Complete set of wear resistant rubber lining system for Wet Ball Mill

1.0 APPLICATION: Limestone grinding Wet Ball Mills 17.15 TPH 2958 of Flue Gas Desulfurization unit.

2.0 TECHNICAL:

This specification governs the procurement of complete set of wear resistant rubber lining system (SBR based rubber) for Wet Ball Mill. Set of liner shall include shell liner, feed end head liners, discharge end head liners along with necessary hardware for fixing arrangement.

Lifter bars have to be fastened to the shell by means of clamp block (which slide into the grooves provided at the underside of the lifter bars), washers and nuts. The fastening system shall be leak-proof and designed to utilize rubber flexibility to the maximum & 6 mm thick rubber backing shall be provided along with standard adhesive.

Diameter of mill shell (ID) 2900 mm

Length of mill shell 5800 mm

Technical properties of Rubber compound shall be as indicated below:

Hardness : 62 (±5) shore A

Tensile strength : 155 Kg/sq cm (minimum)

Elongation at break : 500-700%

Din abrasion loss : 80 mm^3 (maximum)

Specific gravity : 1.12 (±0.005)

Withstand temp. : below 80° C

pH of slurry : upto 11

Ball charge size 100 mm (maximum)

The mill dimensions are indicated in Annexure III, IV, V & VI. Lay out & pitching for fasteners of the liners shall be provided by the vendor. Two man-holes are provided at each end of the shell. Vendor shall supply suitable manhole doors lined with rubber liners such that the door can be removed without disturbing the other liners.

3.0 GUARANTEES:

3.1 The minimum guaranteed wear life shall be 8000 hours (without repair or reversal of liners) for the lime stone & water as specified in Annexure-I & II.

3.2 The supplier shall give back to back guarantee for wear life of liners as per terms and conditions of applicable contract.

3.3 Failure due to manufacturing defects (generally leading to breakage/catastrophic failure of liners elements) shall be replaced and installed immediately.

4. QUANTITY REQUIRED PER MILL

1) Complete set of liners for shell (with inspection door), Discharge Head, delivery head as per the drawing in Annexure III, IV, V & VI.
2) 6 mm back up rubber material with adhesive required for the same
3) Hardware for fastening of liners.

5. MANUFACTURING PROCESS AND QUALITY PLAN:

a. A detailed manufacturing process (along with the process control parameters) and manufacturing and test facilities data shall be submitted for review by BHEL.

b. Material used for the manufacture of the liners shall be specified along with the technical details. The details of the patented portion of the technology need not be provided, however the generic name of the proven patented technology along with the broad details shall be provided.

c. A Quality plan with stage wise inspection and acceptance criteria shall be submitted for approval by BHEL and/or customer.

d. The PROCESS CONTROL shall consist of 100% testing the quality of mixed compound in a Rheometer to ensure that each batch is consistent with the proper proportion of each ingredient of the compound so as to result in a correct and standard quality of product to give desired results in installations.

6. INSPECTION:

a. The inspection of liners will be as per the approved quality plan

b. Tests and inspection are to be conducted in the presence of BHEL/ customer representatives as per approved Quality plan. The representatives shall have free access at all times while the work on the contract is being performed. The supplier shall offer all the tools and tackles required for inspection to the inspection agency.

7. TEST CERTIFICATE:

All the liners shall be identified with a serial number. Supplier shall supply 3 copies of Test certificates with following information for each set:

1. BHEL order number.
2. Supplier's reference and name.
3. Batch Heat No.
4. Results of Hardness Test and all other tests or any other tests as per approved QAP.
5. Drawing no., Material Code.
6. Consignment/ Identification no.

8.PACKING:

Liners shall be suitably packed in metallic boxes set wise to prevent damage during transit. Metallic surfaces shall be properly protected with suitable anti-corrosive compound. Each package shall be legibly marked with following information.

1. BHEL Order No.
2. Consignment/ Identification No.
3. Set No.
4. Drawing no., Material Code
5. Weight in Kg
6. Suppliers Name

9. SUPERVISION & SERVICES:

Personnel for supervision for Erection and commissioning shall be deputed within a period of one week from the notice given by BHEL.

TABLE FOR MATERIAL CODE

Var No.	Mill Type	Item Description	Material Code
01	2958	Liners of Wet Ball Mill 17.15 TPH	BA9789123000

List of Annexures

Annexure No.	Description	Remarks
I	LIMESTONE ANALYSIS /	
II	WATER ANALYSIS	
III	SHELL ASSY	16221500019-00
IV	CHEEK DE	06221500021-00
V	CHEEK NDE	06221500022-00
VI	MILL HALF SHELL MACHINING-DE	06221500038-00
VII	MILL HALF SHELL MACHINING-NDE	06221500039-00

RECORD OF REVISION

REV. NO	DATE	REVISION DETAILS	REVISED	APPROVED

Mounting arrangement for sealing system at feed and discharge liners on cheek with trunnion (DE and NDE) Inner diameter shall be provided during detailing stage. The same shall be incorporated in the respective liner drawing.

3.3. LIMESTONE CHARACTERISTICS CONSIDERED FOR FGD DESIGN:

CHEMICAL ANALYSIS (% BY MASS)			
Sl. No	Description	unit	Values
1.	CaO	%	>= 51.0
2.	MgO	%	0.9 – 3.8
3.	Fe_2O_3	%	0.45 - 1.0
4.	Al_2O_3	%	1.19 – 2.1
5.	Si_2O_3	%	2.1 – 4.5
6.	Mn_2O_3	%	< 0.12
7.	P_2O_5	%	Traces
8.	Cl_2	%	< 0.015
9.	Na_2O	%	< 0.16
10.	K_2O	%	< 0.01
11.	Tio_2	%	< 0.02
12.	Total Sulphur	%	< 0.1
13.	LOI		38 – 41.3
PHYSICAL PROPERTIES			
14.	Bond Index	KWh/Metric ton	14.33
15.	Granule size		Medium (250 mm)
16.	Bulk density		
	a. Volume	Kg/m^3	1400
	b. Torque and drive calculation	Kg/m^3	1700
	c. Structural load calculation	Kg/m^3	2200

Note: BHEL considered CaO % in limestone as 47.0 % for FGD design point and 50 % for FGD guarantee point (CaCO3 of 89 %), BHEL confirms that FGD systems for Kothagudem will work satisfactorily in terms of meeting outlet emission of SO2 even if CaO % of Limestone as 45.9%.

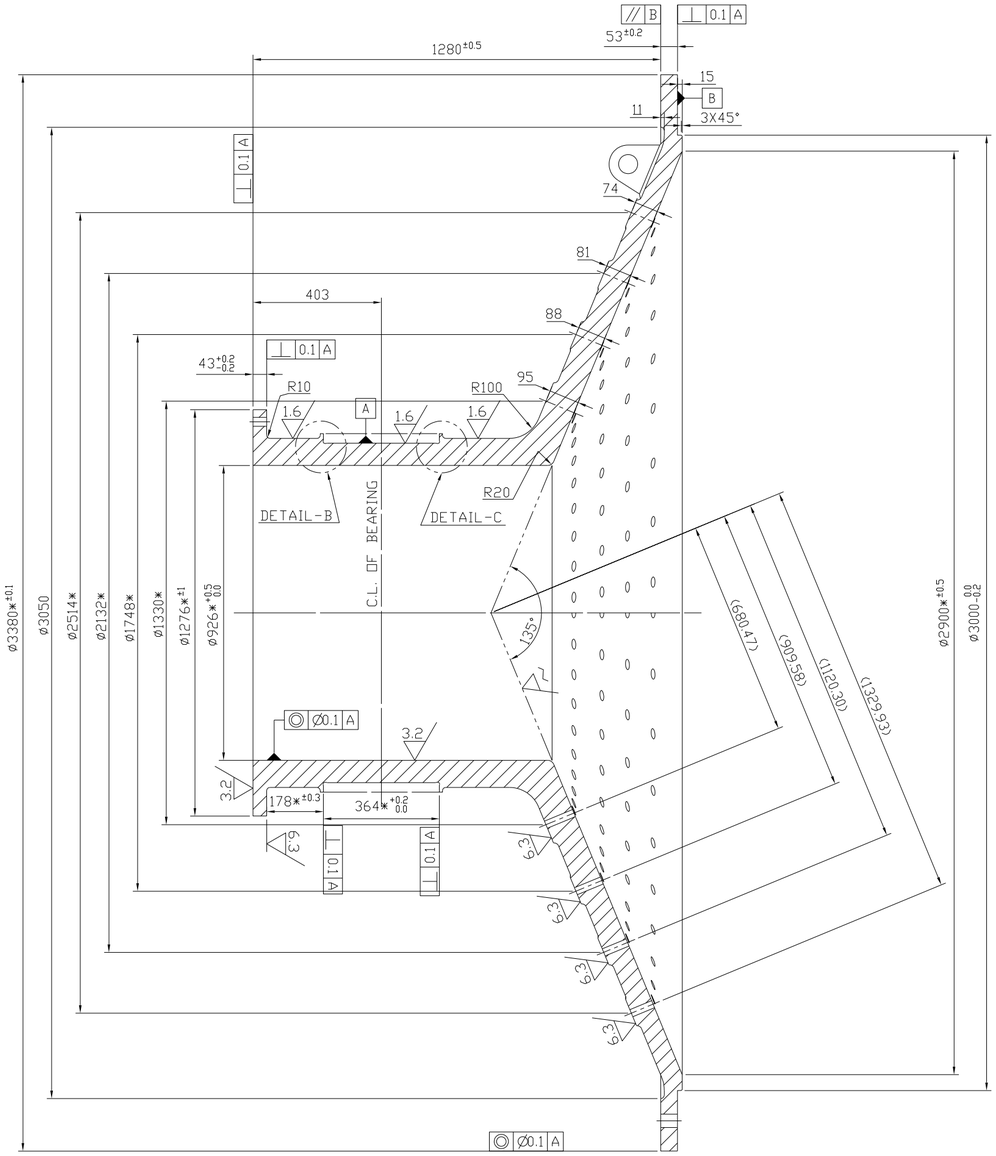
3.4. WATER PROPERTIES CONSIDERED FOR FGD DESIGN:

Sl. No	Constituents	as	mg per litre
1.	Calcium	$CaCO_3$	141.5
2.	Magnesium	$CaCO_3$	45.0
3.	Sodium & Potassium	$CaCO_3$	25.0
4.	Bi-Carbonates	$CaCO_3$	117.5
5.	Chloride	$CaCO_3$	27
6.	Sulphate	$CaCO_3$	67
7.	Carbonate	$CaCO_3$	0
8.	Silica	SiO_2	10
9.	Iron	Fe	0.5
10.	pH value	-	7.8
11.	Turbidity	NTU	<15
12.	TDS		<500

FIRST ANGLE PROJECTION

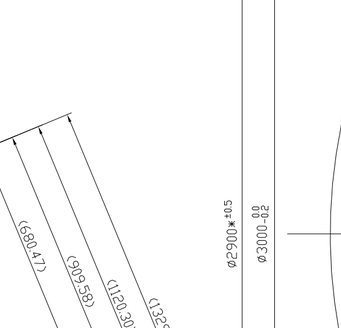
(ALL DIMENSIONS ARE IN mm)

DRG NO 0-62-215-00021



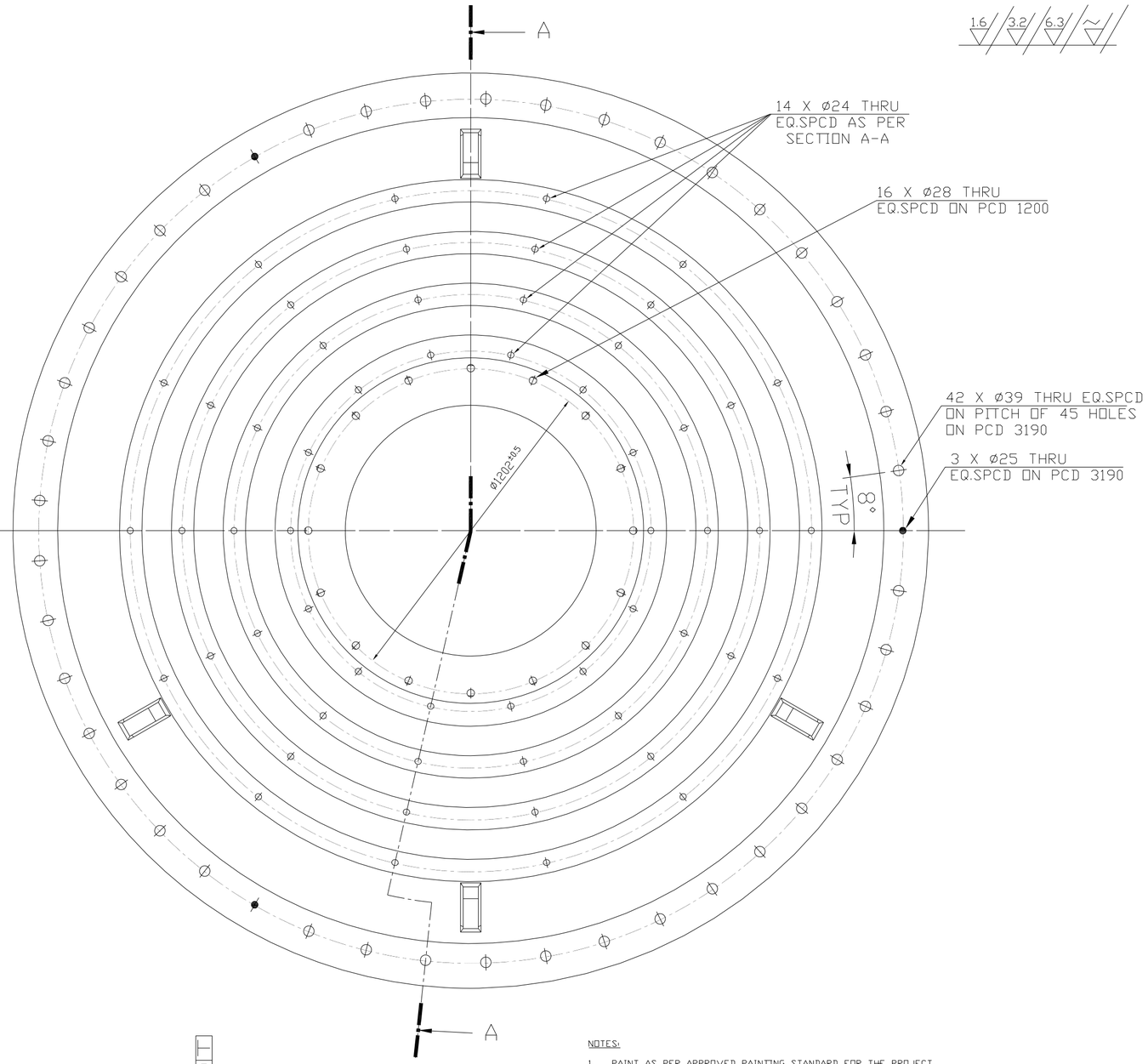
SECTION A-A

DETAIL-D
2 PLACES (TYP)



DETAIL-B

DETAIL-C



NOTES:

1. PAINT AS PER APPROVED PAINTING STANDARD FOR THE PROJECT.
2. FINAL DIMENSIONS TO BE MAINTAINED AS PER SECTION A-A, DETAILS B & C.
3. CRITICAL DIMENSIONS INDICATED WITH *.

ITEM NO	DESCRIPTION	DRAWING NO	VAR NO	RAW MATERIAL SIZE OR CASTING DRG. NO. OR FORGING DRG. NO.	MATERIAL CODE	NET WT.	GROSS WT.
01	CHEEK TRUNNION R/M CASTING WITH LIFTING LUGS	3-62-215-00035			8367		
					MATERIAL SPECN.	01	QUANTITY

NON-CAST PARTS: (FABRICATED AND /OR MACHINED)
ALL DIMENSIONS ARE IN MILLIMETERS
TOLERANCES UNLESS OTHERWISE NO:
XXX ±0.40
X & XX ±0.15 FOR DIM 0-610 MM
X & XX ±0.30 FOR DIM 610-2440 MM
X & XX ±0.3 FOR DIM OVER 2440
ANGULAR: ±0°30'
DRILLED HOLES: Ø 0-25MM +0.25/-0.00 OVER 25 MM +0.50/-0.00
SURFACE TEXTURE: 25 MICRO METERS
ROUGHNESS AVERAGE-Ra
THIS DRAWING IS IN ACCORDANCE WITH IS11 1101
UNLESS OTHERWISE SPECIFIED, THE THREAD PITCH IS STANDARD COARSE.

TYPE OF PRODUCT
NAME OF CUSTOMER/PROJECT: WET BALL MILLS

BHARAT HEAVY ELECTRICALS LIMITED HYDERABAD

	NAME	SIGN	DATE	NO.OF VAR.
DRN.	SHARIFF		04.09.21	
CHD.	K.PAVAN		08.09.21	
APPD.	AMAN		11.09.21	

JOB	SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
4460 PUL. V. ENGG.	NTS	6601.84			

TITLE: CHEEK TRUNNION DE- ø2.9M

DRAWING NO. 0-62-215-00021 REV. 01

SHEET NO. | NO OF SHEETS

REV.	DATE	ALTERED	CHECKED	APPROVED
01	09.05.22	K PAVAN	AMAN	KHRK

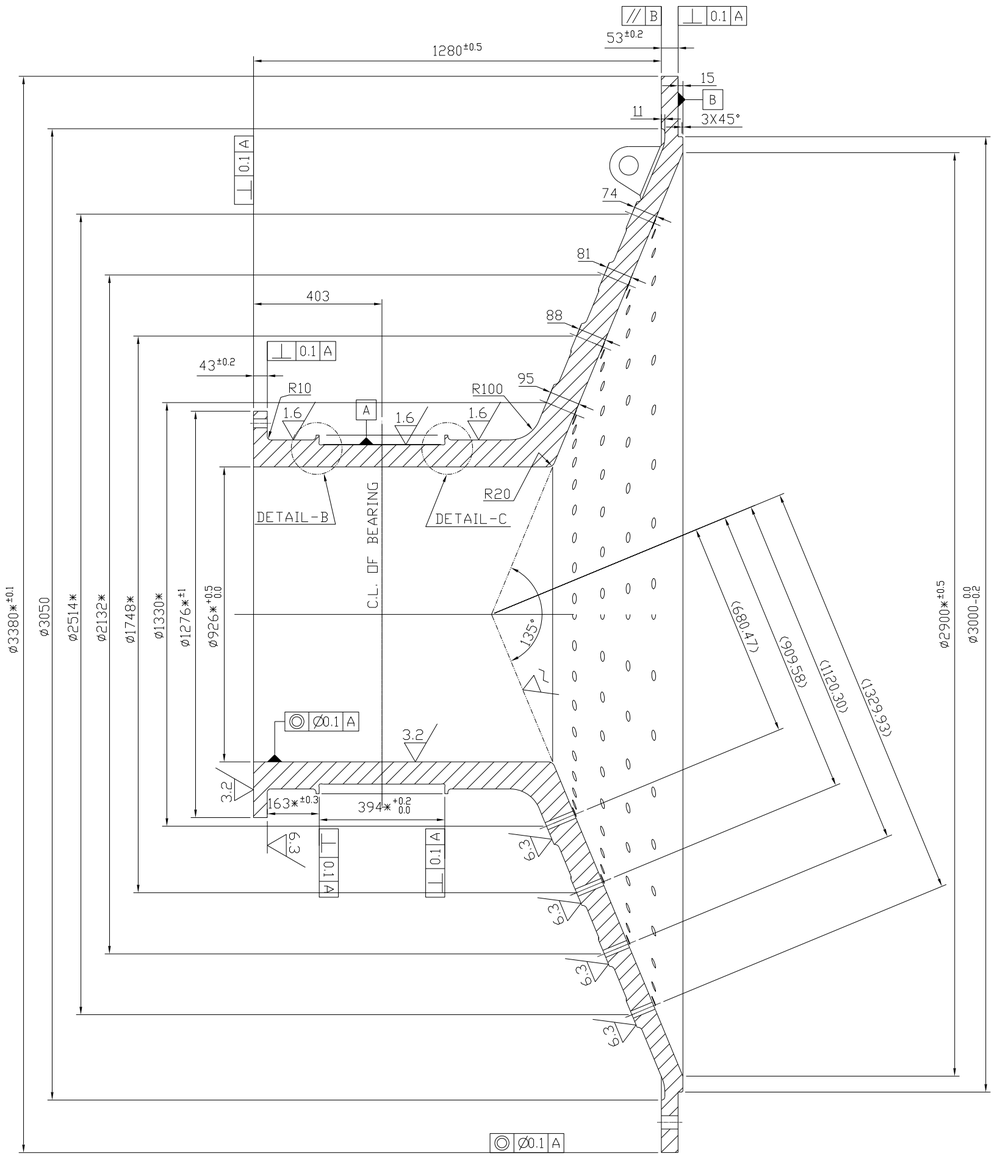
DIMENSION 1202 MM WAS 1200 MM

COMP FILE NAME | REF. DRG. NO. | STORES INVENTORY NO

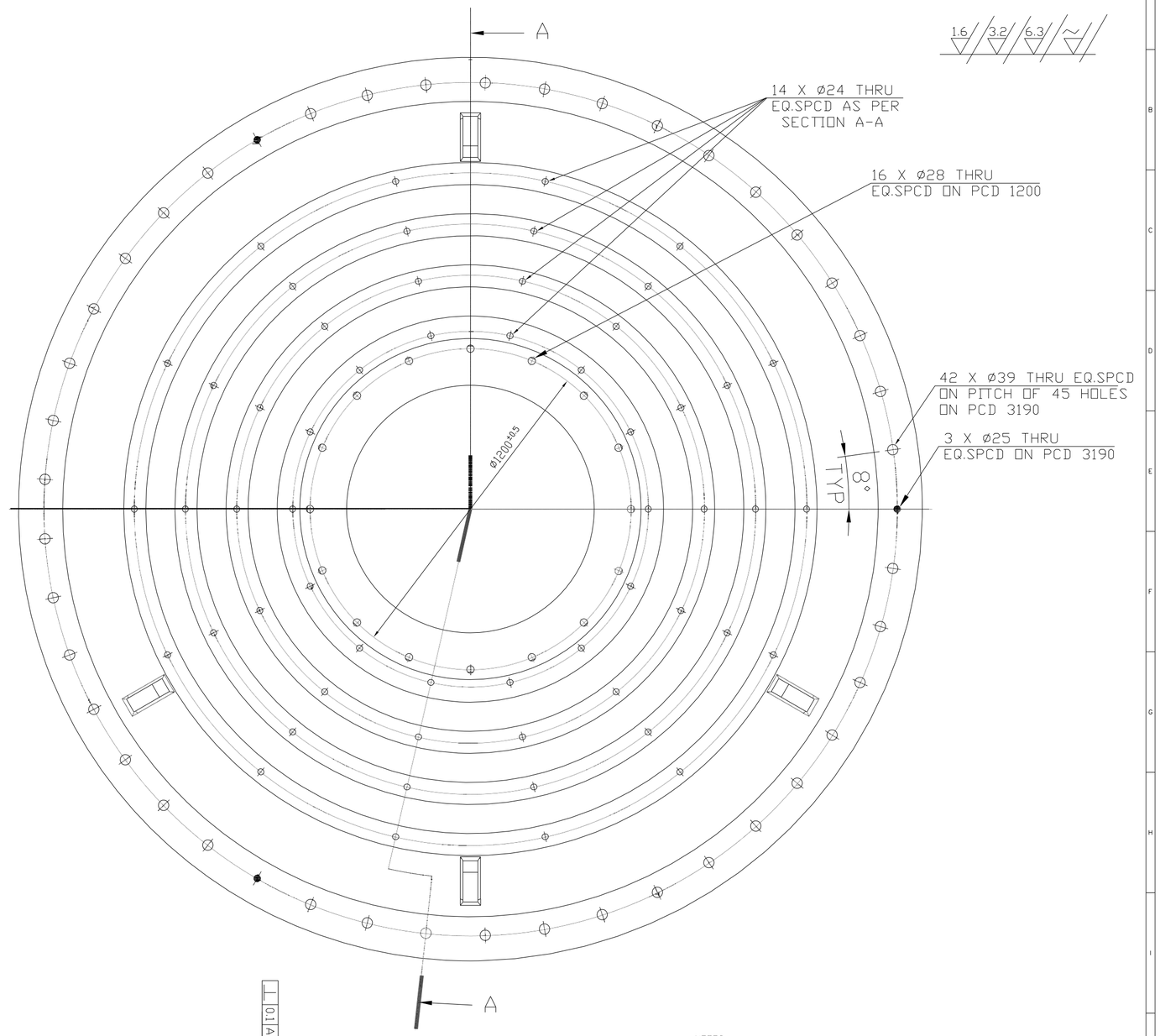
FIRST ANGLE PROJECTION

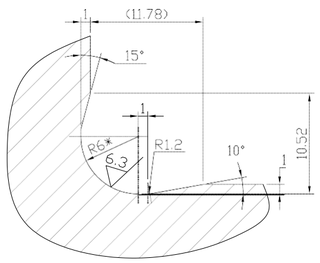
(ALL DIMENSIONS ARE IN mm)

DRG NO 0-62-215-00022

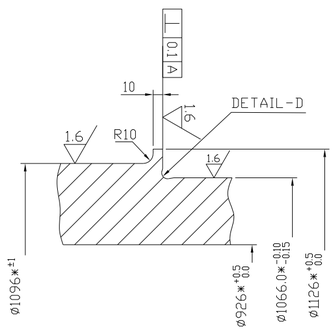


SECTION A-A

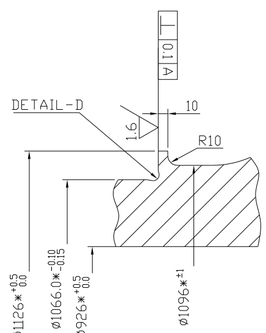




DETAIL-D
2 PLACES (TYP)



DETAIL-B



DETAIL-C

NOTES:

1. PAINT AS PER APPROVED PAINTING STANDARD FOR THE PROJECT.
2. FINAL DIMENSIONS TO BE MAINTAINED AS PER SECTION A-A, DETAILS B & C.
3. CRITICAL DIMENSIONS INDICATED WITH *.

ITEM NO	DESCRIPTION	DRAWING NO	VAR NO	RAW MATERIAL SIZE OR CASTING DRG NO OR FORGING DRG NO	MATERIAL CODE	NET WT.	GROSS WT.
01	CHEEK TRUNNION R/M CASTING WITH LIFTING LUGS	3-62-215-00035			8367		
					01		
					MATERIAL SPECN.	QUANTITY	

NON-CAST PARTS:
(FABRICATED AND /OR MACHINED)

ALL DIMENSIONS ARE IN MILLIMETERS
TOLERANCES UNLESS OTHERWISE NO.
XXX ±0.40
X & XX ±15 FOR DIM 0-610 MM
X & XX ±30 FOR DIM 610-2440 MM
X & XX ±63 FOR DIM OVER 2440

ANGULAR: ±0°30'

DRILLED HOLES: ø 0-25MM +0.25/-0.00 OVER 25 MM +0.50/-0.00

SURFACE TEXTURE: 25 MICRO METERS ROUGHNESS AVERAGE-Ra

THIS DRAWING IS IN ACCORDANCE WITH ISO 1101

UNLESS OTHERWISE SPECIFIED, THE THREAD PITCH IS STANDARD COARSE.

TYPE OF PRODUCT: WET BALL MILLS
NAME OF CUSTOMER/PROJECT:

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN.	DATE	NO OF VAR.
DRN.	SHARIFF		04.09.21	
CHD.	K.PAVAN KUMAR		08.09.21	
APPD.	AMAN		10.09.21	

DEPT: 4460 PULV. ENGG.
SCALE: NTS
WEIGHT (KG): 6589.12
REF. TO ASSY DRG.
ITEM NO.
NO OF ITEMS

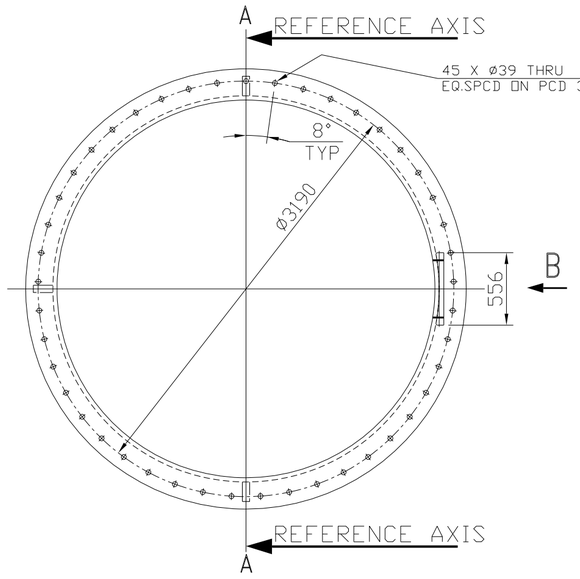
TITLE: CHEEK TRUNNION NDE- ø2.9M
DRAWING NO. 0-62-215-00022
REV. 00
SHEET NO.
NO OF SHEETS

REV	DATE	ALTERED	CHECKED	APPROVED
ZONE				

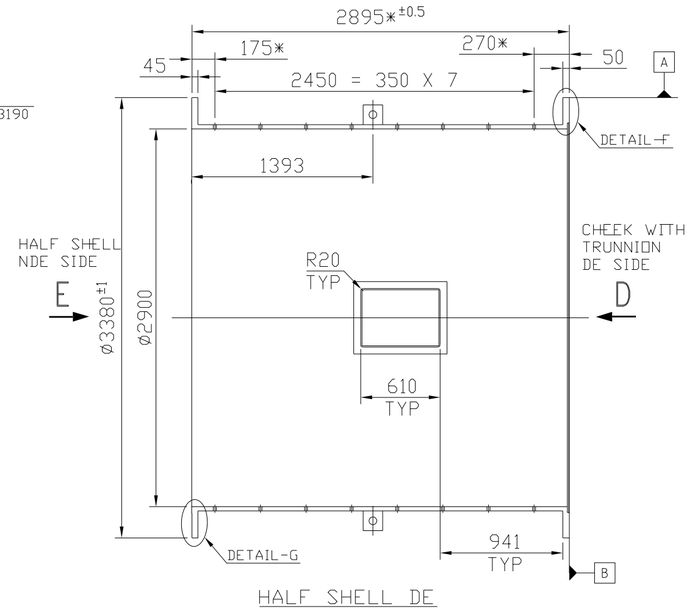
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

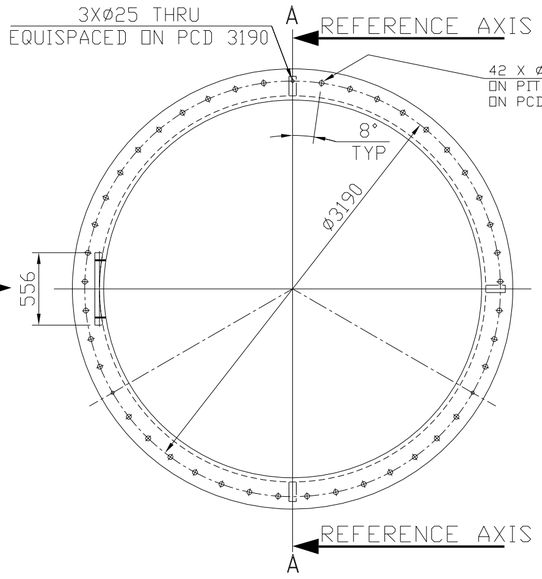
DRG NO 0-62-215-00038



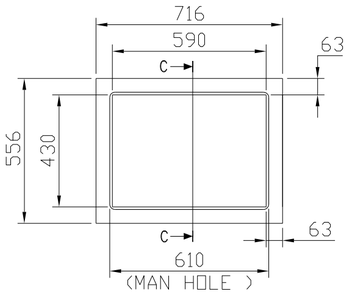
VIEW-E



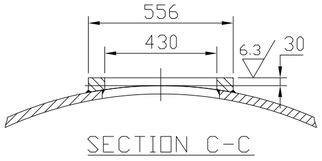
HALF SHELL DE



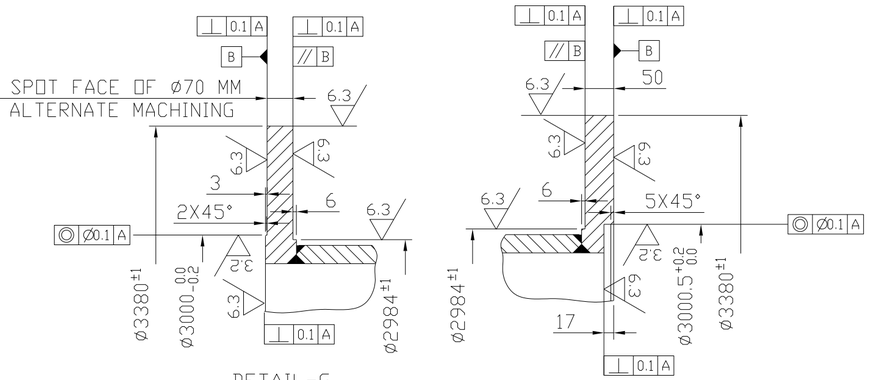
VIEW-D



VIEW-B

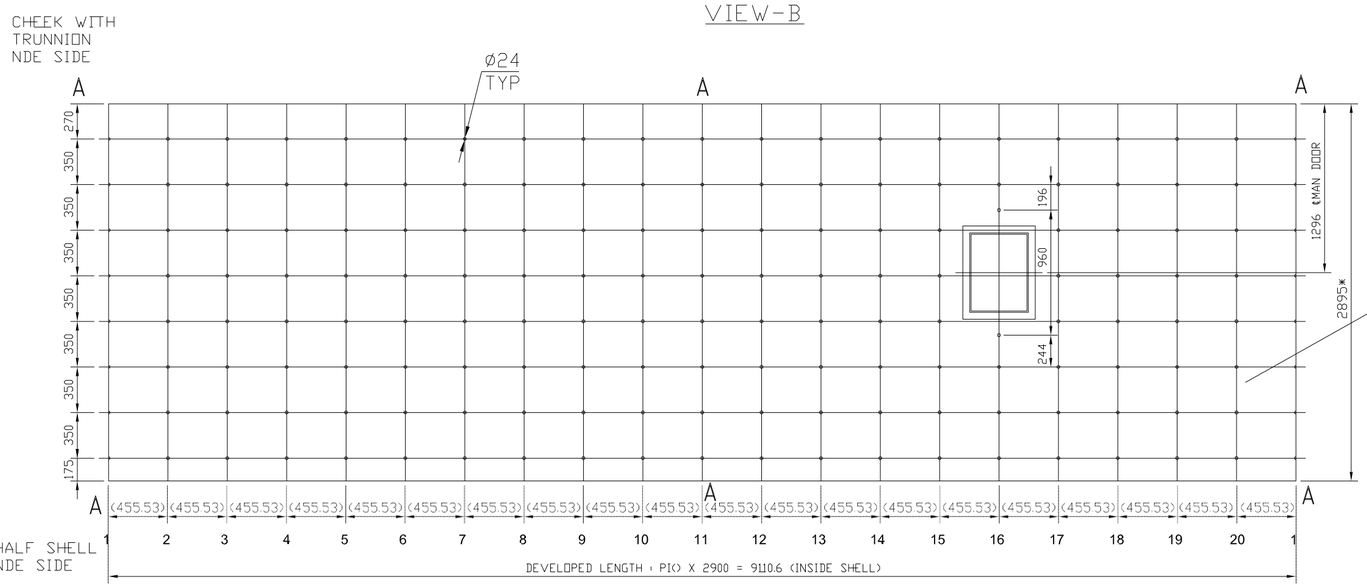


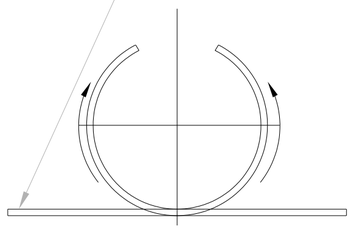
SECTION C-C



DETAIL-G

DETAIL-F





FLANGE MACHINING DETAILS

NOTES:

1. DRILL THE LINER HOLES (ø24 MM) AND HOLES ON SHELL FLANGES (ø 25 AND ø39) WITH REFERENCE TO A-A AXIS.THE POSITIONING DEVIATION OF LINER HOLES MUST NOT EXCEED ±1 MM.
2. ALL HOLES SHALL BE CHAMFERED BY 1MM AT 45° ON OUTSIDE OF SHELL.
3. CRITICAL DIMENSIONS ARE IDENTIFIED WITH '*'.
4. INSPECTION AS PER APPROVED QUALITY PLAN.

ITEM NO	DESCRIPTION	DRAWING NO	VAR NO	RAW MATERIAL SIZE BR CASTING DRG. NO. BR FORGING DRG. NO.	MATERIAL CODE	NET WT.	GROSS WT.
01	MILL SHELL FAB WITH LIFTING LUGS	3-62-215-00039			9142		
					01		
					MATERIAL SPECN.	QUANTITY	

DRILLING LAYOUT OF ø24 MM HOLES (160 Nos) ON HALF SHELL (DE) , PITCH DISTANCE OF 350 MM ALONG AXIS AND 18° ALONG CIRCUMFERENCE

REV	DATE	ALTERED	CHECKED	APPROVED
01	30.04.22	K PAVAN	AMAN	KHRK

SPOT FACING ADDED

NON-CAST PARTS (FABRICATED AND /OR MACHINED)
ALL DIMENSIONS ARE IN MILLIMETERS
TOLERANCES UNLESS OTHERWISE NO.
X.XX ±0.40
X. & XX ±1.5 FOR DIM. 0-610 MM
X. & XX ±3.0 FOR DIM. 610-2440 MM
X. & XX ±6.3 FOR DIM. OVER 2440 MM
ANGULAR: ±0°30'
DRILLED HOLES: ø 0-25MM +0.25/-0.00 OVER 25 MM +0.50/-0.00
SURFACE TEXTURE: 25 MICRO METERS ROUGHNESS AVERAGE-Ra
THIS DRAWING IS IN ACCORDANCE WITH ISO 1101
UNLESS OTHERWISE SPECIFIED, THE THREAD PITCH IS STANDARD COARSE.

TYPE OF PRODUCT: WET BALL MILLS
NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN	DATE	NO.OF VAR.
DRN.	SHARIFF		15.03.22	
CHD.	K.PAVAN		15.03.22	
APPD.	AMAN		15.03.22	

SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
NTS	8430			

JOB NO.	DRAWING NO.	REV.
4460	0-62-215-00038	01

PLV. ENGG.

TITTLE: MILL HALF SHELL MACHINING-DE

SHEET NO. | NO.OF SHEETS

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED.
IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY

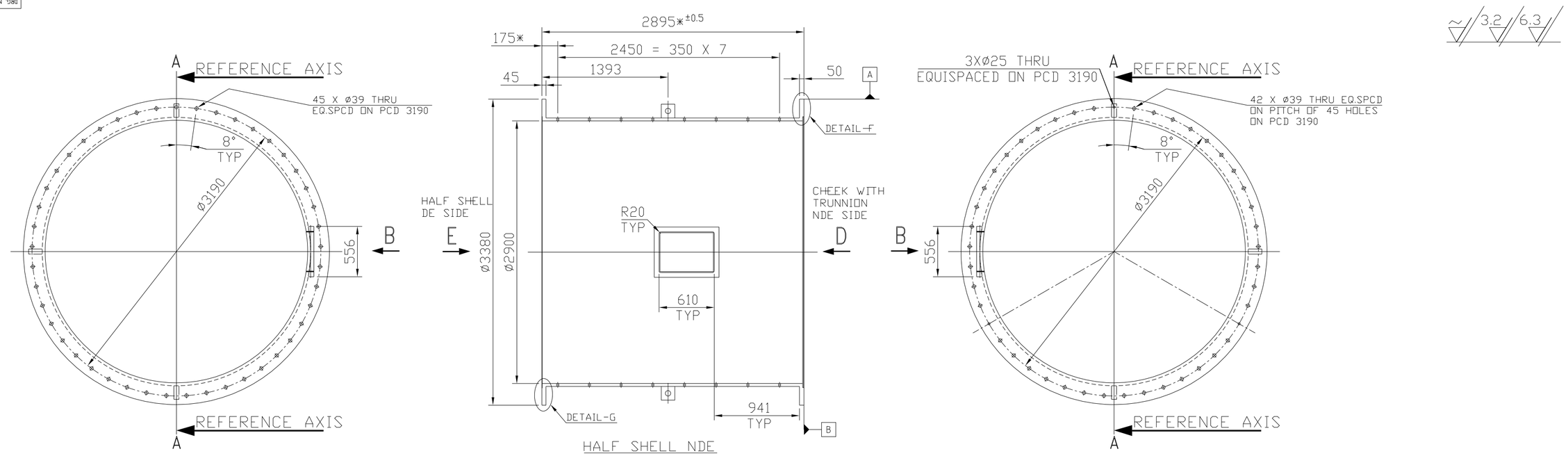
COMP. FILE NAME | REF. DRG. NO. | INVENTORY NO

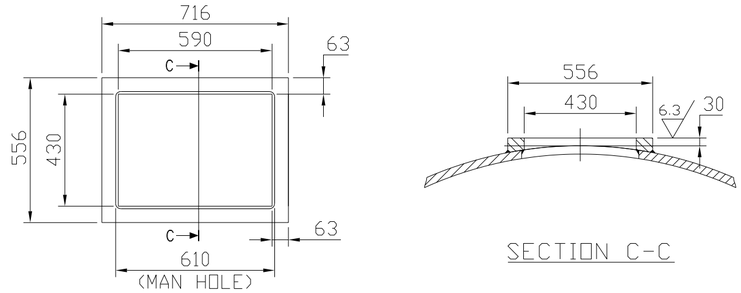
RESTRICTED USE

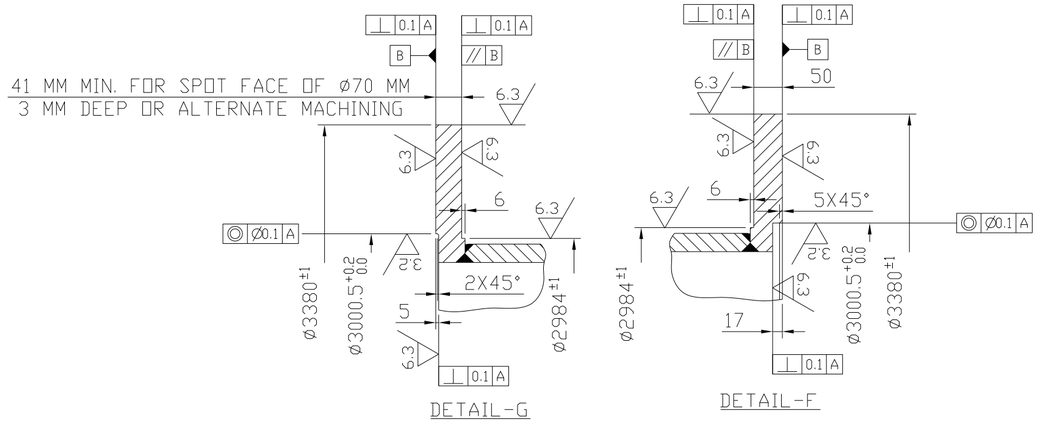
FIRST ANGLE PROJECTION

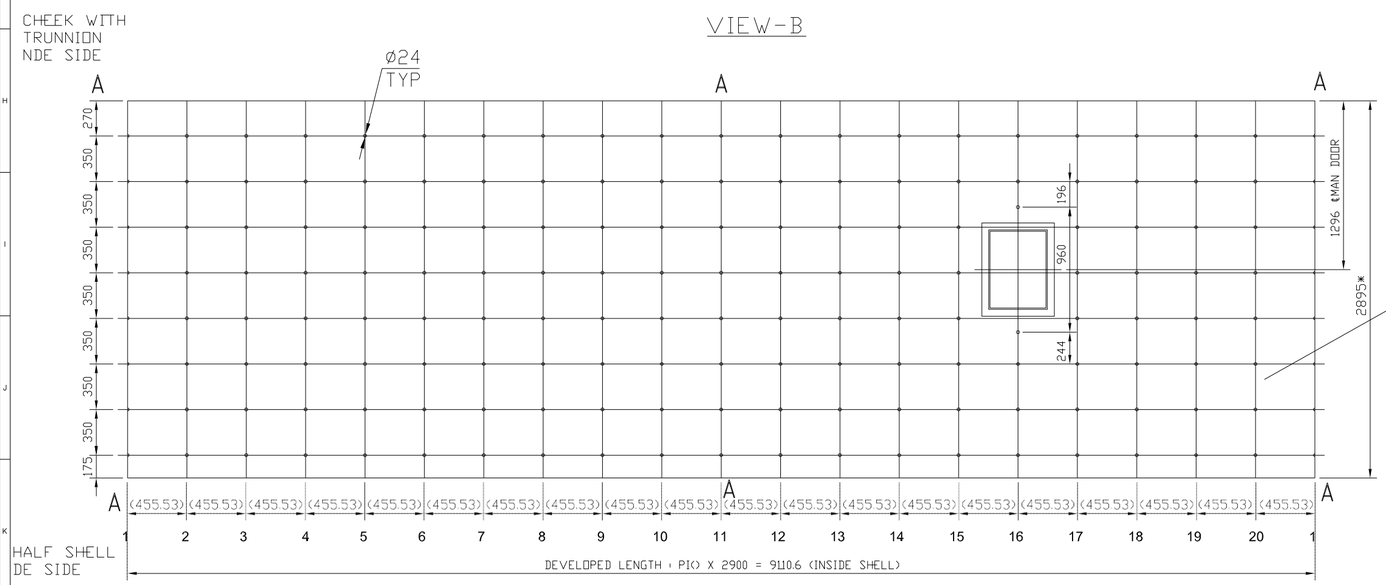
(ALL DIMENSIONS ARE IN mm)

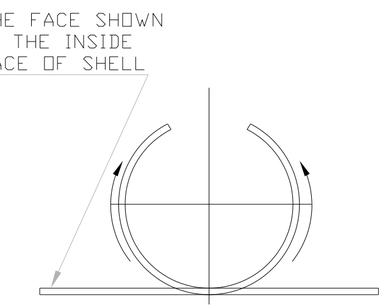
DRG NO 0-62-215-00039











FLANGE MACHINING DETAILS

NOTES:

1. DRILL THE LINER HOLES (ø24 MM) AND HOLES ON SHELL FLANGES (ø 25 AND ø39) WITH REFERENCE TO A-A AXIS.THE POSITIONING DEVIATION OF LINER HOLES MUST NOT EXCEED ±1 MM.
2. ALL HOLES SHALL BE CHAMFERED BY 1MM AT 45° ON OUTSIDE OF SHELL.
3. CRITICAL DIMENSIONS ARE IDENTIFIED WITH '*'.
4. INSPECTION AS PER APPROVED QUALITY PLAN.

ITEM NO	DESCRIPTION	DRAWING NO	VAR NO	RAW MATERIAL SIZE OR CASTING DRG NO. OR FORGING DRG NO.	MATERIAL CODE	NET WT.	GROSS WT.
					MATERIAL SPECN.	QUANTITY	
01	MILL SHELL FAB WITH LIFTING LUGS	3-62-215-00039				9142	
						01	

NON-CAST PARTS (FABRICATED AND /OR MACHINED)
ALL DIMENSIONS ARE IN MILLIMETERS
TOLERANCES UNLESS OTHERWISE NO
X.XX ±0.40
X.X & XX ±1.5 FOR DIM. 0-610 MM
X.X & XX ±2.0 FOR DIM. 610-2440 MM
X.X & XX ±6.3 FOR DIM. OVER 2440
ANGULAR: ±0°30'
DRILLED HOLES: ø 0-25MM +0.25/-0.05 OVER ø 25 MM +0.50/-0.00
SURFACE TEXTURE: ROUGHNESS AVERAGE-Ra 25 MICRO METERS
THIS DRAWING IS IN ACCORDANCE WITH ISO 1101
UNLESS OTHERWISE SPECIFIED, THE THREAD PITCH IS STANDARD COARSE.

TYPE OF PRODUCT: WET BALL MILLS
NAME OF CUSTOMER/PROJECT:

BHARAT HEAVY ELECTRICALS LIMITED HYDERABAD

	NAME	SIGN	DATE	NO.OF VAR.
DRN.	SHARIFF		15.03.22	
CHD.	K.PAVAN		15.03.22	
APPD.	AMAN		15.03.22	

TEST	SCALE	WEIGHT (KG)	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
4460	NTS	8410			

DEPT: PULV. ENGG.

TITLE: MILL HALF SHELL MACHINING-NDE

DRAWING NO. 0-62-215-00039 REV. 01

SHEET NO. NO OF SHEETS

REV	DATE	ALTERED	CHECKED	APPROVED
01	30.04.22	K PAVAN	AMAN	KHRK

SPOT FACING ADDED

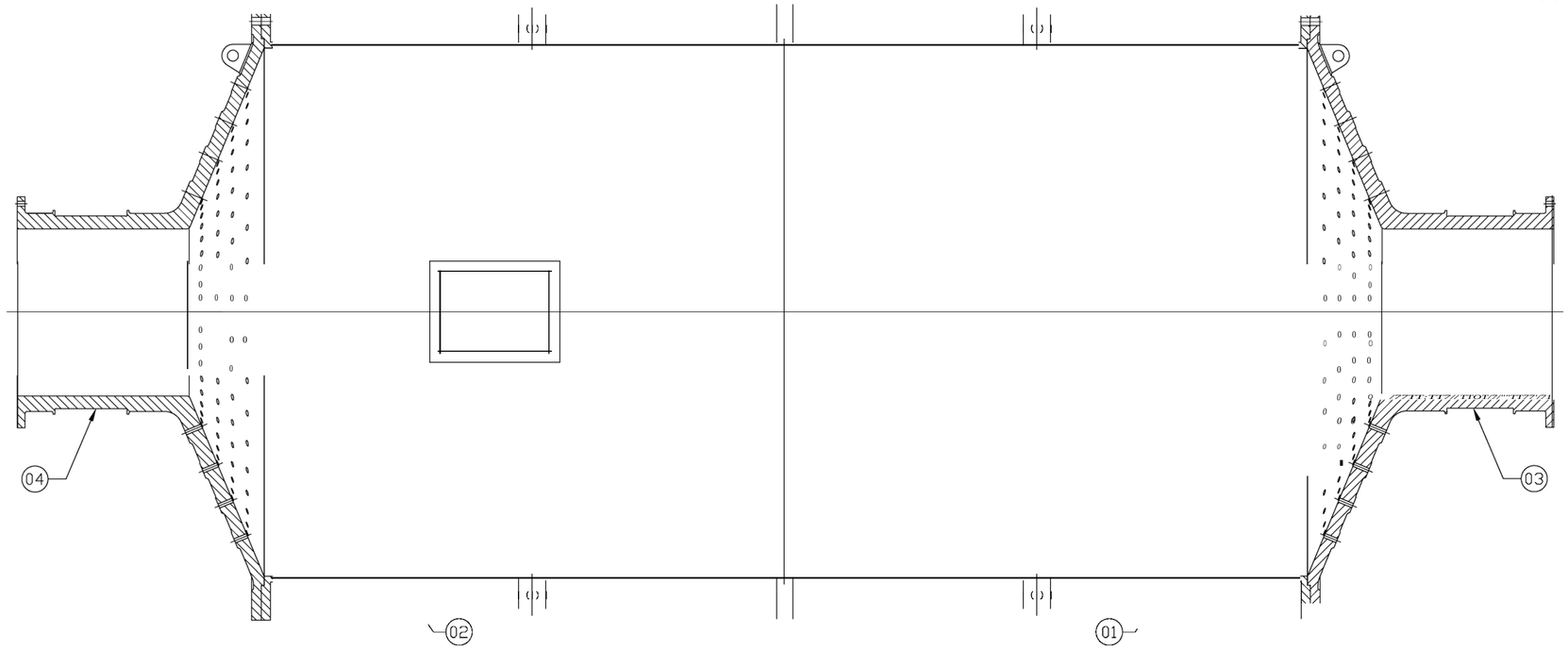
DRILLING LAYOUT OF ø24 MM HOLES (160 Nos) ON HALF SHELL (NDE) : PITCH DISTANCE OF 350 MM ALONG AXIS AND 18° ALONG CIRCUMFERENCE

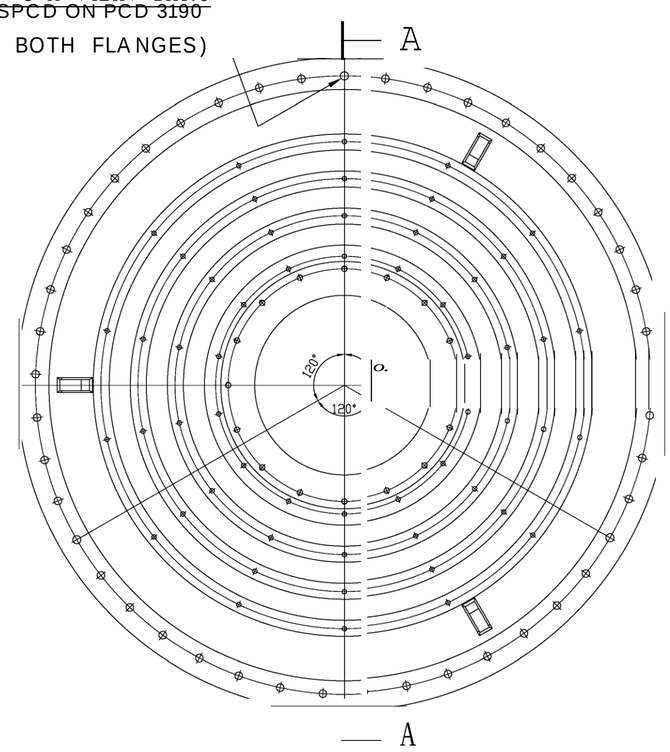
FIRST ANGLE PROJECTION

<ALL DIMENSIONS ARE N MM)

61000- 12-29-1

ISSUE NO.





3 X ¢42H7 THRU
EQ.SPCD ON PCD 3190
CON BOTH FLANGES)

SECTION A-A

NOTES:

1. MILL HALF SHELL DE AND CHEEK WITH TRUNNION DRIVE END SHALL BE HAND TIGHTENED USING 42 NDs OF SCREw M36X 140 CHY7121124610) AND M36 NUT CHY7151115946),
2. COMBINED DRILLING AND REAMING OF SHELL AND CHEEK WITH TRUNNION FLANGE SHALL BE DONE ON THE EXISTING PILOT HOLES (@ 25 MM : 3 Nos) TD ENLARGE THEM TD 0 42H7 MM.
3. REPEAT THE STEPS 1 AND 2 FDR MILL HALF SHELL NDE AND CHEEK WITH TRUNNION NON DRIVE END SIDE ALSO,
4. THESE 42 NDs FASTNERS ARE ONLY FDR HOLDING THE ABOVE MENTIONED COMPONENTS.
5. AFTER THIS DPERATION,MATCH MARKING SHALL BE DONE.

ITEM ND.	DESCRIPTION	DRAIJING ND.	VAR. ND.	RAIJ MATERIAL SIZE DR CASTING DRG. ND. DR FORGING DRG. ND.	MATERIAL CODE	NET IJT.	GROSS IJT.
					MATERIAL SPECN.	QUANTITY	
04	CHEEK TRUNNION NDE- 2.9M	0-62- 215-000 22				6589.12	
						01	
03	CHEEK TRUNNION DE- 2.9M	0-62- 215-000 21				6601.84	
						01	
02	MILL HALF SHELL MACHINING-NDE	0-62-215-00039				8410	
						01	
01	MILL HALF SHELL MACHINING-DE	0-62-215-00038				8430	
						01	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

1. REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.
2. CHAMFER M/CD. SHARP EDGES AT 45°.
3. INTERNAL M/CD. CORNER RADII 1 TO 0.7
4. THE SURFACE ROUGHNESS WHERE-EVER NOT SHOWN SHALL BE TAKEN FROM THE SURFACE ROUGHNESS SHOWN OUT SIDE THE BACK SLASH GIVEN OR THE TOP MOST RIGHT CORNER OF THE DRG.

TYPE OF PRODUCT: WET BALL MILL
NAME OF CUSTOMER/PROJECT:

BHARAT HEAVY ELECTRICALS LIMITED
HYDERABAD

	NAME	SIGN	DATE
DRN.	SHARIFF		26.03.22
CHD.	K.PAVAN		26.03.22
APPD.	S.GHATGE		26.03.22

WEIGHT CKGI REF. TO ASSY DRG.

DEPT. 446 | LNTDL OHS GR. | SCALE NTS | 30030.96

TITLE: MILL BODY ASSEMBLY

CARD CODE | DRAWING ND. 1-62-215-00019 | REV. 00

SHEET ND. 01 ND OF SHEETS 01

REV	DATE ALTERED	CHD./APPD.
ZONE		

REV	DATE ALTERED	CHD./APPD.
ZONE		

REV	DATE ALTERED	CHD./APPD.
ZONE		