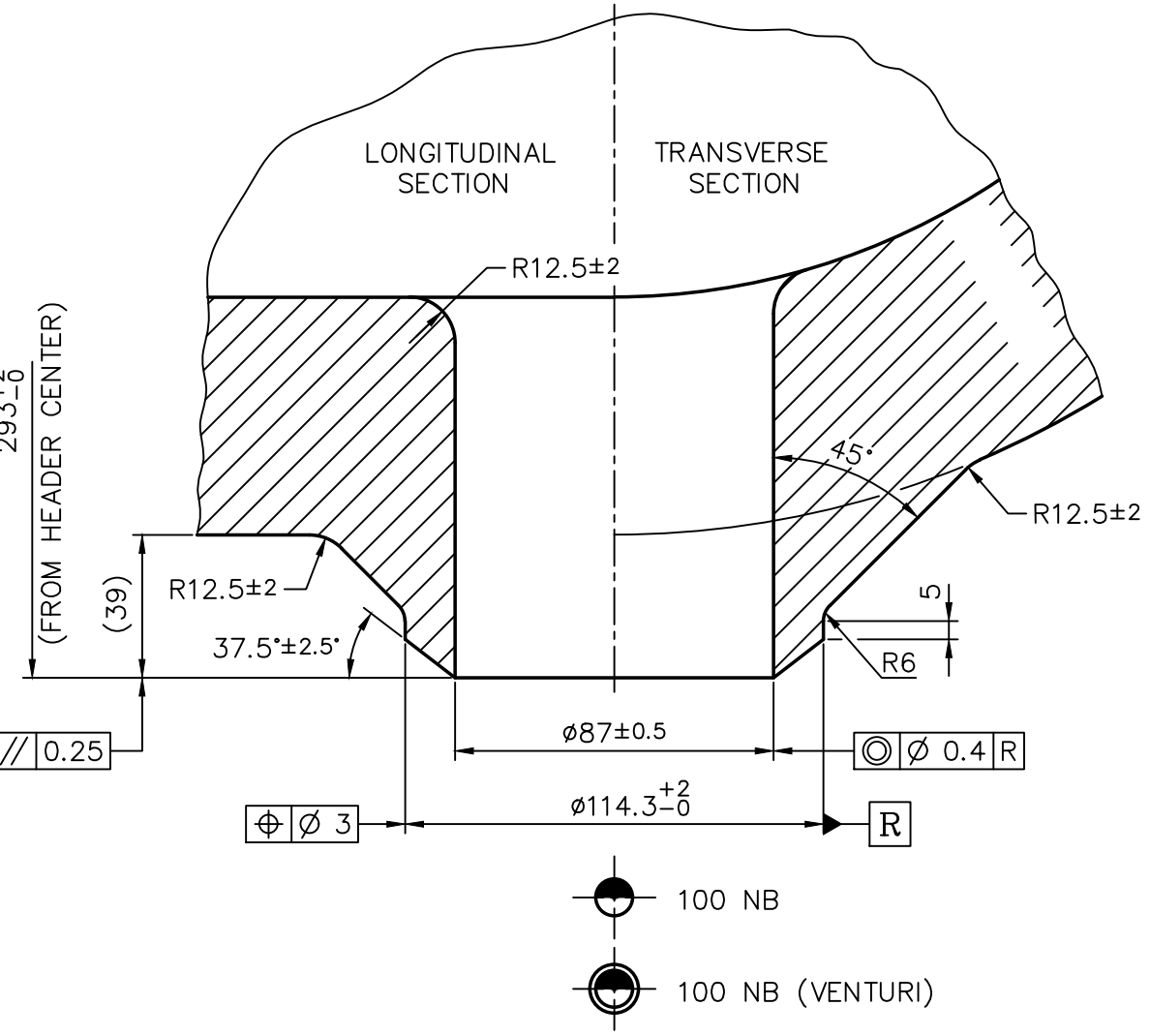
SECTION-DD
(VIEW WITHOUT LARGE SIZE NOZZLE DETAILS)
(1:10)



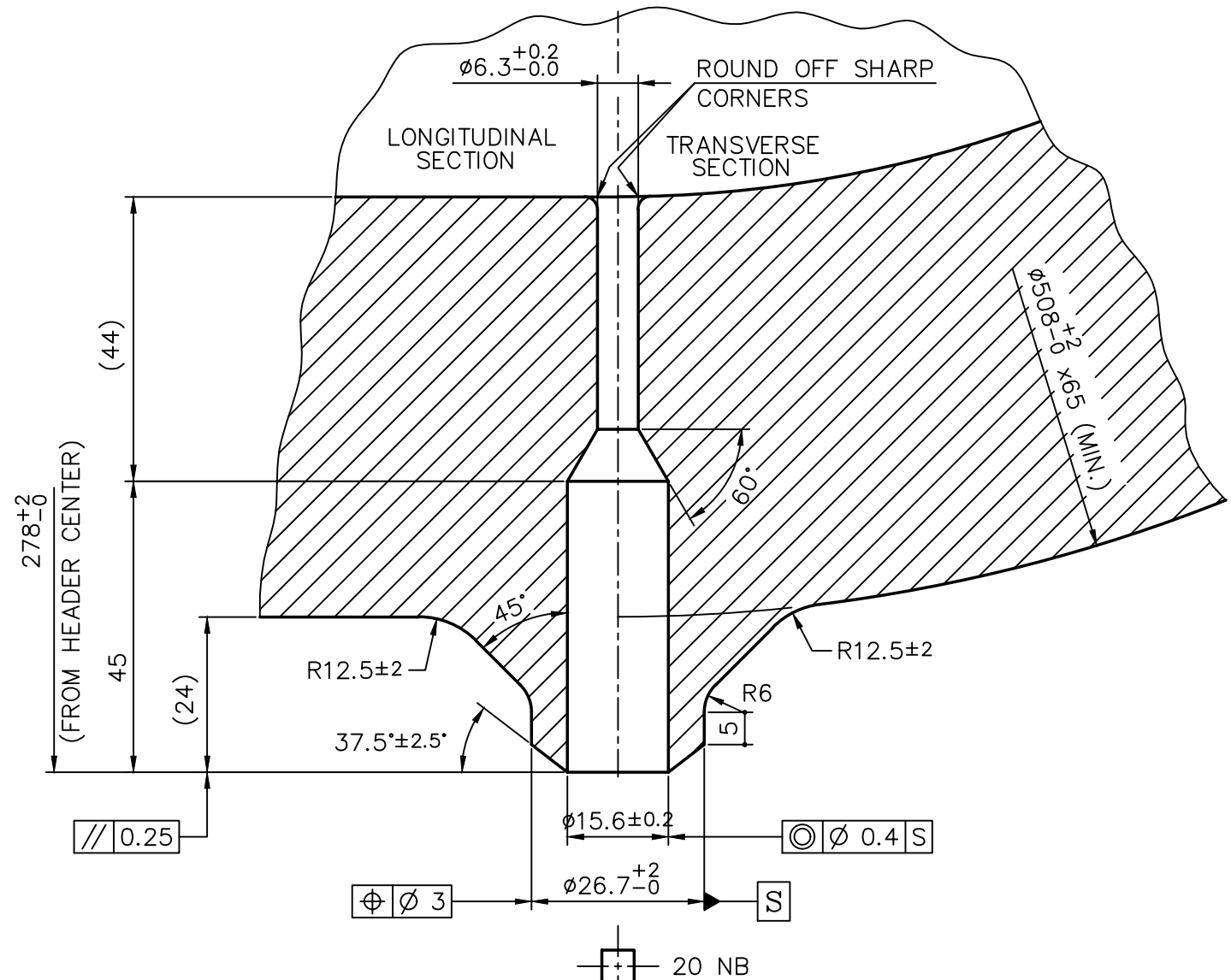
SECTION-EE
(VIEW WITHOUT NOZZLE AND FEEDERS DETAILS)
(1:10)

NOZZLE LEGEND & QUANTITY DETAILS

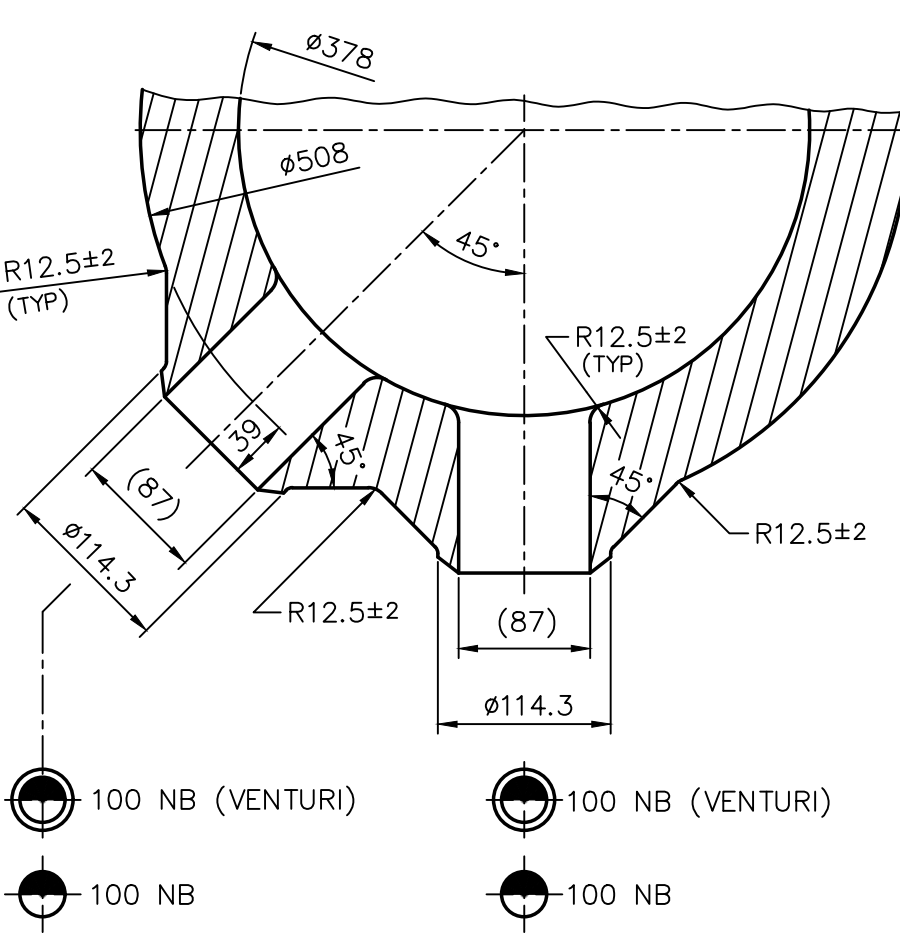
SYMBOL	NOZZLE DESCRIPTION	QUANTITY
	FEEDER PIPE NOZZLE 100NB	87
	FEEDER PIPE NOZZLE 100NB (VENTURI)	11
	INSTRUMENTATION NOZZLE 20NB	8
	SHUT DOWN COOLING INLET	1
	STEAM GENERATOR INLET	2



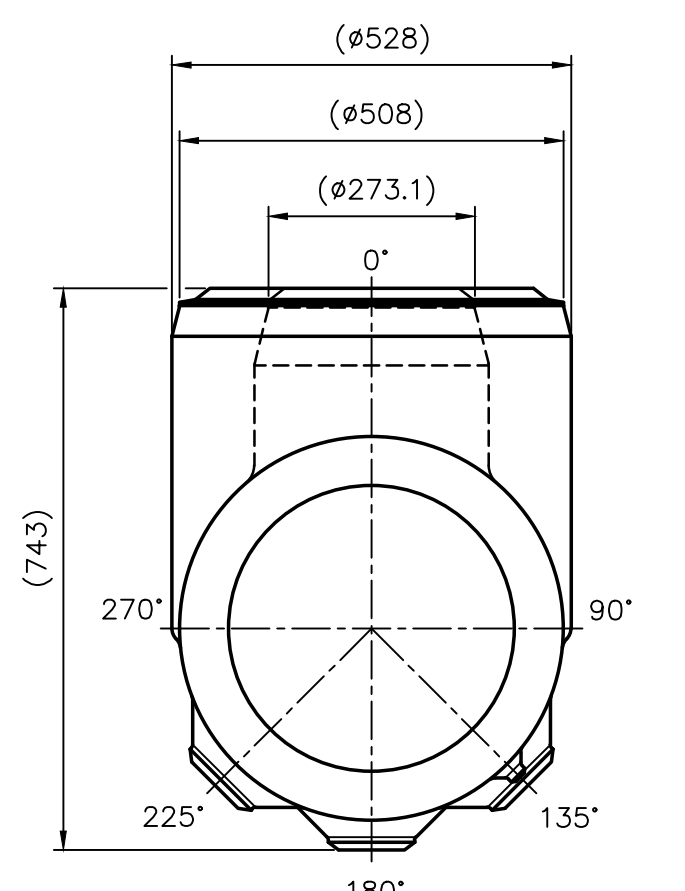
100 NB NOZZLE DETAILS
(1:2)



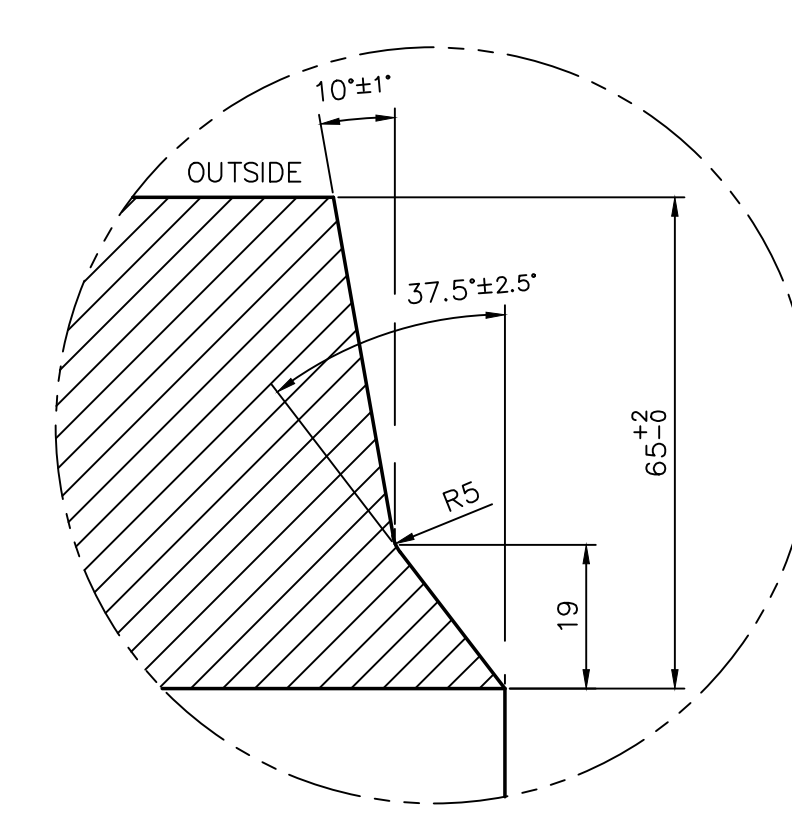
20 NB NOZZLE DETAILS
(1:1)



MERGING DETAILS
(MAJOR NOZZLES)
(1:5)

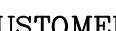


VIEW-X
(1:10)



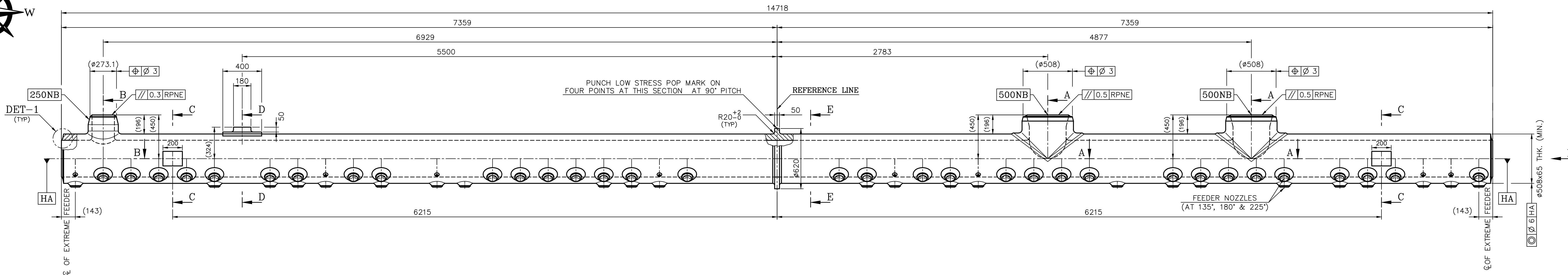
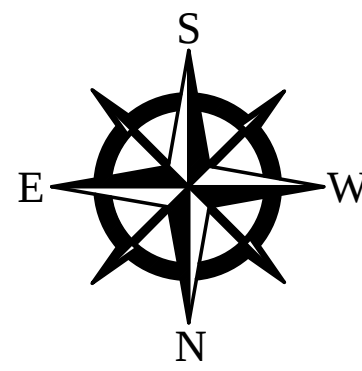
DETAIL-1
(1:1)

REV	DATE	ALTERED	CHD&APPRD
01	13.01.21	CHD&APPRD	

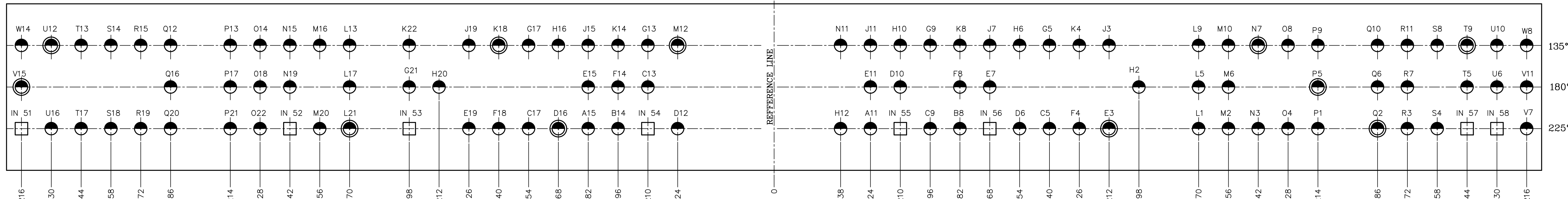
CAUTION: The information on this drawing is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be disclosed to the interest of the company.	TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700MWe REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer DWG.No. 700PLET/33117/2001, 2002 & 2005/DD)			
			Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BLOWER PLANT TIRUCHIRAPALLI - 620014		NAME RAMESH S	
					DATE 14.12.20	
					NO OF REV	
					SIGN RA KRISHNAN	
					DATE 24.12.20	
					NO OF REV	
					APPD	
					NO OF REV	
					ITEM NO	
DEPT NC		SCALE C/M/P		1:20	WEIGHT (Kg) 10722	REF TO ASBY / OLD DWG
TITLE REACTOR OUTLET HEADER-H4 (FORGING)		DRAWING NO : 0-93-422-05308				REV 01

NOTE

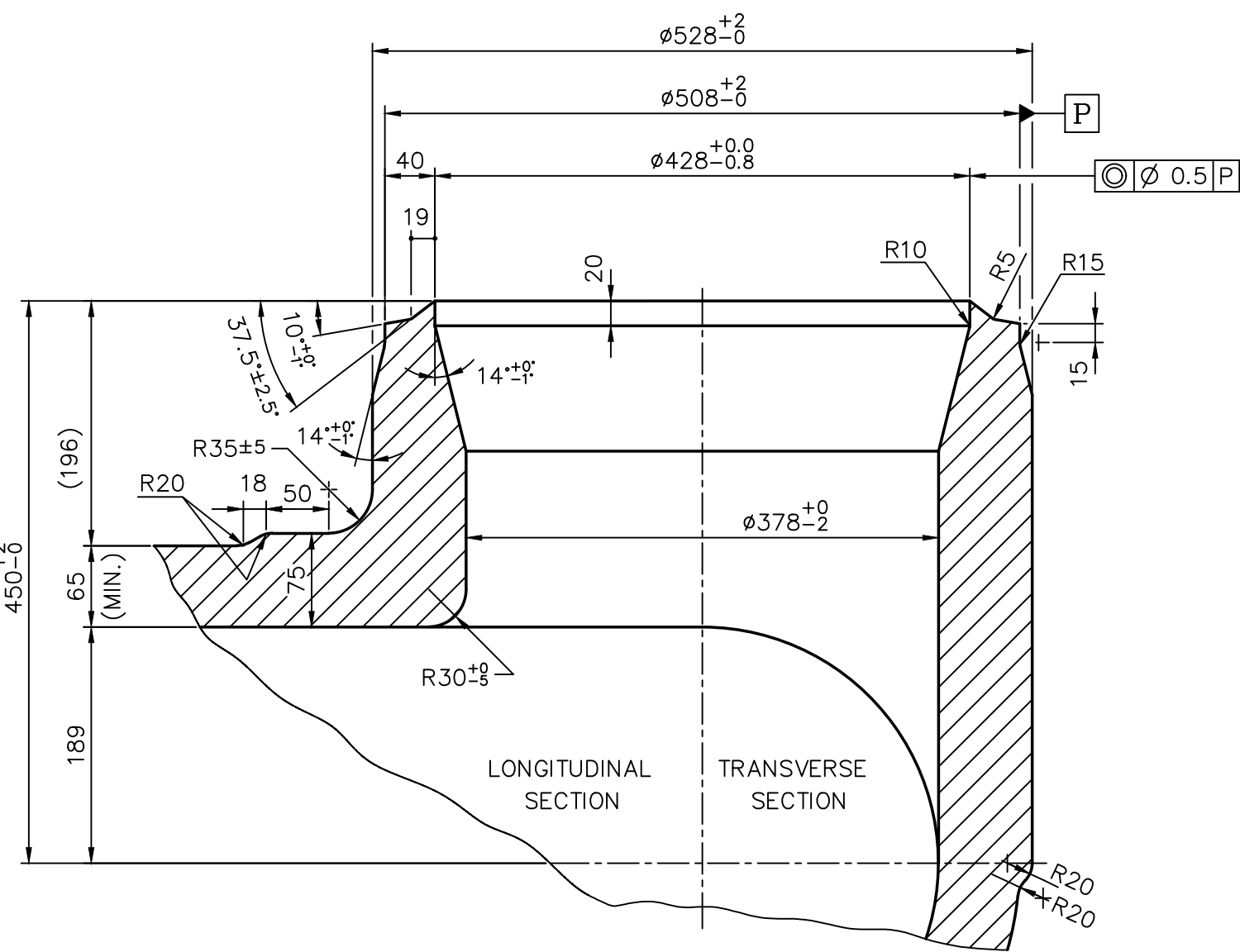
01. MATERIAL SPECIFICATION FOR THE HEADER FORGING IS SA350 GR LF2 CLASS-1 WITH SUPPLEMENTARY REQUIREMENTS ON CHEMICAL COMPOSITION AS GIVEN IN THE APPROVED TDC
02. FORGED HEADER MATERIAL, MANUFACTURING, TESTING, EXAMINATIONS AND PACKING SHALL BE IN ACCORDANCE WITH ASME SEC.III NB CL.1 AND AS PER APPROVED TDC
03. THE HEADER WITH INTEGRAL NOZZLES SHOWN IN THE DRAWING SHALL BE MANUFACTURED BY FORGING AND MACHINING OR COMBINATION OF SIMILAR OPERATIONS
04. HEADER IS TO BE FORGED AS SINGLE PIECE AND IT SHALL BE SUPPLIED IN NORMALISED CONDITION. WELD JOINTS ARE NOT PERMITTED TO FORM THE HEADER
05. HEADERS H1 TO H8 SHALL BE IN FULL COMPLIANCE WITH TDC, WITH THE FOLLOWING EXCEPTIONS AND ADDITIONAL REQUIREMENTS
 - 5.1 FULLY KILLED, FINE GRAINED STEEL PRODUCED BY VACUUM TREATMENT AND REFINED BY ELECTRO SLAG RE-MELTING SHALL BE USED, ADDITIONAL IMPURITY ELEMENTS RESTRICTION AS MENTIONED IN TDC SHALL APPLY
 - 5.2 REPRESENTATIVE NOZZLES SHALL BE SECTIONED AS GIVEN IN TDC AND SHALL BE EXAMINED FOR METAL FLOW, SOUNDNESS, REQUIRED CONTOURS AND REINFORCEMENT BY SUPPLIER. SAMPLE NOZZLES AND HEADER PIPE TEST SECTIONS FROM SAME PRODUCTION HEAT FOR PURCHASER'S USE SHALL BE SUPPLIED
 - 5.3 TEST COUPONS TAKEN FROM EACH HEADER SHALL BE SUBJECTED TO SIMULATED POST WELD HEAT TREATMENT AS PER THE APPROVED TDC
 - 5.4 ADDITIONAL FRACTURE TOUGHNESS REQUIREMENT SHALL BE AS PER THE APPROVED TDC
 - 5.5 ALL SPECIFIED MECHANICAL, METALLOGRAPHIC AND CHEMICAL ANALYSIS: TEST SPECIMENS LOCATION, ORIENTATION AND ACCEPTANCE SHALL BE AS PER THE APPROVED TDC
 - 5.6 SURFACE FINISH SHALL BE $\sqrt{3}$ MICRONS ALL OVER
 - 5.7 WALL THICKNESS SPECIFIED ARE MINIMUM VALUES
06. WHEREVER NOT SPECIFIED, THE BEST TOLERANCE ACHIEVABLE ON THE VARIOUS DIMENSIONS SHALL BE CLEARLY INDICATED BY THE SUPPLIER
07. SPECIAL REQUIREMENTS WHEN NOZZLE PROTRUSIONS ARE OBTAINED BY MACHINING
 - 7.1 SPECIMEN SHALL BE TAKEN FROM THE CORE OF THE LARGE AND SMALL NOZZLE AND FROM THE ADJACENT MATERIAL AS PER APPLICABLE TDC
 - 7.2 DETAILS AND EXTENT OF THE MECHANICAL TEST AND NDE SHALL BE AS PER APPLICABLE TDC
08. DETAILED DRAWING INDICATING VARIOUS STAGES OF MANUFACTURING SHALL BE SUBMITTED FOR APPROVAL
09. WELD EDGES AND MACHINED SURFACES SHALL BE SUBJECTED TO MT / PT AS PER APPROVED TDC
10. ALL MACHINED SURFACES AND WELD EDGES SHALL BE SUITABLY PROTECTED DURING TRANSPORTATION
11. AXIS MARKING SHALL BE DONE ON HEADER FORGING AS PER TDC
12. HEADERS SHALL BE PROPERLY PACKED AND COVERED IN WOODEN BOX STRENGTHENED WITH SUITABLE STEEL STRUCTURE
13. HEADER FORGING SHALL BE SUPPLIED IN FINISH MACHINED CONDITION
14. DETAILED FORGING DRAWING SHALL BE SUBMITTED BY SHOWING LOCATIONS OF THE TEST COUPONS
15. REFERENCE PLANE OF NOZZLE END 'RPNE' - THE PLANE PERPENDICULAR TO THE REFERENCE PLANE OF THE NOZZLE AXIS AND PARALLEL TO THE REFERENCE HEADER AXIS (HA) AT THE DISTANCE SHOWN IN THE DRAWING FROM REFERENCE HEADER AXIS 'HA'
16. SUITABLE PERMANENT MARKS SHALL BE MARKED ON THE EXTERNAL SURFACE OF HEADER FOR DEFINING 'HA'
17. TOLERANCE ON LENGTH DIMENSIONS ARE ±3mm UNLESS OTHERWISE SPECIFIED
18. TOLERANCE IF NOT SPECIFIED SHALL BE AS GIVEN BELOW FOR MACHINING
 - 0 TO 50 ±0.2
 - 50 TO ABOVE ±0.3
19. (") - BRACKETED DIMENSIONS ARE ONLY FOR REFERENCE



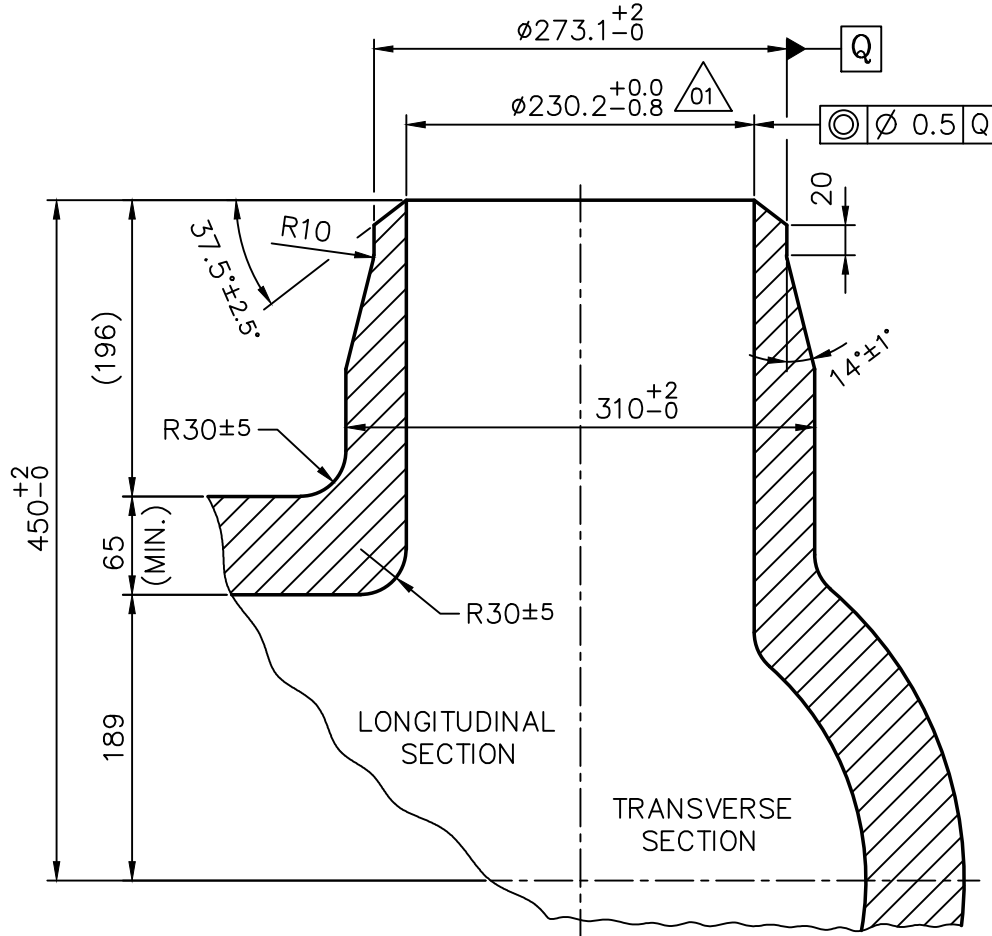
REACTOR OUTLET HEADER (ROH) - H5



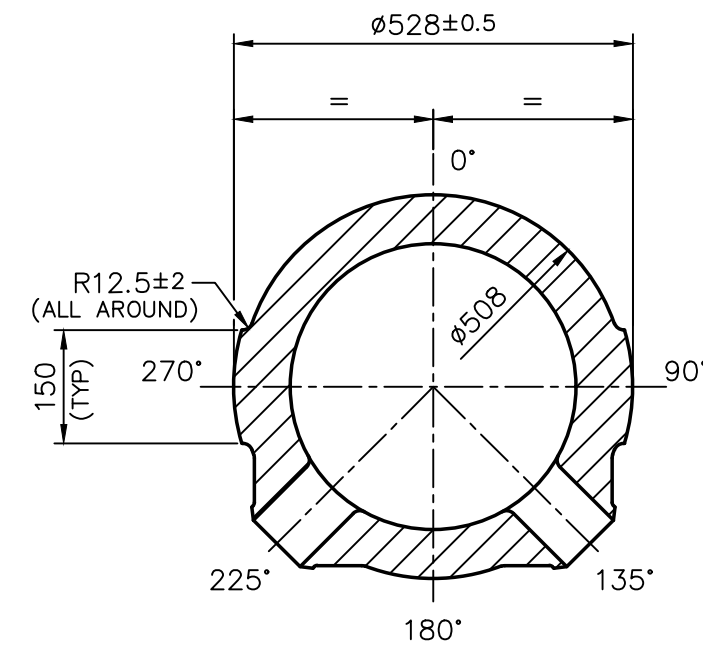
FEEDER PIPE NOZZLE DEVELOPED PLAN FOR (ROH) - H5



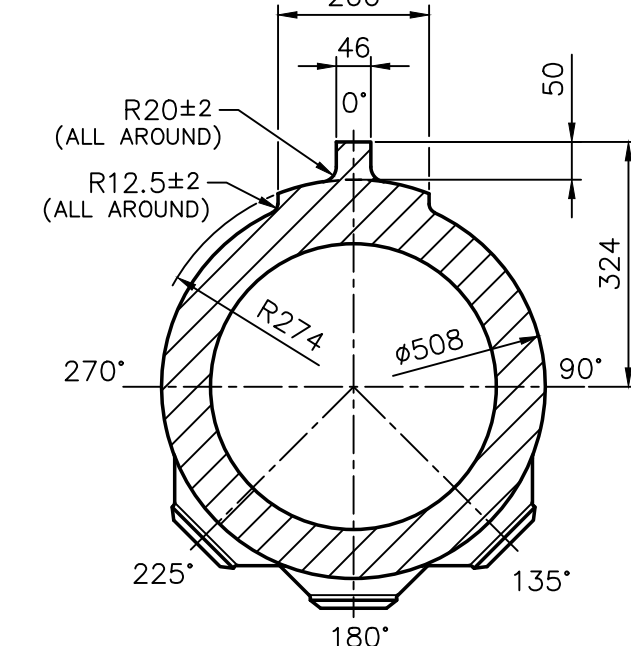
SECTION-AA
(500 NB)
(1:5)



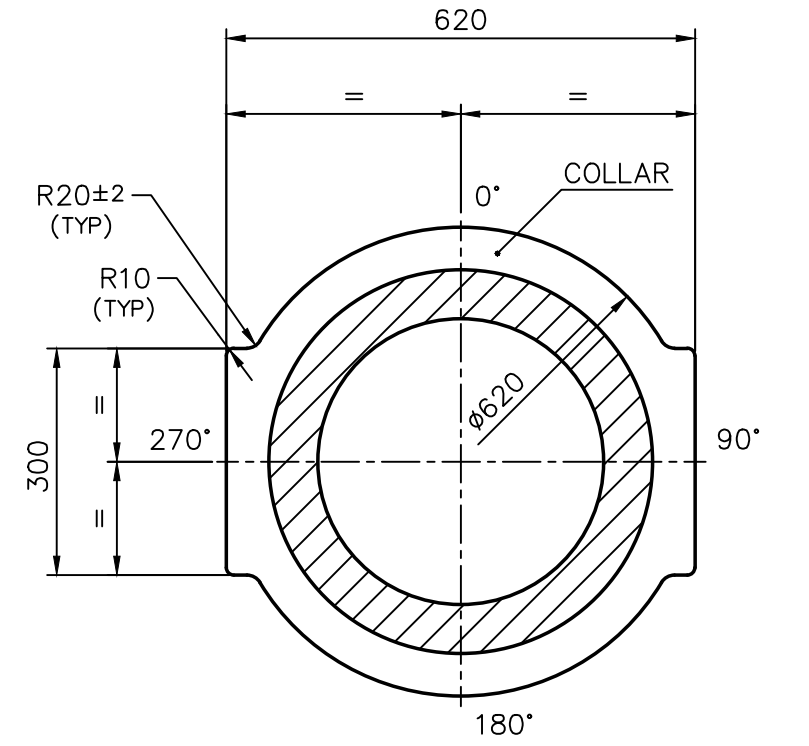
SECTION-BB
(250 NB)
(1:5)



SECTION-CC
(VIEW WITHOUT LARGE SIZE NOZZLE DETAILS)
(1:10)



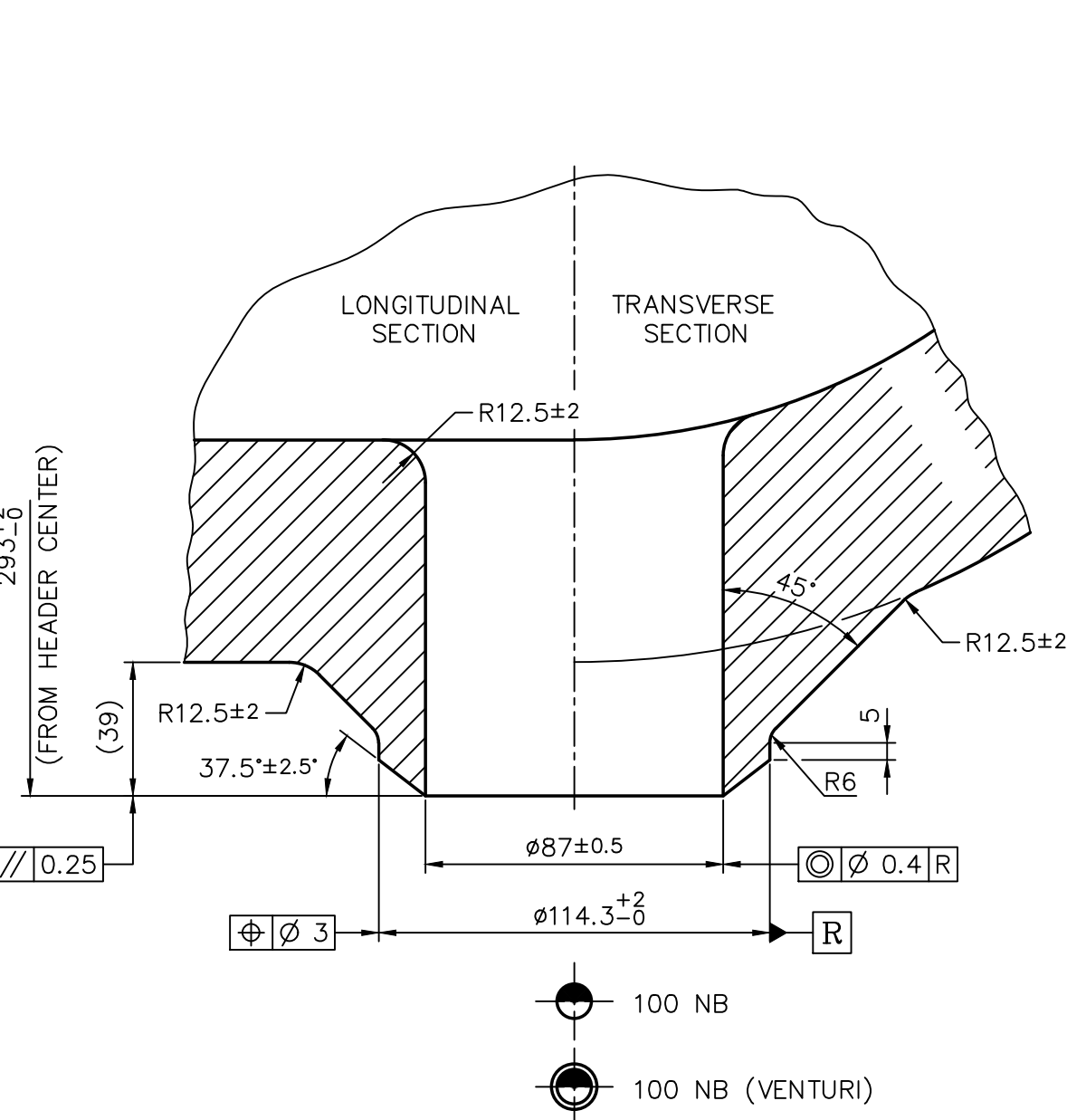
SECTION-DD
(VIEW WITHOUT LARGE SIZE NOZZLE DETAILS)
(1:10)



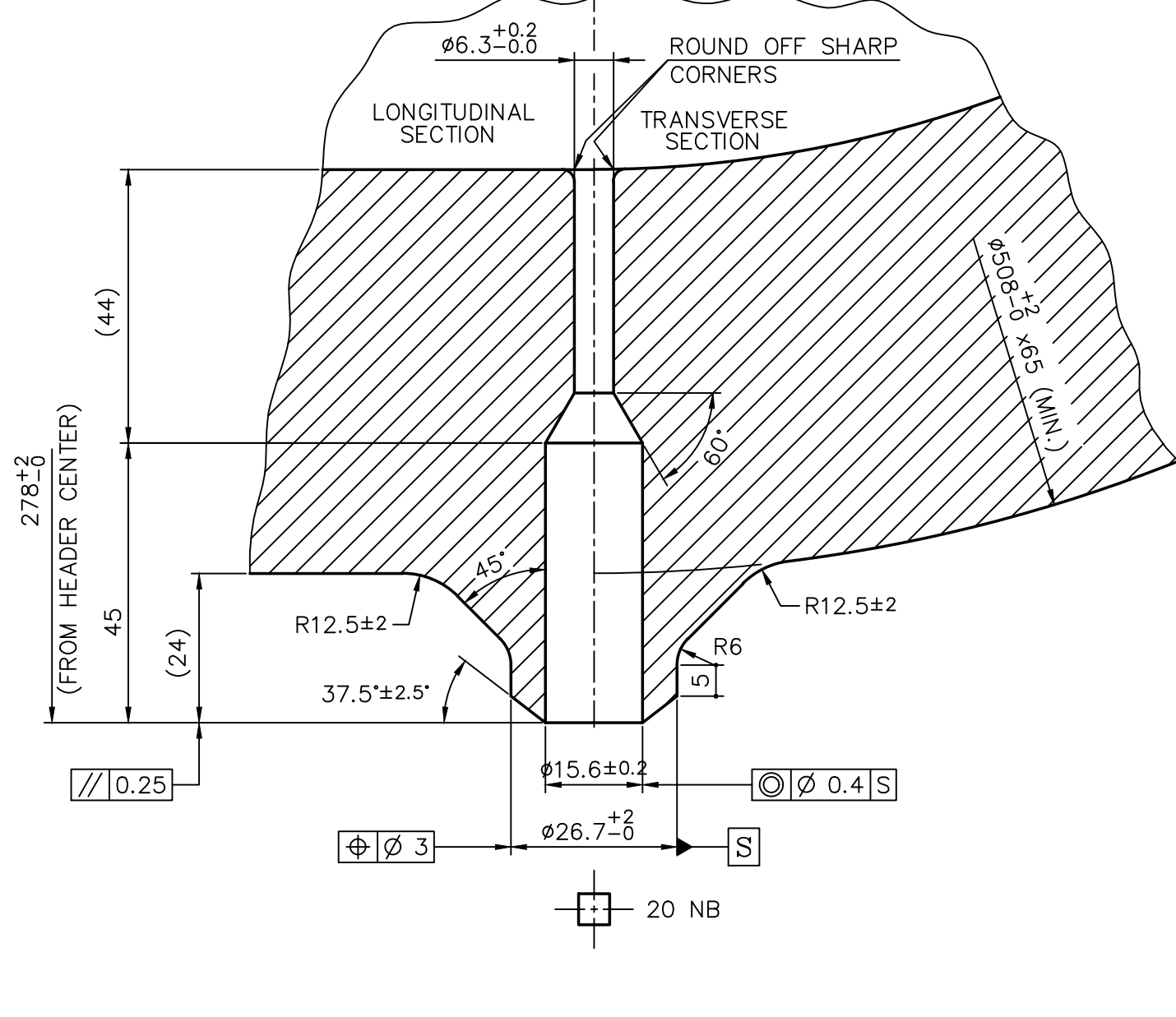
SECTION-EE
(VIEW WITHOUT NOZZLE AND FEEDERS DETAILS)
(1:10)

NOZZLE LEGEND & QUANTITY DETAILS

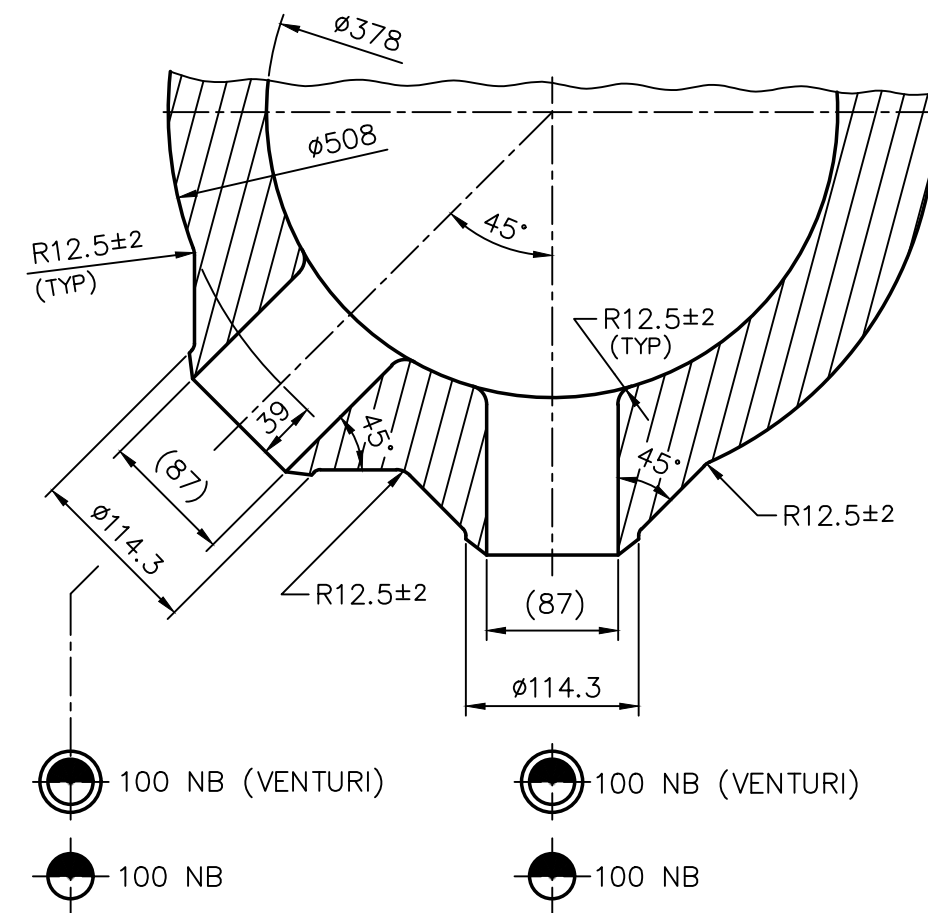
SYMBOL	NOZZLE DESCRIPTION	QUANTITY
	FEEDER PIPE NOZZLE 100NB	87
	FEEDER PIPE NOZZLE 100NB (VENTURI)	11
	INSTRUMENTATION NOZZLE 20NB	8
	250 NB SHUT DOWN COOLING INLET	1
	500 NB STEAM GENERATOR INLET	2



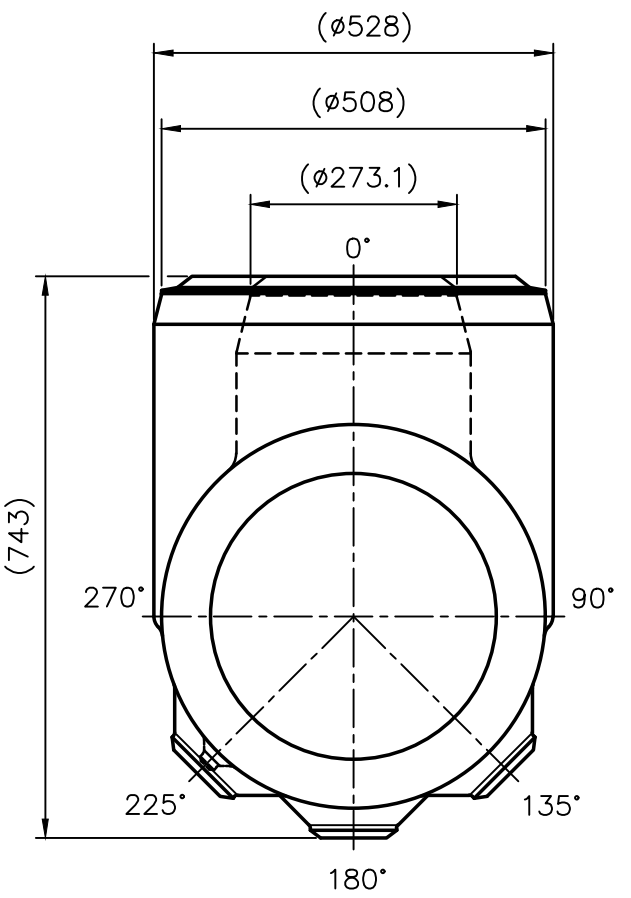
100 NB NOZZLE DETAILS
(1:2)



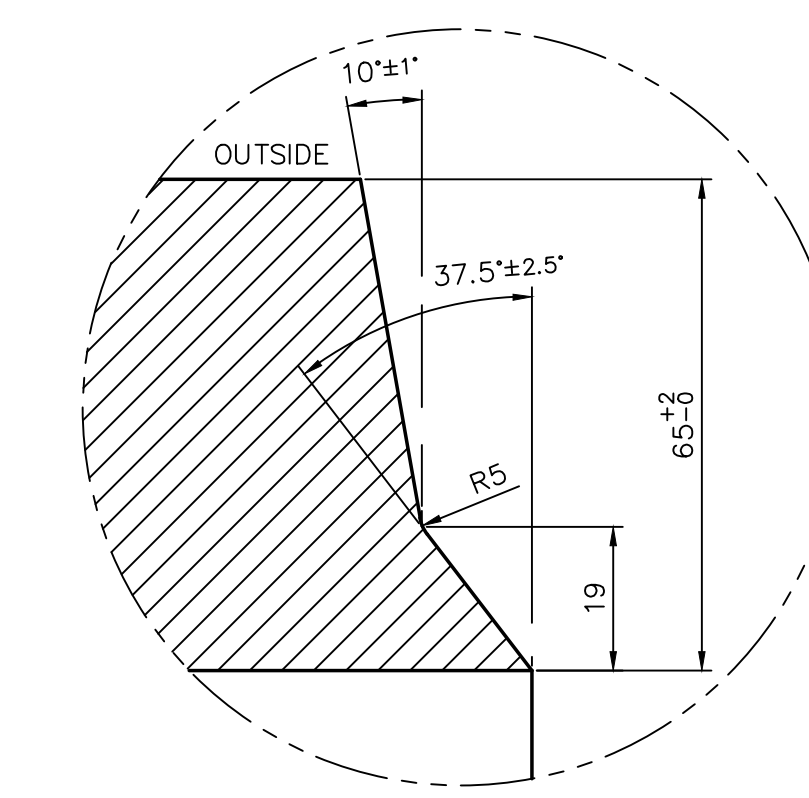
20 NB NOZZLE DETAILS
(1:1)



MERGING DETAILS
(MAJOR NOZZLES)
(1:5)



VIEW-X
(1:10)



DETAIL-1
(1:1)

REV	DATE	ALTERED	CHD&APPRD
01	13.01.21	CHD&APPRD	

TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)		TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700MWc REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer DWG.No. 700PLET/33117/2001, 2002 & 2005/DD)	
0.5 TO 3	±0.1	400 TO 1000	±0.8	0 TO 10	±1°
3 TO 6	±0.1	1000 TO 2000	±1.2	10 TO 50	±30'
6 TO 30	±0.2	2000 TO 4000	±2.0	50 TO 120	±20'
30 TO 120	±0.3	-	120 TO 400	±10'	-
120 TO 400	±0.5	-	OVER 400	±5'	-

DEPT	NC	SCALE	WEIGHT (Kg)	REF TO ASBY / OLD DWG	ITEM NO	NO OF ITEMS
150	C/M/P	1:20	10722			

TITLE	DRAWING NO :	DATE	NO OF
REACTOR OUTLET HEADER-H5 (FORGING)	0-93-422-05309	14.12.20	1

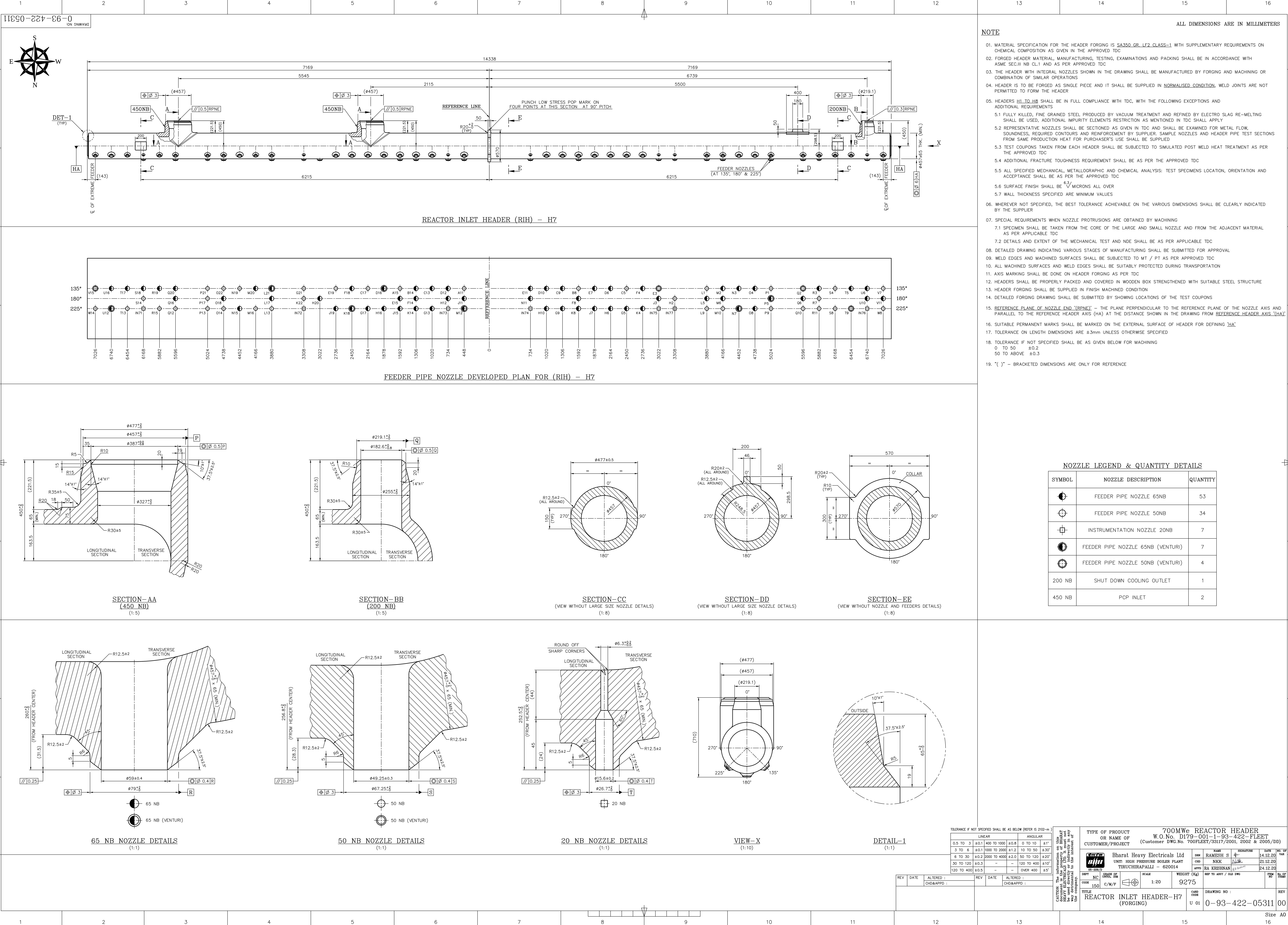
NAME	SIGNATURE	DATE	NO OF
RAMDISH S		14.12.20	1

CHKD	APPD	DATE	NO OF
KKK	RA KRISHNAN	21.12.20	1

ITEM NO	NO OF ITEMS
U 01	1

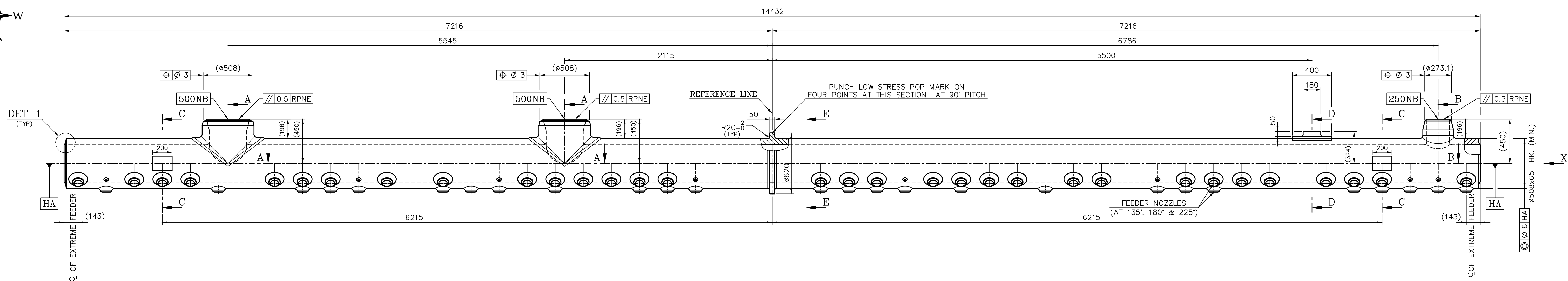
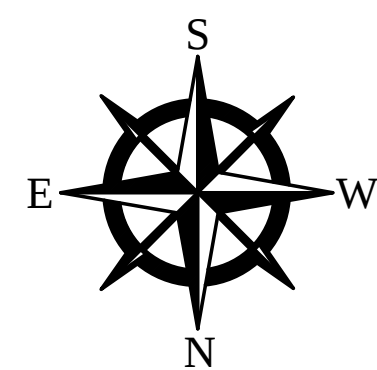
NOTE

- MATERIAL SPECIFICATION FOR THE HEADER FORGING IS SA350 GR LF2 CLASS-1 WITH SUPPLEMENTARY REQUIREMENTS ON CHEMICAL COMPOSITION AS GIVEN IN THE APPROVED TDC
- FORGED HEADER MATERIAL, MANUFACTURING, TESTING, EXAMINATIONS AND PACKING SHALL BE IN ACCORDANCE WITH ASME SEC.III NB CL.1 AND AS PER APPROVED TDC
- THE HEADER WITH INTEGRAL NOZZLES SHOWN IN THE DRAWING SHALL BE MANUFACTURED BY FORGING AND MACHINING OR COMBINATION OF SIMILAR OPERATIONS
- HEADER IS TO BE FORGED AS SINGLE PIECE AND IT SHALL BE SUPPLIED IN NORMALISED CONDITION. WELD JOINTS ARE NOT PERMITTED TO FORM THE HEADER
- HEADERS H1 TO H8 SHALL BE IN FULL COMPLIANCE WITH TDC, WITH THE FOLLOWING EXCEPTIONS AND ADDITIONAL REQUIREMENTS
 - FULLY KILLED, FINE GRAINED STEEL PRODUCED BY VACUUM TREATMENT AND REFINED BY ELECTRO SLAG RE-MELTING SHALL BE USED, ADDITIONAL IMPURITY ELEMENTS RESTRICTION AS MENTIONED IN TDC SHALL APPLY
 - REPRESENTATIVE NOZZLES SHALL BE SECTIONED AS GIVEN IN TDC AND SHALL BE EXAMINED FOR METAL FLOW, SOUNDNESS, REQUIRED CONTOURS AND REINFORCEMENT BY SUPPLIER. SAMPLE NOZZLES AND HEADER PIPE TEST SECTIONS FROM SAME PRODUCTION HEAT FOR PURCHASER'S USE SHALL BE SUPPLIED
 - TEST COUPONS TAKEN FROM EACH HEADER SHALL BE SUBJECTED TO SIMULATED POST WELD HEAT TREATMENT AS PER THE APPROVED TDC
 - ADDITIONAL FRACTURE TOUGHNESS REQUIREMENT SHALL BE AS PER THE APPROVED TDC
 - ALL SPECIFIED MECHANICAL, METALLOGRAPHIC AND CHEMICAL ANALYSIS: TEST SPECIMENS LOCATION, ORIENTATION AND ACCEPTANCE SHALL BE AS PER THE APPROVED TDC
 - SURFACE FINISH SHALL BE $\sqrt{3}$ MICRONS ALL OVER
 - WALL THICKNESS SPECIFIED ARE MINIMUM VALUES
- WHEREVER NOT SPECIFIED, THE BEST TOLERANCE ACHIEVABLE ON THE VARIOUS DIMENSIONS SHALL BE CLEARLY INDICATED BY THE SUPPLIER
- SPECIAL REQUIREMENTS WHEN NOZZLE PROTRUSIONS ARE OBTAINED BY MACHINING
 - SPECIMEN SHALL BE TAKEN FROM THE CORE OF THE LARGE AND SMALL NOZZLE AND FROM THE ADJACENT MATERIAL AS PER APPLICABLE TDC
 - DETAILS AND EXTENT OF THE MECHANICAL TEST AND NDE SHALL BE AS PER APPLICABLE TDC
- DETAILED DRAWING INDICATING VARIOUS STAGES OF MANUFACTURING SHALL BE SUBMITTED FOR APPROVAL
- WELD EDGES AND MACHINED SURFACES SHALL BE SUBJECTED TO MT / PT AS PER APPROVED TDC
- ALL MACHINED SURFACES AND WELD EDGES SHALL BE SUITABLY PROTECTED DURING TRANSPORTATION
- AXIS MARKING SHALL BE DONE ON HEADER FORGING AS PER TDC
- HEADERS SHALL BE PROPERLY PACKED AND COVERED IN WOODEN BOX STRENGTHENED WITH SUITABLE STEEL STRUCTURE
- HEADER FORGING SHALL BE SUPPLIED IN FINISH MACHINED CONDITION
- DETAILED FORGING DRAWING SHALL BE SUBMITTED BY SHOWING LOCATIONS OF THE TEST COUPONS
- REFERENCE PLANE OF NOZZLE END 'RPN' - THE PLANE PERPENDICULAR TO THE REFERENCE PLANE OF THE NOZZLE AXIS AND PARALLEL TO THE REFERENCE HEADER AXIS (HA) AT THE DISTANCE SHOWN IN THE DRAWING FROM REFERENCE HEADER AXIS 'HA'
- SUITABLE PERMANENT MARKS SHALL BE MARKED ON THE EXTERNAL SURFACE OF HEADER FOR DEFINING 'HA'
- TOLERANCE ON LENGTH DIMENSIONS ARE ±3mm UNLESS OTHERWISE SPECIFIED
- TOLERANCE IF NOT SPECIFIED SHALL BE AS GIVEN BELOW FOR MACHINING
 - 0 TO 50 ±0.2
 - 50 TO ABOVE ±0.3
- '(')' - BRACKETED DIMENSIONS ARE ONLY FOR REFERENCE

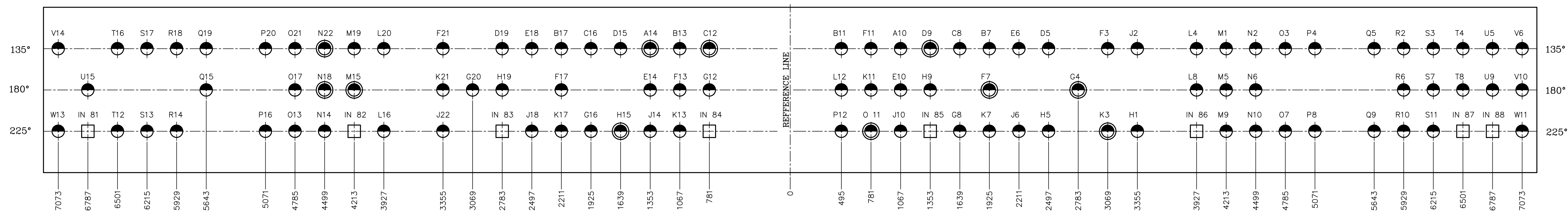


NOTE

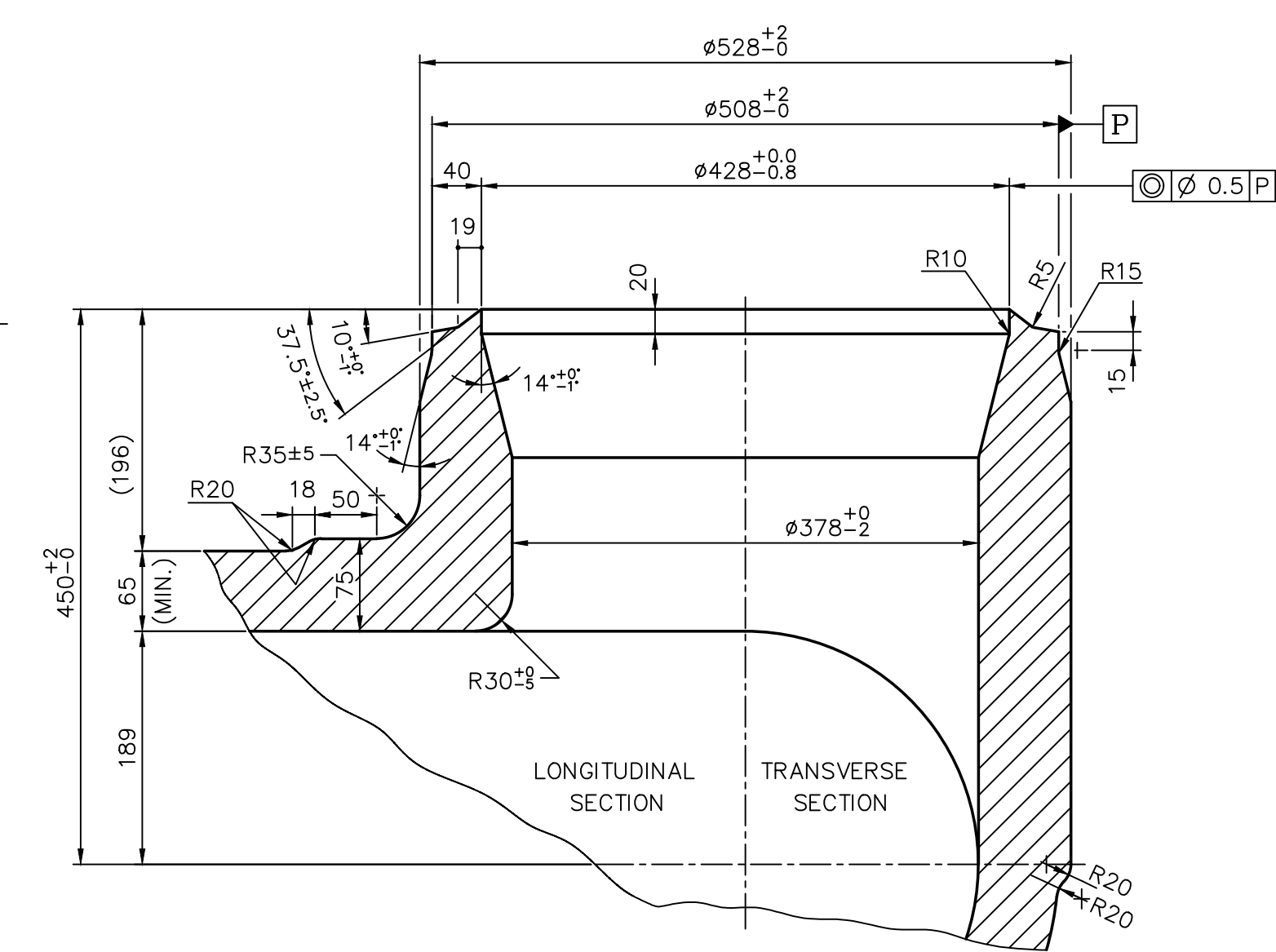
- ALL DIMENSIONS ARE IN MILLIMETERS
- MATERIAL SPECIFICATION FOR THE HEADER FORGING IS SA350 GR. LF2 CLASS-1 WITH SUPPLEMENTARY REQUIREMENTS ON CHEMICAL COMPOSITION AS GIVEN IN THE APPROVED TDC
 - FORGED HEADER MATERIAL, MANUFACTURING, TESTING, EXAMINATIONS AND PACKING SHALL BE IN ACCORDANCE WITH ASME SEC.III NB CL.1 AND AS PER APPROVED TDC
 - THE HEADER WITH INTEGRAL NOZZLES SHOWN IN THE DRAWING SHALL BE MANUFACTURED BY FORGING AND MACHINING OR COMBINATION OF SIMILAR OPERATIONS
 - HEADER IS TO BE FORGED AS SINGLE PIECE AND IT SHALL BE SUPPLIED IN NORMALISED CONDITION. WELD JOINTS ARE NOT PERMITTED TO FORM THE HEADER
 - HEADERS H1 TO H8 SHALL BE IN FULL COMPLIANCE WITH TDC, WITH THE FOLLOWING EXCEPTIONS AND ADDITIONAL REQUIREMENTS
 - FULLY KILLED, FINE GRAINED STEEL PRODUCED BY VACUUM TREATMENT AND REFINED BY ELECTRO SLAG RE-MELTING SHALL BE USED, ADDITIONAL IMPURITY ELEMENTS RESTRICTION AS MENTIONED IN TDC SHALL APPLY
 - REPRESENTATIVE NOZZLES SHALL BE SECTIONED AS GIVEN IN TDC AND SHALL BE EXAMINED FOR METAL FLOW, SOUNDNESS, REQUIRED CONTOURS AND REINFORCEMENT BY SUPPLIER. SAMPLE NOZZLES AND HEADER PIPE TEST SECTIONS FROM SAME PRODUCTION HEAT FOR PURCHASER'S USE SHALL BE SUPPLIED
 - TEST COUPONS TAKEN FROM EACH HEADER SHALL BE SUBJECTED TO SIMULATED POST WELD HEAT TREATMENT AS PER THE APPROVED TDC
 - ADDITIONAL FRACTURE TOUGHNESS REQUIREMENT SHALL BE AS PER THE APPROVED TDC
 - ALL SPECIFIED MECHANICAL, METALLOGRAPHIC AND CHEMICAL ANALYSIS: TEST SPECIMENS LOCATION, ORIENTATION AND ACCEPTANCE SHALL BE AS PER THE APPROVED TDC
 - SURFACE FINISH SHALL BE $\sqrt{3}$ MICRONS ALL OVER
 - WALL THICKNESS SPECIFIED ARE MINIMUM VALUES
 - WHEREVER NOT SPECIFIED, THE BEST TOLERANCE ACHIEVABLE ON THE VARIOUS DIMENSIONS SHALL BE CLEARLY INDICATED BY THE SUPPLIER
 - SPECIAL REQUIREMENTS WHEN NOZZLE PROTRUSIONS ARE OBTAINED BY MACHINING
 - SPECIMEN SHALL BE TAKEN FROM THE CORE OF THE LARGE AND SMALL NOZZLE AND FROM THE ADJACENT MATERIAL AS PER APPLICABLE TDC
 - DETAILS AND EXTENT OF THE MECHANICAL TEST AND NDE SHALL BE AS PER APPLICABLE TDC
 - DETAILED DRAWING INDICATING VARIOUS STAGES OF MANUFACTURING SHALL BE SUBMITTED FOR APPROVAL
 - WELD EDGES AND MACHINED SURFACES SHALL BE SUBJECTED TO MT / PT AS PER APPROVED TDC
 - ALL MACHINED SURFACES AND WELD EDGES SHALL BE SUITABLY PROTECTED DURING TRANSPORTATION
 - AXIS MARKING SHALL BE DONE ON HEADER FORGING AS PER TDC
 - HEADERS SHALL BE PROPERLY PACKED AND COVERED IN WOODEN BOX STRENGTHENED WITH SUITABLE STEEL STRUCTURE
 - HEADER FORGING SHALL BE SUPPLIED IN FINISH MACHINED CONDITION
 - DETAILED FORGING DRAWING SHALL BE SUBMITTED BY SHOWING LOCATIONS OF THE TEST COUPONS
 - REFERENCE PLANE OF NOZZLE END 'RPNE' - THE PLANE PERPENDICULAR TO THE REFERENCE PLANE OF THE NOZZLE AXIS AND PARALLEL TO THE REFERENCE HEADER AXIS (HA) AT THE DISTANCE SHOWN IN THE DRAWING FROM REFERENCE HEADER AXIS 'HA'
 - SUITABLE PERMANENT MARKS SHALL BE MARKED ON THE EXTERNAL SURFACE OF HEADER FOR DEFINING 'HA'
 - TOLERANCE ON LENGTH DIMENSIONS ARE ± 3 mm UNLESS OTHERWISE SPECIFIED
 - TOLERANCE IF NOT SPECIFIED SHALL BE AS GIVEN BELOW FOR MACHINING
 - 0 TO 50 ± 0.2
 - 50 TO ABOVE ± 0.3
 - '(')' - BRACKETED DIMENSIONS ARE ONLY FOR REFERENCE



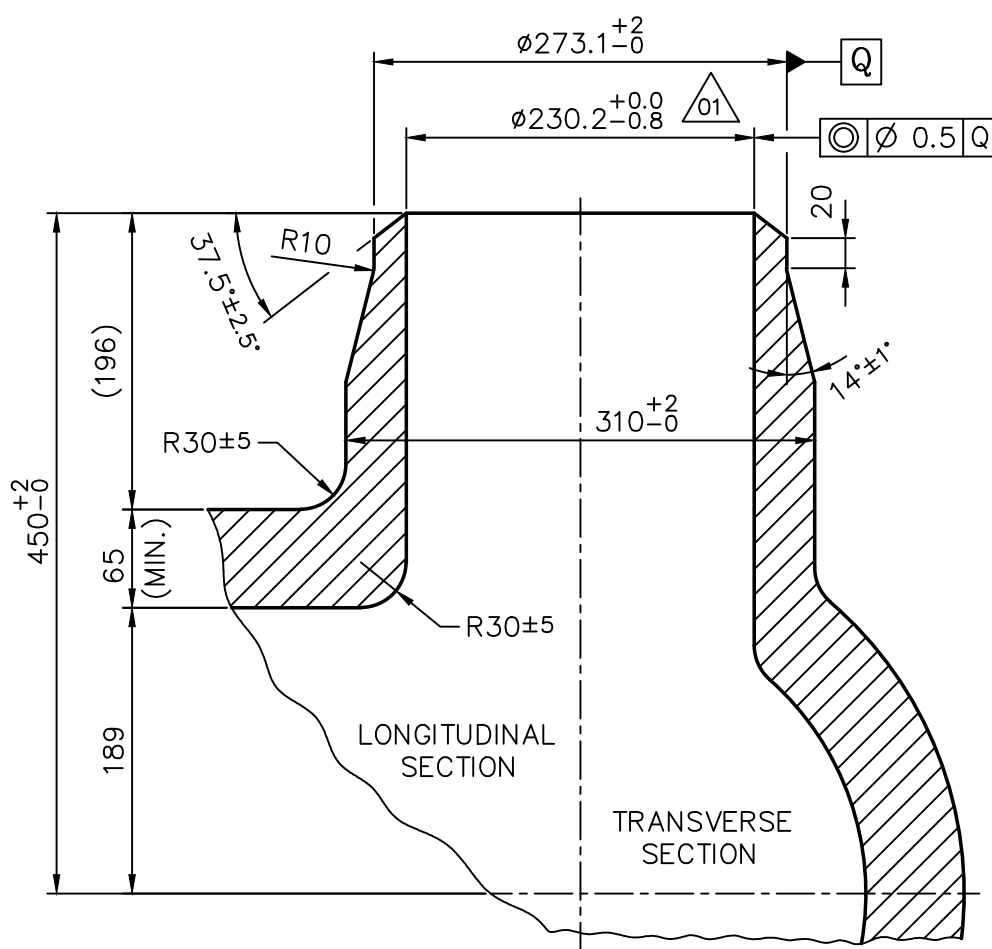
REACTOR OUTLET HEADER (ROH) – H8



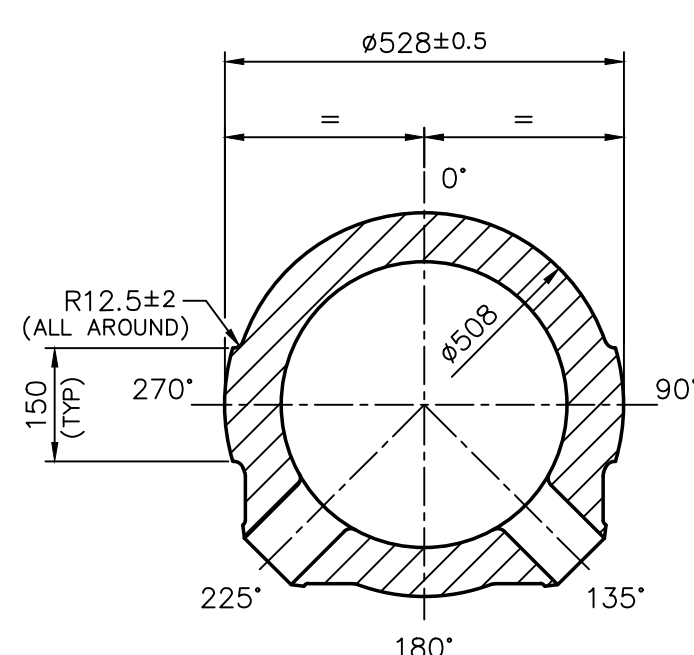
FEEDER PIPE NOZZLE DEVELOPED PLAN FOR (ROH) – H8



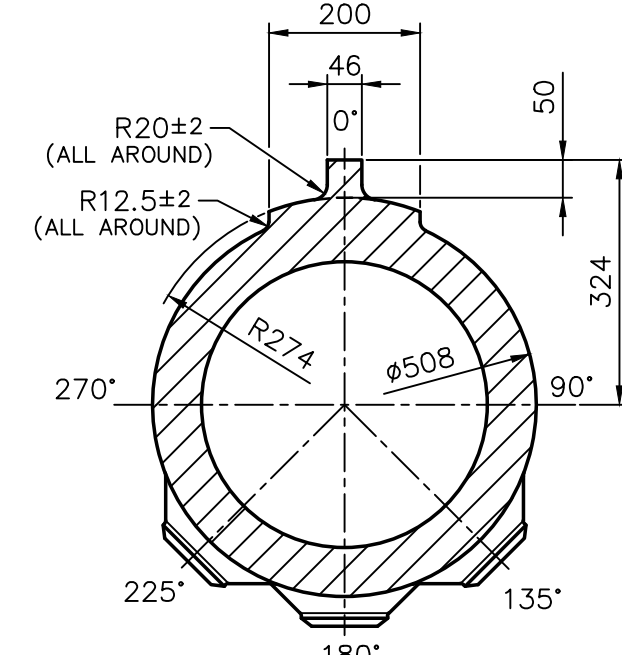
SECTION-AA
(500 NB)
(1:5)



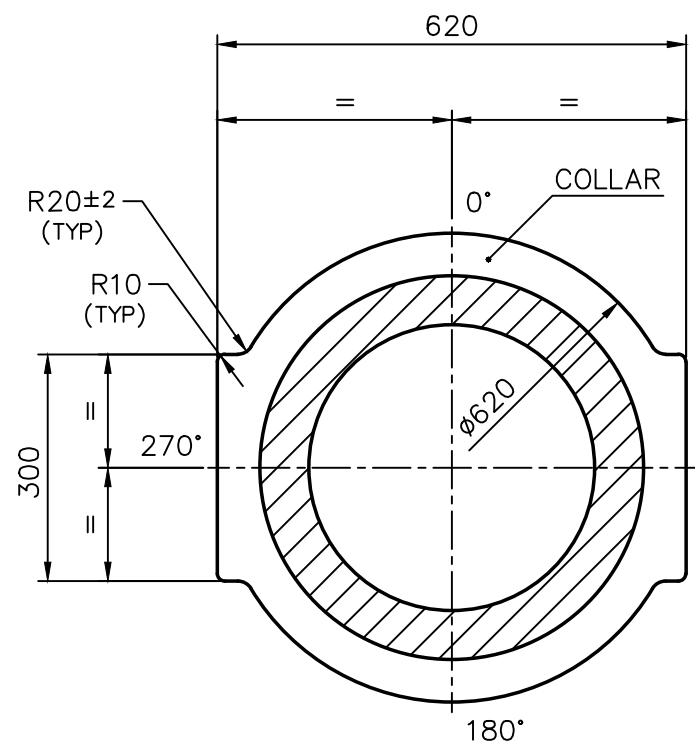
SECTION-BB
(250 NB)
(1:5)



SECTION-CC
(VIEW WITHOUT LARGE SIZE NOZZLE DETAILS)
(1:10)



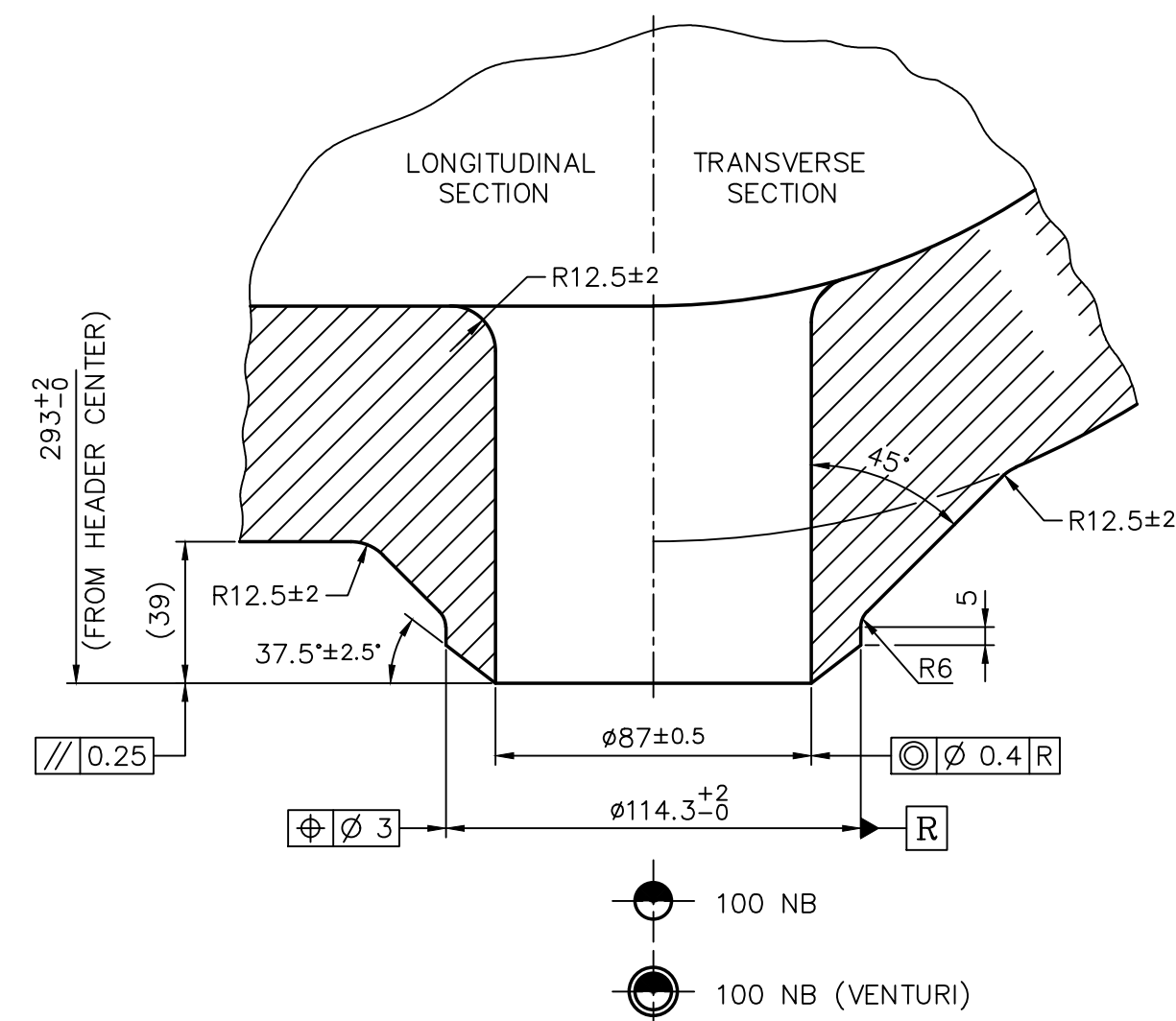
SECTION-DD
(VIEW WITHOUT LARGE SIZE NOZZLE DETAILS)
(1:10)



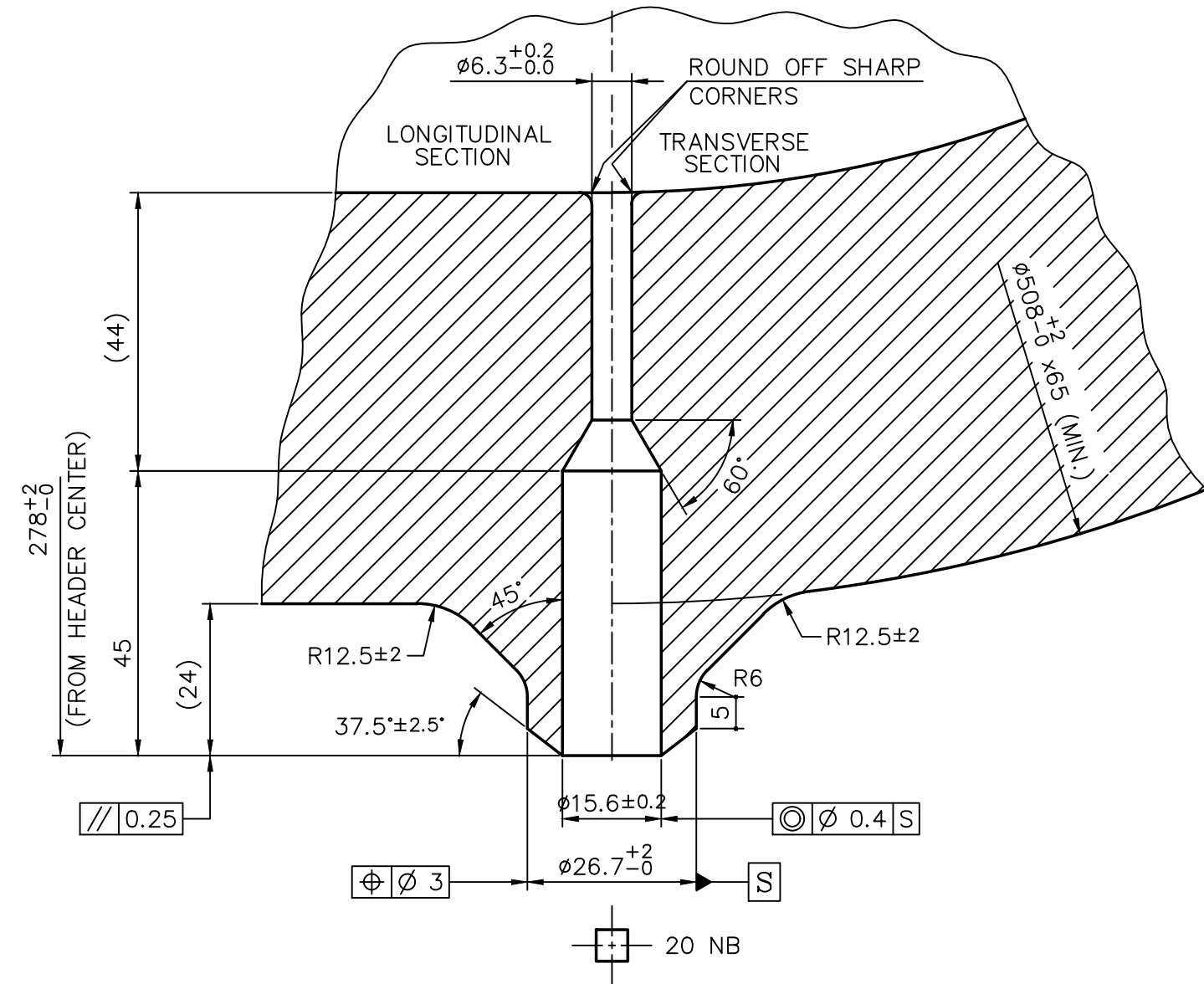
SECTION-EE
(VIEW WITHOUT NOZZLE AND FEEDERS DETAILS)
(1:10)

NOZZLE LEGEND & QUANTITY DETAILS

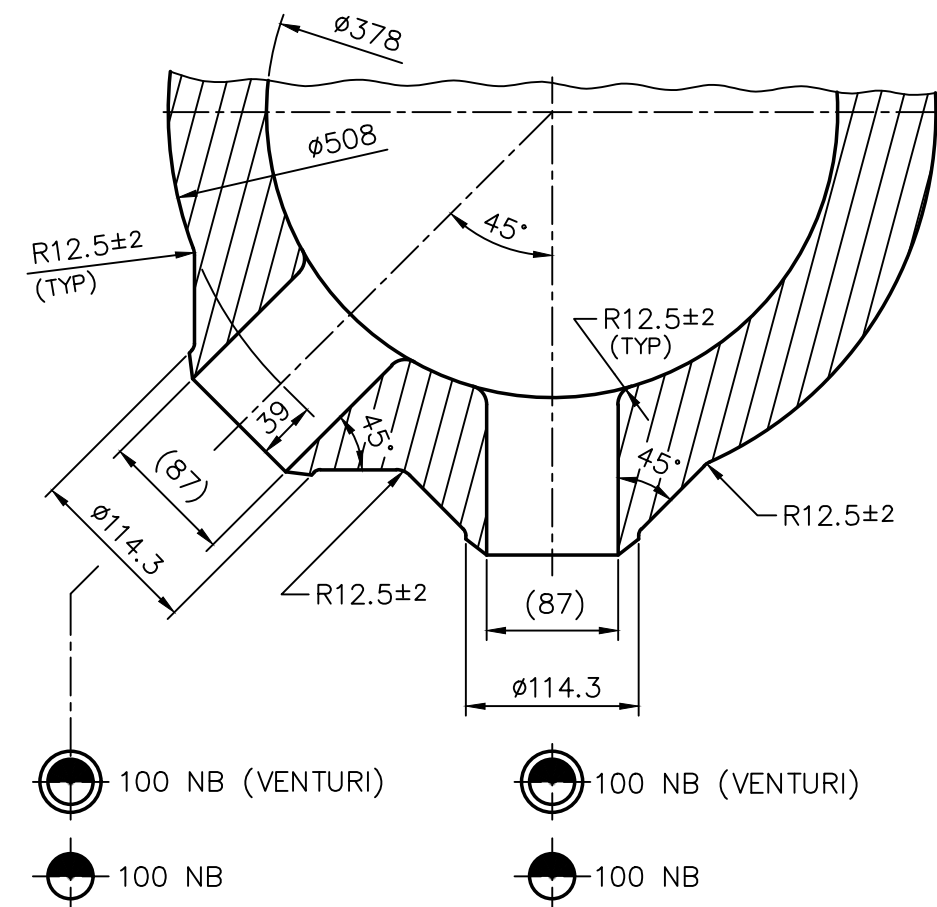
SYMBOL	NOZZLE DESCRIPTION	QUANTITY
	FEEDER PIPE NOZZLE 100NB	87
	FEEDER PIPE NOZZLE 100NB (VENTURI)	11
	INSTRUMENTATION NOZZLE 20NB	8
250 NB	SHUT DOWN COOLING INLET	1
500 NB	STEAM GENERATOR INLET	2



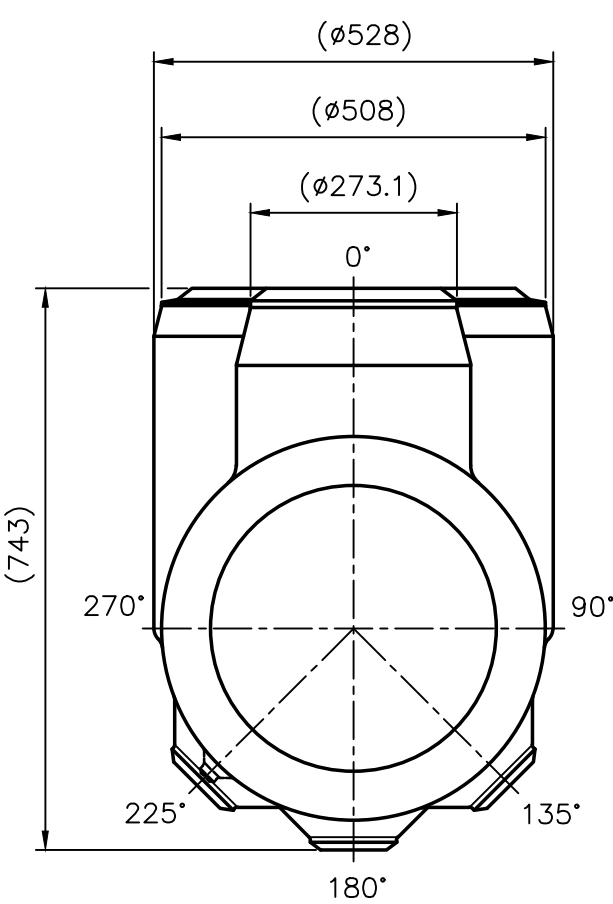
100 NB NOZZLE DETAILS
(1:2)



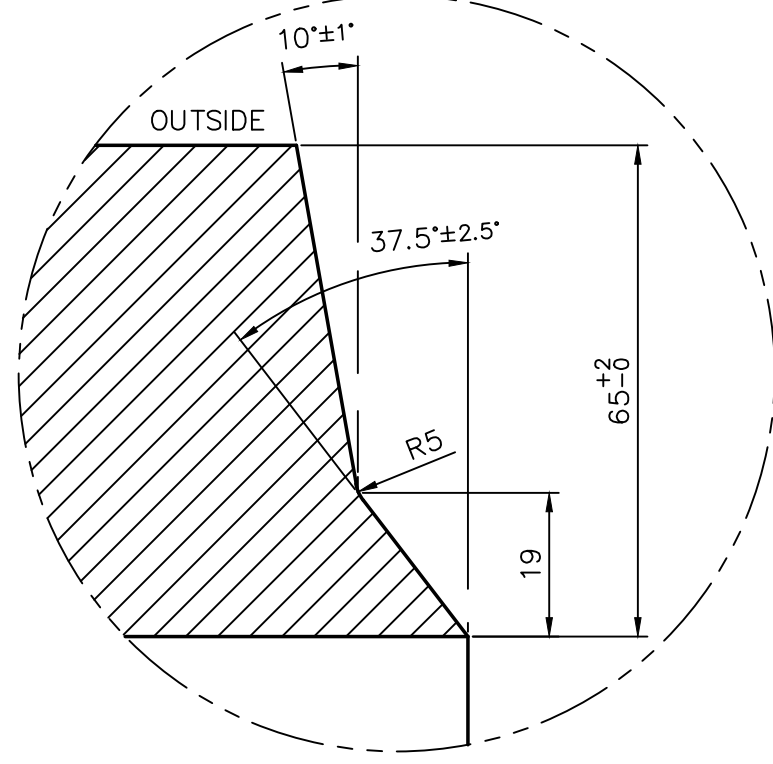
20 NB NOZZLE DETAILS
(1:1)



MERGING DETAILS
(MAJOR NOZZLES)
(1:5)



VIEW—
(1:10)



DETAIL-1
(1:1)

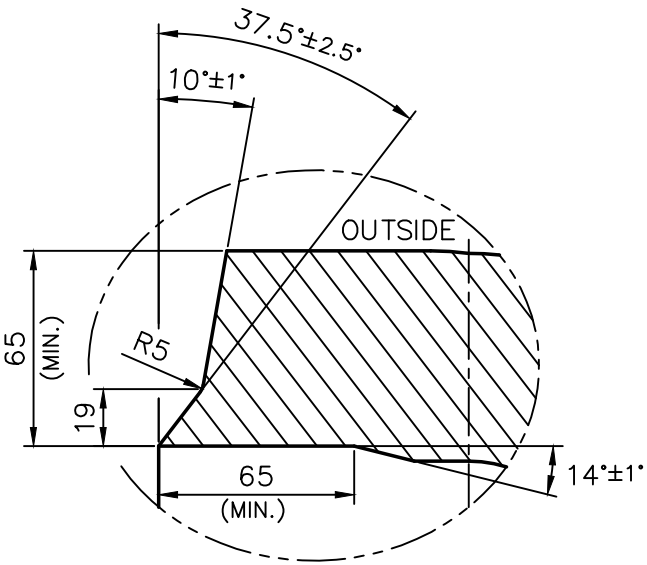
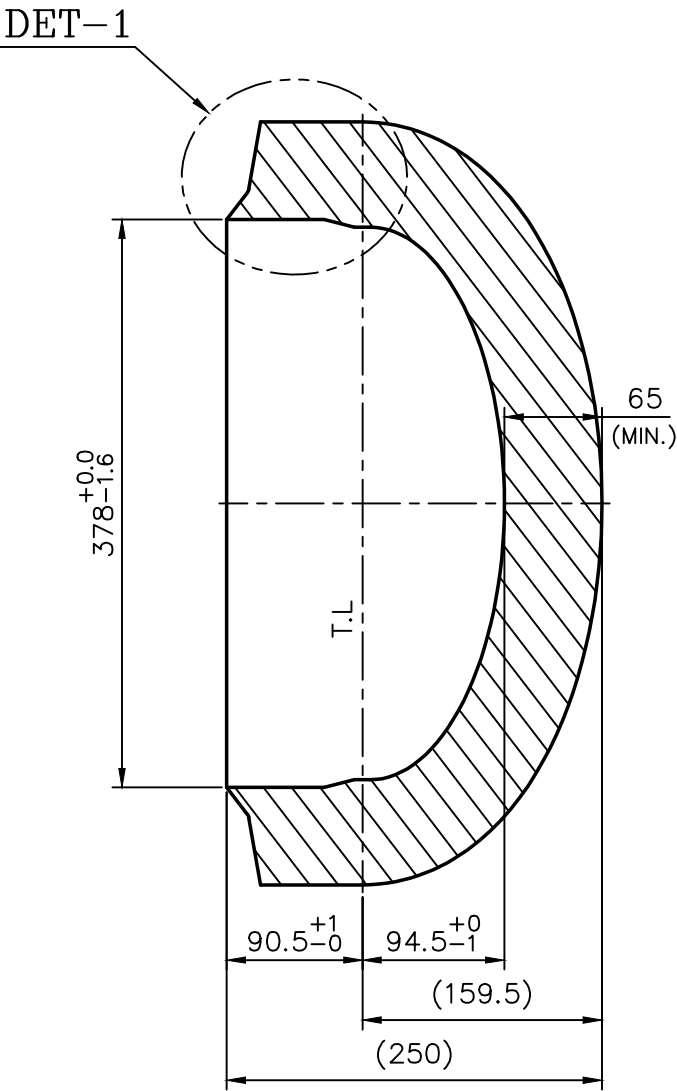
TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)					
LINEAR			ANGULAR		
0.5 TO 3	±0.1	400 TO 1000	±0.8	0 TO 10	±1°
3 TO 6	±0.1	1000 TO 2000	±1.2	10 TO 50	±30'
6 TO 10	±0.2	2000 TO 4000	±2.0	50 TO 120	±20°
30 TO 120	±0.3	—	—	120 TO 400	±10°
120 TO 400	±0.5	—	—	OVER 400	±5°

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700WME REACTOR HEADER W.O. No. D179-001-1-93-422-PLEET (Customer DWG.No. 700FLEET/33117/2001, 2002 & 2005/DD)					
 BHARAT HEAVY ELECTRICALS LTD. 05-225/D	Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPPALLI - 620014		RAMESH NKK RKN		SIGNATURE 	DATE 14.12.20 21.12.20 24.12.20	No. of V/s
	CSD		RAMESH S			14.12.20	
	DRD		NKK			21.12.20	
	APFD		KRISHN			24.12.20	

NOTE

01. MATERIAL SPECIFICATION FOR THE FORGING IS SA-350 Gr.LF2 CLASS-1 WITH SUPPLEMENTARY REQUIREMENT ON CHEMICAL COMPOSITION AS GIVEN IN THE APPROVED TDC
02. DISHED END MATERIAL, MANUFACTURING, EXAMINATION AND PACKING SHALL BE IN ACCORDANCE WITH ASME SEC.III NB CLASS-1 AND AS PER APPROVED TDC
03. DISHED END SHALL BE SUPPLIED IN FINISH MACHINED CONDITION
04. SURFACE FINISH SHALL BE $\sqrt{6.3}$ MICRONS ALL OVER
05. DETAILED DRAWING INDICATING VARIOUS STAGES OF MANUFACTURE SHALL BE SUBMITTED FOR APPROVAL
06. WALL THICKNESS INDICATED ARE SPECIFIED IN MINIMUM VALUES
07. TEST COUPONS REQUIRED SHALL BE MADE FROM SAME MELT AND HEAT TREATMENT BATCH AS SPECIFIED IN THE SPECIFICATION / TDC
08. DISHED END AND WELD EDGES SHALL BE PROPERLY PROTECTED DURING TRANSPORTATION
09. BRACKETED "()" DIMENSIONS ARE FOR REFERENCE ONLY
10. NO REPAIR BY WELDING SHALL BE PERMITTED ON DISHED END
11. APPROXIMATE FINISHED WEIGHT : 171 kg



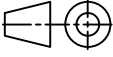
DETAIL-1
(1:2.5)

TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)

LINEAR				ANGULAR	
0.5 TO 3	±0.1	400 TO 1000	±0.8	0 TO 10	±1°
3 TO 6	±0.1	1000 TO 2000	±1.2	10 TO 50	±30'
6 TO 30	±0.2	2000 TO 4000	±2.0	50 TO 120	±20'
30 TO 120	±0.3	-	-	120 TO 400	±10'
120 TO 400	±0.5	-	-	OVER 400	±5'

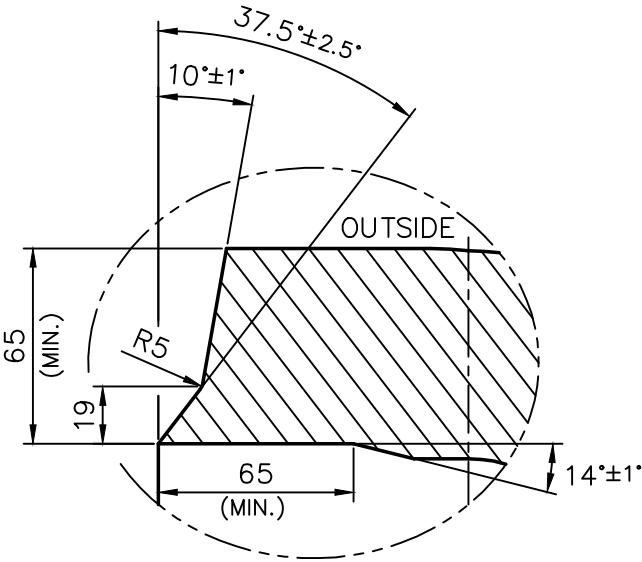
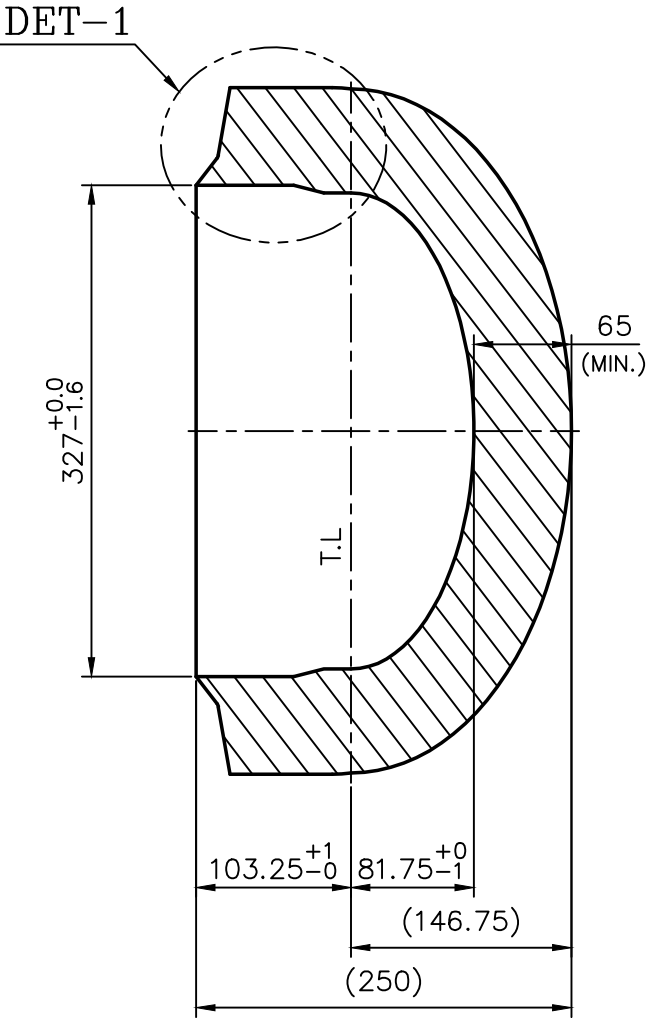
REV	DATE	ALTERED :
		CHD&APPD :

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700 MWe REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer Drg. 700FLEET/33117/2003 & 2005/DD)					
 05-229/D	Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI - 620014		DRN	NAME RAMESH S	SIGNATURE 	DATE 14.12.20	NO. OF VAR
			CHD	NITHIN		21.12.20	
			APPD	RA KRISHNAN		24.12.20	
DEPT NC	GRADE OF UNTOL. DIM	SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG		ITEM NO	No OF ITEMS
CODE 150	C/M/F	 1:5					
TITLE DISHED END FORGING (REACTOR OUTLET HEADER) (2:1 ELLIPSOIDAL)			CARD CODE U 01	DRAWING NO : 3-93-422-05457		REV 00	

NOTE

- 01. MATERIAL SPECIFICATION FOR THE FORGING IS SA-350 Gr.LF2 CLASS-1 WITH SUPPLEMENTARY REQUIREMENT ON CHEMICAL COMPOSITION AS GIVEN IN THE APPROVED TDC
- 02. DISHED END MATERIAL, MANUFACTURING, EXAMINATION AND PACKING SHALL BE IN ACCORDANCE WITH ASME SEC.III NB CLASS-1 AND AS PER APPROVED TDC
- 03. DISHED END SHALL BE SUPPLIED IN FINISH MACHINED CONDITION
- 04. SURFACE FINISH SHALL BE 6.3 MICRONS ALL OVER
- 05. DETAILED DRAWING INDICATING VARIOUS STAGES OF MANUFACTURE SHALL BE SUBMITTED FOR APPROVAL
- 06. WALL THICKNESS INDICATED ARE SPECIFIED IN MINIMUM VALUES
- 07. TEST COUPONS REQUIRED SHALL BE MADE FROM SAME MELT AND HEAT TREATMENT BATCH AS SPECIFIED IN THE SPECIFICATION / TDC
- 08. DISHED END AND WELD EDGES SHALL BE PROPERLY PROTECTED DURING TRANSPORTATION
- 09. BRACKETED "()" DIMENSIONS ARE FOR REFERENCE ONLY
- 10. NO REPAIR BY WELDING SHALL BE PERMITTED ON DISHED END
- 11. APPROXIMATE FINISHED WEIGHT : 148 kg



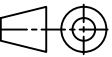
DETAIL-1
(1:2.5)

TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)

LINEAR				ANGULAR	
0.5 TO 3	±0.1	400 TO 1000	±0.8	0 TO 10	±1°
3 TO 6	±0.1	1000 TO 2000	±1.2	10 TO 50	±30'
6 TO 30	±0.2	2000 TO 4000	±2.0	50 TO 120	±20'
30 TO 120	±0.3	-	-	120 TO 400	±10'
120 TO 400	±0.5	-	-	OVER 400	±5'

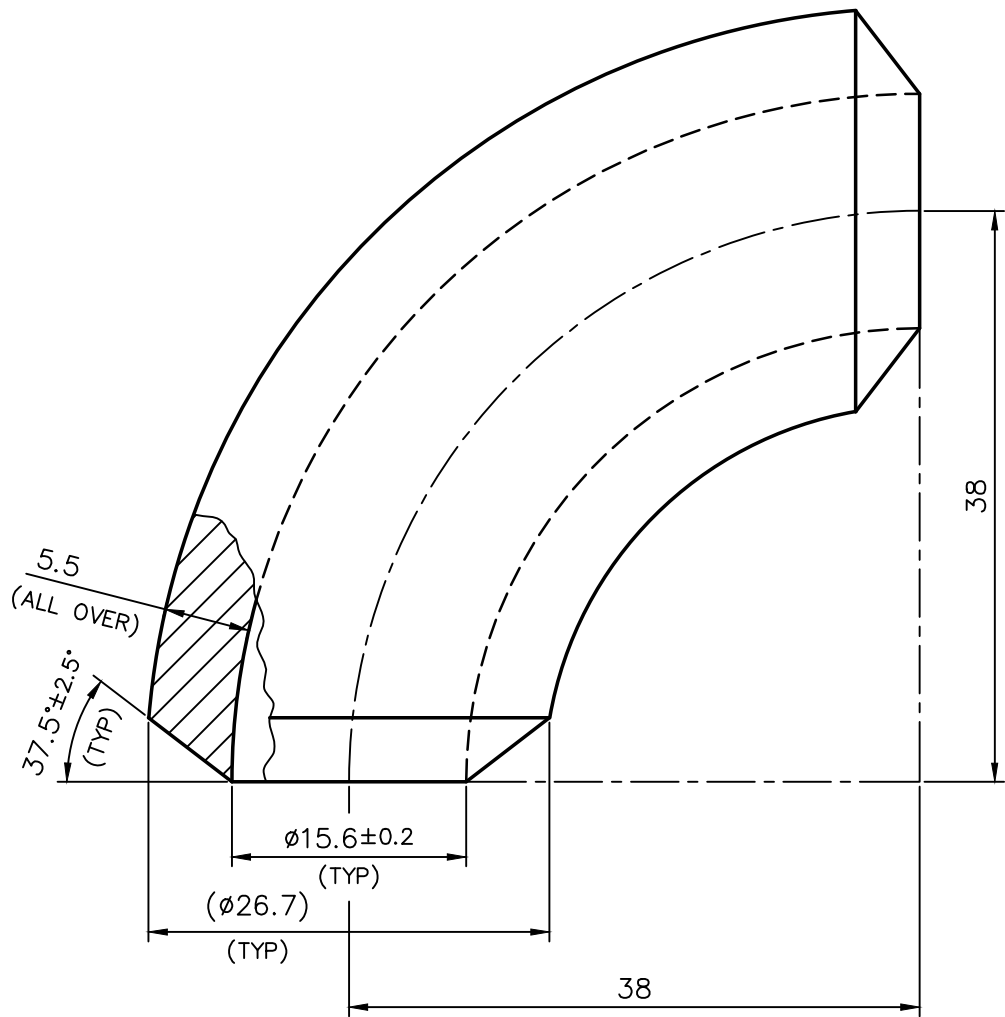
REV	DATE	ALTERED :
		CHD&APPD :

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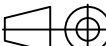
TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700 MWe REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer Drg. 700FLEET/33117/2003 & 2005/DD)								
 05-229/D	Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI - 620014				DRN	NAME RAMESH S	SIGNATURE 	DATE 14.12.20	NO. OF VAR	
					CHD	NITHIN		21.12.20		
					APPD	RA KRISHNAN		24.12.20		
DEPT NC	GRADE OF UNTOL. DIM C/M/F		SCALE 1:5	WEIGHT (Kg)		REF TO ASSY / OLD DWG			ITEM NO	No OF ITEMS
CODE 150										
TITLE DISHED END FORGING (REACTOR INLET HEADER) (2:1 ELLIPSOIDAL)					CARD CODE U 01	DRAWING NO : 3-93-422-05458			REV 00	

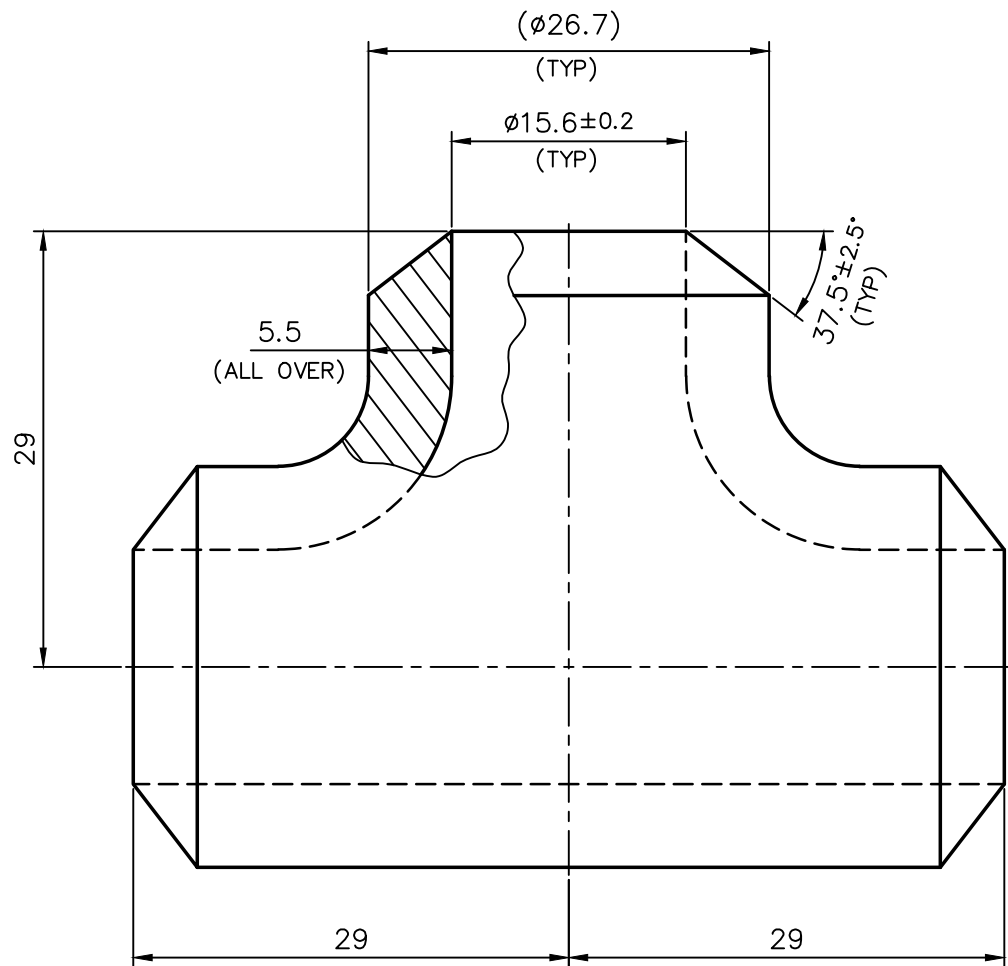
NOTE

01. MATERIAL SPECIFICATION FOR THE FORGED FITTING IS SA-420 Gr.WPL-6 (MODIFIED)
02. MATERIAL, CHEMICAL COMPOSITION, MANUFACTURING, EXAMINATION, TESTING AND PACKING SHALL BE AS PER APPROVED TDC
03. COMPONENT SHALL BE SUPPLIED IN FINISH MACHINED CONDITION
04. OVALITY, CONCENTRICITY AND TOLERANCES OTHER THAN MENTIONED IN THE DRAWING SHALL BE AS PER ANSI B16.9
05. SURFACE FINISH SHALL BE $\sqrt{6.3}$ MICRONS ALL OVER
06. BUTT WELDING EDGE PREPARATION SHALL BE AS SHOWN IN THE DRAWING
07. COMPONENT SHALL BE PROPERLY PROTECTED DURING TRANSPORTATION
08. NO REPAIR BY WELDING SHALL BE PERMITTED ON ELBOW
09. APPROXIMATE FINISHED WEIGHT : 0.16 kg



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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT			700 MWE REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer Drg. 700FLEET/33117/2006/DD)							
 05-229/D			Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI - 620014			DRN	NAME RAMESH S	SIGNATURE 	DATE 14.12.20	NO. OF VAR
						CHD	NITHIN		21.12.20	
						APPD	RA KRISHNAN		24.12.20	
DEPT NC	GRADE OF UNTOL. DIM		SCALE 2:1		WEIGHT (Kg)	REF TO ASSY / OLD DWG			ITEM NO	No OF ITEMS
CODE 150	C/M/F									
TITLE 90° ELBOW (20NB) (LONG RADIUS)					CARD CODE U 01	DRAWING NO : 3-93-422-05459 00				REV

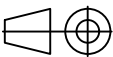


NOTE

01. MATERIAL SPECIFICATION FOR THE FORGED FITTING IS SA-420 Gr.WPL-6 (MODIFIED)
02. MATERIAL, CHEMICAL COMPOSITION, MANUFACTURING, EXAMINATION, TESTING AND PACKING SHALL BE AS PER APPROVED TDC
03. COMPONENT SHALL BE SUPPLIED IN FINISH MACHINED CONDITION
04. OVALITY, CONCENTRICITY AND TOLERANCES OTHER THAN MENTIONED IN THE DRAWING SHALL BE AS PER ANSI B16.9
05. SURFACE FINISH SHALL BE $\sqrt{6.3}$ MICRONS ALL OVER
06. BUTT WELDING EDGE PREPARATION SHALL BE AS SHOWN IN THE DRAWING
07. COMPONENT SHALL BE PROPERLY PROTECTED DURING TRANSPORTATION
08. NO REPAIR BY WELDING SHALL BE PERMITTED ON TEE
09. APPROXIMATE FINISHED WEIGHT : 0.19 kg

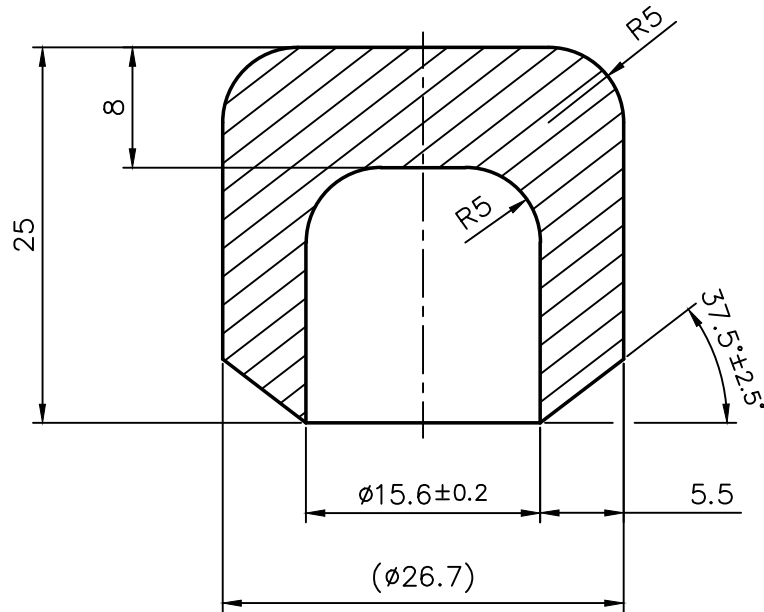
REV	DATE	ALTERED :
		CHD&APPD :

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700 MWe REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer Drg. 700FLEET/33117/2006/DD)									
 05-229/D	Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI - 620014				DRN	NAME RAMESH S	SIGNATURE 	DATE 14.12.20	NO. OF VAR		
					CHD	NITHIN		21.12.20			
					APPD	RA KRISHNAN		24.12.20			
DEPT NC	GRADE OF UNTOL DIM		SCALE 2:1	WEIGHT (Kg)	REF TO ASSY / OLD DWG				ITEM NO	No OF ITEMS	
CODE 150	C/M/F										
TITLE EQUAL TEE (20NB)				CARD CODE U 01	DRAWING NO : 3-93-422-05460				REV 00		

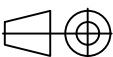
NOTE

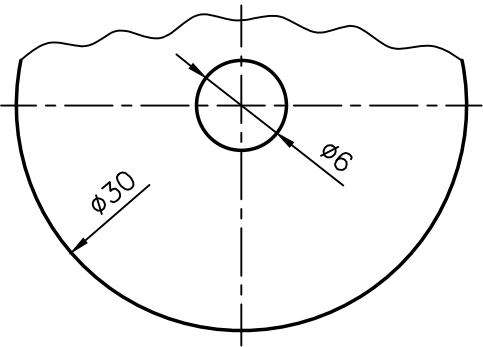
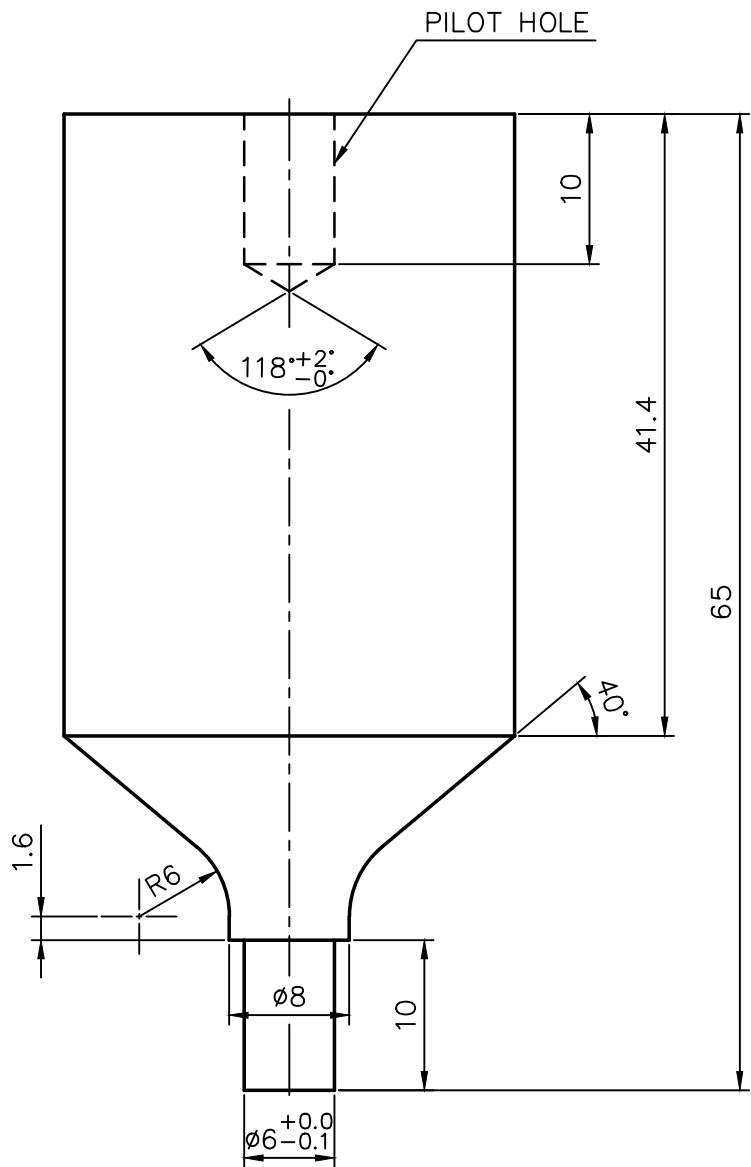
01. MATERIAL SPECIFICATION FOR THE FORGED FITTING IS SA-420 Gr.WPL-6 (MODIFIED)
02. MATERIAL, CHEMICAL COMPOSITION, MANUFACTURING, EXAMINATION, TESTING AND PACKING SHALL BE AS PER APPROVED TDC
03. COMPONENT SHALL BE SUPPLIED IN FINISH MACHINED CONDITION
04. OVALITY, CONCENTRICITY AND TOLERANCES OTHER THAN MENTIONED IN THE DRAWING SHALL BE AS PER ANSI B16.9
05. SURFACE FINISH SHALL BE 6.3 MICRONS ALL OVER
06. BUTT WELDING EDGE PREPARATION SHALL BE AS SHOWN IN THE DRAWING
07. COMPONENT SHALL BE PROPERLY PROTECTED DURING TRANSPORTATION
08. NO REPAIR BY WELDING SHALL BE PERMITTED ON END CAP
09. APPROXIMATE FINISHED WEIGHT : 0.075 kg



REV	DATE	ALTERED :
		CHD&APPD :

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700 MWe REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer Drg. 700FLEET/33117/2006/DD)									
 05-229/D	Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI - 620014				DRN	NAME RAMESH S	SIGNATURE 	DATE 14.12.20	NO. OF VAR		
					CHD	NITHIN		21.12.20			
					APPD	RA KRISHNAN		24.12.20			
DEPT NC	GRADE OF UNTOL. DIM		SCALE 2:1	WEIGHT (Kg)	REF TO ASSY / OLD DWG				ITEM NO	No OF ITEMS	
CODE 150	C/M/F										
TITLE END CAP (20NB)					CARD CODE U 01	DRAWING NO : 3-93-422-05461					REV 00

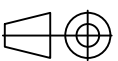


NOTE

01. MATERIAL SPECIFICATION FOR THE FORGING IS SA-350 Gr.LF2 CLASS-1 WITH SUPPLEMENTARY REQUIREMENT ON CHEMICAL COMPOSITION AS GIVEN IN THE APPROVED TDC
02. MATERIAL, MANUFACTURING, EXAMINATION AND PACKING SHALL BE IN ACCORDANCE WITH ASME SEC.III NB CLASS-1 AND AS PER APPROVED TDC
03. INSTRUMENTATION NOZZLE SHALL BE SUPPLIED IN FINISH MACHINED CONDITION
04. SURFACE FINISH SHALL BE $\sqrt{6.3}$ MICRONS ALL OVER
05. DETAILED DRAWING INDICATING VARIOUS STAGES OF MANUFACTURE SHALL BE SUBMITTED FOR APPROVAL
06. COMPONENT SHALL BE PROPERLY PROTECTED DURING TRANSPORTATION
07. NO REPAIR BY WELDING SHALL BE PERMITTED ON INSTRUMENTATION NOZZLE
08. APPROXIMATE FINISHED WEIGHT : 0.26 kg

REV	DATE	ALTERED :
		CHD&APPD :

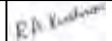
CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

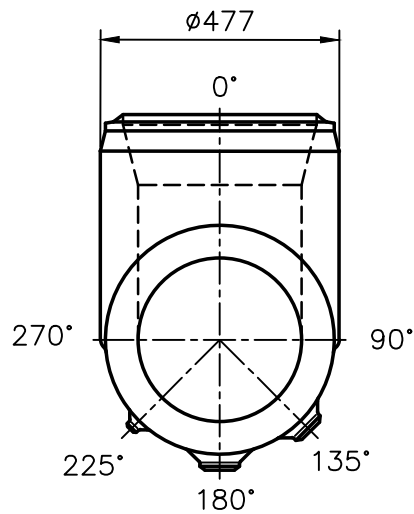
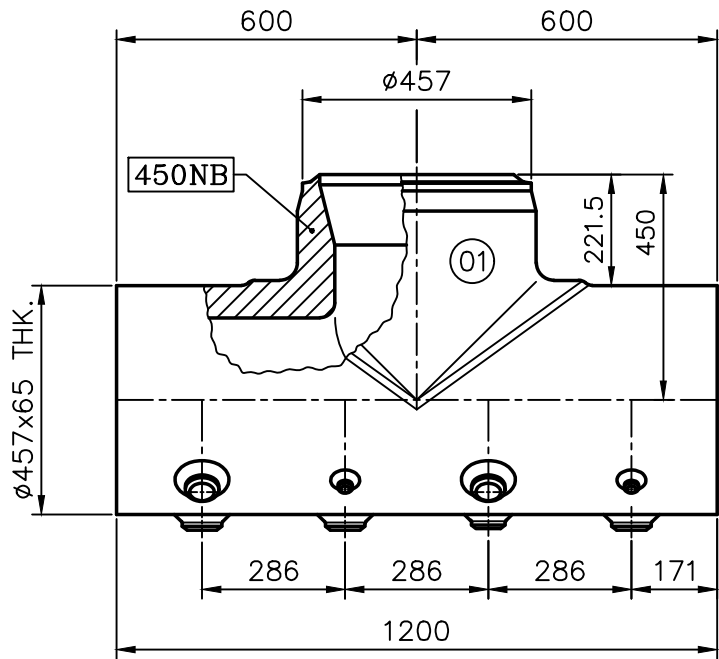
TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT			700 MWe REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer Drg. 700FLEET/33117/2006/DD)						
 05-229/D	Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI - 620014			DRN	NAME RAMESH S	SIGNATURE 	DATE 14.12.20	NO. OF VAR	
				CHD	NITHIN		21.12.20		
				APPD	RA KRISHNAN		24.12.20		
DEPT NC	GRADE OF UNTOL. DIM		SCALE 2:1	WEIGHT (Kg)	REF TO ASSY / OLD DWG			ITEM NO	No OF ITEMS
CODE 150	C/M/F								
TITLE INSTRUMENTATION NOZZLE (3/8"NB)				CARD CODE U 01	DRAWING NO : 3-93-422-05462			REV 00	

01. MATERIAL SPECIFICATION FOR THE COMPONENT IS SA-105
02. MATERIAL, MANUFACTURING & EXAMINATION SHALL BE IN ACCORDANCE WITH ASME
03. COMPONENT SHALL BE SUPPLIED IN FINISH MACHINED CONDITION
04. SURFACE FINISH SHALL BE $\nabla^{6.3}$ MICRONS ALL OVER
05. WALL THICKNESS INDICATED ARE SPECIFIED IN MINIMUM VALUES
06. COMPONENT SHALL BE PROPERLY PROTECTED DURING TRANSPORTATION
07. NO REPAIR BY WELDING SHALL BE PERMITTED ON FEEDER PIPE CLOSURES

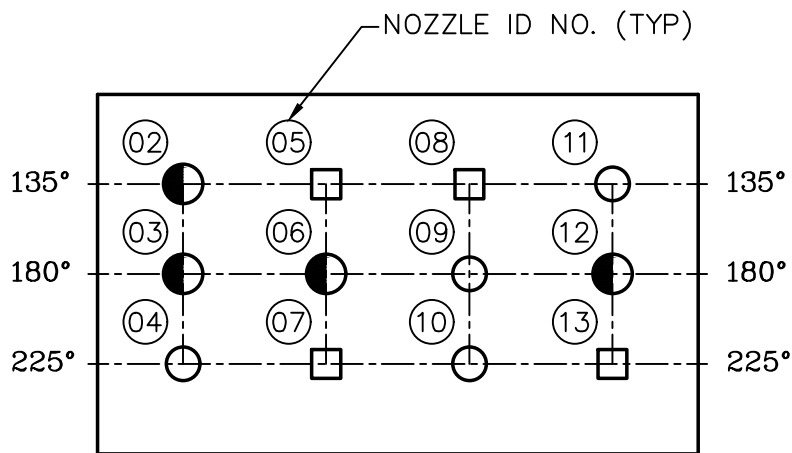
VAR No.	DESCRIPTION	ØD1	ØD2	T	L	FINISHED WEIGHT (Approx.) (kg)
01	FEEDER PIPE CLOSURE – 100NB	116	138	22	82	4.70
02	FEEDER PIPE CLOSURE – 65NB	81	98	15	75	2.04
03	FEEDER PIPE CLOSURE – 50NB	69.3	85	15	75	1.60
04	FEEDER PIPE CLOSURE – 20NB	28	40	10	60	0.39

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700 MWe REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer Drg. 700FLEET/33117/2006/DD)							
 05-229/D		Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI - 620014			DRN	NAME RAMESH S	SIGNATURE 	DATE 14.12.20	NO. OF VAR
					CHD	NITHIN		21.12.20	
					APPD	RA KRISHNAN		24.12.20	
DEPT NC	GRADE OF UNTOL DIM		SCALE 1: 1	WEIGHT (Kg)	REF TO ASSY / OLD DWG	ITEM NO	No OF ITEMS		
CODE 150	C/M/F								
TITLE FEEDER PIPE CLOSURES (SLIP ON TYPE)				CARD CODE U 01	DRAWING NO : 3-93-422-05463			REV 00	



VIEW-X



FEEDER PIPE NOZZLES
DEVELOPED PLAN

NOTE

01. FOR ALL OTHER DETAILS, (SECTIONAL DIMENSION, TOLERANCE, SURFACE FINISH...) REFER RELEVANT HEADER DRAWING AND TDC
02. SECTIONING OF NOZZLE IN LONGITUDINAL AND TRANSVERSE DIRECTIONS SHALL BE CARRIED OUT OF CONFIRM NOZZLE PROFILE AND OTHER DETAILS, SECTIONING PLAN AND DETAIL SHALL BE SUBMITTED TO PURCHASER FOR APPROVAL
03. THE SECTIONED NOZZLES AND BALANCE MATERIAL SHALL BE DISPATCHED ALONG WITH MAIN HEADER WITH PROPER IDENTIFICATION

NOZZLE LEGEND & QUANTITY

SYMBOL	NOZZLE DESCRIPTION	QUANTITY
	FEEDER PIPE NOZZLE 65NB	04
	FEEDER PIPE NOZZLE 50NB	04
	INSTRUMENTATION NOZZLE 20NB	04

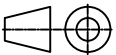
SAMPLE ID No. : RIH-S1-A
MATERIAL SPECIFICATION : SA350 LF2 CLASS-1

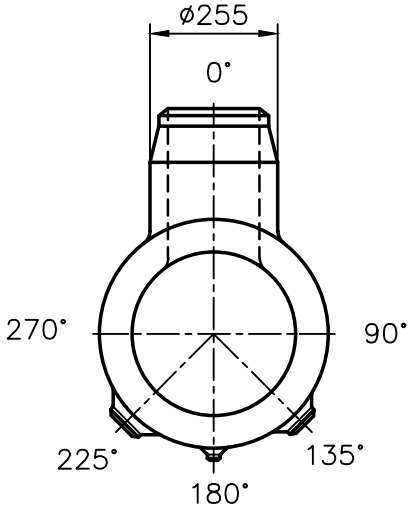
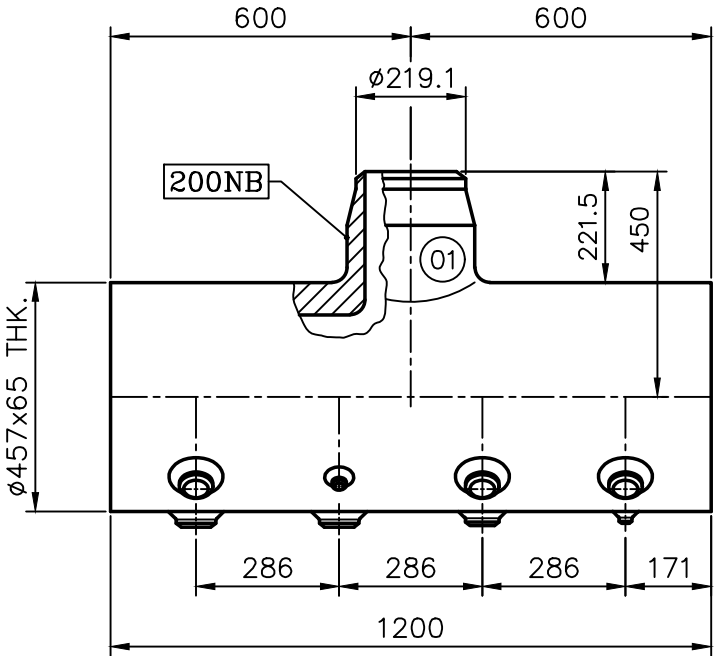
TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)

LINEAR				ANGULAR	
0.5 TO 3	±0.1	400 TO 1000	±0.8	0 TO 10	±1°
3 TO 6	±0.1	1000 TO 2000	±1.2	10 TO 50	±30'
6 TO 30	±0.2	2000 TO 4000	±2.0	50 TO 120	±20'
30 TO 120	±0.3	-	-	120 TO 400	±10'
120 TO 400	±0.5	-	-	OVER 400	±5'

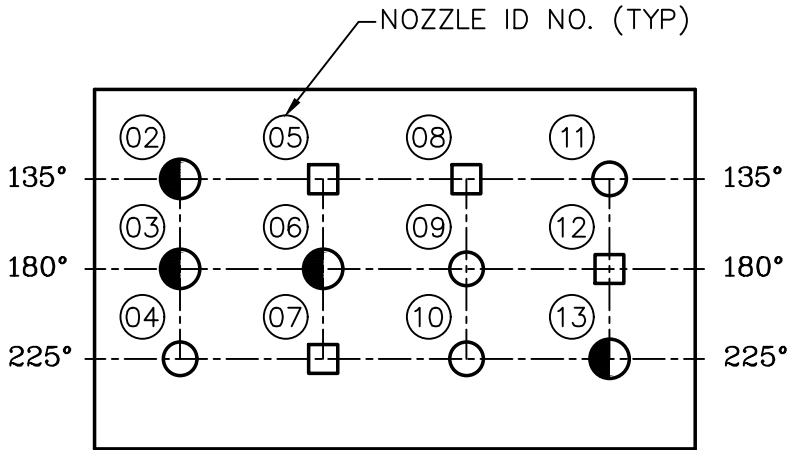
REV	DATE	ALTERED :
		CHD&APPD :

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700 MWE REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer Drg. 700FLEET/33117/2015/DD)						
 05-229/D		Bharat Heavy Electricals Ltd		DRN	NAME RAMESH S	SIGNATURE 	DATE 14.12.20	No. OF VAR
		UNIT: HIGH PRESSURE BOILER PLANT		CHD	NITHIN		21.12.20	
		TIRUCHIRAPALLI - 620014		APPD	RA KRISHNAN		24.12.20	
DEPT NC	GRADE OF UNTOL DIM		SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG		ITEM NO	No. OF ITEMS
CODE 150	C/M/F		1:15					
TITLE				CARD CODE	DRAWING NO :			REV
SAMPLE FORGING (450NB NOZZLE) (REACTOR INLET HEADER)				U 01	3-93-422-05464			00



VIEW-X



FEEDER PIPE NOZZLES
DEVELOPED PLAN

NOTE

- 01. FOR ALL OTHER DETAILS, (SECTIONAL DIMENSION, TOLERANCE, SURFACE FINISH...) REFER RELEVANT HEADER DRAWING AND TDC
- 02. SECTIONING OF NOZZLE IN LONGITUDINAL AND TRANSVERSE DIRECTIONS SHALL BE CARRIED OUT OF CONFIRM NOZZLE PROFILE AND OTHER DETAILS, SECTIONING PLAN AND DETAIL SHALL BE SUBMITTED TO PURCHASER FOR APPROVAL
- 03. THE SECTIONED NOZZLES AND BALANCE MATERIAL SHALL BE DISPATCHED ALONG WITH MAIN HEADER WITH PROPER IDENTIFICATION

NOZZLE LEGEND & QUANTITY

SYMBOL	NOZZLE DESCRIPTION	QUANTITY
	FEEDER PIPE NOZZLE 65NB	04
	FEEDER PIPE NOZZLE 50NB	04
	INSTRUMENTATION NOZZLE 20NB	04

SAMPLE ID No. : RIH-S1-B
MATERIAL SPECIFICATION : SA350 LF2 CLASS-1

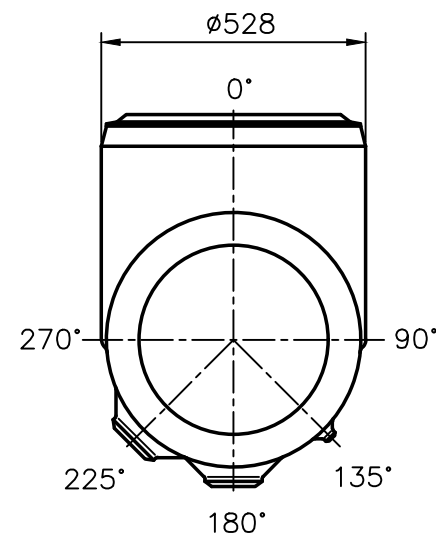
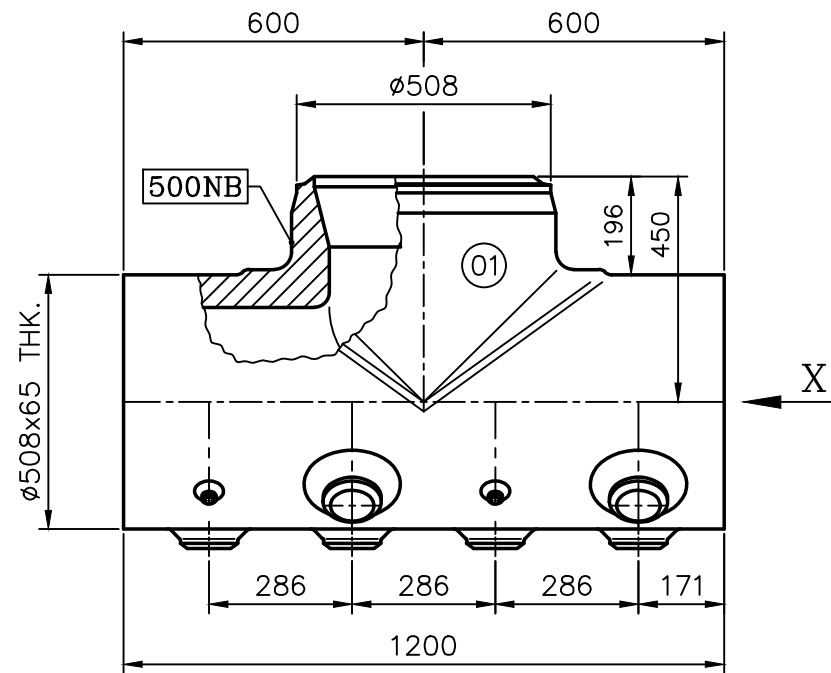
TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)

LINEAR				ANGULAR	
0.5 TO 3	±0.1	400 TO 1000	±0.8	0 TO 10	±1°
3 TO 6	±0.1	1000 TO 2000	±1.2	10 TO 50	±30'
6 TO 30	±0.2	2000 TO 4000	±2.0	50 TO 120	±20'
30 TO 120	±0.3	-	-	120 TO 400	±10'
120 TO 400	±0.5	-	-	OVER 400	±5'

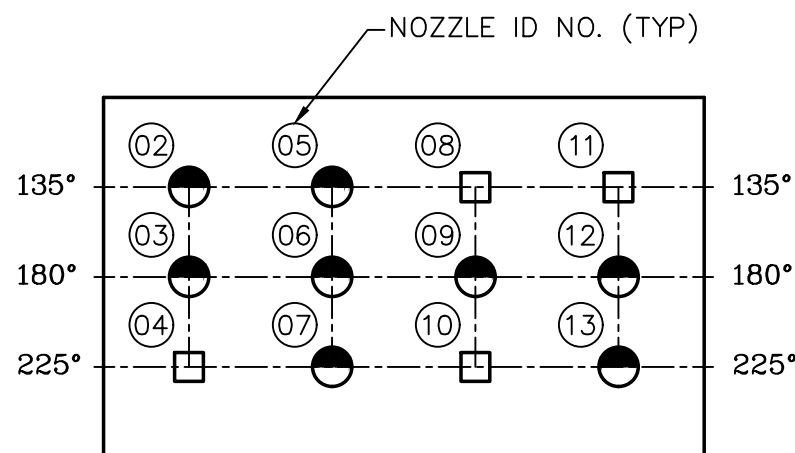
REV	DATE	ALTERED :
		CHD&APPD :

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700 MWE REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer Drg. 700FLEET/33117/2016/DD)						
 05-229/D		Bharat Heavy Electricals Ltd		DRN	NAME RAMESH S	SIGNATURE 	DATE 14.12.20	NO. OF VAR
		UNIT: HIGH PRESSURE BOILER PLANT		CHD	NITHIN		21.12.20	
		TIRUCHIRAPALLI - 620014		APPD	RA KRISHNAN		24.12.20	
DEPT NC	GRADE OF UNTOL DIM		SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG		ITEM NO	No OF ITEMS
CODE 150	C/M/F		1:15					
TITLE				CARD CODE	DRAWING NO :			REV
SAMPLE FORGING (200NB NOZZLE) (REACTOR INLET HEADER)				U 01	3-93-422-05465			00



VIEW-X



FEEDER PIPE NOZZLES
DEVELOPED PLAN

NOTE

01. FOR ALL OTHER DETAILS, (SECTIONAL DIMENSION, TOLERANCE, SURFACE FINISH...) REFER RELEVANT HEADER DRAWING AND TDC
02. SECTIONING OF NOZZLE IN LONGITUDINAL AND TRANSVERSE DIRECTIONS SHALL BE CARRIED OUT OF CONFIRM NOZZLE PROFILE AND OTHER DETAILS, SECTIONING PLAN AND DETAIL SHALL BE SUBMITTED TO PURCHASER FOR APPROVAL
03. THE SECTIONED NOZZLES AND BALANCE MATERIAL SHALL BE DISPATCHED ALONG WITH MAIN HEADER WITH PROPER IDENTIFICATION

NOZZLE LEGEND & QUANTITY

SYMBOL	NOZZLE DESCRIPTION	QUANTITY
	FEEDER PIPE NOZZLE 100NB	08
	INSTRUMENTATION NOZZLE 20NB	04

SAMPLE ID No. : ROH-S1-A
MATERIAL SPECIFICATION : SA350 LF2 CLASS-1

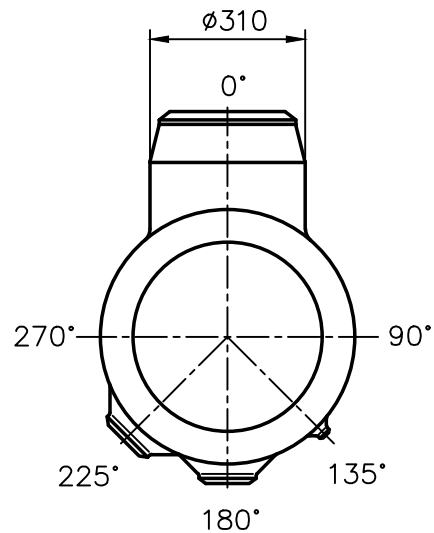
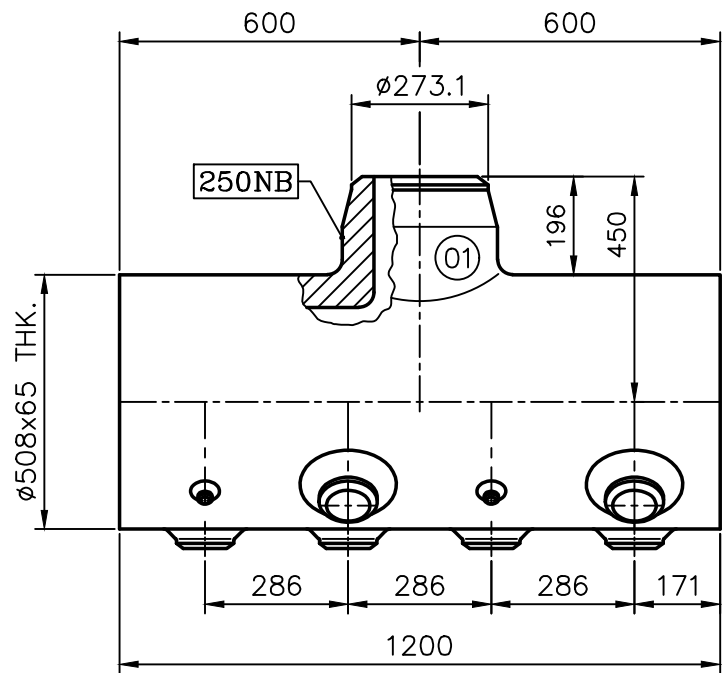
TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)

LINEAR				ANGULAR	
0.5 TO 3	±0.1	400 TO 1000	±0.8	0 TO 10	±1°
3 TO 6	±0.1	1000 TO 2000	±1.2	10 TO 50	±30'
6 TO 30	±0.2	2000 TO 4000	±2.0	50 TO 120	±20'
30 TO 120	±0.3	-	-	120 TO 400	±10'
120 TO 400	±0.5	-	-	OVER 400	±5'

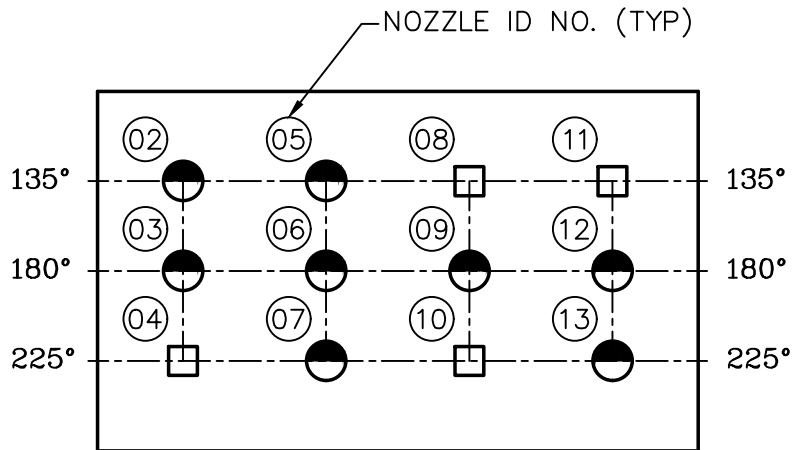
REV	DATE	ALTERED :
		CHD&APPD :

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700 MWe REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer Drg. 700FLEET/33117/2018/DD)					
	Bharat Heavy Electricals Ltd		DRN	NAME	SIGNATURE	DATE	NO. OF VAR
	UNIT: HIGH PRESSURE BOILER PLANT		CHD	NITHIN		21.12.20	
	TIRUCHIRAPALLI - 620014		APPD	RA KRISHNAN		24.12.20	
DEPT NC	GRADE OF UNTOL. DIM	SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG		ITEM NO	No OF ITEMS
CODE 150	C/M/F	1:15					
TITLE			CARD CODE	DRAWING NO :			REV
SAMPLE FORGING (500NB NOZZLE) (REACTOR OUTLET HEADER)			U 01	3-93-422-05466			00



VIEW-X



FEEDER PIPE NOZZLES
DEVELOPED PLAN

NOTE

01. FOR ALL OTHER DETAILS, (SECTIONAL DIMENSION, TOLERANCE, SURFACE FINISH...) REFER RELEVANT HEADER DRAWING AND TDC
02. SECTIONING OF NOZZLE IN LONGITUDINAL AND TRANSVERSE DIRECTIONS SHALL BE CARRIED OUT OF CONFIRM NOZZLE PROFILE AND OTHER DETAILS, SECTIONING PLAN AND DETAIL SHALL BE SUBMITTED TO PURCHASER FOR APPROVAL
03. THE SECTIONED NOZZLES AND BALANCE MATERIAL SHALL BE DISPATCHED ALONG WITH MAIN HEADER WITH PROPER IDENTIFICATION

NOZZLE LEGEND & QUANTITY

SYMBOL	NOZZLE DESCRIPTION	QUANTITY
	FEEDER PIPE NOZZLE 100NB	08
	INSTRUMENTATION NOZZLE 20NB	04

SAMPLE ID No. : ROH-S1-B
MATERIAL SPECIFICATION : SA350 LF2 CLASS-1

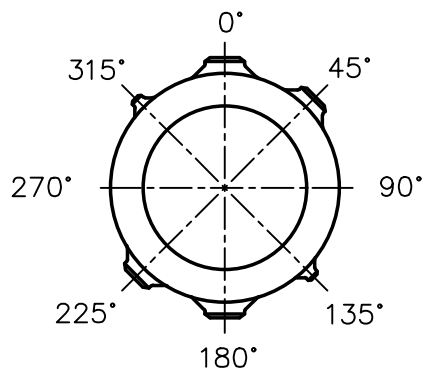
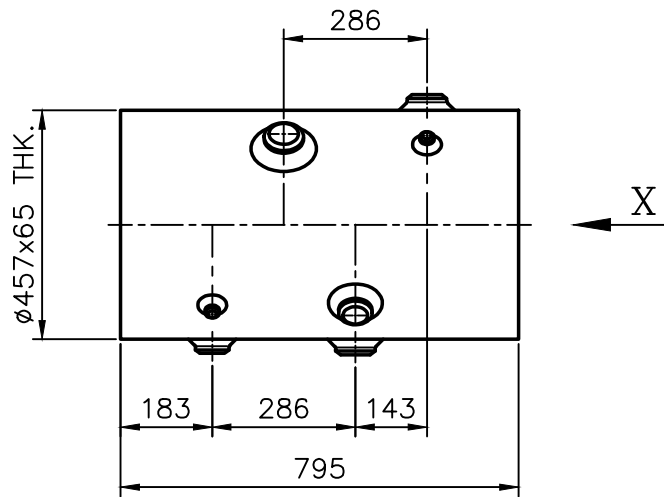
TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)

LINEAR				ANGULAR	
0.5 TO 3	±0.1	400 TO 1000	±0.8	0 TO 10	±1°
3 TO 6	±0.1	1000 TO 2000	±1.2	10 TO 50	±30'
6 TO 30	±0.2	2000 TO 4000	±2.0	50 TO 120	±20'
30 TO 120	±0.3	-	-	120 TO 400	±10'
120 TO 400	±0.5	-	-	OVER 400	±5'

REV	DATE	ALTERED :
		CHD&APPD :

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		700 MWe REACTOR HEADER W.O.No. D179-001-1-93-422-FLEET (Customer Drg. 700FLEET/33117/2019/DD)					
	Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI - 620014	DRN	NAME RAMESH S	SIGNATURE	DATE 14.12.20	NO. OF VAR	
		CHD	NITHIN		21.12.20		
		APPD	RA KRISHNAN		24.12.20		
DEPT NC	GRADE OF UNTOL. DIM	SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG		ITEM NO	No OF ITEMS
CODE 150	C/M/F		1:15				
TITLE SAMPLE FORGING (250NB NOZZLE) (REACTOR OUTLET HEADER)			CARD CODE U 01	DRAWING NO : 3-93-422-05467		REV 00	



VIEW-X

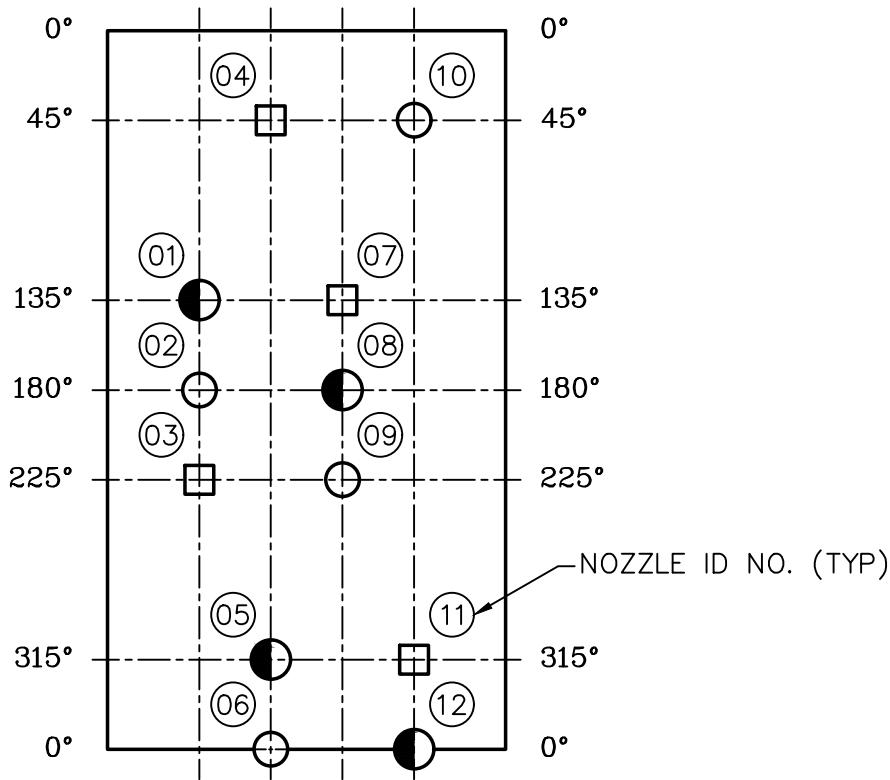
NOTE

01. FOR ALL OTHER DETAILS, (SECTIONAL DIMENSION, TOLERANCE, SURFACE FINISH...) REFER RELEVANT HEADER DRAWING AND TDC
02. THE SAMPLE FORGING SHALL BE DISPATCHED ALONG WITH MAIN HEADER WITH PROPER IDENTIFICATION

NOZZLE LEGEND & QUANTITY

SYMBOL	NOZZLE DESCRIPTION	QUANTITY
	FEEDER PIPE NOZZLE 65NB	04
	FEEDER PIPE NOZZLE 50NB	04
	INSTRUMENTATION NOZZLE 20NB	04

SAMPLE ID No. : RIH-S1-C
MATERIAL SPECIFICATION : SA350 LF2 CLASS-1



FEEDER PIPE NOZZLES
DEVELOPED PLAN

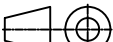
TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)

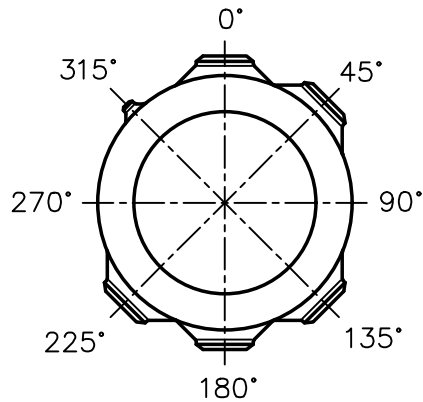
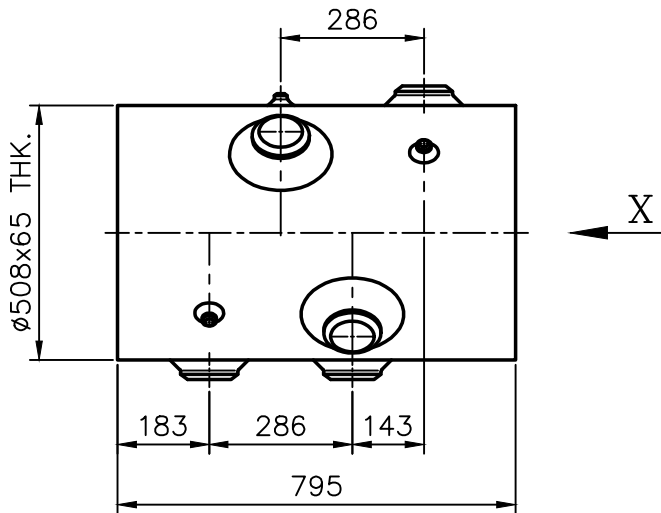
LINEAR				ANGULAR	
0.5 TO 3	±0.1	400 TO 1000	±0.8	0 TO 10	±1°
3 TO 6	±0.1	1000 TO 2000	±1.2	10 TO 50	±30'
6 TO 30	±0.2	2000 TO 4000	±2.0	50 TO 120	±20'
30 TO 120	±0.3	-	-	120 TO 400	±10'
120 TO 400	±0.5	-	-	OVER 400	±5'

REV	DATE	ALTERED :
		CHD&APPD :

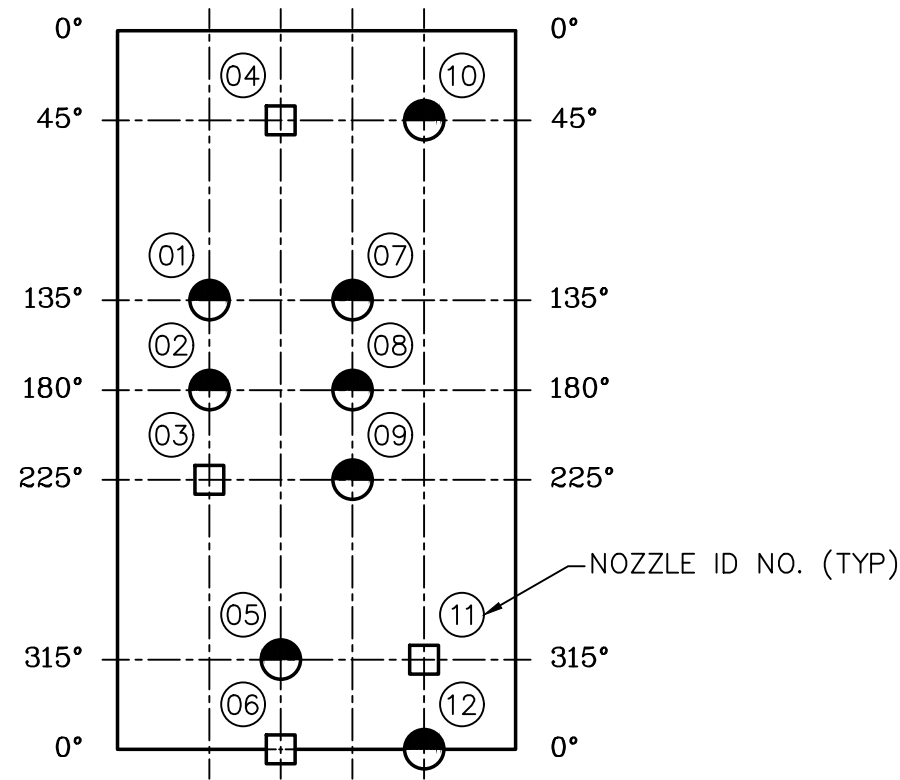
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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT
700 MWe REACTOR HEADER
W.O.No. D179-001-1-93-422-FLEET
(Customer Drg. 700FLEET/33117/2017/DD)

 Bharat Heavy Electricals Ltd UNIT: HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI – 620014					NAME	SIGNATURE	DATE	NO. OF VAR
				DRN	RAMESH S		14.12.20	
				CHD	NITHIN		21.12.20	
		APPD	RA KRISHNAN		24.12.20			
DEPT	GRADE OF UNTOL DIM		SCALE	WEIGHT (Kg)	REF TO ASSY / OLD DWG	ITEM NO	No OF ITEMS	
NC	C/M/F		1:15					
CODE	150							
TITLE				CARD CODE	DRAWING NO :		REV	
SAMPLE FORGING (FEEDER NOZZLE) (REACTOR INLET HEADER)				U 01	3-93-422-05468		00	



VIEW-X



FEEDER PIPE NOZZLES
DEVELOPED PLAN

TOLERANCE IF NOT SPECIFIED SHALL BE AS BELOW (REFER IS 2102-m)

LINEAR				ANGULAR	
0.5 TO 3	±0.1	400 TO 1000	±0.8	0 TO 10	±1°
3 TO 6	±0.1	1000 TO 2000	±1.2	10 TO 50	±30'
6 TO 30	±0.2	2000 TO 4000	±2.0	50 TO 120	±20'
30 TO 120	±0.3	-	-	120 TO 400	±10'
120 TO 400	±0.5	-	-	OVER 400	±5'

REV	DATE	ALTERED :
		CHD&APPD :

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

NOTE

01. FOR ALL OTHER DETAILS, (SECTIONAL DIMENSION, TOLERANCE, SURFACE FINISH...) REFER RELEVANT HEADER DRAWING AND TDC
02. THE SAMPLE FORGING SHALL BE DISPATCHED ALONG WITH MAIN HEADER WITH PROPER IDENTIFICATION

NOZZLE LEGEND & QUANTITY

SYMBOL	NOZZLE DESCRIPTION	QUANTITY
	FEEDER PIPE NOZZLE 100NB	08
	INSTRUMENTATION NOZZLE 20NB	04

SAMPLE ID No. : ROH-S1-C
MATERIAL SPECIFICATION : SA350 LF2 CLASS-1

TYPE OF PRODUCT
OR NAME OF
CUSTOMER/PROJECT

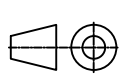
700 MWe REACTOR HEADER
W.O.No. D179-001-1-93-422-FLEET
(Customer Drg. 700FLEET/33117/2020/DD)



Bharat Heavy Electricals Ltd
UNIT: HIGH PRESSURE BOILER PLANT
TIRUCHIRAPALLI - 620014

DEPT NC
CODE 150

GRADE OF
UNTOL DIM
C/M/F



SCALE
1:15

WEIGHT (Kg)

NAME	SIGNATURE	DATE	NO. OF VAR
RAMESH S		14.12.20	
NITHIN		21.12.20	
RA KRISHNAN		24.12.20	

TITLE
SAMPLE FORGING
(FEEDER NOZZLE)
(REACTOR OUTLET HEADER)

CARD
CODE
U 01

DRAWING NO :
3-93-422-05469 00