DADRI– 2X490 MW
FLUE GAS DESULFURIZATION SYSTEM

TECHNICAL SPECIFICATION

FOR

RUBBER EXPANSION JOINTS/ BELLOWS

CUSTOMER : **NTPC LIMITED**

NTPC:DADRI:FGD:REJ:R01

Prepared	Checked	Approved
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R00 dated 14-05-2019		
R01 dated 30-05-2019		

CONTENTS

1.0 PROJECT INFORMATION:

a.	Owner	NTPC
b.	Buyer	BHEL, Ranipet
c.	Process/Application	Flue Gas Desulphurization

A) SITE CONDITIONS

1.	**Ambient Temperature and Relative Humidity**		
a.	**Average Site Condition ASC**		
	Ambient Temperature	:	27 deg C
	Ambient Temperature (Design)	:	45 deg C
	Relative Humidity	:	60 %

Note:

1) Reference site conditions shall apply for the Guarantee Values as well as for the Guarantee test/Performance test
2) Equipment and Material must be suitable for the range of ambient site conditions.

B) PROJECT LOCATION AND APPROACH

a.	Country	**India**
b.	State/Division	**Uttar Pradesh**
c.	District	Gautam Buddha Nagar

2.0 APPLICABLE CODES AND REGULATIONS

Bellows in general shall conform to the requirements of the following standards:

a. Bellows shall be designed as per applicable latest Indian / international standards.

b. ANSI-B-16.5 specification for flange.

3.0 INTENT OF SPECIFICATION

1 This Specification and the attached Data sheets defines the minimum requirements for Rubber Expansion Joints for use in the process of Flue Gas Desulphurization (FGD).

2 The Rubber Expansion Joints shall be of proven design for slurry application in FGD system. Refer clause 6.1 for Slurry analysis.

3 The Rubber Expansion Joints shall be used in pipes which will handle limestone Gypsum slurry/ water/air.

4 Expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipe lines.

5 In case of deviation, it shall be listed in the vendor's proposal under separate section titled as "list of deviations/exceptions to the enquiry documents.

6 Design, Manufacturing, Inspection and Testing of the Rubber Expansion Joints shall comply with all the currently applicable statutes, regulation and safety codes in the locality where the equipment are to be installed. The Equipment shall also conform to the latest applicable Indian/British/American Standards. Nothing in this specification shall construed to relieve the contractor of the required statutory responsibility.

7 Compliance to this specification shall not relieve the vendor of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified requirements.

4.0 SCOPE OF SUPPLY

- Design, manufacture, testing and supply of Rubber Expansion Joints for the duty condition as specified in Annexure-I.
- Vendor to provide both side flanges as per Annexure- I. Counter/ Companion flange shall be in the BHEL scope.
- Vendor to provide the type of flanges as indicated in Annexure-I
- Vendor to provide the Painting as Annexure-III

- Vendor to provide galvanised fasteners i.e. bolts, nuts and washers as per enclosed Annexure-I
- Rubber Expansion Joints of each size/ Type/ rating/ Standard/Material should be suitably packed separately. Each package shall marked with same details so that the Expansion Joints shall be identified easily.
- The part items of the equipment should be identified by Tag Nos and should be packed as to minimize the possibility of damage during storage or transit. The equipment shall be protected for a storage of 12 months at site, if any extra precaution is to be taken by the Purchaser for storage beyond 12 months the same shall be explicitly indicated in the operation and maintenance manuals.

5.0. ELIGIBILITY CRITERIA

1. Vendor should be a manufacturer of Rubber Expansion Joints.
2. List of customer to whom Rubber Expansion Joints of similar size supplied (Unpriced PO Copy to be furnished along with offer).
3. Previous inspection/ test report to be furnished for the similar sizes along with offer.

6.0 MATERIAL OF CONSTRUCTION

Material of construction for Rubber Expansion Joints shall be as per **Annexure-I .**

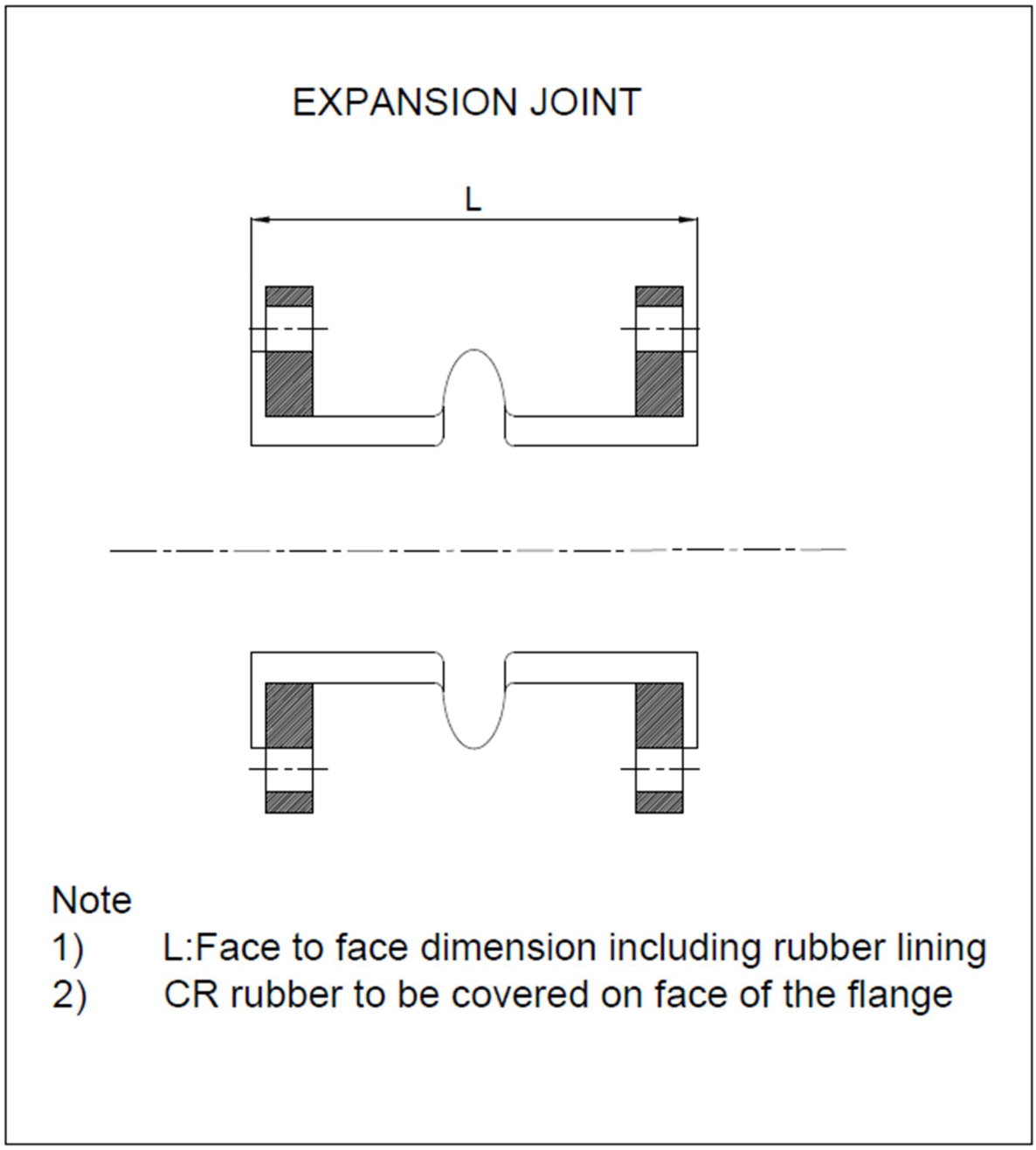
6.1 SLURRY ANALYSIS

S.No	Constituents	Parameters
1.	Slurry to be handled	Gypsum Slurry
2.	Chloride Content	<20,000 ppm
3.	Specific Gravity	**1.215**
4.	Vapor Pressure	20.3 KPa
5.	Viscosity	0.01 Pa.S
6.	Concentration of Solid	30% wt.
7.	SiO_2 Content	4 to 6 g/l

8.	pH	4-8
9.	Slurry Temperature	55 - 65 deg C

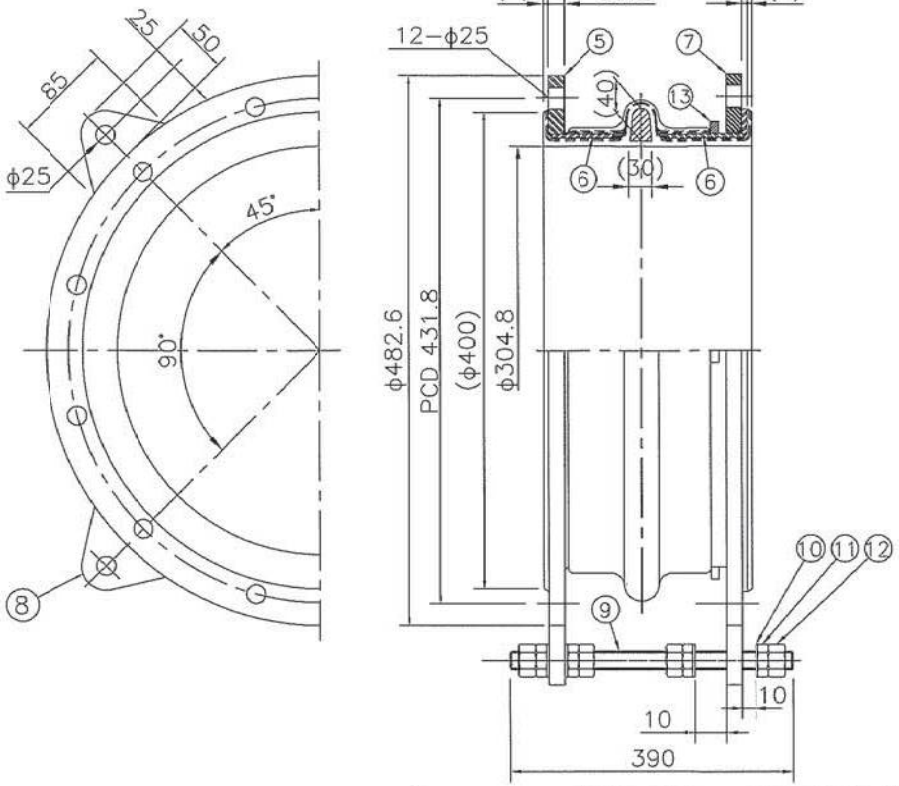
7.0 Sketch of Expansion Joint

Fig: 01



7.1 Sketch Of Typical Drawing

Fig. 02

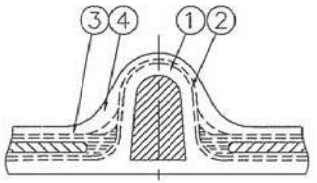


PAINTING

Surface Preparation : Sa 2.5
Under Coating : Inorganic Zinc Primer
75μm/one coat
Second Coating : High build polyamine adduct cured epoxy top coat
35μm/one coat
Finish Coating : High build polyamine adduct cured epoxy top coat
125μm/two coat

Total minimum 360μm

CAREER		
MARK	DATE	EXPLANATION



DETAIL OF CONSTRUCTION

13	STOPPER	4		
12	NUT	4×4		M22
11	LOCK NI	4×4		M22
10	WASHER	4×4		M22
9	CONTROL BOLT	4		M22
8	CONTROL PLATE	4×2		
7	LOOSE FLANGE	1		ANSI 150Lb 12"
6	NIPPLE	2		
5	FLANGE	1		ANSI 150Lb 12"
4	RUBBER OUTER COVER	1	EPDM	2.5 mm
3	REINFORCING FABRIC	1	CHEMICAL FIBER	1 P
2	REINFORCING CORD	1	CHEMICAL FIBER	4 CP
1	RUBBER INNER TUBE	1	CR	6 mm
PART NO.	NAME OF PART	NO.REQ'D	MATERIAL	REMARKS

TITLE	RUBBER EXPANSION JOINT 12" × 1ARCH × 300L				
USER				DR'D BY.	
DATE		SCALE		CH'D BY.	
DWG No.				APPROVED BY.	

8.0 GENERAL REQUIREMENTS:

S.No	Description
1.	Metric unit shall be used in the drawings and in the any displays on the equipments.
2.	Descriptions in the drawings, in the documents, and in the displays shall be in English.
3.	The equipment shall be designed to withstand the corrosive and moist environment in which these are proposed to operate.
4.	The equipment shall be suitable for stable operation continuously.
5.	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be minimum 2.0. The position of lifting lugs and reference dimension shall be shown on GA and/or outline drawings.
6.	All the surfaces of the carbon steel should be rust prevented before shipment for the period of at least 12 months for storage and construction.
7.	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted.
8.	Quality Plan to be submitted along with the offer.
9.	Cost towards the participation in discussions/meetings, providing technical assistance during technical discussions/meetings with customer for approval of drawing/documents etc. TA/DA, boarding and lodging to attend these meetings shall be borne by the bidder and shall be inclusive in supply portion.
10.	The modalities of inspection (Stage, Final, In-process) shall be finalized during detail engineering after submission of quality assurance plan (QAP). It shall be reviewed by the NTPC/ NTPC's consultant and BHEL. Bidder shall follow the procedures of inspection as per the approved QAP. Bidder has to submit the following documents along with inspection call and if any other documents required as per approved QAP. - Raw material inspection certificate - Internal test reports - All inspection & testing shall be carried out based on the following documents: a. Relevant Standards b. Specifications c. Approved drawings d. Data Sheets e. Bidder should also coordinate in getting the MDCC's (Material Dispatch clearance certificate) and all types of IC's (Inspection Certificates) from the customer/customer's consultant along with BHEL.
11.	During detail engineering, bidder to strictly adhere to BHEL/NTPC drawing formats,

S.No	Description
	document numbering, quality plan & FQP formats
12.	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/NTPC during detail engineering
13.	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.
14.	During detail engineering, successful bidder shall ensure flow of drawings/documents as per schedule. Any comments from BHEL/NTPC should be addressed timely by the bidder.
15.	Bidder to note that list above is not exhaustive and any work /items required for completing the smooth operation and ensuring satisfactory running of the expansion joints till final hand over to the end user shall also be in the scope of the bidder.
16.	Bidder shall submit the signed and stamped copy of all the pages which constitutes this technical enquiry specification signed by authorized signatory and clearly mentioning each clause under following two categories to avoid any ambiguity in scope understanding & the scope division along with technical offer. a. "Accepted without deviation and considered in scope of work" b. "Not considered in scope of work"

9.0	PACKING AND FORWARDING
1.	Proper packing to be ensured. Indigenous Supply: The equipment shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the equipment during storage in the outer yard of power plant. Imported Supply: All imported supply should be packed as per Sea worthy packing standards Annexure - V. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.
2.	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.
3.	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive

	compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.
4.	Crates and packing material used for shipping will become the property of owner.(NTPC)
5.	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking
6.	Each package or shipping units shall be clearly marked or stenciled on at least two sides as follows. **NTPC NATIONAL CAPITAL THERMAL POWER PROJECTS STAGE – II** **DADRI, 2 X 490 MW.** **UP INDIA** **EPC CONTRACTOR:BHARAT HEAVY ELECTRICALS LIMITED, INDIA"** In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.
7.	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.
8.	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.
9.	Wherever necessary besides usual inscriptions the cases shall bear special indication such as "Top", "Do not turn over", "Care" , "Keep Dry" etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks)
10.	Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following: a. Upright position b. Sling position and center of Gravity position c. Storage category d. Fragile components (to be marked properly with a clear warning for safe handling)
11.	Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be

	clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating them to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.
12.	**The packing slip shall contain the following information: -** Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number, BHEL item Code, Gross Weight and Net weight of Supplied items.
13.	Prior to transport from manufacturer's work to destination, components of the unit shall be completely cleaned to remove any foreign particles. Flange faces and other machined surfaces shall be protected by an easily removable rust preventive coating followed by suitable wrapping.
14.	All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the coastal environment zone which is defined as "very severe" during final finishing/shipping.
15.	Successful bidder shall furnish the detail packing /shipment box details with information like packing box size, type of packing, weight of each consignment, sequence no. of dispatch, no. of consignment for each deliverable item against each billing break up units/ billable blocks. Without these details the BBU shall not be approved during detail engineering. Also, complete billing break-up with above mentioned details shall be submitted within 10days of LOI.
16.	All items/equipment shall be dispatched in properly packed condition (i.e. no item shall be dispatched in loose condition such that it becomes difficult to store/identify its location at site at a later stage).
17.	Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, Skid, Case or package shipped separately shall be labelled or tagged properly.

10.0	**INSPECTION AND TESTING**
A)	**Minimum Test requirements**
	• Dimensional checks • Material test certificates • Final test.
B)	**General Inspection requirements to be considered are as below:**
1.	Bidder shall furnish written copies of shop production, fabrication and quality test procedures and drawings to be used for review by NTPC/ BHEL prior to manufacture. Inspection of above mentioned tests by BHEL representative at bidder's works is envisaged.

2.	Acceptance tolerance shall be as per applicable standard.
3.	Rubber Expansion joints shall not be released for shipment, until tests/inspection have been approved by BHEL/NTPC.
4.	BHEL shall witness the test at Bidder's works and a notice of minimum three (3) weeks shall be given for attending the inspection.
5.	Bidder to arrange all calibrated gauges, Instruments during inspection.
6.	Bidder shall submit Quality Plan for BHEL/ NTPC approval.

11.0	**WARRANTY**
1.	The warranty period shall begin on the date of taking over by NTPC/ BHEL and shall end after twenty-four (24) months. Provided that the successful bidder shall extend the provisions of this warranty to cover all repaired and replacement parts furnished under the warranty obligations hereunder, subject to the warranty period for the same being for a period of 24 months from the date on which replacement or renewal work is completed.
2.	In case of failure of the equipment to meet the guarantee, NTPC/BHEL reserves the right to reject the equipment. However, NTPC/BHEL reserves the right to use the equipment until new equipment supplied by bidder meets the guaranteed requirement .
12.0	**CONFLICT**
	Bidder's equipment shall be designed for and shall meet the service, performance and minimum level of quality requirements specified. Bidder shall be solely responsible for advising NTPC in writing of any conflicts between the specifications and Bidder's design, including performance and levels of quality. Bidder agrees that its obligations, liabilities and warranties shall not be diminished or extinguished due to its meeting the requirements of the Specification.
13.0	**DOCUMENTATION**
A	**DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER**
	The Bidder shall submit all documents, drawings, diagrams and all such information, which are necessary to fully understand the offer for techno – commercial evaluation. The below mentioned documents are required for proper evaluation purpose and vendors are requested to comply with above in all respect. ▪ General arrangement drawing showing all descriptions, dimensions part numbers, material specification , quantity and weight details of the complete system with part list, quantity, material specification and weight.

	▪ Data sheet as per Annexure – I ▪ Quality Plan. ▪ Catalogues. ▪ Reference list of supply along with PO copy & test reports. ▪ Deviation list, if any.
B	**DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT**
	The Successful bidder shall submit necessary data, documents and drawings for review, approval with requirements specified here under. However as minimum the following shall be submitted as per Annexure-IV. Drawings that are reviewed by the NTPC / BHEL will be returned to bidder with a transmittal letter with any comments and / or questions marked on the drawings or noted in the letter. All comments and questions must be resolved before a resubmission of drawings / documents. If the design has not developed enough to resolve some of the comments or questions, bidder shall place a "hold" on those items or areas of design. NTPC / BHEL reserves the right to return drawings unprocessed to bidder if there exists any evidence that bidder has not acknowledged all comments and questions. All necessary GA drawings, sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by NTPC/ BHEL must be furnished by bidder in soft and hard copy forms. For all documents softcopy format shall be searchable pdf, however in addition all drawings, diagrams like P&IDS shall be supplied in ACAD or other editable format and all lists in Excel format. Further break up of technical documents will be discussed during finalization of the purchase contract. Unless agreed otherwise, Five (05) hard copies and One (01) sets of electronic copies of all documents are to be submitted in the English language. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF). Especially P&IDs shall be submitted as DWG files and PDF files. Bidder to ensure submission of hard copies as per NTPC's requirement for all engineering drg/doc and for all subsequent revisions along with a soft copy through email to concerned project team. However all the engineering related information shall be furnished in soft form to BHEL. ▪ Quality plan, packing drawing and GA drawing showing all descriptions, dimensions part numbers, Material specification ,quantity and weight details are to be submitted in 5(five) sets for our approval before proceeding with manufacturing & one copy of the reproducible approved drawing. ▪ Test certificates.

14.0 ANNEXURES

ANNEXURE-I

DATA SHEET FOR EXPANSION JOINTS					
Location	**Absorber Spray Pipe Inlet**	**Absorber JAS Gypsum Slurry Supply**	**Absorber JAS Air Supply**	**Mist Eliminator washing pipe Inlet**	**Bidder to confirm**
Quantity required	80	16	16	64	
Type	Arch Type	Arch Type	Arch Type	Arch Type	
Purpose	Anti-Vibration/ Diaplacement	Anti-Vibration/ Diaplacement	Anti-Vibration/ Diaplacement	Anti-Vibration/ Diaplacement	
Design Conditions					
Fluid	Gypsum Slurry	Gypsum Slurry	Air	Water	
Design Press. $Kg/cm^2(g)$	6.00	6.00	6.00	8.00	
Test Pressure $Kg/cm^2(g)$	9.00	9.00	9.00	12.00	
Fluid Temp. °C	65	65	100	45	
Design Temp. °C	70	70	120	55	
Atm Temp. °C	0-50	0-50	0-50	0-50	
Movement					
Axial mm	±10	±10	±10	±10	
Lateral mm	±10	±10	±10	±10	
Installation Position	HORIZONTAL/ VERTICAL/ INCLINED	HORIZONTAL/ VERTICAL/ INCLINED	HORIZONTAL/ VERTICAL/ INCLINED	HORIZONTAL/ VERTICAL/ INCLINED	
Dimension					
Size	300 (12")	200 (8")	150 (6")	100 (4")	
Connection Type	Flange ANSI 150	Flange ANSI 150	Flange ANSI 150	Flange ANSI 150	
	One side flange shall be loosed/ slip on	One side flange shall be loosed/ slip on	One side flange shall be loosed/ slip on	One side flange shall be loosed/ slip on, other side flange shall be SORF type	
Face to Face dimension of bellow with rubber lining (in mm) (refer fig 1.0)	230	180	150	150	
Materials & quantity of bellow & Accessories as					

per enclosed typical drg. Fig. 02 (Clause #7)					
Body					
Rubber Inner tube	CR	CR	CR	CR	
Reinforcing cord	Chemical Fiber	Chemical Fiber	Chemical Fiber	Chemical Fiber	
Reinforcing fabric	Chemical Fiber	Chemical Fiber	Chemical Fiber	Chemical Fiber	
Rubber outer cover	EPDM	EPDM	EPDM	EPDM	
Flange (1 fixed+ 1 slip on) - A36 +CR	160 Nos.	32 Nos.	32 Nos.	128 Nos.	
Control Ring/ Plate - A 307-B	640 Nos.	128 Nos.	128 Nos.	512 Nos.	
Fasteners (A307-B + GAL)					
Tie Rod/ Control Bolt	320 Nos.	64 Nos.	64 Nos.	256 Nos.	
Washer	1280 Nos.	256 Nos.	256 Nos.	1024 Nos.	
Lock Nut	1280 Nos.	256 Nos.	256 Nos.	1024 Nos.	
Nut	1280 Nos.	256 Nos.	256 Nos.	1024 Nos.	

Note: CR- Chloroprene rubber

SIGNATURE OF BIDDER ----------

NAME ----------

DESIGNATION ----------

Annexure-II: Painting Procedure

Surface Preperation	**Primer Coat**		**Intermediate Coat**		**Finish coat**			**Total DFT µm (min)**
	Under Coating	No of Coats	Paint	No of Coats	Paint	No of Coats	Shade	
Sa 2.5	Inorganic Zinc Primer 75µm	1	High build polyamine adduct cured epoxy top coat 35µm	1	High build polyamine adduct cured epoxy top coat 125µm	2	Gray White shade : RAL 9002	360

Note: This painting schedule is tentative. Painting shall be done as per approved painting procedure as approved by BHEL/ customer during detail engineering stage. Bidder to confirm.

SIGNATURE OF BIDDER ----------

NAME ----------

DESIGNATION ----------

ANNEXURE – III : LIST OF DEVIATIONS/EXCEPTIONS TO THE ENQUIRY DOCUMENT

Sl No	Clause No	Page No	Description of Deviation

Note: Enlarge the table to incorporate items

SIGNATURE OF BIDDER ----------

NAME ----------

DESIGNATION ----------

ANNEXURE-IV: DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER/AWARD OF CONTRACT

S.No	Description	Along with offer	After Award of Contract
1	Compliance to Specification	Yes	--
2	Deviation List	Yes	--
3	Data Sheet & General Assembly Drawing	Yes	Yes
4	Manufacturing Drawing & Part Drawing	--	Yes
5	Data sheet	Yes	Yes
6	Sub Vendor List	Yes	Yes
7	Test certificates	--	Yes
8	Erection check list	--	Yes
9	Scope of supply	Yes	--
10	Quality plan	Yes	Yes
11	Operation & Maintenance manual	--	Five (05) hard copies and One (01) sets of electronic copies of all documents are to be submitted in the English language.
12	Delivery Schedule	Yes	Yes
13	Test & Inspection Procedure	--	Yes
14	Catalogue	Yes	--

SIGNATURE OF VENDOR ----------

NAME ----------

DESIGNATION ----------