	PRE - QUALIFYING REQUIREMENTS	DOCUMENT NO: PE-TS-445-000-M052
		REVISION NO: 00
		DATE: 24.11.2021
		SHEET: 1 of 2

Project: 1X660MW SAGARDHIGI STPP
Package: METAL EXPANSION BELLOWS

CRITERIA FOR EVALUATION (TECHNICAL):

1. Technical Pre-Qualifying Requirements:

1.1 The bidder should have designed, in-house manufactured, tested, inspected and supplied metal expansion bellows (Gimbal / Hinged) with minimum size of 1600 NB (Min. Design pressure: 1.1 Kg/cm2(g), Min Design temperature: 50°C), for use in power cycle piping of power plant or for similar application in other industries.

1.2 The item(s) mentioned in point 1.1 should have performed successfully for at least one year. To establish meeting this requirement, the bidder shall conform to any one of the following clauses:

(i) Execution of two purchase orders for different End-users with the item(s) performing successfully for one (1) year from date of commissioning to the date of bid submission as defined in Notice Inviting Tender (NIT) by BHEL-PEM. Different projects of a customer shall be considered as different End-users.

(ii) Minimum one (1) repeat contract from two (2) different Purchasers (i.e. 2 Nos of Purchase orders from each purchaser). A contract shall be considered as repeat, when the second contract is given by the same purchaser after lapse of minimum one (1) year from supply completion of first contract.

(iii) Execution of one (1) purchase order as per sl. no. (i) above from one End-user and one (1) repeat contract from another Purchaser as per sl. No. (ii) above.

(iv) Three (3) repeat contracts from one (1) Purchaser. Second and third repeat contract shall be after lapse of minimum one (1) & two (2) years respectively from supply completion of first contract.

1.3 The bidder to furnish the following documents, as applicable, in support of the above:

a) For point 1.2(i): Performance certificates from End-user (duly signed & dated) specifying that the product is performing successfully for one (1) year from date of commissioning along with correlated purchase order(s).

b) For point 1.2 (ii) & (iv): Purchase order(s), Material dispatch clearance certificate (MDCC)/ Material receipt certificate (MRC)/Lorry receipt (LR)/supply invoice.

1.4 In addition to above, bidder should have the following facilities for Metal expansion bellows of max. size of each type as per BHEL requirement as mentioned in Data sheet of technical specification:

a) In-house capability of manufacturing metal expansion bellows.

b) In-house testing facilities for carrying out tests as per relevant standards & Quality plan. In case, the in-house testing facilities are not available, then bidder shall furnish undertaking that test(s) will be carried out from govt. approved lab or test house recognized by reputed customers.

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Bidder to submit supporting documents (Purchase order (s) / Certificate indicating capacity and details/undertaking of manufacturing & testing facilities) for point (a) & (b) above.

1.5 To establish business continuity, bidder is required to submit at least (2) Purchase order for any type of Metal expansion bellows (from Data Sheet Part-1 of technical specification) for minimum 300NB size in last 3 (three) years from date of bid submission as defined by BHEL-PEM in NIT.

2. Bidder to also comply with general points mentioned below:

2.1 Offers of the JV companies/ Joint bidders/ bidders having collaboration/ licensing agreement/ MOU/ Indian subsidiaries shall be evaluated as follows:

a) If bidder happens to be an Indian subsidiaries of foreign OEM, then the credentials of the foreign OEM can also be considered for meeting PQR.

b) If bidder happens to be the Joint Venture Company, then the credentials of any of JV partners can be also considered for meeting PQR.

c) If bidder happens to be the having valid collaboration agreement/ MOU/ licensing agreement with some other company, then the credentials of collaborator/ MOU partner/ licensing company can also be considered for meeting PQR.

Note: If bidder(s) qualifies on the basis of credentials of his principal/ JV partner/ Collaborator/ joint bidder etc., then the principal/ JV partner/ Collaborator/ MOU partner/ joint bidder shall be responsible for overall design vetting and warranty/ guarantee of the package. The scope matrix clearly defining their respective roles including design vetting, manufacturing of critical component, E&C etc. and warranty/ guarantee shall be submitted along with the offer.

2.2 Bidder to note that the arrangement of bidding (joint bid partners/ collaborator/ MOU partner/ licensing company etc.) once offered to BHEL as a part of bidding documents cannot be changed till the execution of contract(s).

2.3 Consideration of offer shall be subject to customer's approval of bidders, if applicable.

2.4 Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.

2.5 Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder/collaborators to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.

2.6 After satisfactory fulfillment of all the above criteria/requirement, offer shall be considered for further evaluation as per NIT and all the other items of the tender.

2.7 Bidder to ensure that Third Party/customer issued certificates being submitted as proof of PQR qualification should have verifiable details of document/ certificate issuing authority such as name & designation of issuing authority and its organization contact number and email-id etc. In case the same found not available, purchaser has right to reject such document from evaluation.

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1 X 660 MW SAGARDIGHI TPS UNIT-V												
M.E. BELLOWS												
SL. NO.	**ITEM DESCRIPTION**			**TOTAL QTY (Nos)**	**HSN Code**	**UNIT EX-WORKS PRICE (DULY PACKED) (Rs.)**	**TOTAL EX-WORKS DULY PACKED (Rs.)**	**FREIGHT @....% OF TOTAL EX-WORKS (Rs.)**	**TOTAL PRICE (EXWORKS + FREIGHT) (Rs.)**	**GST @....% ON (TOTAL EXWORKS +FREIGHT) (Rs.)**	**TOTAL FOR SITE PRICE (Rs.)**
	SIZE (NB)	**TYPE**	**TAG NO**								
1	2000	GIMBAL BELLOWS	E1, E2, E4 & E5	4	83071000						
2	2000	HINGED ANGULAR BELLOWS	E3 & E6	2	83071000						
3	800	HINGED ANGULAR BELLOWS	E7 & E9	2	83071000						
4	800	TIED LATERAL ANGULAR BELLOWS	E8 & E10	2	83071000						
5	500	UNTIED BELLOWS	E15, E16 & E17	3	83071000						
6	350	UNTIED BELLOWS	E11, E12, E13 & E14	4	83071000						
TOTAL				17							

NOTES

1	If Type Tests & FEA are required to be carried out in line with technical specification then the charges for the same shall deemed to be included in the unit quoted prices of main item. Bidder shall not indicate these charges as a separate head in the price bid.

1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V

Annexure A for Delivery Schedule

Sl. No.	Package name	BHEL Drawing No	Drawing Title	Primary/ Secondary	BHEL Inputs	Drg Sch for Vendors	Standard Delivery Terms for Supply Portion
1	**ME BELLOWS**	PE-V0-XXX-100-M171	GA Drawing indicating all necessary dimensions (with tolerance as per EJMA), cross sectional arrangement, arrangement of tie rods or limit rods or hinge arrangement or gimbal arrangement as applicable, along with washers, nuts, pins, arrangement of sleeves and shroud, bill of material incorporating all material of construction (MOC) of various parts & relevant standard to which MOC confirms to and total weight, welding standards and welding details, flange details/butt weld end details, design deflections, stiffness rates for each bellow and painting detail.	Primary		R-0 within 14 days from PO & subsequent revisions incorporating all the BHEL comments within 10 days of comments received from BHEL. BHEL shall furnish comments / approval on each submission within 18 days from receipt.	Within Six (06) months, from date of CAT-1 approval of Primary drawing/documents, subjected to drawing/document submission/re-submission schedule as stipulated, in case of any delay in submission/re-submission of Primary drawing/documents, then same shall be reduced from the given delivery period.Delay in BHEL's comments/approval beyond 18 days shall also be considered for delay analysis.
		PE-QP-XXX-100-M021	Quality Plan (QP) for ME BELLOWS	Primary			
		PE-V0-XXX-100-M172	Type Test reports in accordance with clause No. 8 of technical specification **Or** Type test procedures (if type test is not performed/ Valid type test report is not available).	Secondary			
		PE-V0-XXX-100-M173	AXIAL SPRING RATE TEST PROCEDURE FOR M.E. BELLOWS	Secondary			
		PE-V0-XXX-100-M174	Project specific, routine test procedure (hydro, vacuum and deflection) for ME bellows.	Secondary			

Notes

a. The end period specified is for completion of the deliveries. Deliveries to start progressively so as to meet the completion schedule.

b. The delivery conditions specified are for contractual LD purposes, however BHEL may ask for early deliveries without any compensation thereof.

c. Non-applicable drawings shall be decided during bid evaluation.

d. Wherever schedule of drawings/documents submission / re-submission is stipulated in the Technical Specifications, same shall be superseded by delivery specified in NIT.

e. Vendor to start manufacturing activities only after obtaining specific manufacturing clearance from BHEL Purchase group.

f. Submission and resubmission of the primary documents shall be considered for delay analysis by BHEL.

g. Approval on Secondary documents shall be obtained before final inspection.

ADDITIONAL TERMS AND CONDITIONS OF GeM NIT - SAME SHALL SUPERSEDE TERMS AND CONDITIONS MENTIONED ELSEWHERE IN BID

1) Payment Terms - As per clause no. 12 (i) of GTC on GeM. Supplier has to provide Tax invoice, Packing List, LR/RR, CRAC, Insurance intimation, Guarantee Certificate, E-way bill (as applicable) for payment.

   Offline payment mode shall be selected. Payment will be released to seller within 60 days after submission of complete documents (45 days for vendors qualified and registered as Micro or Small as per MSMED Act). Provision of offline payment in GeM shall be utilized.

2) Terms of Delivery - As per cl. No. 13 of GTC on GeM. However, loading & Transit insurance shall be in the scope of Seller and unloading of items at delivery point shall be in the scope of BHEL. Bidder to quote prices accordingly.

3) Delivery - Delivery schedule shall be as per "Annexure A for Delivery Schedule" mentioned in technical specification document.
   Delivery period chosen as 999 days from PO date shall not be considered for Delivery and Delay analysis purpose as same has been selected for sake of GeM.
   For Delivery and delay analysis purpose, delivery schedule mentioned in "Annexure A for Delivery Schedule" available in technical specification document shall be considered.

4) Class 1 Local Supplier & Class 2 Local Supplier are eligible to bid in this tender. This package is divisible in nature and purchase preference shall be 20%.

5) Liquidated Damages - Purchaser reserves the right to recover from the Seller/ Contractor, as agreed liquidated damages and not by way of penalty, a sum equivalent to half (½) percent and applicable GST thereon, of the total main supply contract price excluding GST per week or part thereof, subject to a maximum of ten(10) percent of the total main supply contract price excluding GST, if the Seller/ Contractor fails to deliver any part of the ordered goods/stores within the period stipulated in the Order/ Contract.
   NOTES:
   i. LR/RR date for indigenous supplies (Bill of Lading/AWB for Foreign supplies) shall be treated as the date of dispatch for levying LD. However, if receipted LR date for indigenous supply is beyond 30 days for FTL/ 45 days for PTL from the date of LR (PTL to be clearly mentioned in LR), such excess period shall be considered for LD purpose irrespective of dispatch date. Import General Manifest (IGM)/Bill of entry date (whichever is earlier), for foreign supplies, is beyond 90 days from the date of Bill of Lading/AWB, such excess period shall be considered for LD purpose irrespective of dispatch date.

ii. In case of any amendment/ revision, LD shall be linked to the amended/ revised contract value and delivery date(s).

iii. If Order/ Contract involves two or more Units/ Sets/ Lots/ Stages, then Liquidated Damages shall be levied on order/ contract value excluding GST of the delayed Unit/ Set/ Lot/ Stage, provided delivery stipulated in the Order/ Contract is Unit/ Set/ Lot/Stage wise, however total LD amount shall be limited to 10% of total order/ amended order value excluding GST of delayed Unit/ Set/ Lot/Stage. Any subsequent lot released (not envisaged in original contract) due to increase in quantity within permissible quantity variation shall be treated as separate lot for the purpose of LD.

iv. The sum specified above is not a penalty but a genuine pre-estimate of the loss/ damage which will be suffered by purchaser on account of delay on the part of the Contractor/Seller and the said amount will be deductible without proof of actual loss or damage caused by such delay.

6) Guarantee Terms - As per Cl. No. 10 of GTC on GeM for the bid, however, guarantee period shall be 18 months from the date of last supply for Main Supply scope.

7) Bank Guarantee submission shall be as per cl. No. 7 of GeM GTC with initial validity of 28 Months. Further, extension if any shall be as per GeM Terms/Guarantee terms.

8) Material shall be dispatched only after issuance of MDCC by BHEL. Advance intimation of dispatch by bidder shall be given, to PEM and Insurance agency/Site.

9) Quantity variation shall be NIL for this package.

10) This is a conditional tender enquiry. Reverse Auction of a bidder shall be subjected to the following:
    i) Approval of vendor by end customer i.e. (M/s WBPDCL)
    ii) Techno-Commercial evaluation by BHEL.
    iii) Qualification of Technical PQR.

11) Bidders to ensure that Third party / customer issued certificates being submitted as proof of PQR qualification should have verifiable details of document / certificate issuing authority such as name & designation of Issuing Authority and its organisation contact number and e-mail Id etc. In case the same found not available, Purchaser has right to reject such document from evaluation.

12) This item/package /system falls under the list of items defined in para 3 of ministry of finance guideline dtd. 20.09.16 (Procurement of items related to Public safety, Health, Critical Security operations & Equipments etc.) & hence criteria of prior experience/Turnover shall be same for all the bidders including start-up/MSME.

13) Bidders to,Ministry of Finance (MoF) orders no F.No. 6/18/2019-PPD dated 23/07/2020 and clarification dated 24.07.2020 shall be applicable for this NIT and

compliance of these circulars shall be ensured by bidders. Further, relevant clause of order no. 25-11/6/2018-PG dated 02.07.20 issued by MoP shall also be complied. An undertaking regarding Model Clauses (as applicable from Annexure-III of the said circular) shall be furnished by bidders along with bid documents.

14) Due to COVID-19 pandemic condition prevailing in the country, BHEL/PEM may go for Remote Inspection of Offered items, if required. Vendors are requested to be equipped with the facilities/gadgets as indicated in the guidelines mentioned in "https://pem.bhel.com/Documents/VendorSection/Vendor/Guidelines.pdf" to take up the inspection REMOTELY.

    Inspection call to be raised by bidder on BHEL CQIR portal (details shall be shared at the of execution of order) and Inspection agency shall attend at the inspection within seven (07) days of the date on which the material is notified as being ready. In case of delay in witnessing of inspection beyond stipulated time (i.e. 7 days from the date on which the material is notified as being ready), by BHEL arising due to reasons not attributable to vendor, BHEL will extend the delivery period for such delay in carrying out inspection. If BHEL is not able to witness inspection up to 15 days then in addition to delay beyond stipulated period, extension in delivery time of 07 days for arranging fresh inspection will be given.

    When the tests have been satisfactorily completed at Seller/ Contractor's works, the Inspection Agency shall issue an inspection report that effect within seven (07) days after completion of the tests, but if the tests were not witnessed by the Inspection Agency or his representative, the material acceptance report would be issued within seven (07) days after receipt of the test certificates by the Purchaser.

    Purchaser will issue MDCC to the Seller/ Contractor within 7 days based on inspection report/ test certificates/Certificate of Conformance as applicable. In case of delay in issuance of MDCC beyond 7 days stipulated time (i.e. from the date of successful inspection report), by BHEL arising due to reasons not attributable to vendor, BHEL will extend the delivery period for such delay in issuing MDCC. If BHEL is not able to issue MDCC up to 15 days then in addition to delay beyond stipulated period, 7 days' additional time shall be given to vendor to facilitate the vendor for arranging logistics arrangements.

15) The Bidder declares that they will not enter into any illegal or undisclosed agreement or understanding, whether formal or informal with other Bidder(s). This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process. In case, the bidder is found having indulged in above activities, suitable action shall be taken by BHEL as per extant policies/guideline.

16) Bidders to inform freight/GST percentage for all the items as part of un-priced bid to be submitted along with their Techno-Commercial offer. However, negotiation/RA shall be on Total Evaluation (FOR as per GeM) price only as per GeM conditions. Detailed Price Break shall be reverse calculated based on freight/GST percentage furnished by bidder for Order Placement. Same shall be mentioned in NIT.

17) Bidder has to provide the details as per TECHNICAL PQR (attached with Specifications of product catalogue) in its offer and has to note that bids of only those bidders shall be evaluated who meet the Technical Pre-Qualifying requirements.

18) In course of evaluation, if more than one bidder happens to occupy L-1 status, effective L-1 will be decided by soliciting discounts from the respective bidders. In case more than one bidder happens to occupy L-1 status even after soliciting discounts, the L1 bidder shall be decided by a toss / draw of lots, in the presence of respective bidder(s) or their representative(s). Ranking will be done accordingly. BHEL's decision in such situation shall be final and binding.

19) Evaluation will be done on L1 (Total cost to BHEL basis). Incomplete offer or part offer of NIT BOM/BOQ shall be summarily rejected.

20) GeM has the functionality to quote Single Unit Price (FOR) for each item. Bidders to furnish applicable Freight & GST % w.r.t. Ex Works included in Single quoted (FOR) prices before Price Bid Opening.

21) For recognition of dispatch, vendor to submit following documents to BHEL by e-mail/ fax immediately on dispatch: - GST compliant invoice, LR for Indian Vendors (indicating Invoice No., no. of boxes, PTL (if applicable) etc.) / Bill of Lading or AWB for foreign vendor, Packing List (Must be indicating No. of boxes, Packing size, Gross weight and net weight of each package, Contents of the package with cross reference to BoM item code no. or item serial no. and Quantity of each item separately), Insurance Intimation to underwriter through email/fax, Dispatch Clearance.

22) Following ATC available in GEM shall also be part of NIT: -

    i. Bidder's offer is liable to be rejected if they don't upload any of the certificates / documents sought in the Bid document, ATC and Corrigendum if any.

    ii. Bidders are advised to check applicable GST on their own before quoting. Buyer will not take any responsibility in this regards. GST reimbursement will be as per actuals or as per applicable rates (whichever is lower), subject to the maximum of quoted GST %.

    iii. Data Sheet of the product(s) offered in the bid, are to be uploaded along with the bid documents. Buyers can match and verify the Data Sheet with the product specifications offered. In case of any unexplained mismatch of technical parameters, the bid is liable for rejection.

iv. The bidder is required to upload, along with the bid, all relevant certificates such as BIS licence, type test certificate, approval certificates and other certificates as prescribed in the Product Specification given in the bid document.

v. While generating invoice in GeM portal, the seller must upload scanned copy of GST invoice and the screenshot of GST portal confirming payment of GST.

23) For bidders (who are not registered with BHEL-PEM) - For registration in BHEL PEM-Online registration portal is operational, Non-registered Vendors who wish to apply for registration in BHEL-PEM can apply through Online Registration Portal available at www.pem.bhel.com - vendor section - Online Supplier Registration. All credentials and/or documents duly signed and stamped related to registration can be uploaded on the website and submit the application for registration. However, registration of suppliers is not mandatory in case of open tender.

24) All terms & conditions shall be as per GeM bid (including this document regarding additional terms and conditions of GeM NIT), selected Additional Terms & Conditions from GeM library and GTC on GeM version available on GeM Portal as on the date of bid publication.

25) Bidders have to note, “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), (PPP-MII) Order 2017 dt. 16/09/2020 issued by DPIIT. In case of subsequent orders issued by the 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.”

Following point to be noted regarding verification of local content: -

a. Eligibility of Suppliers: Class I & Class II Local Suppliers are eligible to quote against this tender.
b. b. Minimum Local Content required for qualifying a bidder as "Class I / Class II Local Supplier": As per para no. 5 of Public Procurement (Preference to Make in India), (PPP-MII) Order 2017 dt. 16/09/2020 issued by DPIIT.
c. In accordance with para 9 (a) of DPIIT’s PP-MII order 2017 revision dated 04/06/2020, Class-I local suppliers” / “Class-II local suppliers” at the time of tender, bidding or solicitation shall be required to indicate percentage of local content and provide self-certification that the item offered meets the local content requirement for the Class-I local supplier” / “Class-II local supplier” as the case may be. They shall also give details of the location(s) at which the local value addition is made.

RISK & COST PURCHASE.

DEFAULT/ BREACH OF CONTRACT, INSOLVENCY AND RISK PURCHASE

In case of delays (beyond the maximum late delivery period as per LD clause) in supplies, or if there be defective supplies or non-fulfilment of any other terms and conditions of the Contract as enumerated subsequently in this clause, then, without prejudice to its right to recover any expenses, losses or damages to which the Buyer may be put to incur or sustain by reason of the Seller/Contractor's default or breach of Order/Contract or to suspend business dealings with the Seller/Contractor in terms of the Buyers' Guidelines for Suspension of Business Dealings as applicable from time to time, the Buyer shall also be entitled to cancel the Order/ Contract either in whole or portion thereof without compensation to Seller. On the occurrence of any of the acts/omissions mentioned below, the Buyer may if it so desires, procure upon such terms and in such manner as deemed appropriate, plant/ equipment/ stores not so delivered or others of similar description where plant/ equipment/ stores exactly complying with particulars are not, in the opinion of the Buyer (which shall be final), readily procurable, at the risk and cost of the Seller.

The Seller shall be liable to the Buyer for any excess costs incurred thereof and the Seller shall continue the performance of the Order/Contract to the extent not cancelled under the provisions of this clause. The Seller shall on no account be entitled to any gain on such repurchases. If the Bidder does not agree to this Risk Purchase clause, BHEL reserves the right to reject the bid/offer of the Bidder.

The order/contract may be cancelled in whole or part thereof and Risk & Cost Clause in line with terms and conditions of PO/Contract may be invoked by the Buyer in any of the following cases:

i. If the Seller/Contractor fails to deliver the goods or materials or any installment thereof within the period(s) fixed for such delivery or the Seller's poor progress of the supply/services vis-à-vis delivery/execution timeline as stipulated in the contract, backlog attributable to the Seller including unexecuted portion of supply does not appear to be executable within balance period available;
ii. delivers goods or materials not of the contracted quality and failing to adhere to the contract specifications/execution methodology;
iii. withdrawal from or repudiation/abandonment of the supply/services by the Seller before completion as per contract or if the Seller refuses or is unable to supply goods or materials covered by the order/Contract either in whole or in part or otherwise fails to perform the Order/Contract.

iv. Non supply by the Seller within scheduled completion/delivery period as per contract or as extended from time to time for reasons attributable to the Seller;

v. Termination of Contract on account of any other reason(s) attributable to the Seller.

vi. Assignment, transfer, sub-letting of Contract without BHEL's written permission resulting in termination of Contract or part thereof by BHEL.

vii. If the Seller be an individual or a Sole Proprietorship, in the event of death or insanity of the Seller.

viii. If the Seller/Contractor being an individual or if a partnership firm thereof, shall at any time be adjudged insolvent or shall have a receiving order for administration of his estate made against him or shall take any proceeding for composition under any Insolvency Act for the time being in force or make any assignment of the order/Contract or enter into any arrangement or composition with his creditors or suspend payment or if the firm dissolved under the Partnership Act;

ix. If the Seller/Contractor being a Company is wound up voluntarily or by order of a Court or a Receiver, Liquidator or Manager on behalf of the debenture holders and creditors is appointed or circumstances have arisen which entitles the Court of debenture holder and creditors to appoint a receiver, liquidator or manager

x. Non- Compliance to any contractual condition or any other default attributable to the Seller.

Such defaulting vendor/Seller shall not be eligible to participate in re-tendering conducted on account of risk purchase made due to fault of such vendor/Seller.

BHEL's right to go for Risk and Cost, Calculation of Risk and Cost amount & LD, recovery options to BHEL are given in detail in Annexure-V hereto.

ANNEXURE-V

(RISK AND COST CLAUSE)

1. BHEL reserves the right to terminate the contract or withdraw portion of work and get it done through other agency, at the risk and cost of the contractor *after due notice of a period of 14 days' by BHEL* in any of the following cases:

   i) If the Seller/Contractor fails to deliver the goods or materials or any instalment thereof within the period(s) fixed for such delivery or the Seller's poor progress of the supply/ services vis-a-vis delivery/execution timeline as stipulated in the Contract, backlog attributable to seller including unexecuted portion of supply does not appear to be executable within balance available period;
   ii) Delivers goods or materials not of the contracted quality and failing to adhere to the contract specifications;
   iii) Withdrawal from or repudiation/ abandonment of the supply/ services by Seller before completion as per contract or if the Seller refuses or is unable to supply goods or materials covered by the Order/Contract either in whole or in part or otherwise fails to perform the Order/Contract;
   iv) Non-supply by the Seller within scheduled completion/delivery period as per Contract or as extended from time to time, for the reasons attributable to the Seller;
   v) Termination of Contract on account of any other reason (s) attributable to Seller.
   vi) Assignment, transfer, subletting of Contract without BHEL's written permission resulting in termination of Contract or part thereof by BHEL.
   vii) If the Seller be an individual or a sole proprietorship Firm, in the event of the death or insanity of the Seller;
   viii) If the Seller/Contractor being an individual or if a firm on a partnership thereof, shall at any time, be adjudged insolvent or shall have a receiving order for administration of his estate made against him or shall take any proceeding for composition under any Insolvency Act for the time being in force or make any assignment of the Order/Contract or enter into any arrangement or composition with his creditors or suspend payment or if the firm dissolved under the Partnership Act;
   ix) If the Seller/Contractor being a company is wound up voluntarily or by order of a Court or a Receiver, Liquidator or Manager on behalf of the debenture holders and creditors is appointed or circumstances shall have arisen which entitles the Court of debenture holder and creditors to appoint a receiver, liquidator or manager;
   x) Non-compliance to any contractual condition or any other default attributable to Seller.

1.1 **Risk & Cost Amount against Balance Work:**

Risk & Cost amount against balance work shall be calculated as follows:

Risk & Cost Amount= [(A-B) + (A x H/100)]

Where,
A= Value of Balance scope of Work (*) as per rates of new contract
B= Value of Balance scope of Work (*) as per rates of old contract being paid to the contractor at the time of termination of contract i.e. inclusive of PVC & ORC, if any.
H = Overhead Factor to be taken as 5

In case (A-B) is less than 0 (zero), value of (A-B) shall be taken as 0 (zero).

1.2 *** Balance scope of work (in case of termination of contract):**

Difference of Contract Quantities and Executed Quantities as on the date of issue of Letter for 'Termination of Contract', shall be taken as balance scope of Work for calculating risk & cost amount.

Contract quantities are the quantities as per original contract. If, Contract has been amended, quantities as per amended Contract shall be considered as Contract Quantities.

Items for which total quantities to be executed have exceeded the Contract Quantities based on drawings issued to contractor from time to time till issue of Termination letter, then for these items total Quantities as per issued drawings would be deemed to be contract quantities.

Substitute/ extra items whose rates have already been approved would form part of contract quantities for this purpose.

Substitute/ extra items which have been executed but rates have not been approved, would also form part of contract quantities for this purpose and rates of such items shall be determined in line with contractual provisions.

However, increase in quantities on account of additional scope in new tender shall not be considered for this purpose.

NOTE: In case portion of work is being withdrawn at risk & cost of contractor instead of termination of contract, contract quantities pertaining to portion of work withdrawn shall be considered as 'Balance scope of work' for calculating Risk & Cost amount.

1.3 **LD against delay in executed work in case of Termination of Contract:**

LD against delay in executed work shall be calculated in line with LD clause no. 16 of GCC, for the delay attributable to contractor. For limiting the maximum value of LD, contract value shall be taken as Executed Value of work till termination of contract.

Method for calculation of LD against delay in executed work in case of termination of contract" is given below.

i. Let the time period from scheduled date of start of work till termination of contract excluding the period of Hold (if any) not attributable to contractor = T1
ii. Let the value of executed work till the time of termination of contract = X
iii. Let the Total Executable Value of work for which inputs/fronts were made available to contractor and were planned for execution till termination of contract = Y
iv. Delay in executed work attributable to contractor i.e. T2 = [1-(X/Y)] x T1
v. LD shall be calculated in line with LD clause (clause 16) of the Contract for the delay attributable to contractor taking "X" as Contract Value and "T2" as period of delay attributable to contractor.

2. Recoveries arising out of Risk & Cost and LD or any other recoveries due from Contractor

Without prejudice to the other means of recovery of such dues from the Seller recoveries from the Seller on whom risk & cost has been invoked shall be made from the following:

a) Dues available in the form of Bills payable to seller, SD, BGs against the same contract.
b) Dues payable to seller against other contracts in the same Region/Unit/ Division of BHEL.
c) Dues payable to seller against other contracts in the different Region/Unit/ division of BHEL.

In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against contractor.

1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V

GeM BID NO. -……..., Dt:-

ANNEXURE -II (INSTRUCTIONS TO PACKING LIST)

For faster verification of bills, successful bidder to submit detailed Bill of Material (BOM) at the time of drawings/ documents submission after placement of PO. Each item of the BOM to be uniquely identified with item code no. or item Sl. No. Supplier to ensure that all items which will find separate mention in the packing list are covered in this detailed BOM.

Supplier to also give the following undertaking in the BOM:
"The BOM provided herewith completes the scope (in content and intent) of material supply under PO No. ……. Dated …… Any additional material which may become necessary for the intended application of the supplied items/package will be supplied free of cost in most reasonable time.

Packing List must indicate:

a) Packing size
b) Gross weight and net weight of each package
c) Contents of the package with cross reference to BOM item code no. / Sl. No.
d) Quantity of each items separately.

The packing list must cover all the BOM items.

Supplier to give following undertaking in the packing list:

The Packing list provided herewith is as per BOM approved under PO No. -----

THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.(WBPDCL)

1X660 MW SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT#5)

TECHNICAL SPECIFICATION FOR METAL EXPANSION BELLOWS

SPECIFICATION NO: PE-TS-445-100-M021 REV-00

BHARAT HEAVY ELECTRICALS LIMITED, POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

	TECHNICAL SPECIFICATION METAL EXPANSION BELLOWS 1X660 MW SAGARDIGHI THERMAL UNIT#5	SPECIFICATION NO. PE-TS-445-100-M021 REV-00 DATE: 24/11/2021

C O N T E N T S

SECTION-I: SPECIFIC TECHNICAL REQUIREMENTS

1. GENERAL

1.1. The Metal Expansion Bellows shall meet the technical requirements and conform to the requirements of Section-I and Data Sheet of section II. However, in the event of contradictions between Section-I & Data sheet of Section-II, Data Sheet will prevail.

1.2. Vendor to manufacture bellows as per final BHEL approved GA drawings which will be prepared in accordance with reference drawings & DATA Sheet. Any ambiguity in constructional/dimensional detail must be communicated to BHEL. Such changes, if any, will be subjected to BHEL approval and will NOT have any cost implication on BHEL.

2. SCOPE OF SUPPLY

2.1 The bellows to be supplied shall be as per Data Sheet. For detail, refer the same.

2.2 Special Tools and tackles, if any.

3. CODES & STANDARDS

3.1 The design, manufacturing, performance and testing of the expansion bellows shall conform to the latest editions of the relevant codes and standards inclusive of the stipulations in the latest edition of Expansion Joint Manufacturers Association Standards (EJMA), ASME Section IX, ASME B 16.25, ASME Section VIII, ASTM E-165, ASME SEC-V and ASME- B31.1.

3.2 In case the specification differs with the requirement of Codes/Standards, the specification shall govern.

4. DESIGN REQUIREMENTS

4.1 The design calculations of bellows shall be as per latest edition of EJMA.

4.2 Dimensional tolerance for the expansion bellows should be as per latest edition of EJMA.

4.3 The expansion bellows shall be capable of withstanding design pressure and 50mm of Hg (abs).

4.4 FEA analysis shall be carried out for Tied, Hinged and Gimbal Bellows of all sizes. The FEA report shall be submitted for approval of GA drawings. However, if the FEA of same sized bellows with similar parameters have been carried out, then test reports of same can be submitted for the approval of GA drawings. But, these reports shall not be older than 10 (ten) years from the date of placement of purchase order.

4.5 The expansion bellows shall be designed for the deflections indicated in GA drawing. The spring rates of the bellow expansion joint shall be within +15% to -30% of the values specified in GA drawing.

4.6 Designed cycle life of the expansion bellows shall be minimum of 10,000 cycles.

4.7 Stress relieving or annealing/heat treatment after forming of bellows is not recommended.

4.8 No pre-tension of bellows is permitted.

5. MATERIAL

5.1 The material of construction of bellows shall be as indicated in Data sheet and GA drawings.

5.2 The materials of construction of the remaining parts shall be to suit service conditions. These materials shall be subject to approval of the BHEL.

5.3 Materials used in manufacturing of bellows shall be of tested quality.

6. CONSTRUCTIONAL FEATURES

6.1 METALLIC BELLOWS

a) The bellows shall be manufactured by hydraulic forming, roll forming or any other method specified in latest edition of EJMA. They should be formed from perfect cylinders of single ply, 304 grade stainless steel.

b) The number of longitudinal weld seam shall be minimum & Circumferential welding of elements to make bellows is not permitted. The welding procedure and welder qualification shall be as per ASME Section IX.

c) All bellow elements shall be pickled after forming.

d) Butt welded expansion joints shall have adequate length of pipe so that site welding does not impair or reduce the metallic expansion bellows efficiency.

e) Bidder to ensure that thinning due to forming shall be less than 15%.

6.2 SLEEVES & SHROUDS

a) Expansion joints will be furnished with sleeves of the same material as the bellows and installed with sufficient clearance to allow full rated deflection. The sleeves shall be welded on the flow inlet end of the bellows only. The sleeves shall also be provided with a drain hole wherever necessary to avoid condensate accumulation.

b) Bellows shall have shrouds with an arrow indicating the direction of flow on the outside. These are the external steel covers provided to protect bellows from physical damages during shipping, installation and while in operation. The arrangement of shrouds shall be suitable for supporting insulation where necessary and shall be detachable. Shrouds shall not restrict the free deflection of bellows.

6.3 TIE BARS & LIMIT RODS

a) Untied expansion joints shall have a minimum of two limit rods across the bellows to prevent the bellows from closing/opening under vacuum / pressure beyond limit.

b) Tied lateral angular expansion joints shall be provided with two tie rods to take care of vacuum/pressure thrust. These tie rods shall have spherical washers with sufficient clearances in flange holes to accommodate lateral deflections of bellows. These bellows shall be capable of taking care of angulation in one plane.

c) Spherical washers/hinges should have a low coefficient of friction preferably with P.T.F.E. lining.

d) Bellows shall be provided with complete round flanges housing the tie rods/ limit rods.

6.4 HINGE & GIMBAL COMPONENTS

a) Hinged bellows shall be provided with hinge plates and hinge pin permitting the bellows for angular rotation about one plane while taking care of pressure thrust.

b) Gimbal bellows shall have a gimbal ring, which is square (as indicated in standard GA drawing) with hinge plates and pins allowing the bellows to angulate in both planes while taking care of pressure thrust.

7. QUALITY ASSURANCE, TESTING AND INSPECTION

7.1 The items covered under this contract shall be subjected to inspection, testing and quality surveillance. The Inspection Agency shall, at all reasonable times have access to Vendor's works, Quality Control records and all facilities as reasonably required for carrying out the inspection and testing efficiently, and these shall be provided by the vendor free of cost.

7.2 The Quality Plan enclosed with this specification specify minimum quality control requirement. During contract stage, vendor shall furnish this Quality Plan duly signed & stamped for BHEL approval. The final quality plan may incorporate some changes based on BHEL's customer comments (if any). Quality plans shall be approved by BHEL and/or the customer. All inspection and testing shall be carried out by BHEL/ BHEL representative and the customer (as applicable). In case, inspection is by both BHEL and the customer, then the inspection can be carried out jointly or separately, which will be informed accordingly. In case of the foreign bidder, inspection shall be carried out by reputed third party.

7.3 For foreign bidders, charges for third party inspection (Lloyds, TUV or equivalent) shall be included in the base price of the item by the bidder. This third party agency shall be approved by BHEL. Bidder to inform the same in the offer and mention the same in Quality Plan.

Note: There may be some changes in quality plan depending on customer/consultant comments which will have to be accommodated by vendor at no extra cost.

7.4 Bellows shall be subject to all test and inspection required by the applicable codes and standards as per quality plan and those specified below. The vendor shall fully shop assemble the expansion bellow and perform test to demonstrate that its performance is as specified:

a) All welds shall be dye-penetrant tested as per ASTM E-165/ASME SEC-V. Post cleaning of dye penetrant shall be taken care.

b) Material test certificates for both chemical and mechanical properties as per the relevant code shall be furnished.

c) The expansion bellow shall be assembled and hydro-statically tested with calibrated gauge at shop at 1.5 times the design pressure for a period of half-an hour.

d) The expansion bellow shall be subject to vacuum test with calibrated gauge at the shop at a pressure of 50 mmHg (abs) for a period of half-an hour.

e) All attachment welds and fillet welds in the bellow assembly shall be either magnetic particle tested or dye-penetrant tested or as per quality plan.

f) Axial spring rate test (stiffness test) for verifying actual spring rate with theoretical value with a tolerance of +15% to -30%.

g) Deflection test is to ensure that the bellow deflect for the designed movement in any direction when induced individually or simultaneously without any obstruction. Deflection test shall be carried out considering the effects of combined movement of axial, lateral and angular (equivalent axial movement per convolution shall be calculated as per EJMA).

h) Examination of radiography including radiographic techniques, radiographic examination of the longitudinal seam of the bellows should be performed before the bellow is convoluted. No lack of fusion is allowed. The test procedures shall be as per ASME SEC-V & acceptable norms as per ASME SEC VIII.

i) Test will be witnessed by the customer / consultants/ BHEL unless otherwise waived.

8. TYPE TESTS (CYCLE LIFE, SQUIRM AND YIELD RUPTURE TESTS)

8.1 Type tests as per EJMA are required to be carried out for bellows. These shall be done as per classification given below:

Based on Diameter of Bellows: The categories are as follows:

a) Nominal diameter up to 800mm NB.
b) Nominal diameter greater than 800mm NB & up to 1600 NB.
c) Each size above 1600mm NB shall be a separate category.

8.2 If type tests have been successfully done for earlier BHEL projects for the bellows of the same type* in a group (as indicated in cl. 8.1 above), then test certificates of same will be reviewed and no type test needs to be carried out. But, these test certificates shall not be older than 5 (five) years from the date of placement of Purchase order. However, in this case, type test clearance shall be taken from BHEL prior to offering to routine test. In case no type test has been conducted for earlier projects or type test reports are older than 5 years, type test shall be carried out and type test procedure approval shall be taken from BHEL prior to offering to routine test.

Final decision regarding conductance of type test will be conveyed by BHEL at a later date after award of contract, which will be binding on the bidder without commercial implication.

Note: 1) Same *type* means bellows having same height, pitch, general shape of convolution profile, ply thickness and type of bellow materials.*

2) If Type Tests & FEA are required to be carried out in line with technical specification, then the charges for the same shall deemed to be included in the unit quoted prices of main item and shall not be indicate as a separate head in the price bid.

8.3 CRITERIA OF TEST

Type tests, as per EJMA, shall be carried out on two bellows of any size from each group of bellows (as per clause 8.1 above). One bellow shall be used for life cycle test and the other for Squirm & Yield rupture test. Accordingly, all the bellows of the group shall be qualified on the basis of this test.

8.4 NO. OF CYCLES

For the life cycle test, the number of test cycles shall be minimum 10,000 cycles. The squirm and yield pressure shall be as per approved pressure and calculations.

	TECHNICAL SPECIFICATION METAL EXPANSION BELLOWS	SPECIFICATION NO. PE-TS-445-100-M021 REV-00	
		DATE: 24/11/2021	SECTION-I
	1X660 MW SAGARDIGHI THERMAL UNIT#5	SPECIFIC TECHNICAL REQUIREMENTS	SHEET 5 OF 7

9. PAINTING REQUIREMENT:

The painting requirement will be informed **during detail engineering of the project**. However, a generic painting detail are given below

SERVICE	SURFACE CLEANING	PAINTING DETAIL	COLOUR SHADE
Condensate suction line	SP3, Power tool cleaning	Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer. Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide. Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade / sea green color with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided. Total DFT of paint system shall not be less than 300 microns.	As per IS 5 Sea green shade no. ISC -217
Flash Tank Vents		Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer. Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide. Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade / aluminum color with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided. Total DFT of paint system shall not be less than 300 microns.	Aluminum
TD BFP Exhaust			

10. CLEANING

10.1 All parts which are not made of stainless steel or other corrosion resisting materials shall be cleaned, flushed and coated with anti-corrosive paints of approved make and quality before shipment. Before painting, the surfaces shall be thoroughly cleaned of grease, dirt etc.

10.2 Prior to inspection and shipment, the expansion bellows shall be cleaned from inside and outside to remove all manufacturing wastes, scrap, mill scale, rust, etc.

10.3 Each expansion bellows shall be prepared for shipment in such a manner that the quality, cleanliness and finish shall be maintained during shipment.

11. PROTECTION, PACKING & DESPATCH

11.1 Each expansion bellows shall be fitted with a 2 mm thick rectangular stainless steel name plate indicating the following:

a) Manufacturer's Name
b) Expansion Joint Size & Type
c) Tag No.
d) Assembly Weight.

All detail shall be engraved 1 mm deep and filled with black enamel paint

11.2 Bellows Tag Number shall be incorporated in all the dispatch documents.

.

11.3 Exposed finished surface of metal expansion bellows shall be thoroughly greased before transportation and suitably protected in such a way so as to minimize the possibility of damage and deterioration during transit and storage.

11.4 The bellows has to be dispatched in total assembled form and shall be shipped at neutral length. They shall be provided with suitable erection and knock-off type temporary tie rods/ shipping brackets, wherever required, to prevent damage and misalignment during transit. These rods shall be tagged with instruction that they are to be left in place during erection but shall be removed before the system is placed in operation. These rods shall be provided in yellow colour.

11.5 Proper care shall be taken to avoid damage to the painted surface during transit and storage.

11.6 Expansion joints weighing more than 250kgs are to be provided with lifting lugs.

11.7 Bellows shall be packed in following manner:

a) First layer of hessian cloth.

b) Second layer of bubble sheet wrapping.

c) Third layer of stretch sheet wrapping.

d) Wrapped Bellows up to 1200 NB (inclusive) size shall be packed in wooden box suitable for handling and storage.

e) Wrapped Bellows above 1200 NB shall be placed in wooden box suitable for storage purpose. The box shall have clear marking that "The bellows to be handled separately from box."

f) The wooden boxes shall be suitable for storage at site in tropical climate conditions for a period of 15-18 months.

11.8 Vendor to provide soft copy of photos/snaps of duly packed ME Bellows. The soft copies to be provided by vendor to BHEL after final inspection of ME Bellows.

11.9 Clearance for dispatch of ME Bellows will be given only after verification of satisfactory packing conditions of ME Bellows from vendor's works.

12. DOCUMENTS TO BE SUBMITTED ALONG WITH OFFER

Bidder shall submit the following documents duly filled, signed and stamped along with the bid:

- Compliance sheet
- Documents as per the list indicated in the NIT

The above are the only documents which will be used for technical evaluation unless other documents are asked for during technical clarifications. Any other technical document enclosed with the bid shall be ignored for the purpose

of technical evaluation. All other documents attached with the specification are for information of the bidder and no comments shall be marked on these.

13. **DOCUMENTS TO BE SUBMITTED AFTER AWARD OF PROJECT.**

Category-A (Primary Documents):

1. GA Drawing indicating all necessary dimensions (with tolerance as per EJMA), cross sectional arrangement, arrangement of tie rods or limit rods or hinge arrangement or gimbal arrangement as applicable, along with washers, nuts, pins, arrangement of sleeves and shroud, bill of material incorporating all material of construction (MOC) of various parts & relevant standard to which MOC confirms to and total weight, welding standards and welding details, flange details/butt weld end details, design deflections, stiffness rates for each bellow and painting detail.

2. Quality plan duly signed and stamped.

Submission and resubmission of the above documents shall be considered for delay analysis by BHEL.

Category-B (Secondary Documents):

1. Type Test reports in accordance with clause No. 8 of technical specification

Or

Type test procedures (if type test is not performed/ Valid type test report is not available).

2. Axial spring rate test procedure for ME bellows.
3. Project specific, routine test procedure (hydro, vacuum and deflection) for ME bellows.

Approval on these documents shall be obtained before final inspection.

14. EXCLUSIONS

Erection & commissioning at site are excluded from the bidder's scope.

	TECHNICAL SPECIFICATION METAL EXPANSION BELLOWS 1X660 MW SAGARDIGHI THERMAL UNIT#5	SPECIFICATION NO. PE-TS-445-100-M021 REV-00	
		DATE: 24/11/2021	SECTION-II
		DATA SHEET- PART-1	SHEET 1 OF 1

SECTION-II

DATA SHEET

PART-1: BOQ FOR METAL EXPANSION BELLOWS

SL. NO.	ITEM DESCRIPTION			TOTAL QTY
	SIZE (NB)	TYPE	TAG NO	
1	2000	GIMBAL BELLOWS	E1, E2, E4 & E5	4
2	2000	HINGED ANGULAR BELLOWS	E3 & E6	2
3	800	HINGED ANGULAR BELLOWS	E7 & E9	2
4	800	TIED LATERAL ANGULAR BELLOWS	E8 & E10	2
5	500	UNTIED BELLOWS	E15, E16 & E17	3
6	350	UNTIED BELLOWS	E11, E12, E13 & E14	4
TOTAL				17

NOTE: If Type Tests & FEA are required to be carried out in line with technical specification then the charges for the same shall deemed to be included in the unit quoted prices of main item. Bidder shall not indicate these charges as a separate head in the price bid.

	TECHNICAL SPECIFICATION METAL EXPANSION BELLOWS 1X660 MW SAGARDIGHI THERMAL UNIT#5	SPECIFICATION NO. PE-TS-445-100-M021 REV-00	
		DATE: 24/11/2021	SECTION-II
		DATA SHEET PART-2	SHEET 1 OF 1

PART-2: GENERAL CONSTRUCTIONAL DETAIL

CONSTRUCTIONAL DETAILS FOR METAL EXPANSION BELLOWS							
SL. NO.	CONSTRUCTIONAL DETAIL	GIMBAL	HINGED	HINGED	TIED	UNTIED	UNTIED
	BELLOWS SIZE (NB)	2000	2000	800	800	500	350
1	PIPE SIZE (OD X THK)	2032X16	2032X16	813X10	813X10	508X9.53	355.6X9.53
2	ASSEMBLY TYPE	SINGLE	SINGLE	SINGLE	UNIVERSAL	UNIVERSAL	UNIVERSAL
3	OVERALL LENGTH (MM)	1100	900	800	1198	600	500
4	PLY THICKNESS (MM)	1.2	1.2	1	1	0.6	0.6
5	BELLOWS WIDTH (MM)	49	49	37	37	20	20
6	BELLOWS PITCH(MM)	33	33	28	28	20	20
7	CONVOLUTION	10	10	5	8+8	5+5	5+5
8	TANGENT THICKNESS (MM)	1.2	1.2	1	1	0.6	0.6
9	TANGENT LENGTH (MM)	20	20	20	20	20	20
10	COLLAR THICKNESS (MM)	2	2	1	1	1	1
11	COLLAR LENGTH (MM)	20	20	20	20	20	20
12	SPOOL/MID PIPE LENGTH (MM)	NA	NA	NA	350	150	90
13	SLEEVE THICKNESS (MM)	10	10	6	6	1.5	1.5
14	ROUND FLANGE THICKNESS (MM)	60	60	30	30	20	16
15	SQUARE GIMBAL RING THICKNESS (MM)	60	NA	NA	NA	NA	NA
16	SQUARE GIMBAL RING WIDTH (MM)	350	NA	NA	NA	NA	NA
17	HINGE MAIN PLATE THICKNESS (MM)	NA	60	30	NA	NA	NA
18	HINGE SUPPORT PLATE THICKNESS (MM)	30	30	15	NA	NA	NA
19	HINGE PIN/GIMBAL PIN DIA. (MM)	75	75	30	NA	NA	NA
20	GUSSET PALTE THICKNESS (MM)	30	30	15	NA	NA	NA
21	TIE ROD DIA. (MM)	NA	NA	NA	42	30	25
22	TIE ROD LENGTH (MM)	NA	NA	NA	1300	600	490
23	THICKNESS OF END PIPE LOCAL TO FLANGE (MM)*	22	22	10	10	9.53	9.53

NOTE:

1. *Thickness of end pipe local to flange to be as specified. It is to be step machined equal to pipe thickness near the bellows convolution and edge prepared to suit matching pipe ID at other end.
2. Thickness of pressure parts indicated are minimum requirements and the same shall be as per Finite Element Analysis.

	TECHNICAL SPECIFICATION METAL EXPANSION BELLOWS 1X660 MW SAGARDIGHI THERMAL UNIT#5	SPECIFICATION NO. PE-TS-445-100-M021 REV-00	
		DATE:24/11/2021	SECTION-II
		DATA SHEET PART-3	SHEET 1 OF 1

PART-3: MATERIAL OF CONSTRUCTION DETAIL

TABLE-1

SL. NO	PART NAME	MATERIALS FOR BELLOWS/PRESSURE PARTS/OTHER ATTACHMENTS
1	BELLOWS	ASTM 240 TP 304
2	INTERNAL SLEEVE	ASTM 240 TP 304
3	COLLAR	ASTM 240 TP 304
4	END PIPE/MID PIPE OR SPOOL PIPE	SA 672 GR.B 70/ SA 672 GR.C 70/ SA515 GR. 70/516 GR.70/SA106GR.B
5	HINGE PLATE SUPPORT FLANGE/HOUSING FLANGE/RING	IS 2062 GR.B/ SA515 GR. 70/516 GR.70
6	HINGE PIN / GIMBAL PIN	CARBON STEEL CL.8.8
7	GIMBAL PLATE	SA515Gr.70 /SA516Gr.70/ IS2062Gr.B
8	HINGE MAIN PLATE	SA515Gr.70 /SA516Gr.70/ IS2062Gr.B
9	HINGE SUPPORT PLATE	SA515Gr.70 /SA516Gr.70/ IS2062Gr.B
10	GUSSET PLATE	SA515Gr.70 /SA516Gr.70/ IS2062Gr.B
11	TIE ROD/LIMIT ROD WITH NUT & LOCKNUT	CARBON STEEL (CL. 6.8 & 6.0)
12	SPHERICAL WASHER	SA515Gr.60/ SA515Gr.70 /SA516Gr.60/SA516Gr.70
13	EXTERNAL SLEEVE/COVER/SHROUD & SHROUD SUPPORT	IS 2062 Gr. A/B
14	CIRCLIPS/WASHER	MILD STEEL
15	BOLT & NUT	IS1367 CL6.8/6.0
16	ANY OTHER COMPONENT	SPECIFIED BY BIDDER AND SHALL BE SUITABLE FOR INTENDED DUTY

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-445-100-M021 REV-00	DATE: 24.11.2021
	CUSTOMER : THE WEST BENGAL POWER DEVELOPMENT CORPORATION LTD.		QP NO.: PE-QP-445-100-M021 REV-00	DATE: 24.11.2021
	PROJECT: 1X660MW SAGARDIGHI UNIT#5		PO NO.:	DATE:
	ITEM: ME BELLOWS	SYSTEM: POWER PIPING	SECTION: II	SHEET 1 OF 6

Sl No.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT #	ACCEPTANCE NORMS	Format of RECORD	*	Agency			REMARKS
1	2	3	4	5	6		7	8	9	D	M	C	N	
					M	C/ N					**			
1.0 RAW MATERIAL														
1.1	MATERIAL FOR BELLOWS AND ASSEMBLY PARTS (SHEET/ PIPE / PLATES/ ROD / BAR)	CHEMICAL COMPOSITION	MA	CHEMICAL ANALYSIS	ONE PER BATCH/LOT/HEAT		APPROVED DRAWING		MTC (or) CHECK TEST CERTIFICATE	√	P	V	V	CORELATED TC W.R.T HEAT/BATCH/LOT TO BE REVIEWED BY BHEL QC. REFER NOTE NO:3
		MECHANICAL PROPERTIES		UTS, YS & PERCENTAGE OF ELONGATION	ONE PER BATCH/LOT/HEAT					√	P	V	V	
		DIMENSIONAL CHECK		MEASUREMENT	100 %	100 %			INTERNAL INSPECTION REPORTS	-	P	V	V	
		SURFACE EXAMINATION	MI	VISUAL	100 %	100 %				-	P	V	V	
2.0	**WELDING**													
2.1	1) WELDING PROCEDURE	CORRECTNESS OF PROCEDURE	CR	VERIFICATION OF WPS	100 %		IS 7307 / ASME SEC IX	IS 7307 / ASME SEC IX	IS 7307 / ASME SEC IX	√	P	V	V	
	2) PROCEDURE QUALIFICATION	WELD SOUNDNESS		DESTRUCTIVE TESTS	100%					√	P	V	V	REFER NOTE NO: 4
	3) WELDER PERFORMANCE QUALIFICATION	WELDERS' PERFORMANCE		DESTRUCTIVE TESTS / NON DESTRUCTIVE TEST OF A TEST COUPON	100%		IS 7310 / ASME SEC IX	IS 7310 / ASME SEC IX	IS 7310 / ASME SEC IX	√	P	W / V	V	REFER NOTE NO: 4

BHEL						BIDDER/VENDOR	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	Prabhjyot Singh	Prabhjyot Singh	Checked by:	Ashish Panigrahi	Ashish Panigrahi		
Reviewed by:	sweta singhal	Sweta Singhal	Reviewed by:	RITESH KUMAR JAISWAL	R K Jaiswal		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-445-100-M021 REV-00	DATE: 24.11.2021
	CUSTOMER : THE WEST BENGAL POWER DEVELOPMENT CORPORATION LTD.		QP NO.: PE-QP-445-100-M021 REV-00	DATE: 24.11.2021
	PROJECT: 1X660MW SAGARDIGHI UNIT#5		PO NO.:	DATE:
	ITEM: ME BELLOWS	SYSTEM: POWER PIPING	SECTION: II	SHEET 2 OF 6

Sl No	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	D*	**			
					M	C /N					M	C	N	
2.2	**BUTT / GROOVE WELDS**													
	1) BELLOWS AND PLATE FORMED PIPES	FITUP,SIZE OF WELD	MA	VISUAL AND MEASUREMENT	100 %	-	APPD DRG / ASME SEC VIII – DIVISION 1	ASME SEC VIII – DIVISION 1	INTERNAL INSPECTION REPORTS	-	P	-	-	
		SOUNDNESS OF WELD	CR	PT FOR BELLOWS LONG SEAM BEFORE FORMING	100 %		ASTM E 165	NO SURFACE DEFECT	INTERNAL INSPECTION REPORTS	-	P	V	V	
				RT FOR BELLOWS LONG SEAM BEFORE FORMING	100 %		ASME SEC V / APPD. DRG	ASME SEC VIII – DIVISION 1	RT REPORT	√	P	V	V	REVIEW OF FILM BY BHEL & CUSTOMER DURING INSPECTION FOR SL. NO. 3.1
				RT FOR PIPE LONG SEAM					RT REPORT	√	P	V	V	
	2) SEGMENTAL FLANGES	SURFACE DEFECTS OF WELDMENTS	MA	PT	100 %	100 %	ASTM E 165	NO SURFACE DEFECT	INTERNAL INSPECTION REPORTS	√	P	V	V	
		INTERNAL DEFECTS OF WELDMENTS i) FOR THICKNESS 40 MM & BELOW	MA	RT	100 %		ASME SEC V	ASME SEC VIII – DIVISION 1	RT REPORT	√	P	V	V	REVIEW OF FILM BY BHEL & CUSTOMER DURING INSPECTION FOR SL. NO. 3.1
		ii)FOR THICKNESS ABOVE 40 MM		UT			ASTM A388 &A435	ASTM A388 &A435	UT REPORT	√	P	V	V	
2.3	FILLET WELDS	SOUNDNESS OF WELDMENTS	MA	PT	100 %		ASME SEC V	ASME SEC VIII – DIVISION 1	INTERNAL INSPECTION REPORTS	√	P	V	V	

BHEL						BIDDER/VENDOR	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	Prabhjyot Singh	Prabhjyot Singh	Checked by:	Ashish Panigrahi	Ashish Panigrahi		
Reviewed by:	sweta singhal	Sweta Singhal	Reviewed by:	RITESH KUMAR JAISWAL	R.K Jaiswal		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-445-100-M021 REV-00	DATE: 24.11.2021
	CUSTOMER : THE WEST BENGAL POWER DEVELOPMENT CORPORATION LTD.		QP NO.: PE-QP-445-100-M021 REV-00	DATE: 24.11.2021
	PROJECT: 1X660MW SAGARDIGHI UNIT#5		PO NO.:	DATE:
	ITEM: ME BELLOWS	SYSTEM: POWER PIPING	SECTION: II	SHEET 3 OF 6

SL NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	D*	AGENCY ** M	C	N	REMARKS
1	2	3	4	5	6 M	6 C / N	7	8	9					
3.0	**INSPECTION & TESTS**												
3.1	BELLOWS CONVOLUTIONS	WORKMANSHIP	MA	VISUAL	100 %	APPD. DRG		INTERNAL INSPECTION REPORTS	√	P	W	V	
		DIMENSIONS		MEASUREMENT					√	P	W	V	
		SURFACE DEFECTS (INSIDE & OUTSIDE OF LONG SEAM)		PT		ASTM E 165	NO SURFACE DEFECT		√	P	W	V	
		THINNING		MOCK UP PIECE (or) UT	ONE / TYPE	EJMA	NOT TO EXCEED 15% OF ACTUAL RAW MATERIAL THICKNESS	INTERNAL INSPECTION REPORTS	√	P	W	V	REFER NOTE-6
3.2	FLANGE, SHROUD, SLEEVE,TIE ROD,WASHER & NUTS	WORKMANSHIP & DIMENSIONS	MA	VISUAL & MEASUREMENT	100 %	APPD. DRG		INTERNAL INSPECTION REPORTS	-	P	V	V	
3.3	SEGMENTAL FLANGE	STRESS RELIEVEVING	MA	REVIEW OF HT CHART	100 %	ASME SEC VIII		SR CHART	√	P	V	V	
3.4	ROUTINE TESTS	1) LEAK TIGHTNESS	CR	1) VACUUM TEST	100 %	1) 50 mm Hg (A)	NO LEAKAGE OR PERMANENT DEFORMATION	TEST REPORTS	√	P	W	V	
				2)HYDROSTATIC PR. TEST		1) APPD. DRG / 1.5 TIMES OF DESIGN PRESSURE			√	P	W	V	
		2) DEFLECTION	CR	DEFLECTION TESTS (EQUIVALENT AXIAL)	100 %	EJMA / APPD. DRG/ APPD. TEST PROCEDURE	EJMA / APPD. DRG/ APPD. TEST PROCEDURE	TEST REPORTS	√	P	W	V	

BHEL						BIDDER/VENDOR	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	Prabhjyot Singh	Prabhjyot Singh	Checked by:	Ashish Panigrahi	Ashish Panigrahi		
Reviewed by:	sweta singhal	Sweta Singhal	Reviewed by:	RITESH KUMAR JAISWAL	R K Jaiswal		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-445-100-M021 REV-00	DATE: 24.11.2021
	CUSTOMER : THE WEST BENGAL POWER DEVELOPMENT CORPORATION LTD.		QP NO.: PE-QP-445-100-M021 REV-00	DATE: 24.11.2021
	PROJECT: 1X660MW SAGARDIGHI UNIT#5		PO NO.:	DATE:
	ITEM: ME BELLOWS	SYSTEM: POWER PIPING	SECTION: II	SHEET 4 OF 6

SL NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	D*	**			
					M	C / N					M	C	N	
	ROUTINE TESTS	3) SPRING RATE (ONLY AXIAL)	CR	STIFFNESS TEST	ONE/ EACH SIZE AND SPRING RATE OF BELLOW		EJMA / APPD GA DRAWING/ APPROVED TEST PROCEDURE	EJMA / APPD GA DRAWING/ APPROVED TEST PROCEDURE	SPRING RATE CURVES REPORT	√	P	W	V	BELLOWS UNDER NORMAL CONDITION DEFLECTED TO THE VALUE AS SPECIFIED IN. APPD. DRAWING/ APPROVED TEST PROCEDURE
		4) CLEANLINESS	MA	VISUAL	100 %	100 %	APPD. DRG	APPD. DRG	INTERNAL INSPECTION REPORTS	√	P	V	V	
		5)WORKMANSHIP		VISUAL						√	P	V	V	
		6) MARKING		VISUAL						√	P	V	V	
3.5	TYPE TEST	CYCLE LIFE (10000 CYCLES), SQUIRM TEST, YIELD & RUPTURE	CR	DESTRUCTIVE TEST	REFER NOTE NO:1		BHEL/CUSTOMER APPD. TEST PROCEDURES / APPD. GA DRGS	BHEL/CUSTOMER APPD. TEST PROCEDURES / APPD. GA DRGS	TEST REPORTS	√	P	W	V	REFER NOTE NO: 2, 5 & 6
3.6	ASSEMBLY	WORKMANSHIP & DIMENSIONS	MA	VISUAL & MEASUREMENT	100 %	100 %	APPD. DRGS	APPD. DRGS	INTERNAL INSPECTION REPORTS	√	P	W	V	
4.0	PAINTING	SURFACE PREPARATION, PAINT THICKNESS & COLOUR OF PAINT		VISUAL & MEASUREMENT	100%	100%	APPD. DRG	APPD. DRG	INTERNAL INSPECTION REPORTS	√	P	V	V	PHOTOGRAPHS OF BELLOWS AFTER PACKING TO BE SEND TO BHEL-PURCHASE GROUP (PG) FOR VETTING BY BHEL-ENGINEERING BEFORE ISSUING MDCC
5.0	PACKING	SOUNDNESS OF PACKING		VISUAL	100 %	100 %	AS PER NOTE-9	AS PER NOTE-9	INTERNAL INSPECTION REPORTS	√	P	W	V	

BHEL						BIDDER/VENDOR	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	Prabhjyot Singh	Prabhjyot Singh	Checked by:	Ashish Panigrahi	Ashish Panigrahi		
Reviewed by:	sweta singhal	Sweta Singhal	Reviewed by:	RITESH KUMAR JAISWAL	R.K Jaiswal		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-445-100-M021 REV-00	DATE: 24.11.2021
	CUSTOMER : THE WEST BENGAL POWER DEVELOPMENT CORPORATION LTD.		QP NO.: PE-QP-445-100-M021 REV-00	DATE: 24.11.2021
	PROJECT: 1X660MW SAGARDIGHI UNIT#5		PO NO.:	DATE:
	ITEM: ME BELLOWS	SYSTEM: POWER PIPING	SECTION: II	SHEET 5 OF 6

NOTES: -

1. In case of foreign supplier, all test certificates shall be furnished by the supplier, duly witnessed/verified by supplier's TPI.

2. a) Life cycle test shall be carried out on one bellow of each group as mentioned in the technical specification.
   b) Squirm & Yield – Rupture test shall also be carried out on one bellow (other than the bellow on which life cycle test has been carried out of each group as mentioned below.

   Based on Diameter of Bellows: The categories are as follows:

   a) Nominal diameter up to 800mm NB.
   b) Nominal diameter greater than 800mm NB up to 1600 NB.
   c) Each size above 1600mm NB shall be a separate category.

3. For, clause 1.1, in case co related test certificates are not available, check testing shall be carried out by vendor at approved lab (NABL).

4. Welding to be done only by qualified welders. For qualified welders, WPS & PQR shall be reviewed by BHEL/Customer.

5. If type tests as mentioned at cl.3.5 and note2 above, have been successfully done for earlier BHEL projects for the bellows of the same type (refer note-6) in a group (as indicated above), then only TCs of same shall be reviewed and no type test needs to be carried out. But TC's of the bellows shall not be older than 5 years from the date of placement of project specific Purchase order. However, type test clearance shall be taken from BHEL/Customer prior to offering to routine test. In case the type test is to be done, type test procedure approval shall be taken from BHEL/Customer.

6. Bellows of the same type would mean those having the same height, pitch, general shape of convolution profile, ply thickness and type of bellow materials.

7. All materials of construction shall be as per approved GA drawing.

8. Manufacturing tolerances for fabricated assemblies containing expansion joints shall be as per EJMA/Approved GA drawing.
9. Packing: Bellows shall be packed in following manner:

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	Prabhjyot Singh	Prabhjyot Singh	Checked by:	Ashish Panigrahi	Ashish Panigrahi
Reviewed by:	sweta singhal	Sweta Singhal	Reviewed by:	RITESH KUMAR JAISWAL	R K Jaiswal

BIDDER/VENDOR	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-445-100-M021 REV-00	DATE: 24.11.2021
	CUSTOMER : THE WEST BENGAL POWER DEVELOPMENT CORPORATION LTD.		QP NO.: PE-QP-445-100-M021 REV-00	DATE: 24.11.2021
	PROJECT: 1X660MW SAGARDIGHI UNIT#5		PO NO.:	DATE:
	ITEM: ME BELLOWS	SYSTEM: POWER PIPING	SECTION: II	SHEET 6 OF 6

a) First layer of hessian cloth, second layer of bubble sheet wrapping and third layer of stretch sheet wrapping.
b) Wrapped Bellows shall be placed in wooden box suitable handling. Wrapped Bellows up to 1200 NB (inclusive) size shall be packed in wooden box suitable for handling and storage. Wrapped Bellows above 1200 NB shall be placed in wooden box suitable for storage purpose. The box shall have clear marking that “The bellows to be handled separately from box.”
c) The wooden boxes shall be suitable for storage at site in tropical climate conditions for a period of 15-18 months.
d) Photographs of the wooden box (with LR No.) in which items are finally packed as per approved packing procedure is to submitted to BHEL (wherever applicable) before dispatch. Clearance for dispatch of items will be given only after receipt of above photos.

10. BHEL reserves the right for conducting repeat tests, if required.

11. The latest revision/year of issue of all the standard indicated in the Quality plan shall be referred.

LEGENDS:

*: Records, identified with "Tick"(√) shall be essentially included by supplier in QA Documentation.

** **M**: Supplier/ Manufacturer/ Sub-Supplier
P: Perform
MA: Major Characteristic
MTC: Mill Test Certificate
RT: Radiography Test
C: Main Supplier/BHEL/ Third Party Inspection agency
W: Witness
MI: Minor Characteristic
PT: Penetrant Test
D: Documentation
N: Customer
V: Verification
CR: Critical Characteristic
UT: Ultrasonic Test

BHEL						BIDDER/VENDOR		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	Prabhjyot Singh	Prabhjyot Singh	Checked by:	Ashish Panigrahi	Ashish Panigrahi			Reviewed by:			
Reviewed by:	sweta singhal	Sweta Singhal	Reviewed by:	RITESH KUMAR JAISWAL	R K Jaiswal			Approved by:			

COMPLIANCE SHEET

I hereby comply/not comply (*) to all the requirements of this technical specification in totality.

*** In case the bidder does not comply to the technical specification, the deviations shall be explicitly listed in the technical deviation sheet of GCC. Deviations listed in technical deviation sheet shall only be considered.**

Name of Bidder / Authorized Representative: - _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Designation: - _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Signature: - _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Company Seal: - _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

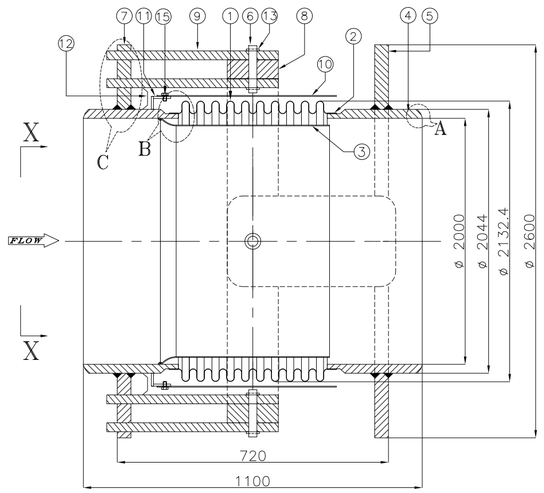
Date: - _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

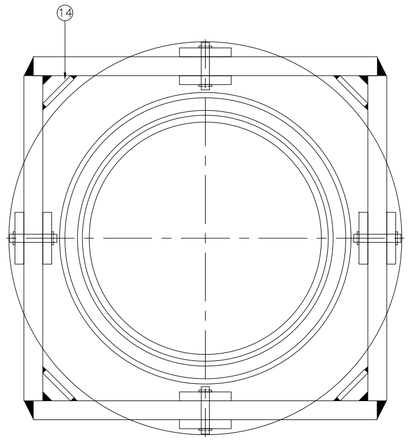
ANNEXURE-1
GA DRAWINGS OF ME BELLOWS

DRAWING NO. PE-DG-445-100-M171

FIRST ANGLE PROJECTION

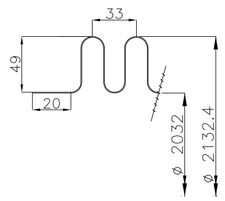
ALL DIMENSIONS ARE IN MM



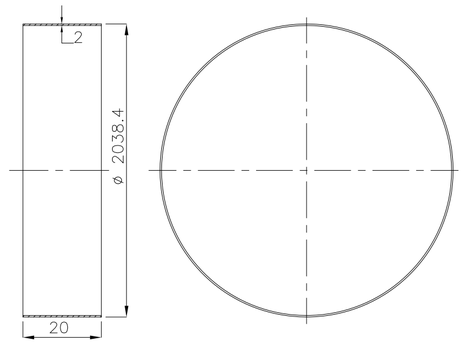


VIEW X-X

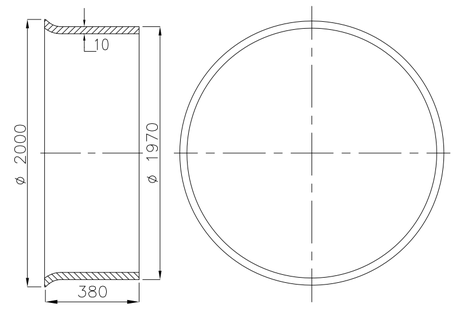
BELLOW : 1.2 THK x 1PLY
No. OF CONV. : 10
DEPTH OF CONV. : 49
PITCH OF CONV. : 33



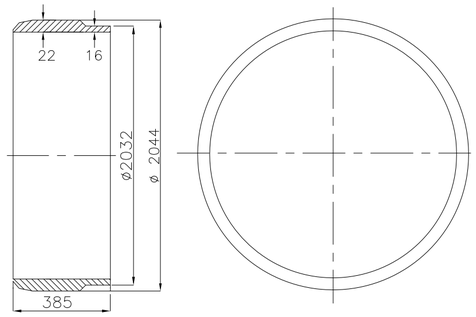
DETAIL OF SL.NO.1



DETAIL OF SL.NO.2



DETAIL OF SL.NO.3



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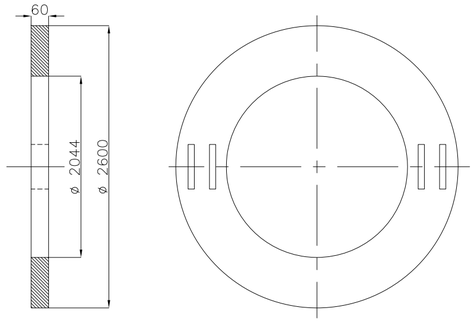
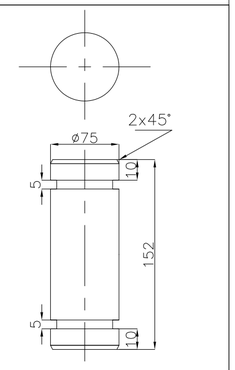
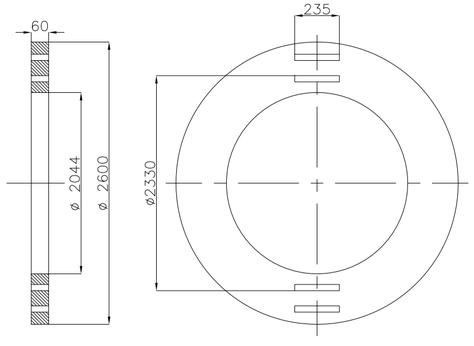


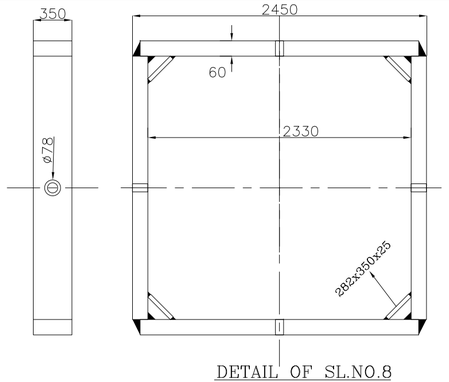
DETAIL OF SL.NO.5



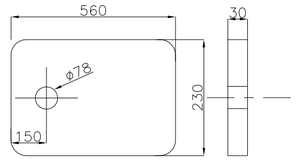
DETAIL OF SL.NO.6



DETAIL OF SL.NO.7



DETAIL OF SL.NO.8



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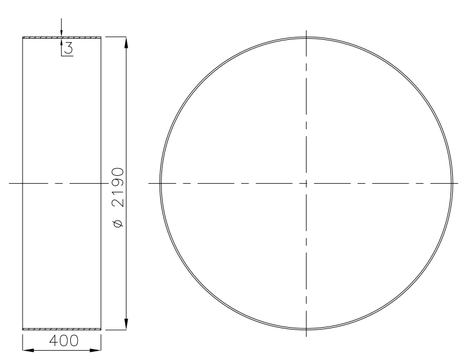

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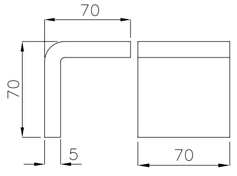

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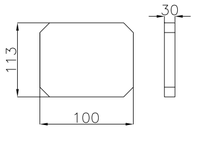

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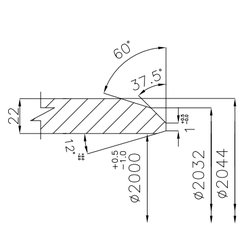
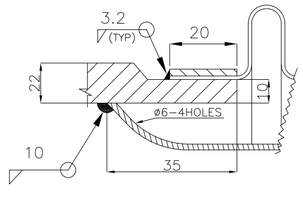
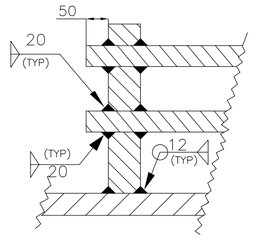


DETAIL-A



DETAIL-B



DETAIL-C

BELLOW DETAILS

SL NO		DESCRIPTION	UNITS	DATA/ PARTICULARS.
1	GENERAL	TAG No.	-	E1, E2, E4 & E5
2		QUANTITIES PER SET	Nos.	04
3		TOTAL QUANTITY	Nos.	04
4		LOCATION	-	BFPT-B/A EXHAUST TO CONDENSER
5		FLUID	-	STEAM
6		INSTALLATION	-	LATER
7	DESIGN & OPERATING DATA	PIPE SIZE(ODxTHK)	mm	2032x16
8		OPERATING PRESSURE	Kg/cm²(A)	0.1
9		DESIGN PRESSURE	Kg/cm²(G)	1.1
10		HYDRO TEST PRESSURE (FOR 30 Min.)	Kg/cm²(G)	1.65
11		VACUUM TEST PRESSURE(FOR 30 Min.)	mm-Hg	50mm of Hg (ABS)
12		OPERATING TEMPERATURE	°C	45.5
13		DESIGN TEMPERATURE	°C	120
14		BELLOW CYCLE LIFE	Nos.	255676
15		ANGULAR DEFLECTION (DESIGN)	DEGREE	3
16		AXIAL SPRING RATE	Kg/mm	65.4
17		ANGULAR SPRING RATE	Kg-M/Deg.	618.81
18		TOTAL EQUIVALENT MOVEMENT	mm	56.874
19		OVERALL LENGTH	mm	1100
20		BELLOW CONVOLUTED LENGTH	mm	330
21		LIMITING INTERNAL DESIGN PRESSURE BASED ON COLUMN INSTABILITY (Psc)	Kg/cm²	15.32
22		LIMITING INTERNAL DESIGN PRESSURE BASED ON INPLANE INSTABILITY (Psi)	Kg/cm²	3.82
23		TOTAL STRESS (St)	Kg/cm²	7154.1

BILL OF MATERIAL PER BELLOW

SL NO	COMPONENT'S NAME	MATERIAL	QUANTITY
1	BELLOWS	SA240TP304	1No
2	COLLAR	SA240TP304	2 Nos.
3	SLEEVE	SA240TP304	1 No.
4	END PIPE	SA672B70/SA672C70/SA515Gr.70 /SA516Gr.70	2 Nos.
5	HINGE SUPPORT FLANGE #1	IS 2062 Gr. B/SA 515 / 516 Gr.70	1 No.
6	HINGE PIN	CARBON STEEL CLASS 8.8	4 Nos.
7	HINGE SUPPORT FLANGE #2	IS 2062 Gr. B/SA 515 / 516 Gr.70	1 No.
8	SQ GIMBAL RING	IS 2062 Gr. B/SA 515 / 516 Gr.70	1 Nos.
9	HINGE SUPPORT PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.70	8 Nos.
10	SHROUD (COVER)	IS 2062 Gr. A/B	1 No.
11	SHROUD (COVER) SUPPORTS	IS 2062 Gr. A/B	4 Nos.
12	GUSSET	IS 2062 Gr. B/SA 515 / 516 Gr.70	8 Nos.
13	CIRCLIP 2mm THK. (DETAIL NOT SHOWN)	MS	8 Nos.
14	STIFFNER	IS 2062 Gr. B/SA 515 / 516 Gr.70	4 Nos.
15	BOLT & NUT-M8	IS 1367 CL6.8/6.0	AR

NOTES:-

1. BELLOW DESIGN CODE : EJMA LATEST EDITION.
2. WELDING CODE/STD : ASME SEC IX.
3. BUTT WELD DETAIL : AS PER ASME B16.25 TO SUIT MATCHING PIPE.
4. INSPECTION & TESTING : AS PER APPROVED QP.
5. SURFACE PREPARATION: SP3, POWER TOOL CLEANING.
6. PAINTING DETAILS : Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer. Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide. Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade / aluminum color with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided. Total DFT of paint system shall not be less than 300 microns.
   OR
   WILL BE SENT DURING DETAILED ENGINEERING
7. SUITABLE SHIPPING BRACKETS WILL BE PROVIDED IN YELLOW COLOUR WHICH MUST BE REMOVED AFTER INSTALLATION.
8. STAINLESS STEEL NAME PLATE WITH REQUIRED DETAILS WILL BE FIXED ON EXPANSION JOINTS.
9. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.
10. EXPANSION JOINTS WEIGHING MORE THAN 250KGS ARE TO BE PROVIDED WITH LIFTING LUGS.
11. DRAWING IS NOT TO SCALE.
12. THICKNESS OF PRESSURE PARTS INDICATED ARE MINIMUM REQUIREMENTS AND THE SAME SHALL BE AS PER FINITE ELEMENT ANALYSIS.

CUSTOMER: WBPDCL
THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.(WBPDCL)
1X660MW, SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)

CONSULTANT:
DEVELOPMENT CONSULTANTS PRIVATE LTD.
KOLKATA

JOB NO. 445
STATUS CONTRACT
DISTRIBUTION

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

REV.	DATE	ALTD	CHD	APPD

DEPT CODE		NAME	SIGN	DATE
M	DRN	PS		24.11.2021
	DESN	PS		24.11.2021
	CHD	GD		24.11.2021
	APPD	SW		24.11.2021

TITLE: GA OF GIMBAL BELLOW- SIZE 2000NB

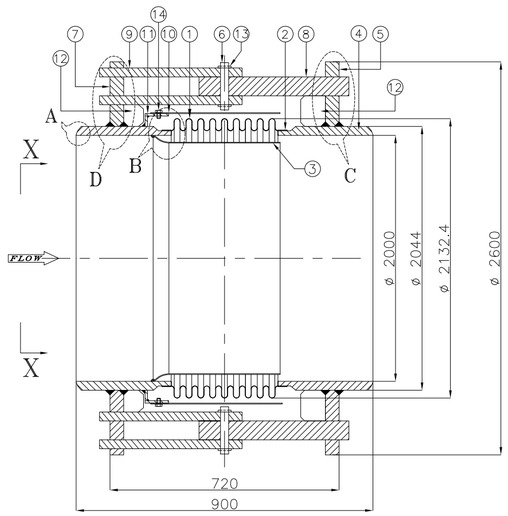
DEPT. | SCALE | SIGN | DRAWING NO. PE-DG-445-100-M171 | SHEET 01 OF 06 | REV. 00

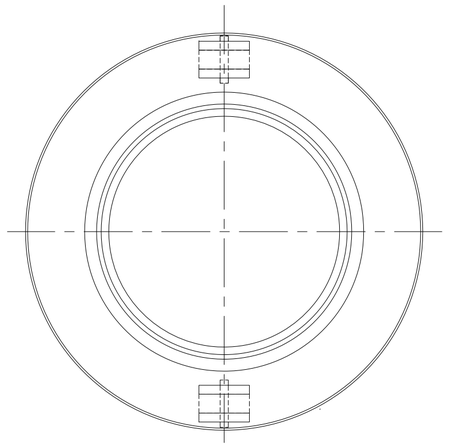
SIZE-A0

ELECTRONIC FILE NAME:445_100_M171_00

DRAWING NO. PE-DG-445-100-M171

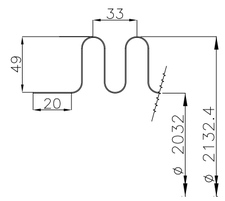
FIRST ANGLE PROJECTION — ALL DIMENSIONS ARE IN MM



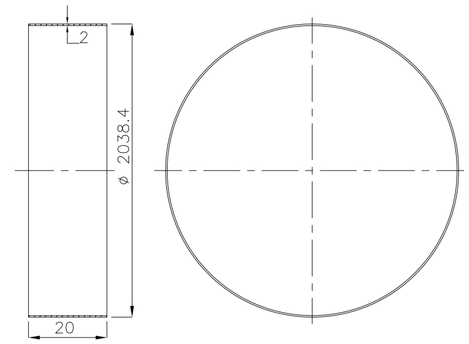


VIEW X-X

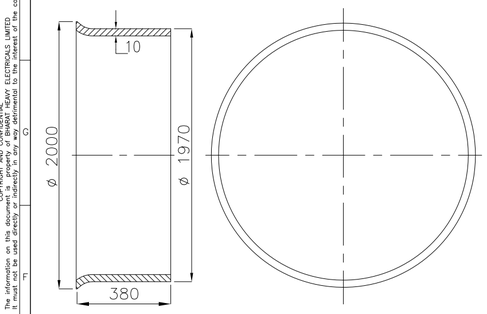
BELLOW : 1.2 THK x 1PLY
No. OF CONV. : 10
DEPTH OF CONV. : 49
PITCH OF CONV. : 33



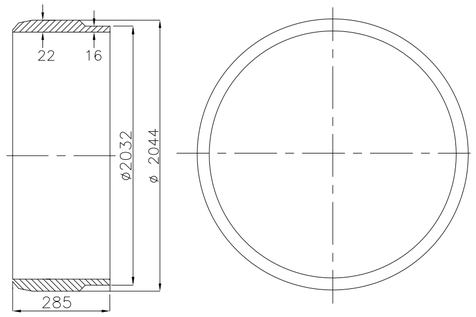
DETAIL OF SL.NO.1



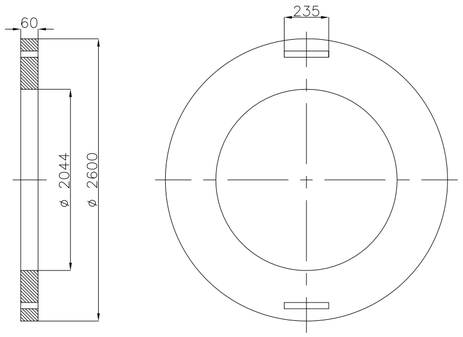
DETAIL OF SL.NO.2



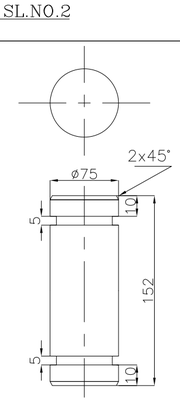
DETAIL OF SL.NO.3



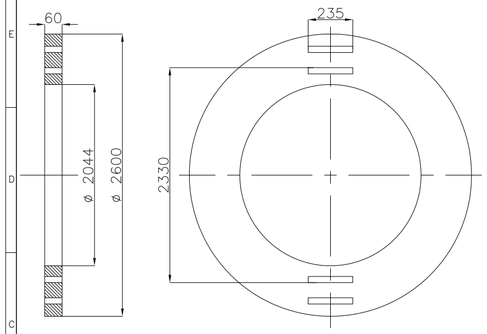
DETAIL OF SL.NO.4



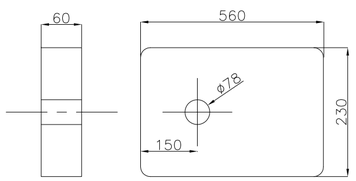
DETAIL OF SL.NO.5



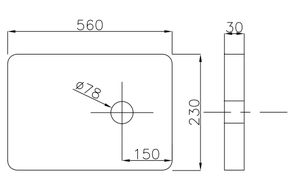
DETAIL OF SL.NO.6



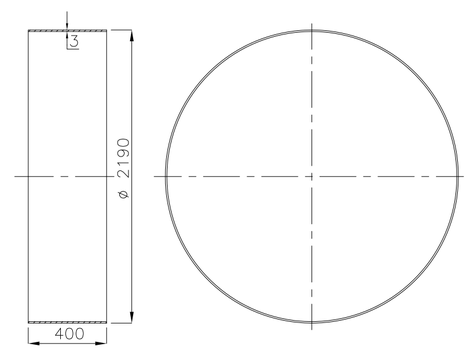
DETAIL OF SL.NO.7



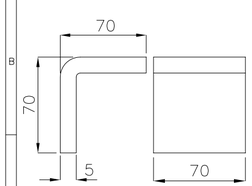
DETAIL OF SL.NO.8



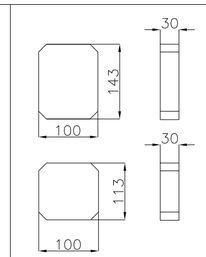
DETAIL OF SL.NO.9



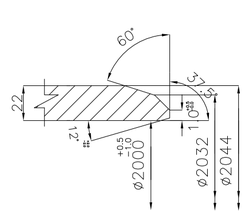
DETAIL OF SL.NO.10



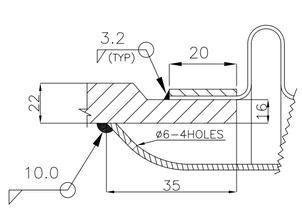
DETAIL OF SL.NO.11



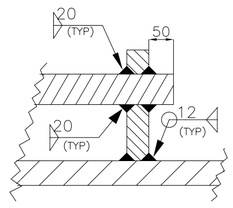
DETAIL OF SL.NO.12



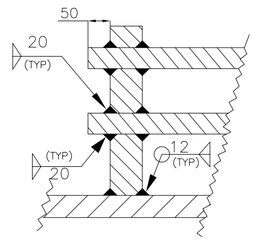
DETAIL-A



DETAIL-B



DETAIL-C



DETAIL-D

BELLOW DETAILS

SL NO		DESCRIPTION	UNITS	DATA/ PARTICULARS.
1	GENERAL	TAG No.	-	E3 & E6
2		QUANTITIES PER SET	Nos.	02
3		TOTAL QUANTITY	Nos.	02
4		LOCATION	-	BFPT-B/A EXHAUST TO CONDENSER
5		FLUID	-	STEAM
6		INSTALLATION	-	LATER
7	DESIGN & OPERATING DATA	PIPE SIZE(ODxTHK)	mm	2032x16
8		OPERATING PRESSURE	Kg/cm²(A)	0.1
9		DESIGN PRESSURE	Kg/cm²(G)	1.1
10		HYDRO TEST PRESSURE (FOR 30 Min.)	Kg/cm²(G)	1.65
11		VACUUM TEST PRESSURE(FOR 30 Min.)	mm-Hg	50mm of Hg (ABS)
12		OPERATING TEMPERATURE	°C	45.5
13		DESIGN TEMPERATURE	°C	120
14		BELLOW CYCLE LIFE	Nos.	255676
15		ANGULAR DEFLECTION (DESIGN)	DEGREE	3
16		AXIAL SPRING RATE	Kg/mm	65.44
17		ANGULAR SPRING RATE	Kg-M/Deg.	618.81
18		TOTAL EQUIVALENT MOVEMENT	mm	56.87
19		OVERALL LENGTH	mm	900
20		BELLOW CONVOLUTED LENGTH	mm	330
21		LIMITING INTERNAL DESIGN PRESSURE BASED ON COLUMN INSTABILITY (Psc)	Kg/cm²	15.32
22		LIMITING INTERNAL DESIGN PRESSURE BASED ON INPLANE INSTABILITY (Psi)	Kg/cm²	3.82
23		TOTAL STRESS (St)	Kg/cm²	7154.1

BILL OF MATERIAL PER BELLOW

SL NO	COMPONENT'S NAME	MATERIAL	QUANTITY
1	BELLOWS	SA240TP304	1No
2	COLLAR	SA240TP304	2 Nos.
3	SLEEVE	SA240TP304	1 No.
4	END PIPE	SA672B70/SA672C70/SA515 Gr.70/SA516Gr.70	2 Nos.
5	HINGE SUPPORT FLANGE #1	IS 2062 Gr. B/SA 515 / 516 Gr.70	1 No.
6	HINGE PIN	CARBON STEEL CLASS 8.8	2 Nos.
7	HINGE SUPPORT FLANGE #2	IS 2062 Gr. B/SA 515 / 516 Gr.70	1 No.
8	HINGE MAIN PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.70	2 Nos.
9	HINGE SUPPORT PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.70	4 Nos.
10	SHROUD (COVER)	IS 2062 Gr. B	1 No.
11	SHROUD (COVER) SUPPORTS	IS 2062 Gr. B	4 Nos.
12	GUSSET	IS 2062 Gr. B/SA 515 / 516 Gr.70	4+4 Nos.
13	CIRCLIP 2mm THK. (DETAIL NOT SHOWN)	MS	4 Nos.
14	BOLT & NUT-M8	IS 1367 CL6.8/6.0	AR

NOTES:-

1. BELLOW DESIGN CODE : EJMA LATEST EDITION.
2. WELDING CODE/STD : ASME SEC IX.
3. BUTT WELD DETAIL : AS PER ASME B16.25 TO SUIT MATCHING PIPE.
4. INSPECTION & TESTING : AS PER APPROVED QP.
5. SURFACE PREPARATION: SP3, POWER TOOL CLEANING.
6. PAINTING DETAILS : Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer. Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide. Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade / aluminum color with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided. Total DFT of paint system shall not be less than 300 microns.
   OR
   WILL BE SENT DURING DETAILED ENGINEERING
7. SUITABLE SHIPPING BRACKETS WILL BE PROVIDED IN YELLOW COLOUR WHICH MUST BE REMOVED AFTER INSTALLATION.
8. STAINLESS STEEL NAME PLATE WITH REQUIRED DETAILS WILL BE FIXED ON EXPANSION JOINTS.
9. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.
10. EXPANSION JOINTS WEIGHING MORE THAN 250KGS ARE TO BE PROVIDED WITH LIFTING LUGS.
11. DRAWING IS NOT TO SCALE.
12. THICKNESS OF PRESSURE PARTS INDICATED ARE MINIMUM REQUIREMENTS AND THE SAME SHALL BE AS PER FINITE ELEMENT ANALYSIS.

CUSTOMER: THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.(WBPDCL)
1X660MW, SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)
CONSULTANT: DEVELOPMENT CONSULTANTS PRIVATE LTD. KOLKATA

JOB NO. 445
STATUS CONTRACT
DISTRIBUTION

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

REV.	DATE	ALTD	CHD	APPD

DEPT CODE		NAME	SIGN	DATE
M	DRN	PS		24.11.2021
	DESN	PS		24.11.2021
	CHD	GD		24.11.2021
	APPD	SW		24.11.2021

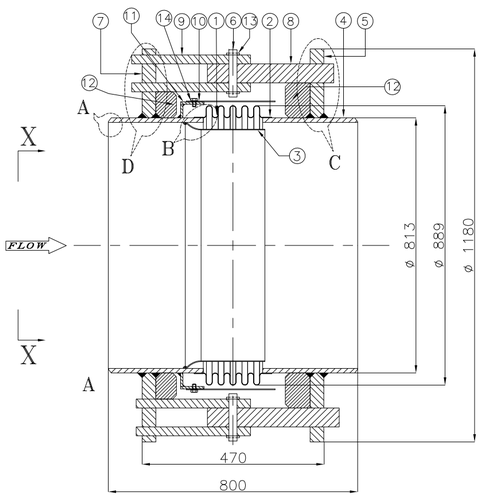
TITLE: GA OF HINGED ANGULAR BELLOWS- SIZE 2000NB

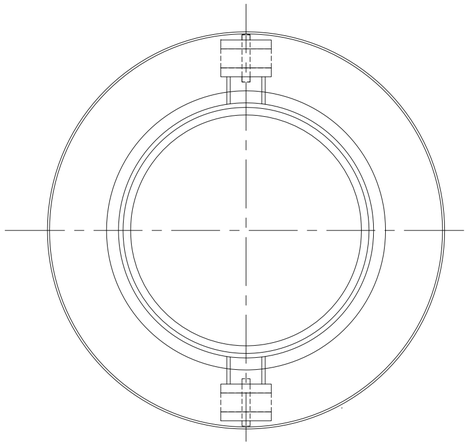
DEPT. SCALE SIGN
DRAWING NO. PE-DG-445-100-M171
SHEET 02 OF 06 REV. 00
SIZE-A0

ELECTRONIC FILE NAME: 445_100_M171_00

DRAWING NO. PE-DG-445-100-M171

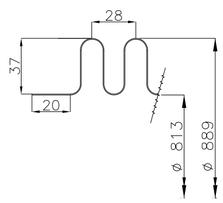
FIRST ANGLE PROJECTION — ALL DIMENSIONS ARE IN MM



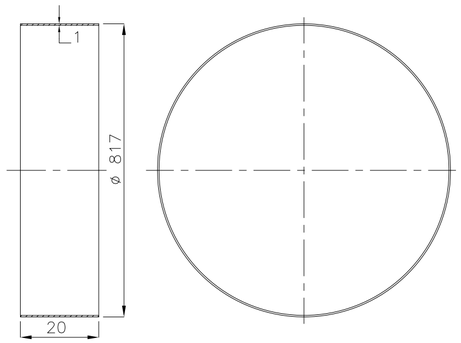


VIEW–X

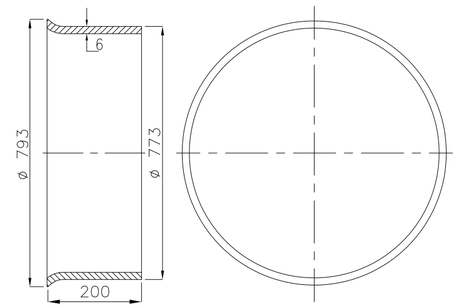
BELLOW : 1.0 THK x 1PLY
No. OF CONV. : 5
DEPTH OF CONV. : 37
PITCH OF CONV. : 28



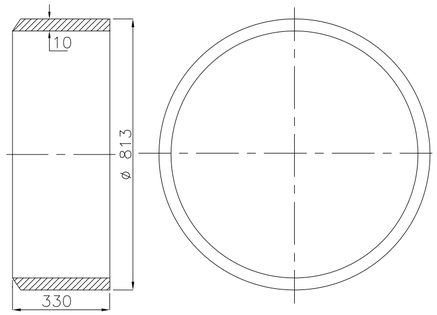
DETAIL OF SL.NO.1



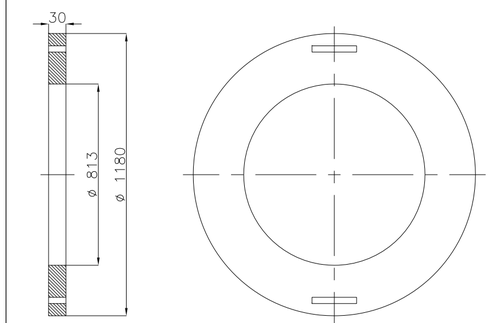
DETAIL OF SL.NO.2



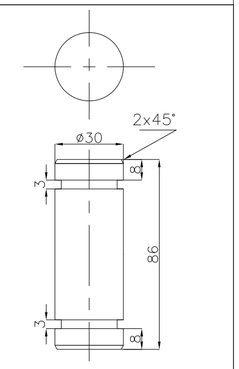
DETAIL OF SL.NO.3



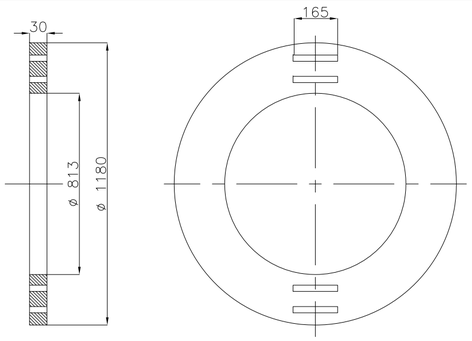
DETAIL OF SL.NO.4



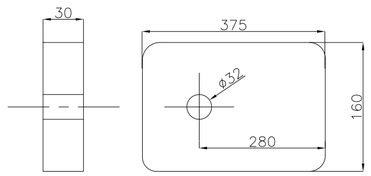
DETAIL OF SL.NO.5



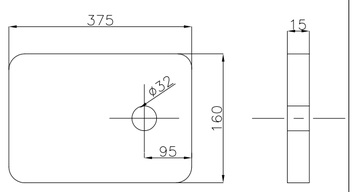
DETAIL OF SL.NO.6



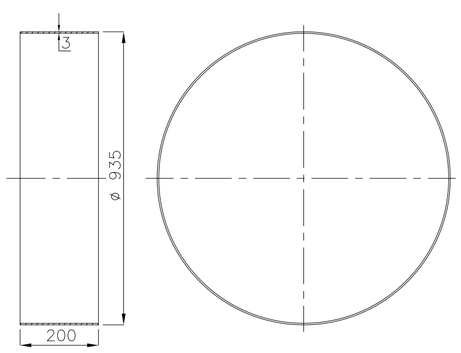
DETAIL OF SL.NO.7



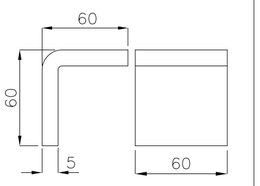
DETAIL OF SL.NO.8



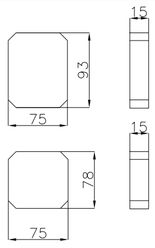
DETAIL OF SL.NO.9



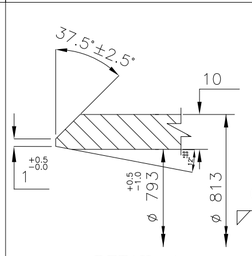
DETAIL OF SL.NO.10



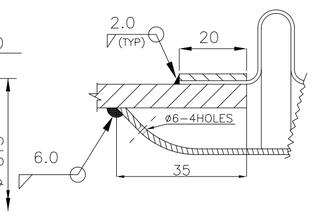
DETAIL OF SL.NO.11



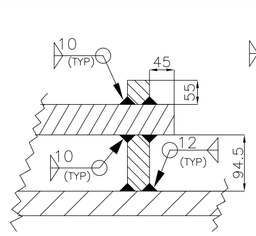
DETAIL OF SL.NO.12



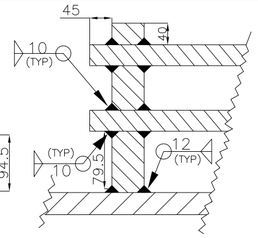
DETAIL–A



DETAIL–B



DETAIL–C



DETAIL–D

BELLOW DETAILS

SL NO		DESCRIPTION	UNITS	DATA/ PARTICULARS.
1	GENERAL	TAG No.	-	E7 & E9
2		QUANTITIES PER SET	Nos.	02
3		TOTAL QUANTITY	Nos.	02
4		LOCATION	-	FLASH TANK-A/B VENT
5		FLUID	-	STEAM
6		INSTALLATION	-	LATER
7	DESIGN & OPERATING DATA	PIPE SIZE(ODxTHK)	mm	813x10
8		OPERATING PRESSURE	Kg/cm²(A)	-
9		DESIGN PRESSURE	Kg/cm²(G)	1.1
10		HYDRO TEST PRESSURE (FOR 30 Min.)	Kg/cm²(G)	1.65
11		VACUUM TEST PRESSURE(FOR 30 Min.)	mm-Hg	50mm of Hg (Abs)
12		OPERATING TEMPERATURE	°C	-
13		DESIGN TEMPERATURE	°C	120
14		BELLOW CYCLE LIFE	Nos.	557322
15		ANGULAR DEFLECTION (DESIGN)	DEGREE	2.5
16		AXIAL SPRING RATE PER CONVOLUTION	Kg/mm	69.58
17		ANGULAR SPRING RATE	Kg-M/Deg.	109.84
18		TOTAL EQUIVALENT MOVEMENT PER BELLOW	mm	18.87
19		OVERALL LENGTH	mm	800
20		BELLOW CONVOLUTED LENGTH	mm	140
21		LIMITING INTERNAL DESIGN PRESSURE BASED ON COLUMN INSTABILITY (Psc)	Kg/cm²	47.83
22		LIMITING INTERNAL DESIGN PRESSURE BASED ON INPLANE INSTABILITY (Psi)	Kg/cm²	5.91
23		TOTAL STRESS (St)	Kg/cm²	6466.38

BILL OF MATERIAL PER BELLOW

SL NO	COMPONENT'S NAME	MATERIAL	QUANTITY
1	BELLOWS	SA240TP304	1No
2	COLLAR	SA240TP304	2 Nos.
3	SLEEVE	SA240TP304	1 No.
4	END PIPE	SA672B70/SA672C70/ SA515GR.70/SA516GR.70	2 Nos.
5	HINGE SUPPORT FLANGE #1	IS 2062 Gr. B/SA 515 / 516 Gr.70	1 No.
6	HINGE PIN	CARBON STEEL CLASS 8.8	2 Nos.
7	HINGE SUPPORT FLANGE #2	IS 2062 Gr. B/SA 515 / 516 Gr.70	1 No.
8	HINGE MAIN PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.70	2 Nos.
9	HINGE SUPPORT PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.70	4 Nos.
10	SHROUD (COVER)	IS 2062 Gr. A/B	1 No.
11	SHROUD (COVER) SUPPORTS	IS 2062 Gr. A/B	4 Nos.
12	GUSSET	IS 2062 Gr. B/SA 515 / 516 Gr.70	4 + 4Nos.
13	CIRCLIP 2mm THK. (DETAIL NOT SHOWN)	SPRING STEEL (EN42J) OR EQUIVALENT	4 Nos.
14	M8 BOLT & NUT	IS 1367 CL 4.6/4.0	AR

NOTES:–

1. BELLOW DESIGN CODE : EJMA LATEST EDITION.
2. WELDING CODE/STD : ASME SEC IX.
3. BUTT WELD DETAIL : AS PER ASME B16.25 TO SUIT MATCHING PIPE.
4. INSPECTION & TESTING : AS PER APPROVED QP.
5. SURFACE PREPARATION: SP3, POWER TOOL CLEANING.
6. PAINTING DETAILS : Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer. Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide. Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade / aluminum color with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided. Total DFT of paint system shall not be less than 300 microns.
   OR
   WILL BE SENT DURING DETAILED ENGINEERING
7. SUITABLE SHIPPING BRACKETS WILL BE PROVIDED IN YELLOW COLOUR WHICH MUST BE REMOVED AFTER INSTALLATION.
8. STAINLESS STEEL NAME PLATE WITH REQUIRED DETAILS WILL BE FIXED ON EXPANSION JOINTS.
9. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.
10. EXPANSION JOINTS WEIGHING MORE THAN 250KGS ARE TO BE PROVIDED WITH LIFTING LUGS.
11. DRAWING IS NOT TO SCALE.
12. THICKNESS OF PRESSURE PARTS INDICATED ARE MINIMUM REQUIREMENTS AND THE SAME SHALL BE AS PER FINITE ELEMENT ANALYSIS.

CUSTOMER: WBPDCL — THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.(WBPDCL)
1X660MW, SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)

CONSULTANT: DEVELOPMENT CONSULTANTS PRIVATE LTD. KOLKATA

JOB NO. 445
STATUS CONTRACT
DISTRIBUTION

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

REV.	DATE	ALTD	CHD	APPD

DEPT CODE		NAME	SIGN	DATE
M	DRN	PS		24.11.2021
	DESN	PS		24.11.2021
	CHD	GD		24.11.2021
	APPD	SW		24.11.2021

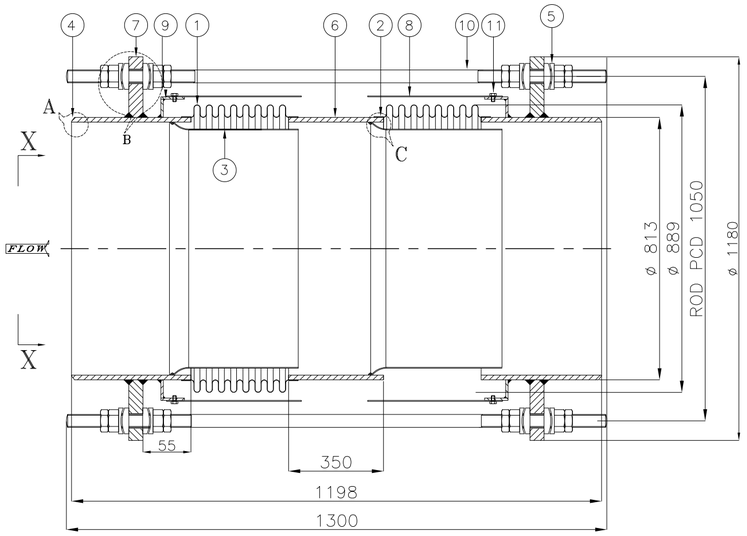
TITLE: GA OF HINGED ANGULAR BELLOW– SIZE 800NB

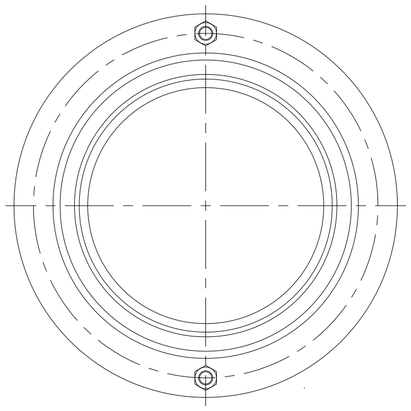
DRAWING NO. PE–DG–445–100–M171
SHEET 03 OF 06 REV. 00
SIZE-A0

ELECTRONIC FILE NAME: 445_100_M171_00

DRAWING NO. PE-DG-445-100-M171

FIRST ANGLE PROJECTION — ALL DIMENSIONS ARE IN MM





VIEW–X

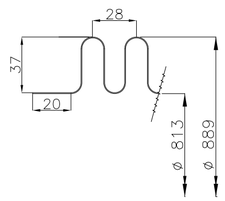
BELLOW DETAILS

SL NO		DESCRIPTION	UNITS	DATA/ PARTICULARS.
1	GENERAL	TAG No.	-	E8 & E10
2		QUANTITIES PER SET	Nos.	02
3		TOTAL QUANTITY	Nos.	02
4		LOCATION	-	FLASH TANK -A/B VENT
5		FLUID	-	STEAM
6		INSTALLATION	-	LATER
7	DESIGN & OPERATING DATA	PIPE SIZE(ODxTHK)	mm	813 x 10
8		OPERATING PRESSURE	Kg/cm²(A)	-
9		DESIGN PRESSURE	Kg/cm²(G)	1.1
10		HYDRO TEST PRESSURE (FOR 30 Min.)	Kg/cm²(G)	1.65
11		VACUUM TEST PRESSURE(FOR 30 Min.)	mm-Hg	50mm of Hg
12		OPERATING TEMPERATURE	°C	-
13		DESIGN TEMPERATURE	°C	120
14		BELLOW CYCLE LIFE	Nos.	682782
15		LATERAL DEFLECTION (DESIGN)	mm	30
16		AXIAL SPRING RATE PER CONVOLUTION	Kg/mm	21.74
17		LATERAL SPRING RATE	Kg/mm	22.74
18		ANGULAR SPRING RATE AT EACH END	Kg-M/Deg.	47.74
19		ANGULAR SPRING RATE FOR FULL ASSEMBLY	Kg-M/Deg.	95.47
20		TOTAL EQUIVALENT MOVEMENT (FOR ASSEMBLY)	mm	58.84
21		TOTAL EQUIVALENT MOVEMENT (PER BELLOW)	mm	29.42
22		OVERALL LENGTH	mm	1198
23		BELLOW CENTER DISTANCE	mm	574
24		BELLOW CONVOLUTED LENGTH	mm	224
25		LIMITING INTERNAL DESIGN PRESSURE BASED ON COLUMN INSTABILITY (Psc)	Kg/cm²	5.18
26		LIMITING INTERNAL DESIGN PRESSURE BASED ON INPLANE INSTABILITY (Psi)	Kg/cm²	5.91
27		TOTAL STRESS (St)	Kg/cm²	6311.62

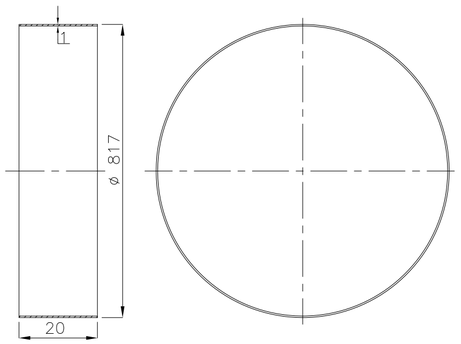
BILL OF MATERIAL PER BELLOW

SL NO	COMPONENT'S NAME	MATERIAL	QUANTITY
1	BELLOWS	SA240TP304	2 Nos.
2	COLLAR	SA240TP304	4 Nos.
3	SLEEVE	SA240TP304	2 Nos.
4	END PIPE	SA672B70/SA672C70/ SA515GR.70/SA516GR.70	2 Nos.
5	SPHERICAL WASHER	SA515GR.60	8 Nos.
6	SPOOL PIPE	SA672B70/SA672C70/ SA515GR.70/SA516GR.70	1 No.
7	ROUND FLANGE	IS 2062 Gr. B/SA 515 / 516 Gr.70	2 Nos.
8	SHROUD (COVER)	IS 2062 Gr. A/B	2 Nos.
9	SHROUD (COVER) SUPPORTS	IS 2062 Gr. A/B	8 Nos.
10	LIMIT ROD WITH NUTS	IS 1367 (CL. 6.8 & 6.0)	2 Nos.
11	M8 BOLT & NUT	IS 1367 CL4.6/4.0	AR

BELLOW : 1THK x 1PLY
No. OF CONV. : 8+8
DEPTH OF CONV. : 37
PITCH OF CONV. : 28



DETAIL OF SL.NO.1



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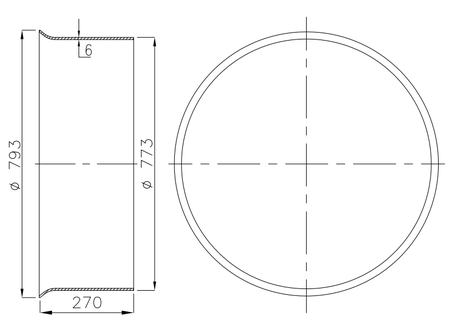

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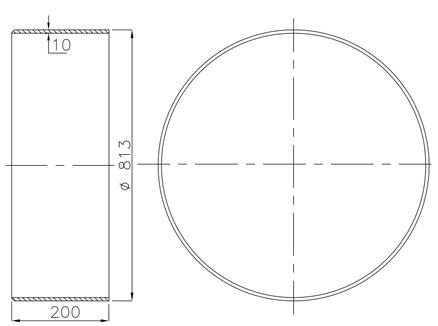

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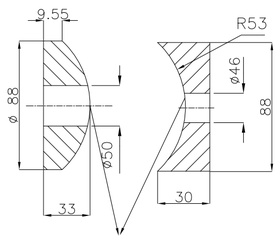
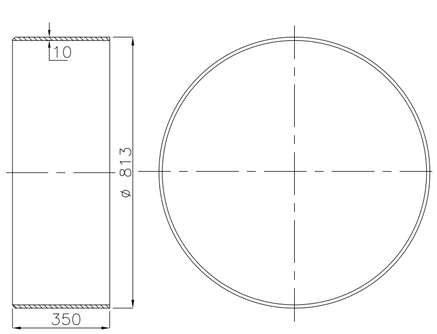
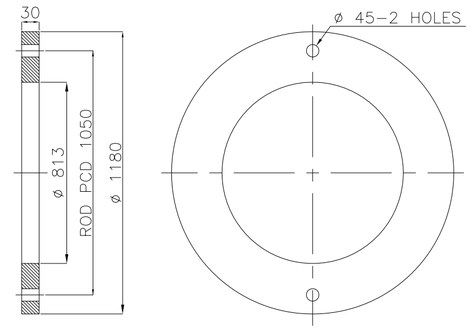


SURFACE FINISH 02 TO 0.4 MICRON, CASE HARDENED HRC–55–65

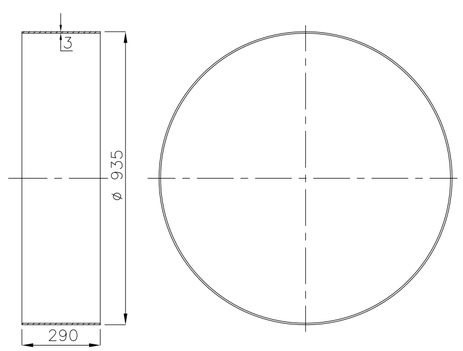
DETAIL OF SL.NO.5



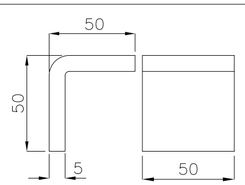
DETAIL OF SL.NO.6



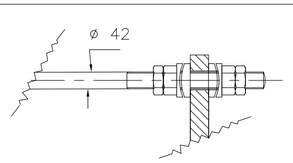
DETAIL OF SL.NO.7



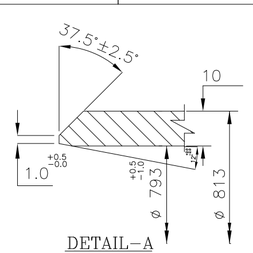
DETAIL OF SL.NO.8



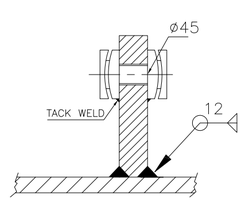
DETAIL OF SL.NO.9



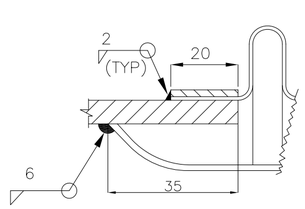
DETAIL OF SL.NO.10



DETAIL–A



DETAIL–B



DETAIL–C

NOTES:–

1. BELLOW DESIGN CODE : EJMA LATEST EDITION.
2. WELDING CODE/STD : ASME SEC IX.
3. BUTT WELD DETAIL : AS PER ASME B16.25 TO SUIT MATCHING PIPE.
4. INSPECTION & TESTING : AS PER APPROVED QP.
5. SURFACE PREPARATION: SP3, POWER TOOL CLEANING.
6. PAINTING DETAILS : Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer. Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide. Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade / aluminum color with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided. Total DFT of paint system shall not be less than 300 microns.
   OR
   WILL BE SENT DURING DETAILED ENGINEERING
7. SUITABLE SHIPPING BRACKETS WILL BE PROVIDED IN YELLOW COLOUR WHICH MUST BE REMOVED AFTER INSTALLATION.
8. STAINLESS STEEL NAME PLATE WITH REQUIRED DETAILS WILL BE FIXED ON EXPANSION JOINTS.
9. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.
10. EXPANSION JOINTS WEIGHING MORE THAN 250KGS ARE TO BE PROVIDED WITH LIFTING LUGS.
11. DRAWING IS NOT TO SCALE.
12. THICKNESS OF PRESSURE PARTS INDICATED ARE MINIMUM REQUIREMENTS AND THE SAME SHALL BE AS PER FINITE ELEMENT ANALYSIS.

CUSTOMER: THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.(WBPDCL)
1X660MW, SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)

CONSULTANT: DEVELOPMENT CONSULTANTS PRIVATE LTD. KOLKATA

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

JOB NO.	445
STATUS	CONTRACT
DISTRIBUTION	

REV.	DATE	ALTD	CHD	APPD

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DEPT CODE		NAME	SIGN	DATE
M	DRN	PS		24.11.2021
	DESN	PS		24.11.2021
	CHD	GD		24.11.2021
	APPD	SM		24.11.2021

TITLE: GA OF TIED ANGULAR LATERAL BELLOW-SIZE 800NB

DEPT. | SCALE | SIGN | DRAWING NO. PE–DG–445–100–M171 | SHEET 04 OF 06 | REV. 00

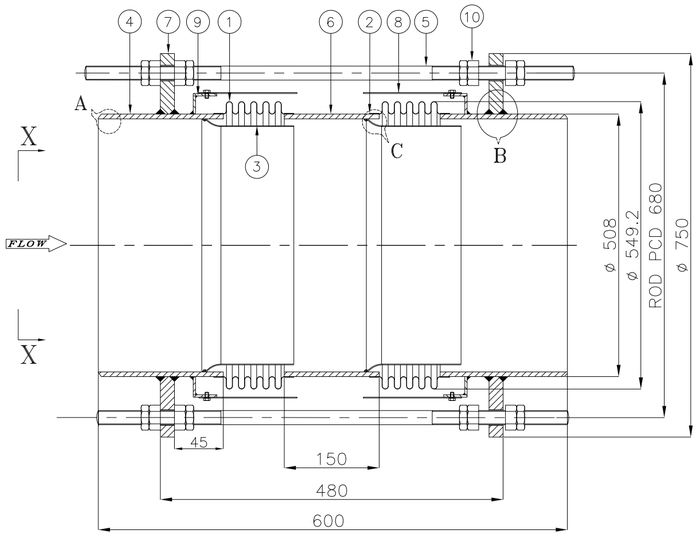
SIZE-A0

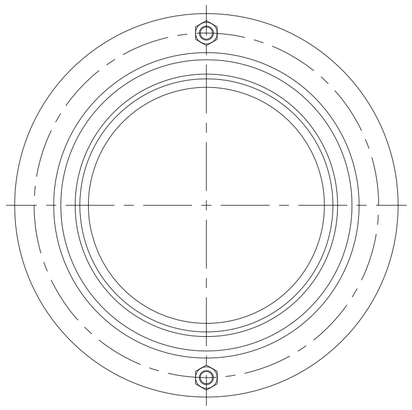
ELECTRONIC FILE NAME: 445_100_M171_00

DRAWING NO. PE-DG-445-100-M171

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM





VIEW X–X

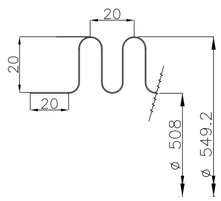
BELLOW DETAILS

SL NO		DESCRIPTION	UNITS	DATA/ PARTICULARS.
1	GENERAL	TAG No.	-	E15, E16 & E17
2		QUANTITIES PER UNIT	Nos.	3
3		TOTAL QUANTITY	Nos.	3
4		LOCATION	-	CEP A/B/C SUCTION
5		FLUID	-	CONDENSATE
6		INSTALLATION	-	HORIZONTAL
7	DESIGN & OPERATING DATA	PIPE SIZE(ODxTHK)	mm	508 x 9.53
8		OPERATING PRESSURE	Kg/cm²(A)	.096
9		DESIGN PRESSURE	Kg/cm²(G)	2.0
10		HYDRO TEST PRESSURE (FOR 30 Min.)	Kg/cm²(G)	3.0
11		VACUUM TEST PRESSURE(FOR 30 Min.)	mm-Hg	50mm of Hg (Abs)
12		OPERATING TEMPERATURE	°C	42.3
13		DESIGN TEMPERATURE	°C	60
14		BELLOW CYCLE LIFE	Nos.	19355
15		AXIAL COMPRESSION (DESIGN)	mm	15
16		LATERAL DEFLECTION (DESIGN)	mm	7
17		AXIAL SPRING RATE PER CONVOLUTION	Kg/mm	28.05
18		LATERAL SPRING RATE	Kg/mm	64.11
19		ANGULAR SPRING RATE	Kg-M/Deg.	NA
20		TOTAL EQUIVALENT MOVEMENT (FOR ASSEMBLY)	mm	35.28
21		TOTAL EQUIVALENT MOVEMENT (PER BELLOW)	mm	17.64
22		OVERALL LENGTH	mm	600
23		BELLOW CENTER DISTANCE	mm	250
24		BELLOW CONVOLUTED LENGTH	mm	100
25		LIMITING INTERNAL DESIGN PRESSURE BASED ON COLUMN INSTABILITY (Psc)	Kg/cm²	14.98
26		LIMITING INTERNAL DESIGN PRESSURE BASED ON INPLANE INSTABILITY (Psi)	Kg/cm²	7.44
27		TOTAL STRESS (St)	Kg/cm²	10969.39

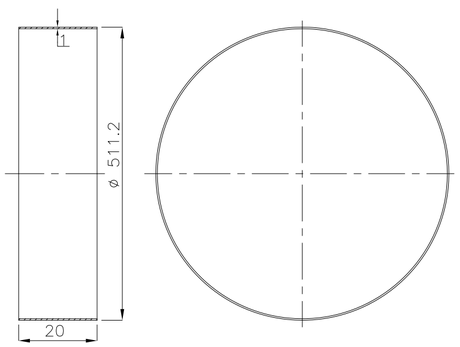
BILL OF MATERIAL FOR SINGLE BELLOW

SL NO	COMPONENT'S NAME	MATERIAL	QUANTITY
1	BELLOWS	SA240TP304	2 Nos.
2	COLLAR	SA240TP304	4 Nos.
3	SLEEVE	SA240TP304	2 Nos.
4	END PIPE	SA106Gr.B	2 Nos.
5	LIMIT ROD WITH NUTS	CS (CL. 6.8 & 6.0)	2 Nos.
6	SPOOL PIPE	SA106Gr.B	1 No.
7	ROUND FLANGE	IS 2062 Gr. B/SA 515 / 516 Gr.70	2 Nos.
8	SHROUD (COVER)	IS 2062 Gr. B	2 Nos.
9	SHROUD (COVER) SUPPORTS	IS 2062 Gr. B	8 Nos.
10	NUT, LOCKNUT & WASHER	IS 1367 CL6.8/6.0	8 SET

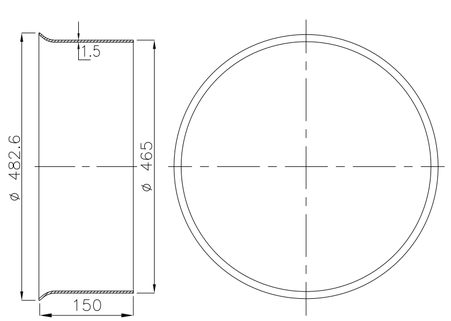
BELLOW : 0.6THK x 1PLY.
No. OF CONV. : 5+5
DEPTH OF CONV. : 20
PITCH OF CONV. : 20



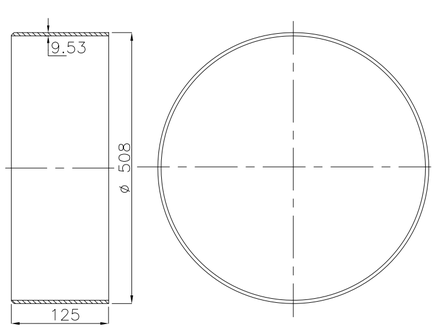
DETAIL OF SL.NO.1



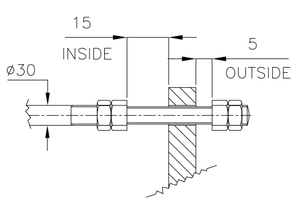
DETAIL OF SL.NO.2



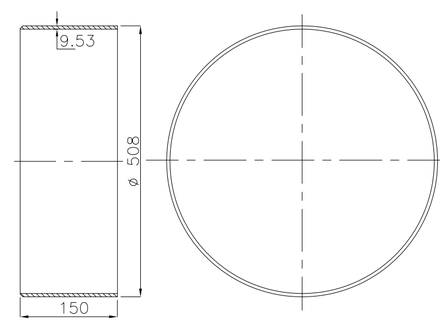
DETAIL OF SL.NO.3



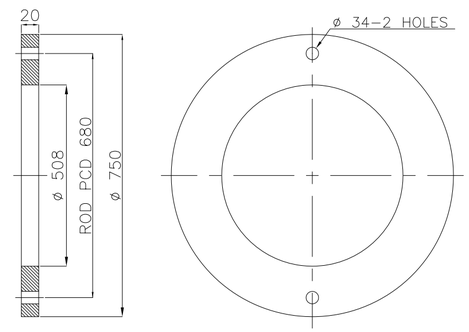
DETAIL OF SL.NO.4



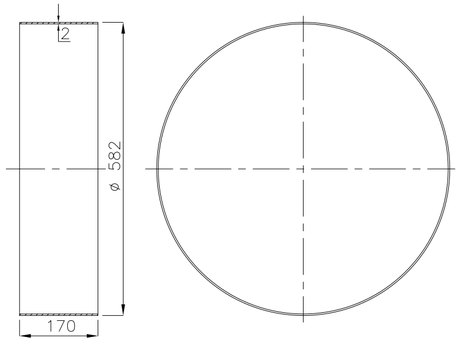
DETAIL OF SL.NO.5



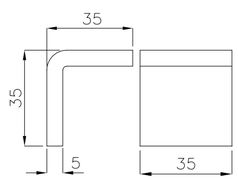
DETAIL OF SL.NO.6



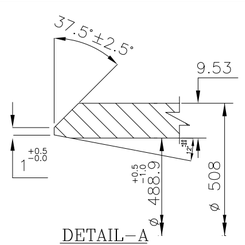
DETAIL OF SL.NO.7



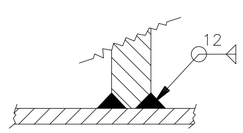
DETAIL OF SL.NO.8



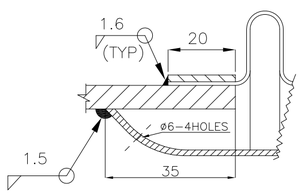
DETAIL OF SL.NO.9



DETAIL–A



DETAIL–B



DETAIL–C

NOTES:–

1. BELLOW DESIGN CODE : EJMA LATEST EDITION.
2. WELDING CODE/STD : ASME SEC IX.
3. BUTT WELD DETAIL : AS PER ASME B16.25 TO SUIT MATCHING PIPE.
4. INSPECTION & TESTING : AS PER APPROVED QP.
5. SURFACE PREPARATION: SP3, POWER TOOL CLEANING.
6. PAINTING DETAILS : Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer. Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide. Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade / sea green color with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided. Total DFT of paint system shall not be less than 300 microns.
   OR
   WILL BE SENT DURING DETAILED ENGINEERING
7. SUITABLE SHIPPING BRACKETS WILL BE PROVIDED IN YELLOW COLOUR WHICH MUST BE REMOVED AFTER INSTALLATION.
8. STAINLESS STEEL NAME PLATE WITH REQUIRED DETAILS WILL BE FIXED ON EXPANSION JOINTS.
9. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.
10. EXPANSION JOINTS WEIGHING MORE THAN 250KGS ARE TO BE PROVIDED WITH LIFTING LUGS.
11. DRAWING IS NOT TO SCALE.
12. THICKNESS OF PRESSURE PARTS INDICATED ARE MINIMUM REQUIREMENTS AND THE SAME SHALL BE AS PER FINITE ELEMENT ANALYSIS.

ELECTRONIC FILE NAME: 445_100_M171_00

CUSTOMER: THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.(WBPDCL)
1X660MW, SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)

CONSULTANT: DEVELOPMENT CONSULTANTS PRIVATE LTD. KOLKATA

JOB NO. 445
STATUS CONTRACT
DISTRIBUTION

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

REV.	DATE	ALTD	CHD	APPD

DEPT CODE		NAME	SIGN	DATE
M	DRN	PS		24.11.2021
	DESN	PS		24.11.2021
	CHD	GD		24.11.2021
	APPD	SW		24.11.2021

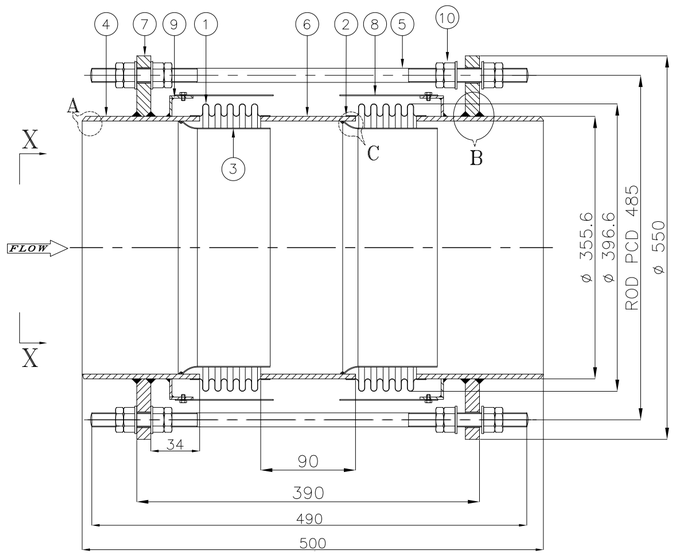
TITLE: GA OF UNTIED BELLOW–SIZE 500NB

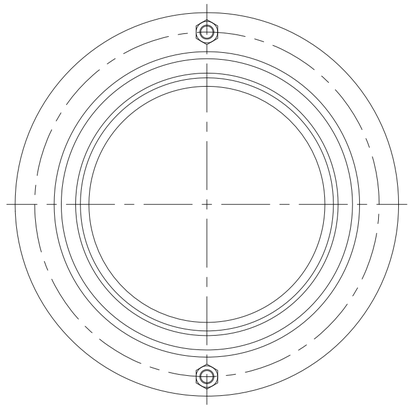
DEPT. | SCALE | SIGN | DRAWING NO. PE–DG–445–100–M171 | SHEET 05 OF 06 | REV. 00

SIZE-A0

DRAWING NO. PE-DG-445-100-M171

FIRST ANGLE PROJECTION | ALL DIMENSIONS ARE IN MM





VIEW X–X

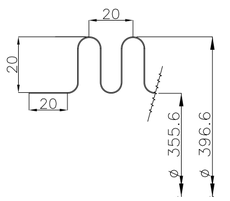
BELLOW DETAILS

SL NO		DESCRIPTION	UNITS	DATA/ PARTICULARS.
1	GENERAL	TAG No.	-	E11, E12, E13 & E14
2		QUANTITIES PER SET	Nos.	04
3		TOTAL QUANTITY	Nos.	04
4		LOCATION	-	MAIN CONDENSATE SUCTION
5		FLUID	-	CONDENSATE
6		INSTALLATION	-	VERTICAL
7	DESIGN & OPERATING DATA	PIPE SIZE(ODxTHK)	mm	355.6 x 9.53
8		OPERATING PRESSURE	Kg/cm²(A)	.092
9		DESIGN PRESSURE	Kg/cm²(G)	2.0
10		HYDRO TEST PRESSURE (FOR 30 Min.)	Kg/cm²(G)	3.0
11		VACUUM TEST PRESSURE(FOR 30 Min.)	mm-Hg	50mm of Hg (Abs)
12		OPERATING TEMPERATURE	°C	41.6
13		DESIGN TEMPERATURE	°C	60
14		BELLOW CYCLE LIFE	Nos.	22583
15		AXIAL COMPRESSION (DESIGN)	mm	15
16		LATERAL DEFLECTION (DESIGN)	mm	7
17		AXIAL SPRING RATE	Kg/mm	20.00
18		LATERAL SPRING RATE	Kg/mm	39.4
19		ANGULAR SPRING RATE	Kg-M/Deg.	NA
20		TOTAL EQUIVALENT MOVEMENT (FOR ASSEMBLY)	mm	35.16
21		TOTAL EQUIVALENT MOVEMENT (PER BELLOW)	mm	17.58
22		OVERALL LENGTH	mm	500
23		BELLOW CENTER DISTANCE	mm	190
24		BELLOW CONVOLUTED LENGTH	mm	100
25		LIMITING INTERNAL DESIGN PRESSURE BASED ON COLUMN INSTABILITY (Psc)	Kg/cm²	10.68
26		LIMITING INTERNAL DESIGN PRESSURE BASED ON INPLANE INSTABILITY (Psi)	Kg/cm²	9.05
27		TOTAL STRESS (St)	Kg/cm²	10651

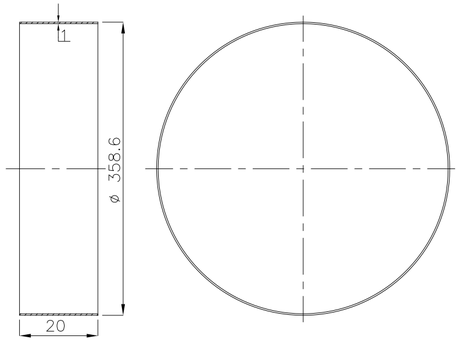
BILL OF MATERIAL

SL NO	COMPONENT'S NAME	MATERIAL	QUANTITY
1	BELLOWS	SA240TP304	2 Nos.
2	COLLAR	SA240TP304	4 Nos.
3	SLEEVE	SA240TP304	2 Nos.
4	END PIPE	SA106Gr.B	2 Nos.
5	LIMIT ROD	IS 1367 CL 6.8	2 Nos.
6	SPOOL PIPE	SA106Gr.B	1 No.
7	ROUND FLANGE	IS 2062 Gr. B/SA 515 / 516 Gr.70	2 Nos.
8	SHROUD (COVER)	IS 2062 Gr. B	2 Nos.
9	SHROUD (COVER) SUPPORTS	IS 2062 Gr. B	8 Nos.
10	BOLT & NUT-M8	IS 1367 CL6.8/6.0	8 Nos.
11	NUT, LOCKNUT & WASHER (size M25)	IS 1367 CL6.8/6.0	AR

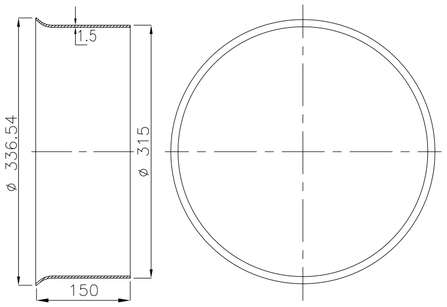
BELLOW : 0.6THK x 1PLY
No. OF CONV. : 5+5
DEPTH OF CONV. : 20
PITCH OF CONV. : 20



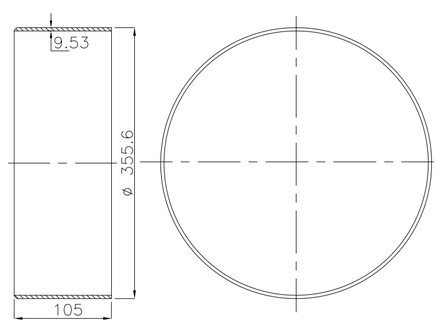
DETAIL OF SL.NO.1



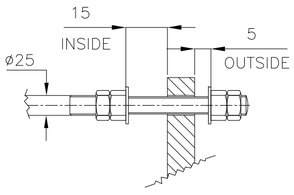
DETAIL OF SL.NO.2



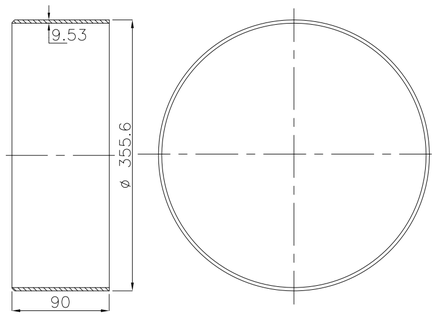
DETAIL OF SL.NO.3



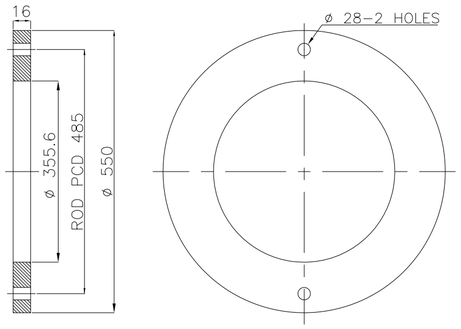
DETAIL OF SL.NO.4



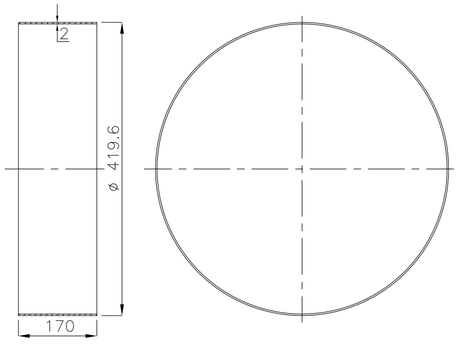
DETAIL OF SL.NO.5



DETAIL OF SL.NO.6



DETAIL OF SL.NO.7



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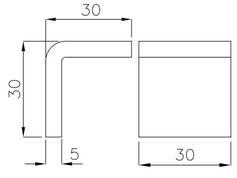
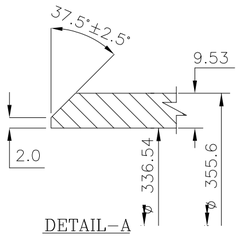
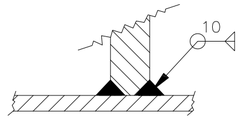


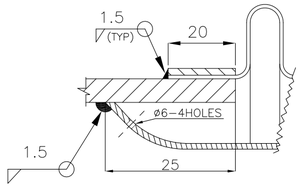
DETAIL OF SL.NO.9



DETAIL–A



DETAIL–B



DETAIL–C

NOTES:–

1. BELLOW DESIGN CODE : EJMA LATEST EDITION.
2. WELDING CODE/STD : ASME SEC IX.
3. BUTT WELD DETAIL : AS PER ASME B16.25 TO SUIT MATCHING PIPE.
4. INSPECTION & TESTING : AS PER APPROVED QP.
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CUSTOMER: WBPDCL — THE WEST BENGAL POWER DEVELOPMENT CORPN. LTD.(WBPDCL)
1X660MW, SAGARDIGHI THERMAL POWER EXTENSION PROJECT (UNIT #5)

CONSULTANT: DEVELOPMENT CONSULTANTS PRIVATE LTD. KOLKATA

JOB NO. 445
STATUS CONTRACT
DISTRIBUTION

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

REV.	DATE	ALTD	CHD	APPD

DEPT CODE		NAME	SIGN	DATE
M	DRN	PS		24.11.2021
	DESN	PS		24.11.2021
	CHD	GD		24.11.2021
	APPD	SW		24.11.2021

TITLE: GA OF UNTIED BELLOW-SIZE 350NB

DEPT. M | SCALE | SIGN | DRAWING NO. PE–DG–445–100–M171 | SHEET 06 OF 06 | REV. 00 | SIZE-A0

ELECTRONIC FILE NAME: 445_100_M171_00