ORISSA POWER GENERATION CORPORATION LTD.

2 X 660 MW, OPGCL IB BANHARPALLI TPP

UNIT 3 & 4

TECHNICAL SPECIFICATION

FOR

METAL EXPANSION BELLOWS

VOLUME – IIB

SPECIFICATION NO: PE-TS-391-100-M021 (REV-00)

Maharatna Company

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

1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1 **Volume-I (CONDITIONS OF CONTRACT)**

This consists of four parts as below:-

Volume-IA : This part contains instructions to bidders for making bids to BHEL.

Volume-IB : This part contains general commercial conditions of the tender & includes provision that vendor is responsible for the quality of item supplied by their sub-vendors.

Volume-IC : This part contains special conditions of contract.

Volume-ID : This part contains commercial conditions for erection & commissioning site work, as applicable.

1.2 **Volume-II** (**TECHNICAL SPECIFICATIONS)**

Technical requirements are stipulated in Volume-II which comprises of :-
Volume-IIA : General Technical Conditions
Volume-IIB : Technical Specification including Drawings, if any.

1.2.1 **Volume-IIB**

This volume is sub-divided into following sections :-

Section-A : This section outlines the scope of enquiry.

Section-B : This section provides “Project Information”.

Section-C : This section indicates technical requirements specific to the contract, not covered in Section-D.

Section-D : This section comprises of technical specifications of equipments complete with data sheet A, B and C.

Data Sheet - A Specifies data and other requirements pertaining to the Equipment.

Data Sheet - B Specifies data to be filled by the bidder (Data Sheet-B is contained in Volume-III).

Data Sheet - C Indicates data/documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).

1.2.2 **Volume-III** (**TECHNICAL SCHEDULES)**

This volume contains technical schedules and Data Sheets-B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in Document No. PE-SS-999-100-Q-002 in Volume-III.

2.0 The requirements mentioned in Section-C / Data Sheets-A of section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section-D.

C O N T E N T S

VOL. IIB

SECTION-A

SCOPE OF ENQUIRY

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1. This specification covers the Design, Manufacture, Inspection & Testing at vendor's and/or his sub-vendor's works, proper packing and delivery to site of the METAL EXPANSION BELLOWS as per the requirements mentioned in different sections of the specification for 2x660 MW BANHARPALLI STPP.

2. The purpose of metallic expansion bellows is to reduce the reactions/forces & moment at the connected equipment terminals due to thermal expansion/contraction and/or vibration of connected equipment and piping. The arrangement of the bellows in the piping, design conditions, size, bellow spring rates, lengths, tag nos. and services etc. are furnished in Data Sheet-A. The bellows shall be installed / located in the position as indicated in the data sheets.

3. It is not the intent to specify herein all the details of design and manufacture. However the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser, who will interpret the meaning of drawing and specification and shall be entitled to reject any work or material, which in his judgment is not in full accordance herewith.

4. The omission of specific reference to any component/ accessories necessary for the proper performance of Metal Expansion Bellows shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of bellows at quoted prices.

5. Design/ drawings/ data sheets etc. shall be subject to approval of BHEL as per specification, in the event of order.

6. The equipment covered under this specification shall not be despatched unless the same have been finally inspected, accepted and shipping release issued by BHEL.

SECTION-B

PROJECT INFORMATION

PROJECT INFORMATION

The bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information provided in this section will be for general guidance and shall not be contractually bidding on BHEL/OWNER. All relevant site data/information as may be necessary shall have to be obtained/ collected by the bidder.

The project site is located at Banaharpalli in the Jharsuguda district of Orissa on the bank of Hirakund Reservoir and about 20 km south of Belpahar railway station and 40km south west of Jharsuguda. The main Howrah-Mumbai railway line passes 20 km north of the plant (at Belpahar). NH-200 (Chandikhole to Raipur) and SH-10 (Sambalpur to Sundergarh) pass through Jharsuguda town. Nearest Airport is Bhubaneswar and Nearest Seaport is Paradeep/Haldia.

SECTION-C

SPECIFIC TECHNICAL REQUIREMENTS

1 GENERAL

1.1 The Metal expansion Bellows shall meet the technical requirements and conform to the 'Standard technical specifications' and Data sheet-A of Section D. In addition, the requirements of this Section-C shall also be complied with. However, wherever the details given in the standard technical specification of Section-D and Data sheet-A are different, the requirements of Data sheet-A shall prevail. Similarly in the event of contradictions between Section–C & Section–D/Data sheet-A; Section–C shall prevail.

1.2 The technical requirements for bellows shall, in general, be as per the attached 'Standard technical specification' for bellows and Data Sheet-A of Vol. II B Section D.

1.3 Based on BHEL's comments on design, EJMA calculations and constructional details, vendor may be required to make changes if needed so that the bellows meet the technical requirements of this specification. BHEL decision will be binding in case of any conflict and the vendor will have to comply with BHEL requirements without cost implication.

2 SCOPE OF SUPPLY

2.1 The bellows to be supplied shall be as per Data sheet-A and 'Standard technical specification' of Section-D.

2.2 Special Tools and tackles, if any.

2.3 Drawings, datasheets, operation and maintenance manuals etc., as specified in Data Sheet-C.

3 EXCLUSIONS

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

4 QUALITY ASSURANCE AND TESTS

4.1 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 customer comments (if any). Quality plans shall be approved by BHEL and customer (If necessary). All inspection and testing shall be carried out by BHEL/ BHEL representative and BHEL customer (if necessary). In case inspection is by both BHEL and their customer, then the inspection can be carried out jointly or separately, which will be informed later.

4.2 Type tests may be required to be done in line with clause 6.2 of Standard Technical specification of Vol. II B section D and quality plan. Final decision regarding conducting of type test will be conveyed by BHEL at a later date which will be binding on the vendor without commercial implication.

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

5 TYPE TESTS

Type tests as per EJMA are required to be carried out for bellows. If type tests have been successfully done for earlier BHEL projects for the bellows of the *same type (as required in the project) in a group (as per clause 6.2 of standard technical specification of Vol. II B section D), 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 years from project bid opening date which will be intimated later. 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 or available type reports are not for *same type (as required in the project) bellows then type test shall be carried out as per clause 6.2 of standard technical specification of Vol. II B section-D 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: **Same type means bellows having same diameter, height, pitch, convolution profile & ply thickness.*

6 PAINTING REQUIREMENT

6.1 NON COASTAL ENVIRONMENT

SERVICE	SURFACE CLEANING	PAINTING DETAIL	COLOUR SHADE
Condensate suction line	SP3, Power tool cleaning	Bellows first shall be painted with two coats of Red oxide zinc chromate primer (alkyd base) with each coat of DFT equal to 25 microns conforming to IS:2074. Finish paint shall be three shop coats (DFT 35 microns each coat) of synthetic enamel paint (long oil alkyd) as per IS: 2932. Total DFT of primer and paint shall be 155 microns.	Sea green shade no. ISC -217
Flash Tank Vents	SP3, Power tool cleaning	2 coats (Total DFT 40 µm) of heat resistant aluminium paint to IS 13183 Gr.2	Aluminium
TD BFP Exhaust	SP3, Power tool cleaning	2 coats (Total DFT 40 µm) of heat resistant aluminium paint to IS 13183 Gr.2	Aluminium

7 PACKING REQUIREMENT

7.1 Refer clause 7 of VOL II-B, Section ‘D’, ‘Standard Technical Specification’ for packing details.

7.2 Vendor to provide soft copy of photos/snaps of duly packed ME Bellows. The soft copies to be provided by vendor to BHEL Engineering after final inspection of ME Bellows. Clearance for dispatch of ME Bellows will be given only after verification of satisfactory packing conditions of ME Bellows from vendor’s works.

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

i. Manufacturer’s Name
ii. Expansion Joint Size
iii. Expansion Joint Type
iv. Tag No.

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

8 SUPPLY OF BELLOWS

Metal expansion bellows for the following type and size is to be supplied for 2X660 MW BANHARPALLI STPP. Design, construction and material details of these bellows have been mentioned in Data Sheet-A, Vol.-II B, Section-D.

SL. NO.	ITEM DESCRIPTION			LOCATION	INSTALLATION	QTY PER UNIT	TOT-AL QTY
	SIZE	TYPE	TAG NO.				
1	1800 NB	GIMBAL BELLOWS	E1,E2,E4,E5	BFPT-B/A EXHAUST TO CONDENSER	HORIZONTAL	4	8
2	1800 NB	HINGED ANGULAR BELLOWS	E3, E6	BFPT-B/A EXHAUST TO CONDENSER	HORIZONTAL	2	4
3	1200 NB	GIMBAL BELLOWS	E7,E8	HP FLASH TANK VENT TO CONDENSER	HORIZONTAL	2	4
4	1200 NB	HINGED ANGULAR BELLOWS	E9	HP FLASH TANK VENT TO CONDENSER	VERTICAL	1	2
5	900 NB	HINGED ANGULAR BELLOWS	E10,E11	LP FLASH TANK VENT TO CONDENSER	HORIZONTAL	2	4
6	900 NB	HINGED ANGULAR BELLOWS	E12	LP FLASH TANK VENT TO CONDENSER	VERTICAL	1	2
7	800 NB	HINGED ANGULAR BELLOWS	E13	SD FLASH TANK VENT TO CONDENSER	VERTICAL	1	2
8	800 NB	HINGED ANGULAR BELLOWS	E14	SD FLASH TANK VENT TO CONDENSER	HORIZONTAL	1	2
9	550 NB	UNTIED BELLOWS	E15,E16,E17	MAIN CONDENSTAE SUCTION PIPING	HORIZONTAL	3	6
TOTAL						17	34

9 DOCUMENTS TO BE SUBMITTED ALONG WITH OFFER

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

a) Compliance sheet
b) Schedule of Deviations if any.
c) Schedule of declaration

For Sl. No. 9 (a), 9 (b) & 9 (c), refer Volume-III.

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 vendor and no comments shall be marked on these.

SEECTION -D

1. STANDARD TECHNICAL SPECIFICATION

2. DATA SHEET – A

3. MANUFACTURING QUALITY PLAN

4. DATA SHEET-C

1.STANDARD TECHNICAL SPECIFICATION

1 GENERAL

This specification covers the design, materials, construction features, manufacture and testing of Metal expansion bellows at Vendor's or/ and sub-Vendor's works inclusive of painting and packing requirements.

2 CODES & STANDARDS

2.1 The design, manufacture, 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 editions of Expansion Joint Manufacturers Association Standards (EJMA) as well as ASME Section III, ASME Section VIII, ASTM E-165 and ASME- B31.1.

2.2 In case of any conflict between the above Codes/Standards and this specification, the latter shall prevail and in case any further conflict in this matter, the interpretation of the specification by the Engineer shall be final & binding.

3 DESIGN REQUIREMENTS

3.1 The design calculations of bellows shall be as per EJMA.

3.2 Dimensional tolerance for the expansion bellows should be as per EJMA.

3.3 The expansion bellows shall be capable of withstanding design pressure and full vacuum also wherever applicable.

3.4 The expansion bellows shall be designed for the deflections /angulations indicated in Data Sheet- A. The spring rates of the bellows expansion joints shall be within the values specified.

3.5 The cyclic life of the expansion bellow shall be minimum of 10,000 cycles.

3.6 Stress relieving or annealing after forming of bellows is not recommended.

3.7 No pre-tension of bellows is permitted.

4 MATERIAL

4.1 The material of construction of main parts of bellows shall be as specified in Data Sheet -A of Vol. IIB Section D.

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

4.3 Materials used in manufacture of valves shall be of tested quality.

5 CONSTRUCTIONAL FEATURES

5.1 METALLIC BELLOWS

i. 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.
ii. 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.

iii. Cold-formed stainless steel bellows shall not be heat-treated.

iv. All bellow elements shall be pickled after forming,

v. Equalizing rings, where required, shall be either from high quality castings of from fabricated metal.

vi. Flanged expansion joints shall be provided with adequate pipe stubs.

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

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

5.2 SLEEVES

i. Expansion joints will be furnished with internal 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 sleeve shall also be provided with a drain hole wherever necessary to avoid condensate accumulation.

ii. Each expansion bellow shall be enclosed in a protective cover or external sleeve to protect the bellows from damage during shipping, installation and while in operation. The arrangement of such cover will enable the thermal insulation to be provided leaving the tie rods uncovered. The cover shall not restrict the free deflection of bellows.

iii. Bellows shall have external sleeves with an arrow indicating the direction of flow on the outside. The external steel shall be detachable.

5.3 TIE BARS

i. All 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.

ii. Tied lateral angular expansion joints shall be provided with two tie rods to take vacuum/pressure thrust and 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.

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

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

v. The tie rods and limit rods shall be adequately sized to absorb pressure thrust and prevent buckling in vacuum service or service with other external loads.

5.4 HINGES

i. Hinged bellow shall be provided with hinge plates and hinge pin permitting the bellows for angulating about one plane while taking the pressure thrust.

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

6 TESTING AND INSPECTION

6.1 GENERAL

i. 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.

ii. 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 as per code requirements 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 12 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.

g) Deflection test for maximum permissible movements in any direction when induced individually or simultaneously. Deflection test is to ensure that bellows deflect for the designed movement without any obstruction. Axial deflection will be seen by deflecting the bellows axially and lateral and angular deflection by deflecting the bellows laterally and angularly. No equivalent movement need be seen.

h) Examination of radiography including radiographic techniques, radiographic examination of the longitudinal seam of the bellow 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 EJMA.

iii. Test will be witnessed by customer / consultants/BHEL unless otherwise waived.

iv. The minimum NDT/testing and inspection requirements for bellows shall be as per the attached Quality Plan. However, in case of order, final inspection and testing shall be carried out as per the final approved quality plan without any price implication.

6.2 TYPE TESTS (CYCLE LIFE, SQUIRM AND YIELD RUPTURE TESTS)

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

6.2.1 CLASSIFICATION OF BELLOWS FOR THE PURPOSE OF TYPE TEST

The bellows shall be classified as per parameters below. The bellows conforming to same combination of categories of these parameters shall constitute one group.

6.2.1.1 Material of Bellows: Three categories are envisaged - Carbon steel, stainless steel (e.g. SS-304, 321, 316 etc.) and High alloy steels (e.g. Inconel)

6.2.1.2 Profile of Convolutions: Each profile shall be considered as separate category (e.g. 'U' profile, 'V' profile, Lyra profile etc.).

6.2.1.3 Diameter of Bellows: The categories are as follows:

a) Nominal dia upto 800mm NB.
b) Nominal dia greater than 800mm NB upto 1600 NB.
c) Each size above 1600mm NB shall be a separate category.

6.2.1.4 Design Pressure: Two categories are envisaged. First is for design pressure from full vacuum up to 5 Kg/cm2 (g) second category is for pressure above 5 Kg/cm2 (g) up to 10 Kg/cm2 (g).

6.2.2 CRITERIA OF TEST:

From each group of bellows, as per clause 6.2.1 above, Type tests shall be carried out on two nos. of bellows which has maximum total stress as per EJMA among the bellows of the same group. One bellow shall be used for life cycle test and the other for Squirm & Yield rupture test. Other bellows of this group shall be qualified on the basis of this test.

6.2.3 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.

7 CLEANING, PROTECTION FOR DESPATCH & PACKING

i. 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.

ii. Exposed finished surface of each 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.

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

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

v. Bellows shall be shipped at neutral length. They shall be provided with suitable erection and knock-off type temporary tie bars, 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 for each expansion bellow.

vi. The bellows has to be despatched in total assembled form and shall be shipped at neutral length.

vii. Bellows Tag Nos. shall be incorporated in all the despatch documents.

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

ix. All bellows shall be individually wrapped with one layer of hessian cloth and one layer of polyethylene sheet. After that wrapped bellows shall be packed suitably in wooden cases in order to avoid damage during transit and also during storage at site in tropical climate conditions for a period of 15-18 months.

2. DATA SHEET-A

PART-1: GENERAL & DESIGN PARAMETERS
PART-2: MATERIAL OF CONSTRUCTION
PART-3: REFERENCE GA DRAWINGS

	TITLE:	SPECIFICATION NO. PE-TS-391-100-M 021	
Maharatna Company	**METAL EXPANSION BELLOWS 2X660 MW BANHARPALLI STPP DATA SHEET- A**	VOLUME : II B	
		SECTION: **D**	
		REV. NO.: 00	DATE: 14/09/2015
		PART 1	SHEET 1/1

SL. NO.	***DETAIL OF GENERAL AND DESIGN PARAMETERS FOR METAL EXPANSION BELLOWS***							
1	TYPE OF BELLOWS	GIMBAL	HINGED	GIMBAL	HINGED	HINGED	HINGED	UNTIED
2	SIZE	1800	1800	1200	1200	900	800	550
3	ASSEMBLY TYPE	SINGLE	SINGLE	SINGLE	SINGLE	SINGLE	SINGLE	UNIVER-SAL
4	MATCHING PIPE (OD X THK)	1829X16	1829X16	1219X10	1219X10	914X10	813X10	559X10
5	OVERALL LENGTH (MM)	1200	900	900	900	900	800	900
6	PLY THICKNESS (MM)	1.2	1.2	1.2	1.2	1	1	0.6
7	BELLOWS WIDTH (MM)	47	47	40	40	39	39	25
8	BELLOWS PITCH(MM)	40	40	40	40	37	30	22
9	CONVOLUTION (MM)	8	8	7	7	5	5	5
10	TANGENT THICKNESS (MM)	1.2	1.2	1.2	1.2	1	1	0.6
11	TANGENT LENGTH (MM)	20	20	20	20	20	20	20
12	COLLAR THICKNESS (MM)	2	2	1.2	1.2	1	1	1
13	COLLAR LENGTH (MM)	20	20	20	20	20	20	20
14	SPOOL/MID PIPE LENGTH (MM)	NA	NA	NA	NA	NA	NA	150
15	SLEEVE THICKNESS (MM)	10	10	6	6	6	6	1.5
16	ROUND FLANGE THICKNESS (MM)	80	80	50	50	45	40	30
17	SQUARE GIMBAL RING THICKNESS (MM)	75	NA	60	NA	NA	NA	NA
18	SQUARE GIMBAL RING WIDTH (MM)	350	NA	225	NA	NA	NA	NA
19	HINGE MAIN PLATE THICKNESS (MM)	NA	75	NA	40	40	40	NA
20	HINGE SUPPORT PLATE THICKNESS (MM)	38	38	20	20	20	20	NA
21	HINGE PIN/GIMBAL PIN DIA. (MM)	90	90	60	60	50	40	NA
22	GUSSET PALTE THICKNESS (MM)	36	36	20	20	20	NA	NA
23	TIE ROD DIA. (MM)	NA	NA	NA	NA	NA	NA	30
24	THICKNESS OF END PIPE LOCAL TO FLANGE (MM)*	30	30	20	20	20	NA	NA

NOTE: *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 at other end.

MATERIAL OF CONSTRUCTION

Material used for manufacture of various bellows components are mentioned in Table-I.

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
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	CARBON STEEL
14	CIRCLIPS/WASHER	MILD STEEL
15	STIFFNER PLATE	SA515Gr.70 /SA516Gr.70/ IS2062Gr.B
16	BOLT & NUT	IS1367 CL4.6/4
17	ANY OTHER COMPONENT	SPECIFIED BY BIDDER AND SHALL BE SUITABLE FOR INTENDED DUTY

REFERENCE GA DRAWINGS

1. Vendor to furnish drawing prepared based on reference drawing with fabrication details included and keeping the basic design and dimensions same as reference drawing, in case of order.

2. If, during detail engineering, some changes w.r.t. to constructional details/dimensional change is required to suits the bellows technical requirement and functionality by bidder, then same is to be inflected in drawing without any price implication on BHEL.

3. All bellows shall be manufactured as per detail given in DATA SHEET-A Part-1. In case of ambiguity, in reference drawing and DATA SHEET-A Part-1; later shall prevail.

4. Bill of material mentioned in drawing are for indicative purpose only. Material of construction to be followed as indicated in DATA SHEET-A Part-2 only. In case of ambiguity, DATA SHEET-A part-2 shall prevail.

5. Bidder to follow the bellows details table (Indicated in reference drawings) for operating parameters, which is final. However, any change, in theses parameters will be informed during detail engineering.

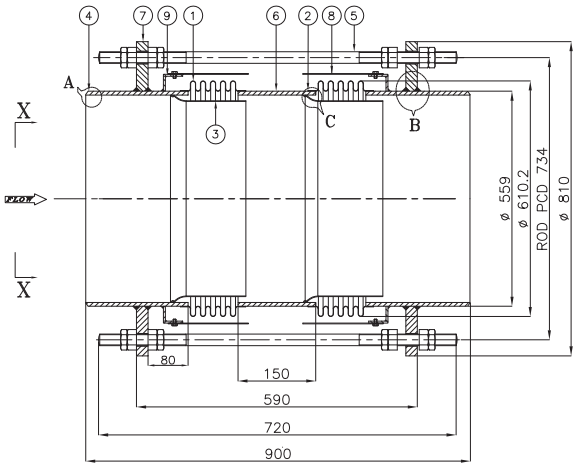
6. For vertical bellows, sleeve shall be provided with a drain hole to avoid condensate accumulation.

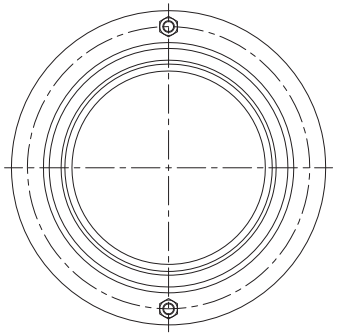
7. There shall be no sharp corners in final assembly. They shall be chamfered suitably.

8. All welds shall be properly done as per ASME section-IX and the assembly finish must be neat & clean.

9. Manufacturing tolerances shall be considered as per standards mentioned in standard technical specification (PE-TS-999-100-M 021 Rev-02).

SHEET 2/8



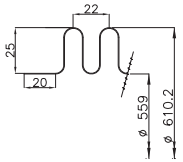


VIEW X–X

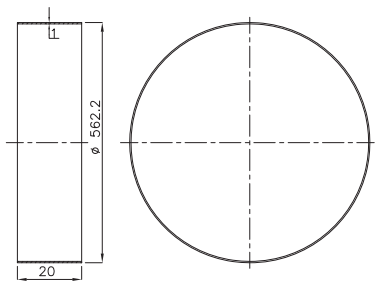
BELLOW DETAILS

SL NO		DESCRIPTION	UNITS	DATA/ PARTICULARS.
1	GENERAL	TAG No.	-	LATER
2		QUANTITIES PER SET	Nos.	LATER
3		TOTAL QUANTITY	Nos.	LATER
4		LOCATION	-	MAIN CONDENSATE SUCTION
5		FLUID	-	CONDENSATE
6		INSTALLATION	-	LATER
7	DESIGN & OPERATING DATA	PIPE SIZE(ODxTHK)	mm	559 x 10
8		OPERATING PRESSURE	Kg/cm²(A)	0.1033
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	12mm of Hg
12		OPERATING TEMPERATURE	°C	46
13		DESIGN TEMPERATURE	°C	55
14		BELLOW CYCLE LIFE	Nos.	161556
15		AXIAL COMPRESSION (DESIGN)	mm	11
16		LATERAL DEFLECTION (DESIGN)	mm	8
17		AXIAL SPRING RATE	Kg/mm	15.99
18		LATERAL SPRING RATE	Kg/mm	40.17
19		ANGULAR SPRING RATE	Kg-M/Deg.	NA
20		TOTAL EQUIVALENT MOVEMENT (FOR ASSEMBLY)	mm	35.68
21		TOTAL EQUIVALENT MOVEMENT (PER BELLOW)	mm	17.84
22		OVERALL LENGTH	mm	900
23		BELLOW CENTER DISTANCE	mm	260
24		BELLOW CONVOLUTED LENGTH	mm	110
25		LIMITING INTERNAL DESIGN PRESSURE BASED ON COLUMN INSTABILITY (Psc)	Kg/cm²	7.77
26		LIMITING INTERNAL DESIGN PRESSURE BASED ON INPLANE INSTABILITY (Psi)	Kg/cm²	5.50
27		TOTAL STRESS (St)	Kg/cm²	7639.41

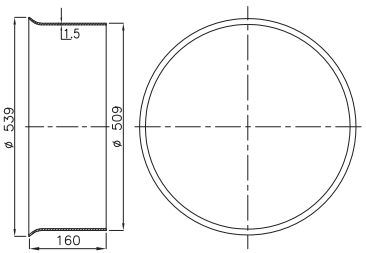
BELLOW : 0.6THK x 1PLY.
No. OF CONV. : 5+5
DEPTH OF CONV. : 25
PITCH OF CONV. : 22



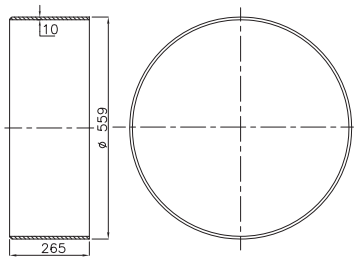
DETAIL OF SL.NO.1



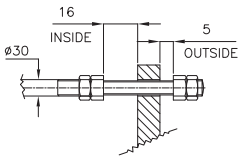
DETAIL OF SL.NO.2



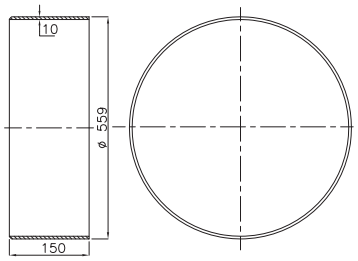
DETAIL OF SL.NO.3



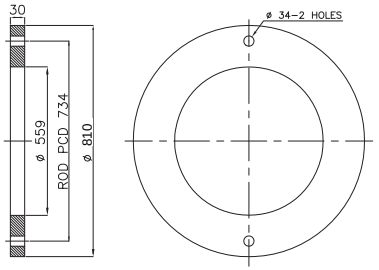
DETAIL OF SL.NO.4



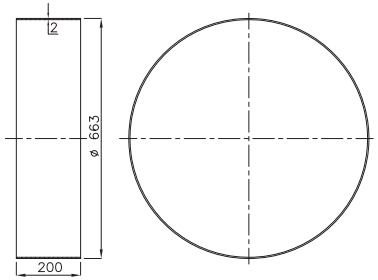
DETAIL OF SL.NO.5



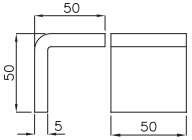
DETAIL OF SL.NO.6



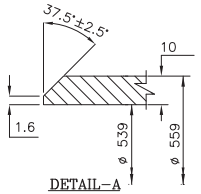
DETAIL OF SL.NO.7



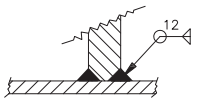
DETAIL OF SL.NO.8



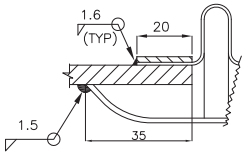
DETAIL OF SL.NO.9



DETAIL–A



DETAIL–B



DETAIL–C

BILL OF MATERIAL

SL NO	COMPONENT'S NAME	MATERIAL	QUANTITY
1	BELLOWS	SA240TP304	2 Nos.
2	COLLAR	SA240TP304	4 Nos.
3	SLEEVE	SA672 GR.B70/SA515/516 GR.70	2 Nos.
4	END PIPE	SA672 Gr. B70	2 Nos.
5	LIMIT ROD WITH NUTS	CS (CL. 6.8 & 6.0)	2 Nos.
6	SPOOL PIPE	SA672 GR.B70/SA515/516 GR.70	1 No.
7	ROUND FLANGE	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	2 Nos.
8	SHROUD (COVER)	IS 2062 Gr. B	2 Nos.
9	SHROUD (COVER) SUPPORTS	IS 2062 Gr. B	4 Nos.

NOTES:–

1. BELLOW DESIGN CODE : EJMA 9 th EDITION 2011 ADDENDA.
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 QP No. PE–QP–XXX–100–M021–R00.
5. PAINTING DETAILS : TWO COATS OF RED OXIDE ZINC PHOSPHATE PRIMER TO IS 124744 WITH EACH COAT OF DFT EQUAL TO 25MICRON. FINISH PAINT SHALL BE ONE COAT OF SYNTHETIC ENAMEL (LONG OIL ALKYD) PAINT TO IS 2932. TOTAL DFT OF PRIMER AND FINISH PAINT SHALL BE 75 MICRON. (COLOUR SHADE–SEA GREEN SHADE NO. ISC–217).
6. SUITABLE SHIPPING BRACKETS WILL BE PROVIDED IN YELLOW COLOUR WHICH MUST BE REMOVED AFTER INSTALLATION.
7. STAINLESS STEEL NAME PLATE WITH REQUIRED DETAILS WILL BE FIXED ON EXPANSION JOINTS.
8. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.

CUSTOMER –
–
CLIENT'S CONSULTANT: –
PROJECT –

JOB No. XXX

REV	DATE	ALTD	CHD	APPD

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NOIDA

	NAME	SIGN	DATE
DRN	–		"
DESN	–		"
CHD	–		"
APPD	–		"

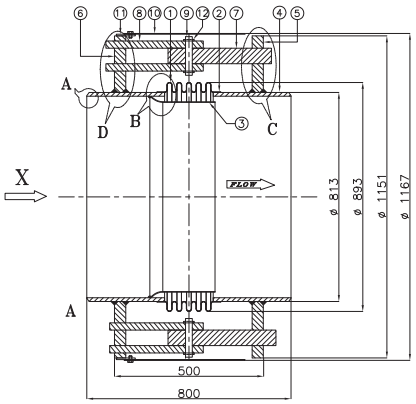
DEPT CODE: M

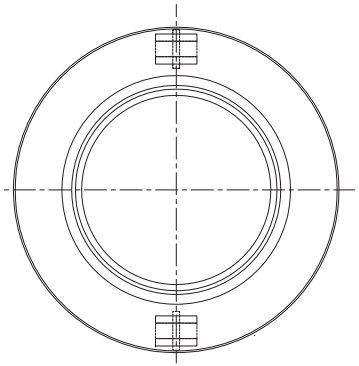
TITLE: UNTIED UNIVERSAL EXPANSION JOINT SIZE–550NB

ASSEMBLY WEIGHT : ~110 kg
TECH. SPEC. No.
SCALE : NTS
DEPT.
SIGN
DATE
DRAWING NO. PE–V0–XXX–100–MXXX
SHEET 1 OF 1 REV 00
SIZE–A3

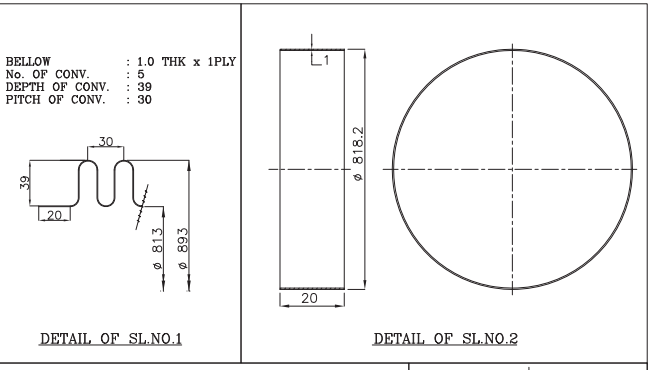
PE–V0–XXX–100–MXXX

SHEET 3/8



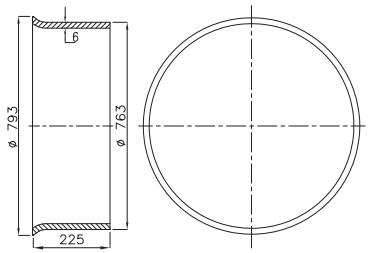


VIEW–X

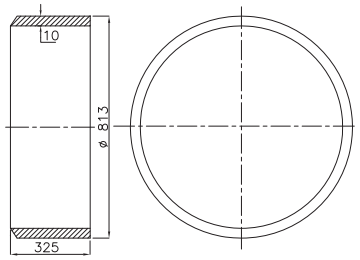


DETAIL OF SL.NO.1

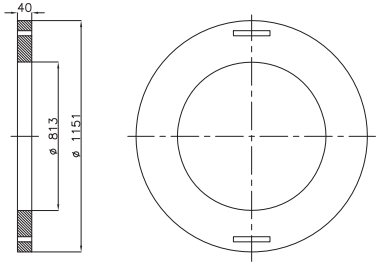
DETAIL OF SL.NO.2



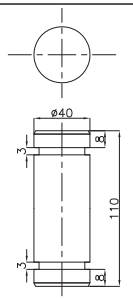
DETAIL OF SL.NO.3



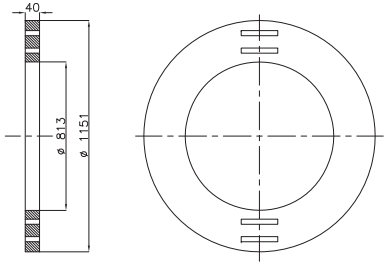
DETAIL OF SL.NO.4



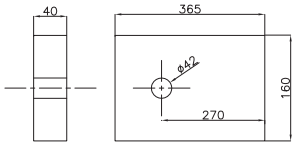
DETAIL OF SL.NO.5



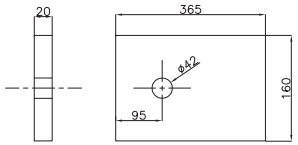
DETAIL OF SL.NO.6



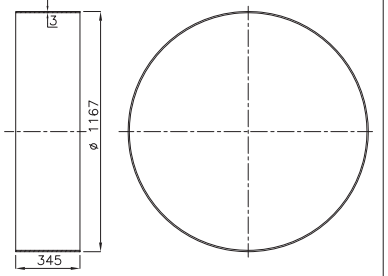
DETAIL OF SL.NO.7



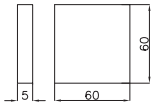
DETAIL OF SL.NO.8



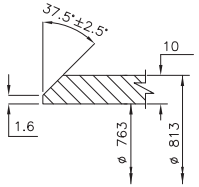
DETAIL OF SL.NO.9



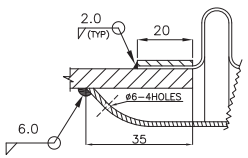
DETAIL OF SL.NO.10



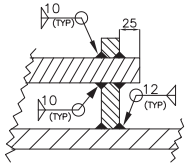
DETAIL OF SL.NO.11



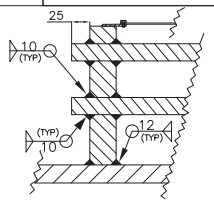
DETAIL–A



DETAIL–B



DETAIL–C



DETAIL–D

BELLOW DETAILS

SL NO		DESCRIPTION	UNITS	DATA/ PARTICULARS.
1	GENERAL	TAG No.	-	LATER
2		QUANTITIES PER SET	Nos.	LATER
3		TOTAL QUANTITY	Nos.	LATER
4		LOCATION	-	LATER
5		FLUID	-	STEAM
6		INSTALLATION	-	LATER
7	DESIGN & OPERATING DATA	PIPE SIZE(ODxTHK)	mm	813x10
8		OPERATING PRESSURE	Kg/cm²(A)	0.11
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	12mm of Hg
12		OPERATING TEMPERATURE	°C	100
13		DESIGN TEMPERATURE	°C	210
14		BELLOW CYCLE LIFE	Nos.	861220
15		ANGULAR DEFLECTION (DESIGN)	DEGREE	2.5
16		AXIAL SPRING RATE	Kg/mm	54.98
17		ANGULAR SPRING RATE	Kg-M/Deg.	87.23
18		TOTAL EQUIVALENT MOVEMENT	mm	19.40
19		OVERALL LENGTH	mm	800
20		BELLOW CONVOLUTED LENGTH	mm	150
21		LIMITING INTERNAL DESIGN PRESSURE BASED ON COLUMN INSTABILITY (Psc)	Kg/cm²	37.7
22		LIMITING INTERNAL DESIGN PRESSURE BASED ON INPLANE INSTABILITY (Psi)	Kg/cm²	4.71
23		TOTAL STRESS (St)	Kg/cm²	6145.61

BILL OF MATERIAL

SL NO	COMPONENT'S NAME	MATERIAL	QUANTITY
1	BELLOWS	SA240TP304	1No
2	COLLAR	SA240TP304	2 Nos.
3	SLEEVE	SA240TP304	1 No.
4	END PIPE	SA672 GR.B70/SA515/516 GR.70	2 Nos.
5	HINGE SUPPORT FLANGE #1	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	1 No.
6	HINGE PIN	CARBON STEEL CLASS6.8	2 Nos.
7	HINGE SUPPORT FLANGE #2	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	1 No.
8	HINGE MAIN PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	2 Nos.
9	HINGE SUPPORT PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	4 Nos.
10	SHROUD (COVER)	IS 2062 Gr. B	1 No.
11	SHROUD (COVER) SUPPORTS	IS 2062 Gr. B	2 Nos.
12	CIRCLIP 2mm THK. (DETAIL NOT SHOWN)	MS	4 Nos.

NOTES:–

1. BELLOW DESIGN CODE : EJMA 9 th EDITION 2011 ADDENDA.
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 QP No. PE–QP–XXX–100–M021–R00.
5. PAINTING DETAILS : TWO COATS (TOTAL DFT 40 MICRON) OF HEAT RESISTANT ALUMINUM PAINT TO IS 13183 Gr.II.
6. SUITABLE SHIPPING BRACKETS WILL BE PROVIDED IN YELLOW COLOUR WHICH MUST BE REMOVED AFTER INSTALLATION.
7. STAINLESS STEEL NAME PLATE WITH REQUIRED DETAILS WILL BE FIXED ON EXPANSION JOINTS.
8. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.

JOB No. XXX				
REV	DATE	ALTD	CHD	APPD

CUSTOMER –

CLIENT'S CONSULTANT: –

PROJECT –

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NOIDA

	NAME	SIGN	DATE
DRN	–		–
DESN	–		–
CHD	–		–
APPD	–		–

TITLE: HINGED EXPANSION JOINT SIZE–800NB

ASSEMBLY WEIGHT | TECH. SPEC. No. | DEPT. | SCALE : NTS | SIGN | DATE

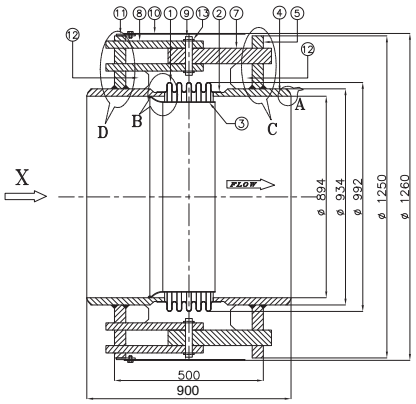
DRAWING NO. PE–V0–XXX–100–MXXX

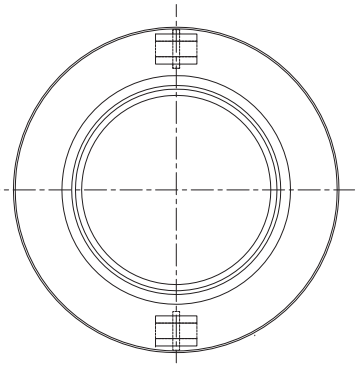
SHEET 1 OF 1 REV 00

SIZE–A3

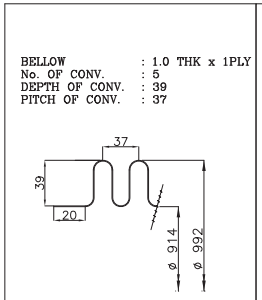
PE–V0–XXX–100–MXXX

SHEET 4/8

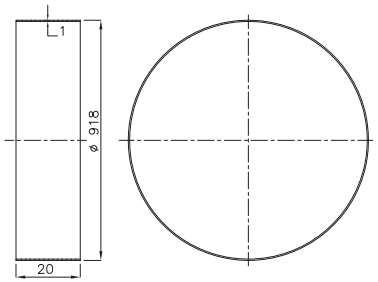




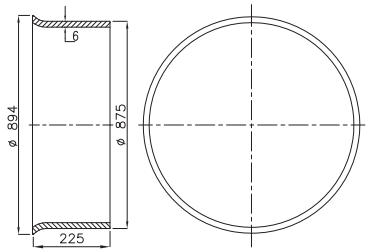
VIEW–X



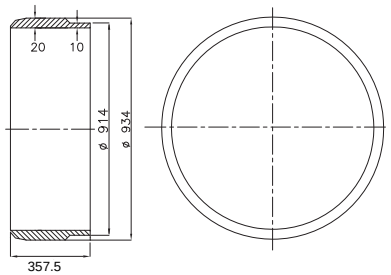
DETAIL OF SL.NO.1



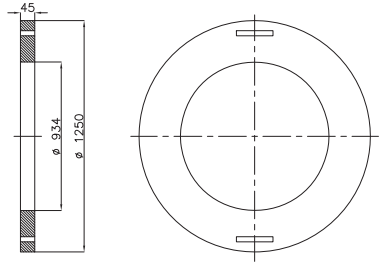
DETAIL OF SL.NO.2



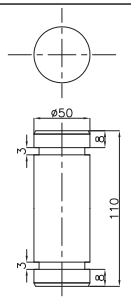
DETAIL OF SL.NO.3



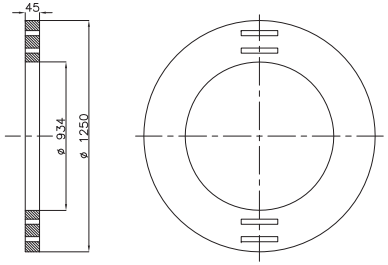
DETAIL OF SL.NO.4



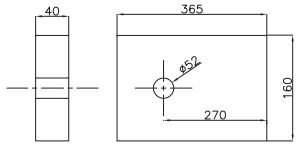
DETAIL OF SL.NO.5



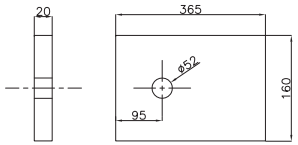
DETAIL OF SL.NO.6



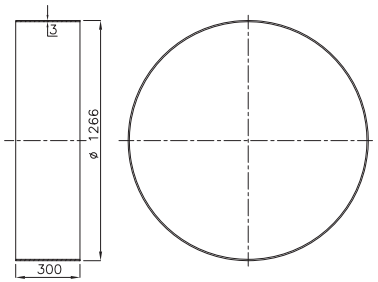
DETAIL OF SL.NO.7



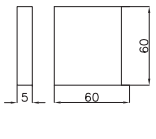
DETAIL OF SL.NO.8



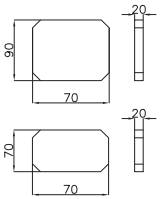
DETAIL OF SL.NO.9



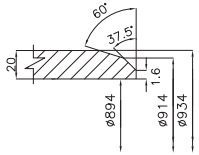
DETAIL OF SL.NO.10



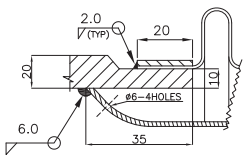
DETAIL OF SL.NO.11



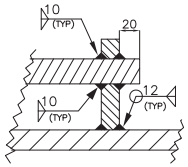
DETAIL OF SL.NO.12



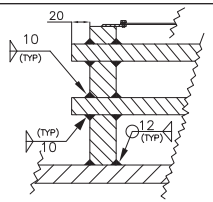
DETAIL–A



DETAIL–B



DETAIL–C



DETAIL–D

BELLOW DETAILS				
SL NO		DESCRIPTION	UNITS	DATA/ PARTICULARS.
1	GENERAL	TAG No.	-	LATER
2		QUANTITIES PER SET	Nos.	LATER
3		TOTAL QUANTITY	Nos.	LATER
4		LOCATION	-	LATER
5		FLUID	-	STEAM
6		INSTALLATION	-	LATER
7	DESIGN & OPERATING DATA	PIPE SIZE(ODxTHK)	mm	914x10
8		OPERATING PRESSURE	Kg/cm²(A)	0.11
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	12mm of Hg
12		OPERATING TEMPERATURE	°C	100
13		DESIGN TEMPERATURE	°C	150
14		BELLOW CYCLE LIFE	Nos.	22504
15		ANGULAR DEFLECTION (DESIGN)	DEGREE	4.5
16		AXIAL SPRING RATE	Kg/mm	58.91
17		ANGULAR SPRING RATE	Kg-M/Deg.	116.93
18		TOTAL EQUIVALENT MOVEMENT	mm	39.30
19		OVERALL LENGTH	mm	900
20		BELLOW CONVOLUTED LENGTH	mm	185
21		LIMITING INTERNAL DESIGN PRESSURE BASED ON COLUMN INSTABILITY (Psc)	Kg/cm²	20.07
22		LIMITING INTERNAL DESIGN PRESSURE BASED ON INPLANE INSTABILITY (Psi)	Kg/cm²	4.52
23		TOTAL STRESS (St)	Kg/cm²	10658.4

BILL OF MATERIAL			
SL NO	COMPONENT'S NAME	MATERIAL	QUANTITY
1	BELLOWS	SA240TP304	1No
2	COLLAR	SA240TP304	2 Nos.
3	SLEEVE	SA240TP304	1 No.
4	END PIPE	SA672 GR.B70/SA515/516 GR.70	2 Nos.
5	HINGE SUPPORT FLANGE #1	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	1 No.
6	HINGE PIN	CARBON STEEL CLASS6.8	2 Nos.
7	HINGE SUPPORT FLANGE #2	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	1 No.
8	HINGE MAIN PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	2 Nos.
9	HINGE SUPPORT PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	4 Nos.
10	SHROUD (COVER)	IS 2062 Gr. B	1 No.
11	SHROUD (COVER) SUPPORTS	IS 2062 Gr. B	2 Nos.
12	GUSSET	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	8 Nos.
13	CIRCLIP 2mm THK. (DETAIL NOT SHOWN)	MS	4 Nos.

NOTES:–

1. BELLOW DESIGN CODE : EJMA 9 th EDITION 2011 ADDENDA.
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 QP No. PE–QP–XXX–100–M021–R00.
5. PAINTING DETAILS : TWO COATS (TOTAL DFT 40 MICRON) OF HEAT RESISTANT ALUMINUM PAINT TO IS 13183 Gr.II.
6. SUITABLE SHIPPING BRACKETS WILL BE PROVIDED IN YELLOW COLOUR WHICH MUST BE REMOVED AFTER INSTALLATION.
7. STAINLESS STEEL NAME PLATE WITH REQUIRED DETAILS WILL BE FIXED ON EXPANSION JOINTS.
8. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.

JOB No. XXX				
REV	DATE	ALTD	CHD	APPD

CUSTOMER – –

CLIENT'S CONSULTANT: –

PROJECT –

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NOIDA

DEPT CODE	NAME	SIGN	DATE
DRN	–	–	–
DESN	–	–	–
CHD	–	–	–
APPD	–	–	–

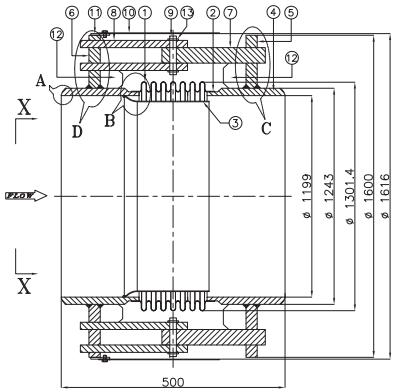
M

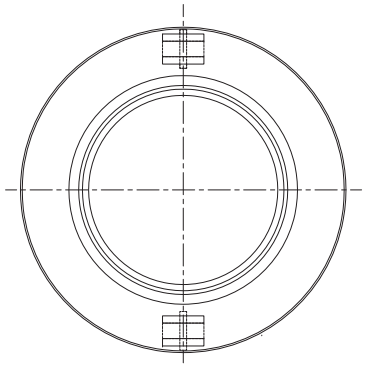
TITLE
HINGED EXPANSION JOINT
SIZE–900NB

ASSEMBLY WEIGHT
TECH. SPEC. No.
DEPT.
SIGN
DATE
SCALE : NTS
DRAWING NO.
PE–V0–XXX–100–MXXX
SHEET 1 OF 1 REV 00
SIZE–A3

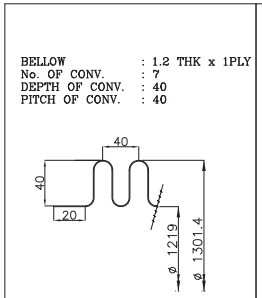
PE–V0–XXX–100–MXXX

SHEET 5/8

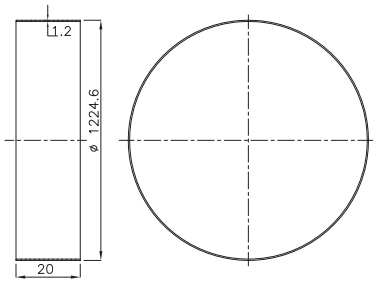




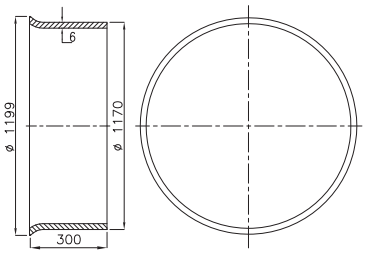
VIEW X–X



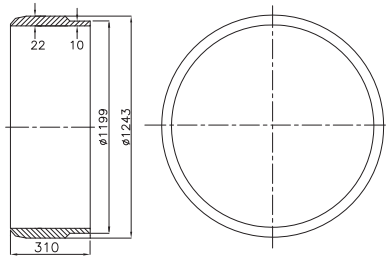
DETAIL OF SL.NO.1



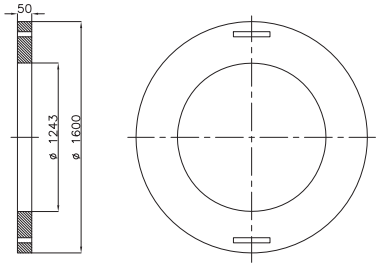
DETAIL OF SL.NO.2



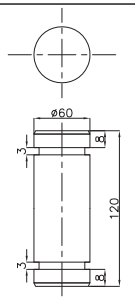
DETAIL OF SL.NO.3



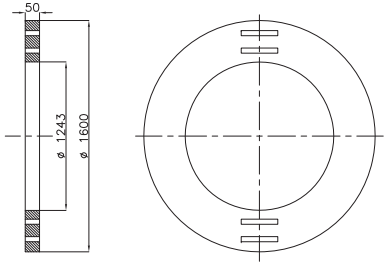
DETAIL OF SL.NO.4



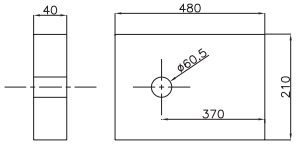
DETAIL OF SL.NO.5



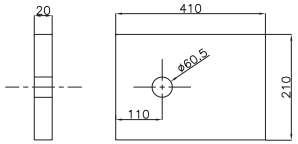
DETAIL OF SL.NO.6



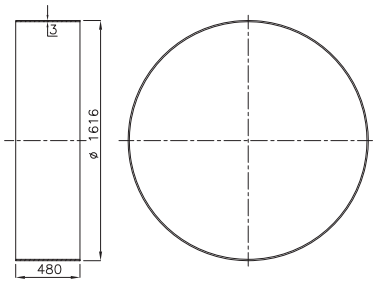
DETAIL OF SL.NO.7



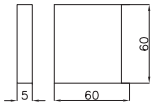
DETAIL OF SL.NO.8



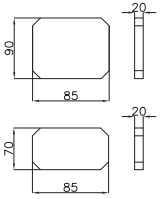
DETAIL OF SL.NO.9



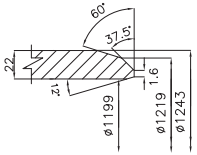
DETAIL OF SL.NO.10



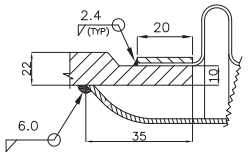
DETAIL OF SL.NO.11



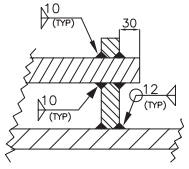
DETAIL OF SL.NO.12



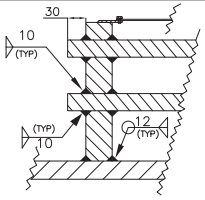
DETAIL–A



DETAIL–B



DETAIL–C



DETAIL–D

BELLOW DETAILS

SL NO		DESCRIPTION	UNITS	DATA/ PARTICULARS.
1	GENERAL	TAG No.	-	LATER
2		QUANTITIES PER SET	Nos.	LATER
3		TOTAL QUANTITY	Nos.	LATER
4		LOCATION	-	LATER
5		FLUID	-	STEAM
6		INSTALLATION	-	LATER
7	DESIGN & OPERATING DATA	PIPE SIZE(ODxTHK)	mm	1219x10
8		OPERATING PRESSURE	Kg/cm²(A)	0.11
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	12mm of Hg
12		OPERATING TEMPERATURE	°C	100
13		DESIGN TEMPERATURE	°C	210
14		BELLOW CYCLE LIFE	Nos.	31370
15		ANGULAR DEFLECTION (DESIGN)	DEGREE	4
16		AXIAL SPRING RATE	Kg/mm	86.84
17		ANGULAR SPRING RATE	Kg-M/Deg.	300.66
18		TOTAL EQUIVALENT MOVEMENT	mm	46.18
19		OVERALL LENGTH	mm	900
20		BELLOW CONVOLUTED LENGTH	mm	280
21		LIMITING INTERNAL DESIGN PRESSURE BASED ON COLUMN INSTABILITY (Psc)	Kg/cm²	25.2
22		LIMITING INTERNAL DESIGN PRESSURE BASED ON INPLANE INSTABILITY (Psi)	Kg/cm²	4.76
23		TOTAL STRESS (St)	Kg/cm²	10019.70

BILL OF MATERIAL

SL NO	COMPONENT'S NAME	MATERIAL	QUANTITY
1	BELLOWS	SA240TP304	1No
2	COLLAR	SA240TP304	2 Nos.
3	SLEEVE	SA240TP304	1 No.
4	END PIPE	SA672 GR.B70/SA515/516 GR.70	2 Nos.
5	HINGE SUPPORT FLANGE #1	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	1 No.
6	HINGE PIN	CARBON STEEL CLASS6.8	2 Nos.
7	HINGE SUPPORT FLANGE #2	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	1 No.
8	HINGE MAIN PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	2 Nos.
9	HINGE SUPPORT PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	4 Nos.
10	SHROUD (COVER)	IS 2062 Gr. B	1 No.
11	SHROUD (COVER) SUPPORTS	IS 2062 Gr. B	2 Nos.
12	GUSSET	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	8 Nos.
13	CIRCLIP 2mm THK. (DETAIL NOT SHOWN)	MS	4 Nos.

NOTES:–

1. BELLOW DESIGN CODE : EJMA 9 th EDITION 2011 ADDENDA.
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 QP No. PE–QP–XXX–100–M021–R00.
5. PAINTING DETAILS : TWO COATS (TOTAL DFT 40 MICRON) OF HEAT RESISTANT ALUMINUM PAINT TO IS 13183 Gr.II.
6. SUITABLE SHIPPING BRACKETS WILL BE PROVIDED IN YELLOW COLOUR WHICH MUST BE REMOVED AFTER INSTALLATION.
7. STAINLESS STEEL NAME PLATE WITH REQUIRED DETAILS WILL BE FIXED ON EXPANSION JOINTS.
8. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.

JOB No. XXX

REV	DATE	ALTD	CHD	APPD

CUSTOMER –

CLIENT'S CONSULTANT: –

PROJECT –

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
M	DRN	–		–
	DESN	–		–
	CHD	–		–
	APPD	–		–

TITLE: HINGED EXPANSION JOINT SIZE–1200NB

ASSEMBLY WEIGHT

TECH. SPEC. No.

DEPT. SIGN DATE

SCALE : NTS

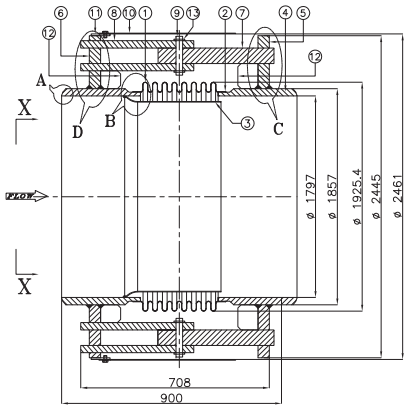
DRAWING NO. PE–V0–XXX–100–MXXX

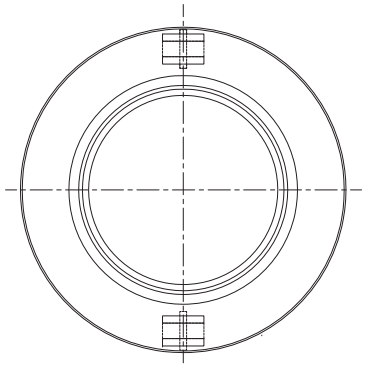
SHEET 1 OF 1 REV 00

SIZE–A3

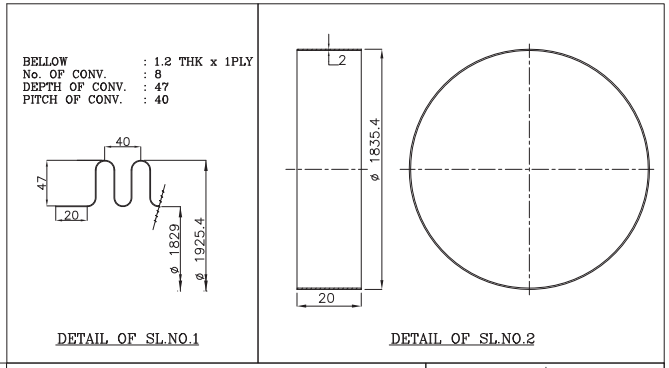
PE–V0–XXX–100–MXXX

SHEET 6/8



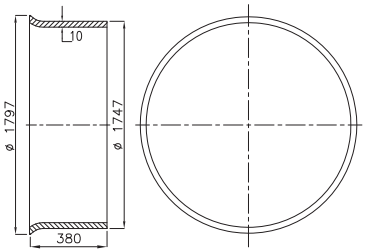


VIEW X–X

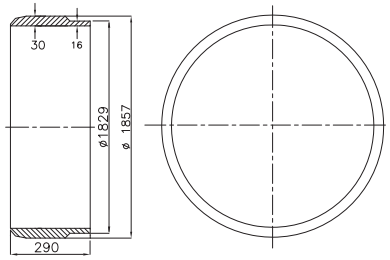


DETAIL OF SL.NO.1

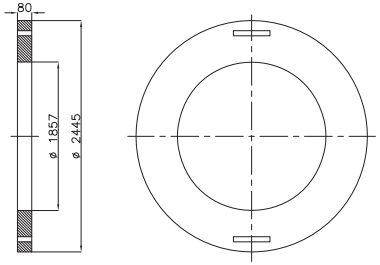
DETAIL OF SL.NO.2



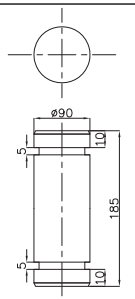
DETAIL OF SL.NO.3



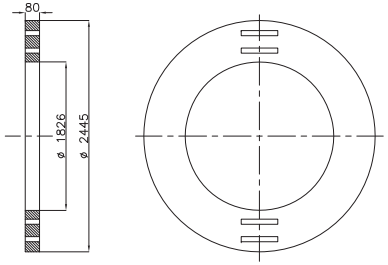
DETAIL OF SL.NO.4



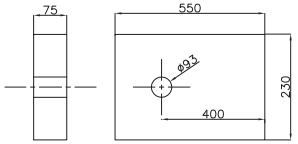
DETAIL OF SL.NO.5



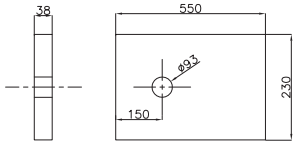
DETAIL OF SL.NO.6



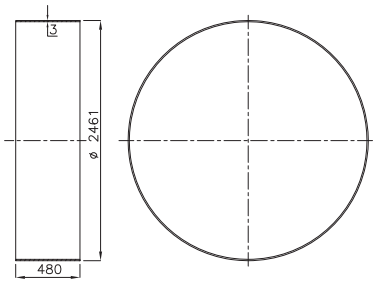
DETAIL OF SL.NO.7



DETAIL OF SL.NO.8



DETAIL OF SL.NO.9



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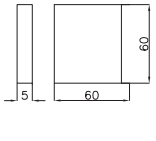
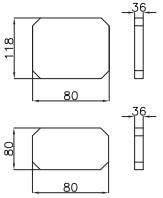
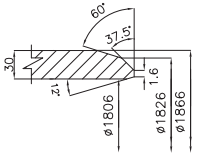


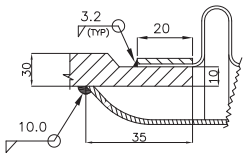
DETAIL OF SL.NO.11



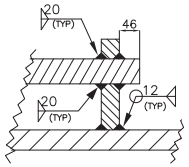
DETAIL OF SL.NO.12



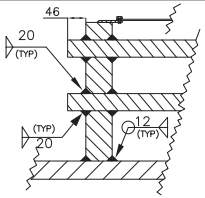
DETAIL–A



DETAIL–B



DETAIL–C



DETAIL–D

BELLOW DETAILS

SL NO		DESCRIPTION	UNITS	DATA/ PARTICULARS.
1	GENERAL	TAG No.	-	LATER
2		QUANTITIES PER SET	Nos.	LATER
3		TOTAL QUANTITY	Nos.	LATER
4		LOCATION	-	LATER
5		FLUID	-	STEAM
6		INSTALLATION	-	LATER
7	DESIGN & OPERATING DATA	PIPE SIZE(ODxTHK)	mm	1829x16
8		OPERATING PRESSURE	Kg/cm²(A)	0.12
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	12mm of Hg
12		OPERATING TEMPERATURE	°C	100
13		DESIGN TEMPERATURE	°C	100
14		BELLOW CYCLE LIFE	Nos.	106456
15		ANGULAR DEFLECTION (DESIGN)	DEGREE	3
16		AXIAL SPRING RATE	Kg/mm	76.13
17		ANGULAR SPRING RATE	Kg-M/Deg.	585.01
18		TOTAL EQUIVALENT MOVEMENT	mm	52.36
19		OVERALL LENGTH	mm	900
20		BELLOW CONVOLUTED LENGTH	mm	320
21		LIMITING INTERNAL DESIGN PRESSURE BASED ON COLUMN INSTABILITY (Psc)	Kg/cm²	19.77
22		LIMITING INTERNAL DESIGN PRESSURE BASED ON INPLANE INSTABILITY (Psi)	Kg/cm²	4.02
23		TOTAL STRESS (St)	Kg/cm²	8141

BILL OF MATERIAL

SL NO	COMPONENT'S NAME	MATERIAL	QUANTITY
1	BELLOWS	SA240TP304	1No
2	COLLAR	SA240TP304	2 Nos.
3	SLEEVE	SA240TP304	1 No.
4	END PIPE	SA672 GR.B70/SA515/516 GR.70	2 Nos.
5	HINGE SUPPORT FLANGE #1	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	1 No.
6	HINGE PIN	CARBON STEEL CLASS6.8	2 Nos.
7	HINGE SUPPORT FLANGE #2	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	1 No.
8	HINGE MAIN PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	2 Nos.
9	HINGE SUPPORT PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	4 Nos.
10	SHROUD (COVER)	IS 2062 Gr. B	1 No.
11	SHROUD (COVER) SUPPORTS	IS 2062 Gr. B	2 Nos.
12	GUSSET	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	8 Nos.
13	CIRCLIP 2mm THK. (DETAIL NOT SHOWN)	MS	4 Nos.

NOTES:–

1. BELLOW DESIGN CODE : EJMA 9 th EDITION 2011 ADDENDA.
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 QP No. PE–QP–XXX–100–M021–R00.
5. PAINTING DETAILS : TWO COATS (TOTAL DFT 40 MICRON) OF HEAT RESISTANT ALUMINUM PAINT TO IS 13183 Gr.II.
6. SUITABLE SHIPPING BRACKETS WILL BE PROVIDED IN YELLOW COLOUR WHICH MUST BE REMOVED AFTER INSTALLATION.
7. STAINLESS STEEL NAME PLATE WITH REQUIRED DETAILS WILL BE FIXED ON EXPANSION JOINTS.
8. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.

JOB No. XXX				
REV	DATE	ALTD	CHD	APPD

CUSTOMER –

CLIENT'S CONSULTANT: –

PROJECT –

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NOIDA

DEPT CODE	NAME	SIGN	DATE
DRN	–		–
DESN	–		–
CHD	–		–
APPD	–		–

TITLE: HINGED EXPANSION JOINT SIZE–1800NB

ASSEMBLY WEIGHT | TECH. SPEC. No.

DEPT. | SIGN | DATE | SCALE : NTS

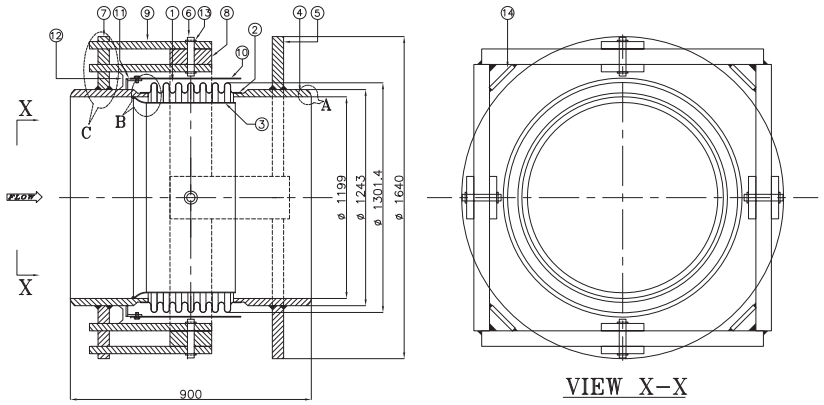
DRAWING NO. PE–V0–XXX–100–MXXX

SHEET 1 OF 1 REV 00

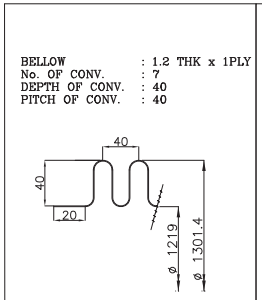
SIZE–A3

PE–V0–XXX–100–MXXX

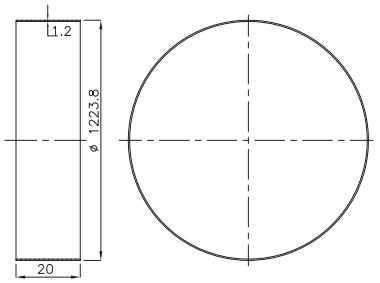
SHEET 7/8



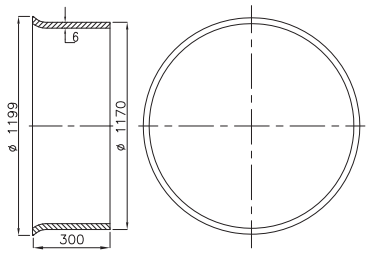
VIEW X–X



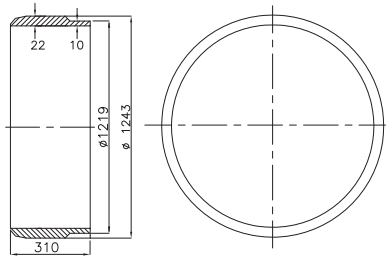
DETAIL OF SL.NO.1



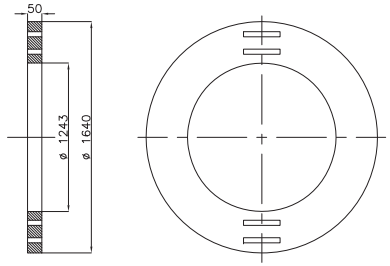
DETAIL OF SL.NO.2



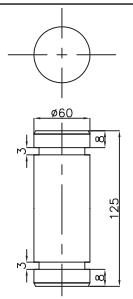
DETAIL OF SL.NO.3



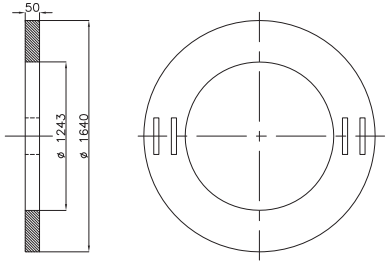
DETAIL OF SL.NO.4



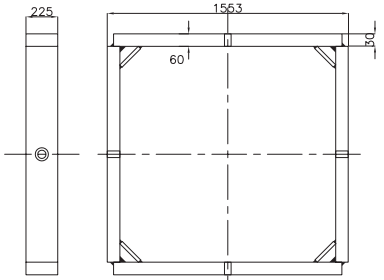
DETAIL OF SL.NO.5



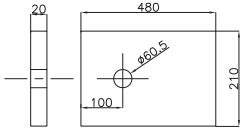
DETAIL OF SL.NO.6



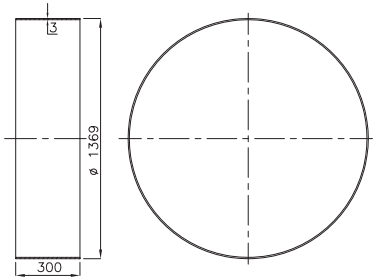
DETAIL OF SL.NO.7



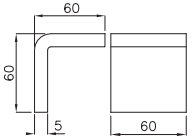
DETAIL OF SL.NO.8



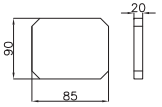
DETAIL OF SL.NO.9



DETAIL OF SL.NO.10



DETAIL OF SL.NO.11



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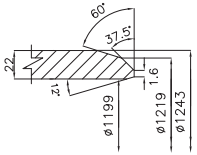
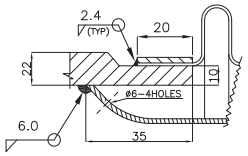
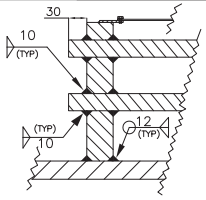


DETAIL–A



DETAIL–B



DETAIL–C

BELLOW DETAILS

SL NO		DESCRIPTION	UNITS	DATA/ PARTICULARS.
1	GENERAL	TAG No.	-	LATER
2		QUANTITIES PER SET	Nos.	LATER
3		TOTAL QUANTITY	Nos.	LATER
4		LOCATION	-	LATER
5		FLUID	-	STEAM
6		INSTALLATION	-	LATER
7	DESIGN & OPERATING DATA	PIPE SIZE(ODxTHK)	mm	1219x10
8		OPERATING PRESSURE	Kg/cm²(A)	0.11
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	12mm of Hg
12		OPERATING TEMPERATURE	°C	100
13		DESIGN TEMPERATURE	°C	210
14		BELLOW CYCLE LIFE	Nos.	31370
15		ANGULAR DEFLECTION (DESIGN)	DEGREE	4
16		AXIAL SPRING RATE	Kg/mm	86.84
17		ANGULAR SPRING RATE	Kg-M/Deg.	300.66
18		TOTAL EQUIVALENT MOVEMENT	mm	46.86
19		OVERALL LENGTH	mm	900
20		BELLOW CONVOLUTED LENGTH	mm	280
21		LIMITING INTERNAL DESIGN PRESSURE BASED ON COLUMN INSTABILITY (Psc)	Kg/cm²	25.2
22		LIMITING INTERNAL DESIGN PRESSURE BASED ON INPLANE INSTABILITY (Psi)	Kg/cm²	4.76
23		TOTAL STRESS (St)	Kg/cm²	10019.7

BILL OF MATERIAL

SL NO	COMPONENT'S NAME	MATERIAL	QUANTITY
1	BELLOWS	SA240TP304	1No
2	COLLAR	SA240TP304	2 Nos.
3	SLEEVE	SA240TP304	1 No.
4	END PIPE	SA672 GR.B70/SA515/516 GR.70	2 Nos.
5	HINGE SUPPORT FLANGE #1	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	1 No.
6	HINGE PIN	CARBON STEEL CLASS6.8	2 Nos.
7	HINGE SUPPORT FLANGE #2	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	1 No.
8	SQ GIMBAL RING	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	2 Nos.
9	HINGE SUPPORT PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	4 Nos.
10	SHROUD (COVER)	IS 2062 Gr. B	1 No.
11	SHROUD (COVER) SUPPORTS	IS 2062 Gr. B	2 Nos.
12	GUSSET	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	8 Nos.
13	CIRCLIP 2mm THK. (DETAIL NOT SHOWN)	MS	4 Nos.
14	STIFFNER	MS	4 Nos.

NOTES:–

1. BELLOW DESIGN CODE : EJMA 9 th EDITION 2011 ADDENDA.
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 QP No. PE–QP–XXX–100–M021–R00.
5. PAINTING DETAILS : TWO COATS (TOTAL DFT 40 MICRON) OF HEAT RESISTANT ALUMINUM PAINT TO IS 13183 Gr.II.
6. SUITABLE SHIPPING BRACKETS WILL BE PROVIDED IN YELLOW COLOUR WHICH MUST BE REMOVED AFTER INSTALLATION.
7. STAINLESS STEEL NAME PLATE WITH REQUIRED DETAILS WILL BE FIXED ON EXPANSION JOINTS.
8. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.

CUSTOMER –

CLIENT'S CONSULTANT: –

PROJECT –

JOB No. XXX

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NOIDA

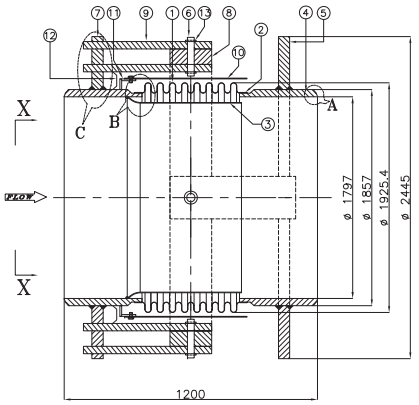
	NAME	SIGN	DATE
DRN	–		–
DESN	–		–
CHD	–		–
APPD	–		–

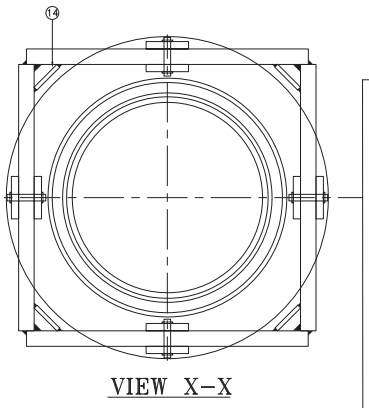
TITLE
GIMBAL EXPANSION JOINT
SIZE–1200NB

ASSEMBLY WEIGHT
TECH. SPEC. No.
SCALE : NTS
DRAWING NO. PE–V0–XXX–100–MXXX
SHEET 1 OF 1 REV 00
SIZE–A3

PE–V0–XXX–100–MXXX

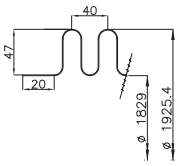
SHEET 8/8



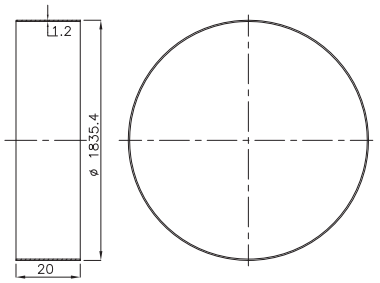


VIEW X–X

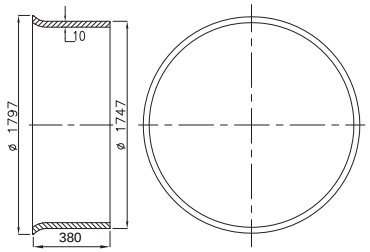
BELLOW : 1.2 THK x 1PLY
No. OF CONV. : 8
DEPTH OF CONV. : 47
PITCH OF CONV. : 40



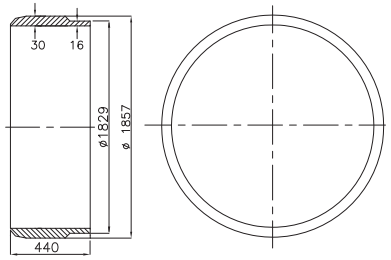
DETAIL OF SL.NO.1



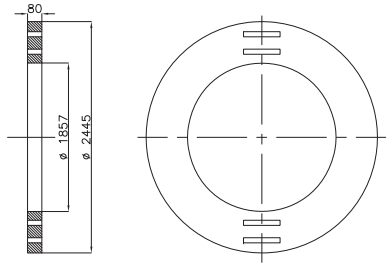
DETAIL OF SL.NO.2



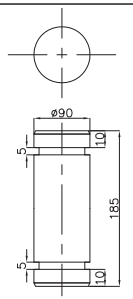
DETAIL OF SL.NO.3



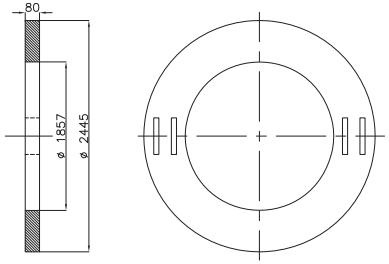
DETAIL OF SL.NO.4



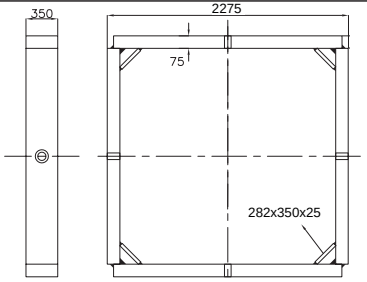
DETAIL OF SL.NO.5



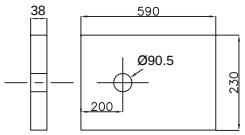
DETAIL OF SL.NO.6



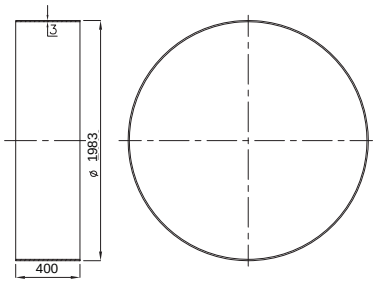
DETAIL OF SL.NO.7



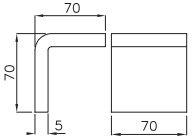
DETAIL OF SL.NO.8



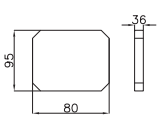
DETAIL OF SL.NO.9



DETAIL OF SL.NO.10



DETAIL OF SL.NO.11



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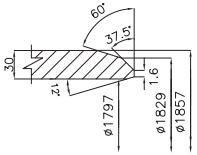
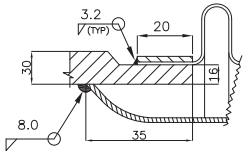
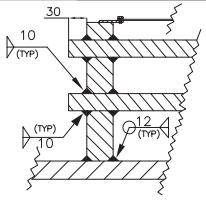


DETAIL–A



DETAIL–B



DETAIL–C

BELLOW DETAILS

SL NO		DESCRIPTION	UNITS	DATA/ PARTICULARS.
1	GENERAL	TAG No.	-	LATER
2		QUANTITIES PER SET	Nos.	LATER
3		TOTAL QUANTITY	Nos.	LATER
4		LOCATION	-	LATER
5		FLUID	-	STEAM
6		INSTALLATION	-	LATER
7	DESIGN & OPERATING DATA	PIPE SIZE(ODxTHK)	mm	1829x16
8		OPERATING PRESSURE	Kg/cm²(A)	0.11
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	12mm of Hg
12		OPERATING TEMPERATURE	°C	100
13		DESIGN TEMPERATURE	°C	100
14		BELLOW CYCLE LIFE	Nos.	106456
15		ANGULAR DEFLECTION (DESIGN)	DEGREE	3
16		AXIAL SPRING RATE	Kg/mm	76.13
17		ANGULAR SPRING RATE	Kg-M/Deg.	585.01
18		TOTAL EQUIVALENT MOVEMENT	mm	52.36
19		OVERALL LENGTH	mm	900
20		BELLOW CONVOLUTED LENGTH	mm	320
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22		LIMITING INTERNAL DESIGN PRESSURE BASED ON INPLANE INSTABILITY (Psi)	Kg/cm²	4.02
23		TOTAL STRESS (St)	Kg/cm²	8141

BILL OF MATERIAL

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3	SLEEVE	SA240TP304	1 No.
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5	HINGE SUPPORT FLANGE #1	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	1 No.
6	HINGE PIN	CARBON STEEL CLASS6.8	2 Nos.
7	HINGE SUPPORT FLANGE #2	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	1 No.
8	SQ GIMBAL RING	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	2 Nos.
9	HINGE SUPPORT PLATE	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	4 Nos.
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11	SHROUD (COVER) SUPPORTS	IS 2062 Gr. B	2 Nos.
12	GUSSET	IS 2062 Gr. B/SA 515 / 516 Gr.60/70	8 Nos.
13	CIRCLIP 2mm THK. (DETAIL NOT SHOWN)	MS	4 Nos.
14	STIFFNER	MS	4 Nos.

NOTES:–

1. BELLOW DESIGN CODE : EJMA 9 th EDITION 2011 ADDENDA.
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 QP No. PE–QP–XXX–100–M021–R00.
5. PAINTING DETAILS : TWO COATS (TOTAL DFT 40 MICRON) OF HEAT RESISTANT ALUMINUM PAINT TO IS 13183 Gr.II.
6. SUITABLE SHIPPING BRACKETS WILL BE PROVIDED IN YELLOW COLOUR WHICH MUST BE REMOVED AFTER INSTALLATION.
7. STAINLESS STEEL NAME PLATE WITH REQUIRED DETAILS WILL BE FIXED ON EXPANSION JOINTS.
8. ALL DIMENSION ARE IN MM UNLESS OTHERWISE SPECIFIED.

CUSTOMER –

CLIENT'S CONSULTANT: –

PROJECT –

JOB No. XXX

REV	DATE	ALTD	CHD	APPD

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
M	DRN	–		–
	DESN	–		–
	CHD	–		–
	APPD	–		–

TITLE
GIMBAL EXPANSION JOINT
SIZE–1800NB

ASSEMBLY WEIGHT
TECH. SPEC. No.
DEPT.
SIGN
DATE
SCALE : NTS

DRAWING NO.
PE–V0–XXX–100–MXXX

SHEET 1 OF 1 REV 00

SIZE–A3

PE–V0–XXX–100–MXXX

3. MANUFACTURING QUALITY PLAN

	MANUFACTURER'S NAME AND ADDRESS: LATER	MANUFACTURING QUALITY PLAN		PROJECT : 2X660 MW BANHARPALLI STPP
Maharatna Company		ITEM : ME BELLOWS (UPTO 2000NB) SUB-SYSTEM: POWER CYCLE PIPING	QP NO. : PE-QP-391-100-M021 REV.NO.:00 DATE: 14/09/2015 PAGE: 1…. OF…5.	CUSTOMER : OPGCL JOB NO. : 391 MAIN-SUPPLIER : BHEL (PEM), NOIDA

SL No	COMPONENT & OPERATIONS	CHARACTERIST -ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT #	ACCEPTANCE NORMS	FORMAT OF RECORD	*	**			REMARKS
1	2	3	4	5	6		7	8	9	D	M	C	-	
					M	C / N								
1.0	**MATERIAL**													
	MATERIAL FOR BELLOWS / PIPE ENDS / PLATES FOR PIPES / FLANGES / LUGS / HINGE PLATES / GIMBLE RING / SLEEVE / PIN / TIE ROD	CHEMICAL COMPOSITION	MAJOR	CHEMICAL ANALYSIS	ONE PER HEAT		BHEL DRAWING / APPROVED DRAWING / TECH SPEC		MTC (or) CHECK TEST CERTIFICATE	√	P	V	-	CO RELATED TC TO BE REVIEWED BY BHEL QC.
		MECHANICAL PROPERTIES		UTS, YS & PERCENTAGE OF ELONGATION	ONE PER HEAT					√	P	V	-	REFER NOTE NO:3
		DIMENSIONAL CHECK		MEASUREMENT	100 %	100 %			INTERNAL INSPECTION REPORTS	-	P	V	-	
		SURFACE EXAMINATION	MINOR	VISUAL	100 %	100 %				-	P	V	-	
2.0	**WELDING**													
2.1	1) WELDING PROCEDURE	CORRECTNESS OF PROCEDURE	CRITICAL	VERIFICATION OF WPS	100 %		IS 7307 / ASME SEC IX	IS 7307 / ASME SEC IX	IS 7307 / ASME SEC IX	√	P	V	-	
	2) PROCEDURE QUALIFICATION	WELD SOUNDNESS		DESTRUCTIVE TESTS	IS 7307 / ASME SEC IX					√	P	V	-	REFER NOTE NO:4
	3) WELDER PERFORMANCE QUALIFICATION	WELDERS' PERFORMANCE		DESTRUCTIVE TESTS / NDE	IS 7310 / ASME SEC IX		IS 7310 / ASME SEC IX	IS 7310 / ASME SEC IX	IS 7310 / ASME SEC IX	√	P	W/ V	-	REFER NOTE NO:4

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** **M:** MANUFACTURER/SUB-SUPPLIER **C:** MAIN SUPPLIER(BHEL)

P: PERFORM **W**: WITNESS & V**:** VERIFICATION. AS APPROPRIATE

DOC. NO.:	REV…… CAT…..	
REVIEWED BY	APPROVED BY	APPROVAL SEAL

	MANUFACTURER'S NAME AND ADDRESS: LATER	MANUFACTURING QUALITY PLAN		PROJECT : 2X660 MW BANHARPALLI STPP
बीएचईएल BHEL Maharatna Company		ITEM : ME BELLOWS (UPTO 2000NB) SUB-SYSTEM: POWER CYCLE PIPING	QP NO. : PE-QP-391-100-M021 REV.NO.:00 DATE: 14/09/2015 PAGE: 2…. OF…5.	CUSTOMER : OPGCL JOB NO. : 391 MAIN-SUPPLIER : BHEL (PEM), NOIDA

SL No	COMPONENT & OPERATIONS	CHARACTERIST -ICS	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	-	
2.2	BUTT / GROOVE WELDS													
	1) BELLOWS AND PLATE FORMED PIPES	FITUP,SIZE OF WELD	MAJOR	VISUAL AND MEASUREMENT	100 %	-	APPD DRG / ASME SEC VIII – DIVISION 1	ASME SEC VIII – DIVISION 1	INTERNAL INSPECTION REPORTS	-	P	-	-	
		SOUNDNESS OF WELD	CRITICAL	PT FOR BELLOW LONG SEAM BEFORE FORMING	100 %		ASME SEC V / APPD. DRG	ASME SEC VIII – DIVISION 1	INTERNAL INSPECTION REPORTS	-	P	V	-	
				RT FOR BELLOW LONG SEAM BEFORE FORMING					LAB REPORT	√	P	V	-	REVIEW OF FILM BY BHEL & NTPC
				RT FOR PIPE LONG SEAM					LAB REPORT	√	P	V	-	
	2) SEGMENTAL FLANGES	SURFACE DEFECTS OF WELDMENTS	MAJOR	PT	100 %	100 %	ASTM E 165	NO SURFACE DEFECT	INTERNAL INSPECTION REPORTS	√	P	V	-	
		INTERNAL DEFECTS OF WELDMENTS i) FOR THICKNESS 40 MM & BELOW	MAJOR	RT	100 %		ASME SEC V	ASME SEC VIII – DIVISION 1	LAB REPORT	√	P	V	-	REVIEW OF FILM BY BHEL & NTPC
		ii) FOR THICKNESS ABOVE 40 MM		UT			ASTM A388&A435	TECH SPEC	LAB REPORT	√	P	V		
2.3	FILLET WELDS	SOUNDNESS OF WELDMENTS	MAJOR	PT	100 %		ASME SEC V / APPD. DRG	ASME SEC VIII – DIVISION 1	INTERNAL INSPECTION REPORTS	√	P	V	-	

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** **M:** MANUFACTURER/SUB-SUPPLIER **C:** MAIN SUPPLIER(BHEL) **P:** PERFORM **W**: WITNESS & V**:** VERIFICATION. AS APPROPRIATE	DOC. NO.: REV…… CAT…..		
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER				
SIGNATURE			REVIEWED BY	APPROVED BY	APPROVAL SEAL

	MANUFACTURER'S NAME AND ADDRESS: LATER	MANUFACTURING QUALITY PLAN		PROJECT : 2X660 MW BANHARPALLI STPP
बीएचईएल BHEL Maharatna Company		ITEM : ME BELLOWS (UPTO 2000NB)	QP NO. : PE-QP-391-100-M021 REV.NO.:00 DATE: 14/09/2015	CUSTOMER : OPGCL
		SUB-SYSTEM: POWER CYCLE PIPING	PAGE: 3…. OF…5.	JOB NO. : 391
				MAIN-SUPPLIER : BHEL (PEM), NOIDA

SL No	COMPONENT & OPERATIONS	CHARACTERIST -ICS	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	-	
3.0	**INSPECTION & TESTS**												
3.1	BELLOWS CONVOLUTIONS	WORKMANSHIP	MAJOR	VISUAL	100 %	APPD. DRG		INTERNAL INSPECTION REPORTS	√	P	W	-	
		DIMENSIONS		MEASUREMENT					√	P	W	-	
		SURFACE DEFECTS (INSIDE & OUTSIDE OF LONG SEAM)		PT		ASME SEC V	NO SURFACE DEFECT		√	P	W	-	
3.2	GIMBAL RING, HINGE PLATE, FLANGE, SHROUD,SLEEVE,PIN, TIE ROD,WASHER & NUTS	WORKMANSHIP & DIMENSIONS	MAJOR	VISUAL & MEASUREMENT	100 %	APPD. DRG		INTERNAL INSPECTION REPORTS	-	P	V	-	
3.3	SEGMENTAL FLANGE	STRESS RELIEVEVING	MAJOR	REVIEW OF HT CHART	100 %	ASME SEC VIII		SR CHART	√	P	V	-	
3.4	ROUTINE TESTS	1) LEAK TIGHTNESS	CRITICAL	1)HYDROSTATIC PR. TEST	100 %	APPD. DRG / 1) 3 Kg /Sq.cm(g)	NO LEAKAGE OR PERMANENT DEFORMATION	TEST REPORTS	√	P	W	-	
				2) VACUUM TEST		2) 12 mm Hg (A)			√	P	W	-	CHP
		2) DEFLECTION	CRITICAL	DEFLECTION TESTS	100 %	EJMA / TECH. SPEC / APPD. DRG	EJMA / TECH. SPEC / APPD. DRG	TEST REPORTS	√	P	W	-	
		3) THINNING	MAJOR	MOCK UP PIECE (or) UT	ONE / TYPE	EJMA / TECH. SPEC	NOT TO EXCEED 15% OF ACTUAL RAW MATERIAL THICKNESS	INTERNAL INSPECTION REPORTS	√	P	W	-	REFER NOTE NO: 6

		LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** **M:** MANUFACTURER/SUB-SUPPLIER **C:** MAIN SUPPLIER(BHEL) **P:** PERFORM **W**: WITNESS & V**:** VERIFICATION. AS APPROPRIATE	DOC. NO.: REV…… CAT…..		
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER				
SIGNATURE			REVIEWED BY	APPROVED BY	APPROVAL SEAL

	MANUFACTURER'S NAME AND ADDRESS: LATER	MANUFACTURING QUALITY PLAN		PROJECT : 2X660 MW BANHARPALLI STPP
बीएचईएल BHEL Maharatna Company		ITEM : ME BELLOWS (UPTO 2000NB) SUB-SYSTEM: POWER CYCLE PIPING	QP NO. : PE-QP-391-100-M021 REV.NO.:00 DATE: 14/09/2015 PAGE: 4…. OF…5.	CUSTOMER : OPGCL JOB NO. : 391 MAIN-SUPPLIER : BHEL (PEM), NOIDA

SL No	COMPONENT & OPERATIONS	CHARACTERIST -ICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT #	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / N				D*	** M	C	-	
1	2	3	4	5	6		7	8	9					
	ROUTINE TESTS	4) SPRING RATE (ONLY AXIAL)	CRITICAL	STIFFNESS TEST	ONE / TYPE		EJMA / TECH. SPEC/APPROVED PROCEDURE	EJMA / TECH. SPEC/APPROVED PROCEDURE	SPRING RATE CURVES REPORT	√	P	W	-	BELLOWS UNDER NORMAL CONDITION DEFLECTED TO THE VALUE AS SPECIFIED IN TECH SPEC./ APPD. DRAWINGS REFER NOTE NO: 6
		5) CLEANLINESS	MAJOR	VISUAL	100 %	100 %	TECH. SPEC / APPD. DRG	TECH. SPEC / APPD. DRG	INTERNAL INSPECTION REPORTS	√	P	V	-	
		6) PAINT THICKNESS		MEASUREMENT						√	P	V	-	
		7) WORKMANSHIP		VISUAL						√	P	V	-	
		8) MARKING		VISUAL						√	P	V	-	
3.5	TYPE TEST	1) CYCLE LIFE (10000 CYCLES), SQUIRM TEST, YIELD & RUPTURE	CRITICAL	DESTRUCTIVE TEST	REFER NOTE NO:1		BHEL/CUSTOMER APPD. TEST PROCEDURES / DATA SHEETS / DRGS	BHEL/CUSTOMER APPD. TEST PROCEDURES / DATA SHEETS / DRGS	TEST REPORTS	√	P	W	-	CHP-REFER NOTE NO: 1 & 5
3.6	ASSEMBLY	WORKMANSHIP & DIMENSIONS	MAJOR	VISUAL & MEASUREMENT	100 %	100 %	APPD. DRGS	APPD. DRGS	INTERNAL INSPECTION REPORTS	√	P	V	-	
4.0	DOCUMENTATION	COMPLETENESS OF RECORDS		VERIFICATION OF RECORDS& CERTIFICATES	100 %	100 %	TECH. SPEC / APPD. DRG	TECH. SPEC / APPD. DRG	INTERNAL INSPECTION REPORTS	√	P	V	-	
5.0	PACKING	SOUNDNESS OF PACKING		VISUAL	100 %	100 %	TECH. SPEC / APPD. DRG	TECH. SPEC / APPD. DRG	INTERNAL INSPECTION REPORTS	√	P	V	-	PHOTOGRAPHS OF BELLOWS AFTER PACKING TO BE VERIFIED BY BHEL ENGGRING BEFORE ISSUING MDCC

LEGEND: * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** **M:** MANUFACTURER/SUB-SUPPLIER **C:** MAIN SUPPLIER(BHEL)

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MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

DOC. NO.:	REV…… CAT…..	
REVIEWED BY	APPROVED BY	APPROVAL SEAL

NOTES:-

1. a) Life cycle test shall be carried out on one bellow of each group as mentioned in Section C of the 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 in Section C of the specification).

2. Test reports for final performance tests, material test certificates and stage inspection records as indicted in the quality plan shall be submitted to BHEL for their scrutiny and approval.

3. In case co related test certificates are not available, check testing shall be carried out by vendor at approved lab.

4. For qualified welders, WPS & PQR shall be reviewed by BHEL. In case welder is not qualified, witnessing will be done by main supplier i.e. BHEL.

5. If type tests as mentioned at 3.5 (1) above, have been successfully done for earlier BHEL projects for the bellows of the same type in a group, then only TCs of same shall be reviewed and no type test needs to be carried out. But TC's of same type of bellows in specified group shall not be older than 5 years from project bid opening date which is 31-March-2014. However, type test clearance shall be taken from BHEL prior to offering to routine test. In case the type test is to be done, type test procedure approval shall be taken from BHEL.

6. Bellows of the same type would mean those having the same diameter, height, pitch, convolution profile & ply thickness.

7. All materials of construction shall be as per approved drawings / data sheet.

4. DATA SHEET- C

DATA SHEET-C

1. The successful bidder shall submit the following drawings/documents for approval within two weeks after ward of contact:

1.1 Relevant GA drawings of each bellow with full details inclusive of the following:
   a. All necessary dimensions (with tolerance as per EJMA).
   b. Cross sectional arrangement.
   c. Arrangement of tie rods (limit rods) along with washers and nuts.
   d. Arrangement of sleeves and cover.
   e. Bill of material and total weight.
   f. Welding standards and welding details.
   g. Flange details/butt weld end details.
   h. Design deflections and stiffness rates for each bellow.
   i. Bellow element details.

1.2 Quality plan

1.3 Design calculations as per EJMA for bellows & other components of bellow assembly such as tie rods, flanges washers etc.

1.4 Stress calculations including Finite element analysis (if required by BHEL) for all pressure carrying parts i.e. flanges, hinge plates, tie rods, gimbal rings etc.

1.5 Stress calculations for local stresses (if required by BHEL) where flanges/lugs are welded to pipe.

1.6 Test procedures for type tests (cycle life, squirm & yield rupture) and axial spring rate test.

2. The following shall be submitted within the stipulated time period as per vendor's drawings/ documents schedule, but not later than one month before first dispatch:

2.1 Instruction manual for erection, operation and maintenance.

2.2 Storage instructions.

3. Before dispatch of the equipment the vendor shall furnish the following:

3.1 Material Test certificates.

3.2 Shop test/inspection reports and certificates.

4. Distribution of drawings / documents for all projects

After award of the contract the successful bidder shall furnish drawings/ documents as per following distribution schedule:

Sl. No.	Type of Document	No of Hard copies	No. of Soft copies
1	Documents submitted for Approval	2 Nos.	1 Nos.
2	Final Distribution (Approved Documents)	14 Nos.	2 Nos.(CD)
3	Test Certificates/Test Reports	4 Nos.	1 Nos.
4	O&M Manuals	14 Nos.	2 Nos.(CD)

ORISSA POWER GENERATION CORPORATION LTD.

2 X 660 MW, OPGCL IB BANHARPALLI TPP

UNIT 3 & 4

TECHNICAL SCHEDULES

FOR

METAL EXPANSION BELLOWS

VOLUME – III

SPECIFICATION NO: PE-TS-391-100-M021 (REV-00)

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

CONTENTS

COMPLIANCE SHEET

The bidder shall sign and return a copy of this compliance sheet along with his offer, indicating his compliance to the points specified herein:

A) Technical Details: Bidder to tick (√) whichever is applicable.

1	Specific Technical requirements of Vol. II B Section-C	**Accepted**	**Not Accepted**
2	Standard Technical Specification of Vol. II B Section-D	**Accepted**	**Not Accepted**
3	DATA SHEET-A of Vol. II B Section-D	**Accepted**	**Not Accepted**
4	Quality Plan	**Accepted**	**Not Accepted**
5	Documentation requirement as per Data sheet-C	**Accepted**	**Not Accepted**
6	As per technical specification if Type Tests are required to be carried out in line with technical specification/final approved QP/customer comments, vendors shall do so at their own cost. No extra charges on this account will be admissible to vendors.	**Accepted**	**Not Accepted**

B) Deviations to the technical specification are not acceptable. However, if there are any deviations due to unavoidable reasons then the same to be clearly specified in the schedule of deviation. In case of no deviations, schedule of deviations to be filled as NIL by bidder.

C) The offered materials should be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty.

D) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. The charges for 3rd party inspection (Lloyds, TUV or equivalent) for foreign bidders shall be included in the base price of the equipment by the bidder. This 3rd party inspection agency shall be approved by BHEL and will be decided in contract stage.

E) GA drawings, submitted with this enquiry are for reference purpose only and minor changes may be done during detail engineering/customer comments at contract stage if required.

F) Bidder confirms that all drawings/documents in soft as well as hard copy shall be submitted within 2 weeks from placement of LOI's in the event of order. Within one (1) week of receipt of BHEL comments a technical representative of bidder shall come for meeting with BHEL along with revised documents to resolve all issues and incorporate all comments in the soft copy here for further submission to customer. Further on receipt of customer comments on the documents a technical representative from bidder shall come for meeting to resolve all issues and incorporate all comments in the soft copy at BHEL and resubmit the drawings/documents for approval and shall visit customer/customer's consultant if required for across the table approval of documents.

G) Any special tools & tackles, if required, shall be in bidder's scope.

H) Prices for recommended spares (if any) for three year operation shall be furnished separately and not to be included in the base price.

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

Maharatna Company	**TITLE** *** SCHEDULE OF DEVIATIONS** ( ) From Technical Specifications (Volume –II B)	SPECIFICATION NO PE-TS-391-100-M021 VOL III 'PART-A' SHEET…….. OF……

We the undersigned hereby certify that the above mentioned are the only deviations.

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

बीएचईएल BHEL Maharatna Company	**TITLE** ***SCHEDULE OF DECLARATIONS**	SPECIFICATION NO PE-TS-391-100-M021 VOL III PART 'A' SHEET…….. OF……

DECLARATION

I ……..……certify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated …….. and there is no deviation to the technical specification other than those listed in "Schedule of deviations" of this Vol III.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Bidder's Company Name …….

Authorized representative's Signature …….

Name ……..

Bidder's Name

The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated

BIDDER SHALL FURNISH THIS PRICE SCHEDULE IN HIS PRICE OFFER ONLY				
PARTICULARS OF BIDDER / AUTHORIZED REPRESENTATIVE				
NAME	**DESIGNATION**	**SIGNATURE**	**DATE**	**COMPANY SEAL**