



**PRODUCT STANDARD  
PULVERISERS  
HYDERABAD**

**GRINDING ELEMENTS FOR BHEL HP BOWL MILLS**

**1.0 GENERAL:**

This specification governs the procurement of grinding elements consisting of Grinding Rolls and matching Bull Ring Segments for OEM Supplies of HP-1103 Bowl Mill. The guaranteed wear life is 24000 running hours (without repair or rebuild of the wear area) for project coal as per Annexure-II, having ash content of about 10% - 18% & meeting the technical requirements / performance requirements for the Bowl Mills.

**2.0 QUALIFYING REQUIREMENTS:**

The bidder shall satisfy the following minimum qualifying requirements by submitting documentary evidences along with the technical offer, failing which the offers shall be summarily rejected.

**2.1 Proven Experience: Documentary evidence to be submitted for the following.**

Bidder should have manufactured and supplied Grinding rolls and matching bull ring segment for 500 MW or higher size pulverized coal fired power generating units such that respective grinding elements have successful achieved a wear life of minimum 10000 hrs. (without repair or rebuild of the wear area) with typical high ash Indian coal as given in Annexure I or should have achieved 24000 hrs wear life with project coal specified in Annexure-II at least minimum two different sites prior to date of techno-commercial bid opening.

The evidences shall be submitted in the following format.

Name of Site	Power unit rating	Mill type	Size of grinding roll	Date of supply	Life achieved in hrs.
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*Amun*  
*P. D. Singh*  
*23/18*

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**2.2 Manufacturing facilities and proven process:**

2.2.1 Vendors to note that at present BHEL is using the Grinding elements as per the following details:

Rolls and Bull ring segments are manufactured using proven casting process. The Inserts of the rolls are made up of hard metal matrix composite comprising of high chrome and ceramic, the high chrome iron having following Chemical composition:

C = 2.5-3.4 %, Cr = 18.0-27.0 %, Mo= 0.5-1.3 %, Ni-0.3-1.3%,  
Mn = 0.5 - 1.5 %, Si = 1.0 % max., S-0.1% Max, P-0.1% Max

This High-Chrome alloy is reinforced with ceramic particles, evenly distributed. The hardness of inserts is in the range of 58 – 66 RC.

These inserts are embedded into a base metal, which is either ductile iron (SG iron) / Hi-Chrome / any other equivalent material, forming a roll by Static / centrifugal process with overall dimensions as per BHEL drawing.

The Chemical composition of SG iron: C- 3.2-3.5%, Si-2.5-3.0%, Mn-0.3% max. Mg-0.04-0.07%.

Any bidder following the above manufacturing process will be qualified subject to meeting the clause 2.1.

However, the above Chemical Composition/Process/ technology do not absolve the supplier from guarantee responsibility. The Heat treatment procedure shall be established by the vendor and shall be indicated in Quality Plan.

**2.2.2 ANY OTHER PROCESS FOLLOWED & MEETING 2.1**

In case the bidder is having a manufacturing process different from 2.2.1, the bidder shall have all the necessary facilities for the manufacture of Grinding rolls and bull ring segments. The process used for manufacture shall be a proven one. Details of their manufacturing facilities shall be submitted.

In case any of the sub-process is out sourced / subcontracted, the tie-up letter with the agency along with details of their facilities and capabilities shall also be submitted for acceptance by BHEL.

**The information given by the bidder is liable for evaluation by BHEL**

**2.2.3 Traders / stockiest / mediators are not allowed to quote. Only manufacturers who are having relevant facilities, proven process and experience will be considered for the supply.**

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**PRODUCT STANDARD  
PULVERISERS  
HYDERABAD**

**2.3 Infrastructure for providing Technical Services for:**

- Bidder shall have the sufficient infrastructure for the following after sales services
- Supervision of erection and commissioning.
  - Performance monitoring with respect to wear life, output, fineness, coal characteristic etc.

Documentary evidences/confirmation for the above shall be submitted.

**3.0 MATERIAL CODE: See Table**

**4.0 QUANTITY REQUIRED PER MILL**

- 1) 3 Nos. Grinding Rolls.
- 2) 1 set of matching Bull Ring Segments.

**5.0 MANUFACTURING PROCESS AND QUALITY PLAN:**

- 5.2 Dimensions:** The overall dimensions of the Grinding Roll and Bull Ring Segments shall be as per BHEL Drawings.
- 5.3** A detailed manufacturing process (along with the process control parameters) and manufacturing and test facilities data shall be submitted for review by BHEL.
- 5.4** Material used for the manufacture of the Grinding rolls and Bull ring segments shall be specified along with the technical details. The specifications shall be submitted for acceptance by BHEL. 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.
- 5.5** A Quality plan with stage wise inspection and acceptance criteria shall be submitted for approval by BHEL and/or customer.

**6.0 INSPECTION:**

- 6.2** The inspection of items will be as per the approved Quality plan.
- 6.3** Inspection of the material will be based on the applicable process of manufacture acceptable to BHEL. The tests like chemical composition, microstructure, hardness and NDT etc as applicable will be part of the approved Quality plan.
- 6.4** The overall dimension of the grinding roll and bull ring segments shall be as per BHEL drawing.
- 6.5** The bullring segments shall be assembled in Check Bowl. After assembling of the segments, final gap should not be more than 20 mm. The drawing for the check Bowl and the arrangement for segment assembly on Check Bowl shall be furnished by BHEL.
- 6.6** The number of segments i.e. Plain, Half, Quarter, Keyed & Shim for each size of the mill shall be shown on Check Bowl drg. However, additional shims/ segment to fill the gap upto 20 mm shall be supplied by the vendor which may be required at site during assembly.

*Amin*  
*R. Chetty*  
2/3/18

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**7.0 GUARANTEES:**

**Wear Life:** The minimum guaranteed wear life shall be 24000 hours (without repair or rebuild of the wear area) for the range of coal mentioned in Annexure-II.

Supplier shall depute his representative while conducting the mill capacity and performance test with originally installed worn out grinding elements after the guaranteed wear life during the Performance Guarantee (PG) test of mills along with BHEL team as per the customer approved PG test procedure and guarantees given there off. Guaranteed wear life is considered to have been met with only when the mill PG test results are achieved. Typical Mill PG Test requirement is as per Annexure III.

7.2 The supplier shall give back to back guarantee for wear life of grinding elements. In case of short fall, supplier shall make one to one replacement of grinding elements to meet guaranteed wear life.

7.3 Consistency in mill output to minimum 90% of the rated capacity and pulverized fuel fineness of minimum 70% through 200 mesh and 99% through 50 mesh at the end of guaranteed wear life.

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

**8.0 INSPECTION AT SUPPLIERS WORK**



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.

**9.0 TEST CERTIFICATE:**

All the rolls shall be identified with a serial number punched. The Bull ring segments set shall be numbered by paint for each set. Supplier shall supply 3 copies of Test certificates with following information for rolls and bull ring segments.

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

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**10.0 ACCESSORIES**

Wear measurement gauge for project site, and any other items/consumables required shall be supplied by the supplier at no extra charge to BHEL.

**11.0 DOCUMENTS**

11.1 Three Copies of test certificates are to be provided.

**12.0 PACKING:**

Bull ring segments shall be suitably packed in seaworthy metallic boxes set wise to prevent Corrosion and damage during transit. Machined/ Ground surfaces shall be properly protected with suitable anti-corrosive compound. Bull ring segments and shims shall also be coated with anti-corrosive compound. Grinding rolls which are being directly dispatched to site shall be packed in seaworthy metallic boxes. Each package shall be legibly marked with following information.

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

Separate identification mark shall be given for spare grinding rolls and bull ring segments .

**13.0 SUPERVISION & SERVICES:**

- 13.1 Personnel for supervision for Erection and commissioning shall be deputed within a period of one week from the notice given by BHEL.
- 13.2 Supplier shall depute his representative while conducting the mill capacity and performance test with originally installed worn out grinding elements after the guaranteed wear life during the Performance Guarantee (PG) test of mills along with BHEL team.

**14.0 TABLE FOR MATERIAL CODE**

Var No.	Mill Type	Item Description	Drawing No.	Malt. Code
01	HP-1103	Grinding roll HP 1103	26101003169	BA9735043017
02	HP-1103	Bull ring segment set HP 1103	16111001564	BA9735043025

*Amrinder Singh*



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**ANNEXURE - I**

**TYPICAL COAL ANALYSIS (INDIAN COAL):**

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Parameter	Unit	Coal Analysis Data (as available)					
		Coal 1	Coal 2	Coal 3	Coal 4	Coal 5	Coal 6
<b>Proximate Analysis (as recd)</b>							
Moisture	%	18	14	18	16	15	15
Ash	%	46	45	38	45	45	45
Volatile Matter	%	16	20	20	19	20	19.5
Fixed Carbon	%	20	21	24	20	20	20.5
<b>Hard Grove Index</b>		45	47	60	50	47	42
<b>Abrasion Index (YGP)</b>	mg steel/ kg coal	85	80	80	80	80	80
<b>Ash Analysis (as recd)</b>							
Silica (SiO2)	%	64.86	62.4	59.79	59.54	62.5	59.6
Alumina (Al2O3)	%	23.8	27.31	25.36	29	27.3	30.75
Iron Oxide (Fe2O3)	%	6.52	4.96	7.2	6.42	4.9	6.5
Balance	%						

*Aminon*  
*D. S. Rao*  
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**ANNEXURE - II**

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**FUEL ANALYSIS - COAL**

Sheet 1 of 2

DESCRIPTION ( Source / Type )	UNIT	PERFORMANCE COAL	WORST COAL	BEST COAL
<b>PROXIMATE ANALYSIS</b>				
Fixed carbon	%	36.0	32.0	44.0
Volatile matter	%	34.0	26.0	45.0
Moisture	%	20.0	24.0	7.0
Ash	%	10.0	18.0	4.0
Total	%	100	100	100
HHV	kcal / kg	5700	5200	6300
LHV	kcal / kg			
<b>ULTIMATE ANALYSIS</b>				
Carbon	%	56.94	48.66	68.50
Hydrogen	%	4.01	4.20	3.62
Sulphur	%	0.80	0.50	0.90
Nitrogen	%	1.54	0.54	2.67
Oxygen (difference)	%	6.71	4.10	13.11
Moisture	%	20.00	24.00	7.00
Ash	%	10.00	18.00	4.00
Carbonates	%			
Phosphorous	%			
<b>HARD GROVE INDEX</b>				
<b>ASH CHARACTERISTICS</b>				
IT - Initial deformation temp.	°C	1150	1100	1100
ST - Softening temp.	°C			
HT - Hemispherical temp.	°C	1200	1150	1150
FT - Fusion temp.	°C	1250	1200	1250
<b>ASH CONSTITUENTS</b>				
A - Si O <sub>2</sub>	%	50.17	42.10	53.73
A - Al <sub>2</sub> O <sub>3</sub>	%	19.06	22.55	17.70
B - Fe <sub>2</sub> O <sub>3</sub>	%	12.3	13.00	13.50
B - CaO	%	8.00	10.28	5.28
- MgO	%	1.50	3.31	0.90
B - Na <sub>2</sub> O	%	0.60	0.35	0.90
B - K <sub>2</sub> O	%			
A - TiO <sub>2</sub>	%	0.69	0.64	1.38
P <sub>2</sub> O <sub>5</sub>	%	0.50	0.80	0.10
SO <sub>3</sub>	%	5.12	4.45	5.34
Others	%	2.06	2.52	1.17
Base / Acid Ratio				
Fe <sub>2</sub> O <sub>3</sub> / CaO Ratio				
Chloride				

Ref: Annexure 1 of Specification No.1 to Bidding Documents

*Amir*

*Platige*  
23/18

**ANNEXURE-III**

**TYPICAL MILLS PG TEST REQUIREMENT:  
Coal Pulveriser Capacity at Rated Fineness**

Performance testing shall be conducted on coal pulverisers towards establishing their guaranteed capacity meeting the specification requirement. Corrections may be applied for the variation in coal characteristics i.e.HGI & Total Moisture of test coal with respect to specified design coal.

Capacity demonstration test shall be carried out for the following conditions.

(a) The Contractor shall demonstrate capacity output on one coal pulverizer of each Steam Generator for establishing its capacity at 100% mill loading at rated pulverized coal fineness with specified design coal with new set of grinding elements.

(b) Further, Contractor shall also demonstrate capacity output on four coal pulverizers (of Employer's choice) of each Steam Generator, not less than the 90% of guaranteed value of (a) above, at 100% mill loading with the originally, installed grinding elements in after the guaranteed wear life of grinding elements.

Capacity test as mentioned at (a) & (b) above shall be demonstrated at the following condition occurring simultaneously during testing:

Rated Pulverised coal fineness	i) Not less than 70% through 200 mesh and ii) Not less than 99% through 50 mesh screen
Test coal	Any available coal from the specified range

In case the Contractor successfully demonstrates the guaranteed capacity of coal pulverisers as stated above remaining coal pulverisers of corresponding steam generator will also be considered to have successfully met the above capacity guarantee requirement. However, in the event of any of the coal pulverizers not meeting the guarantee test, all the coal pulverizers of corresponding steam generator will have to be tested by the contractor to demonstrate guaranteed capacity.

During the demonstration of the mill capacity output, manufacturer's operating instructions will be followed and mill will be operated with the specified range of coals without any such readjustment that requires a shutdown of the mill or reduction of the load and / or any replacement of any mill wear parts.

For the purpose of testing to demonstrate the capacity, if HGI (grindability) and total moisture vary from those given in coal characteristics, the above pulverizer measured capacity shall be corrected using the capacity correction curves furnished by the Contractor and approved by the Employer. HGI versus coal pulverizer capacity curve shall be furnished for HGI variation upto a value above which the capacity remain constant.

  
  
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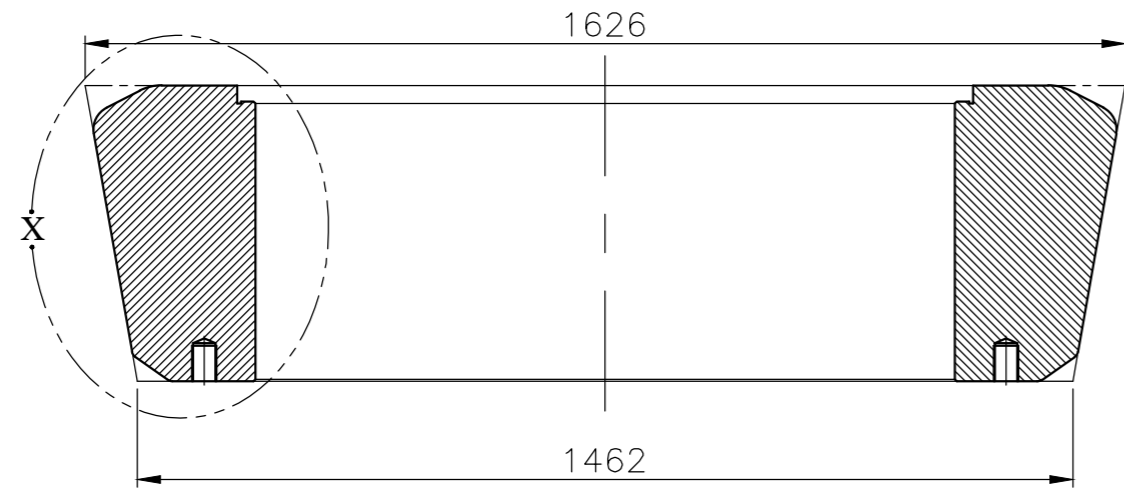


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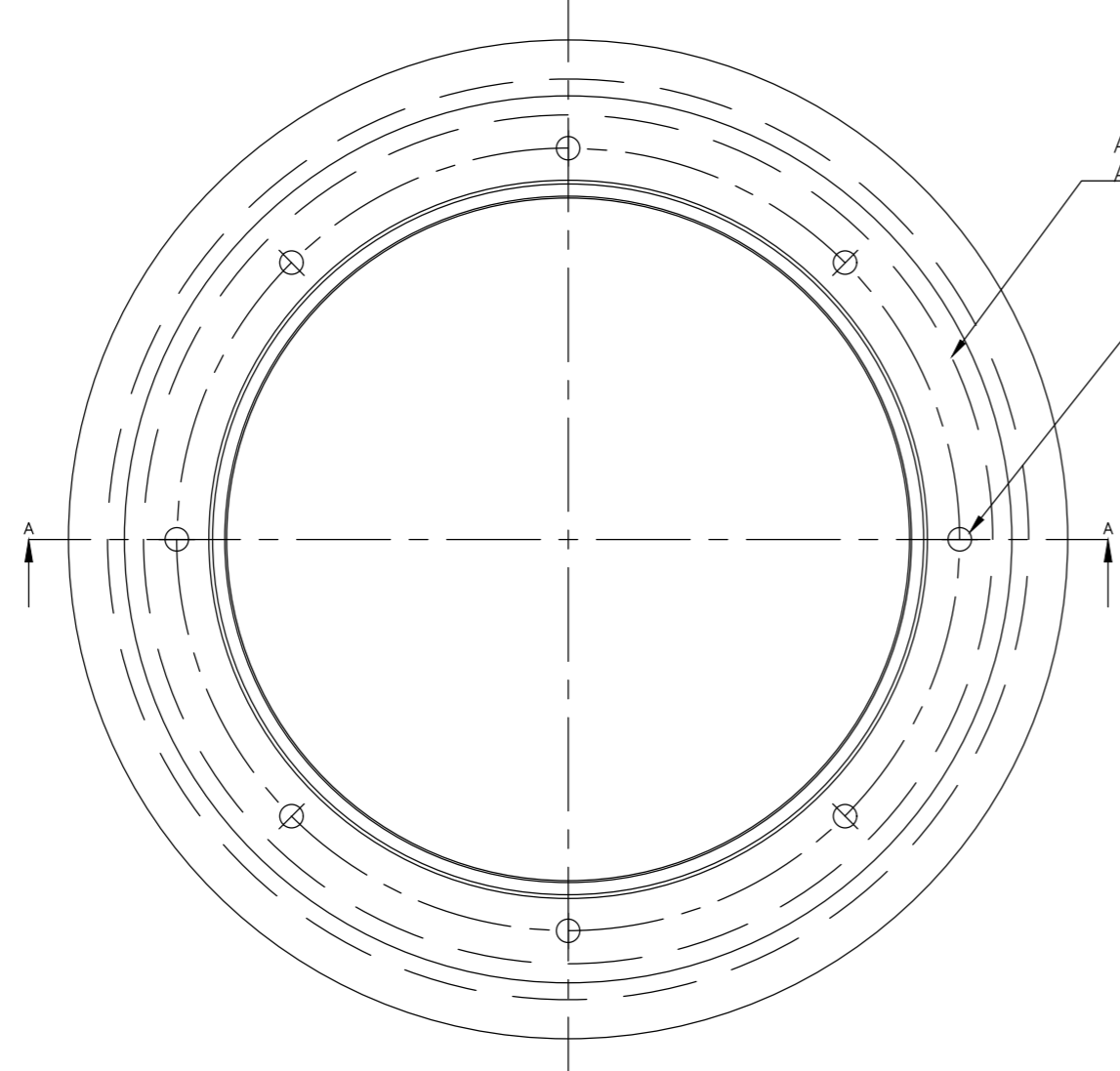
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DRG. NO. 2-61-010-03169

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SECTION: A-A

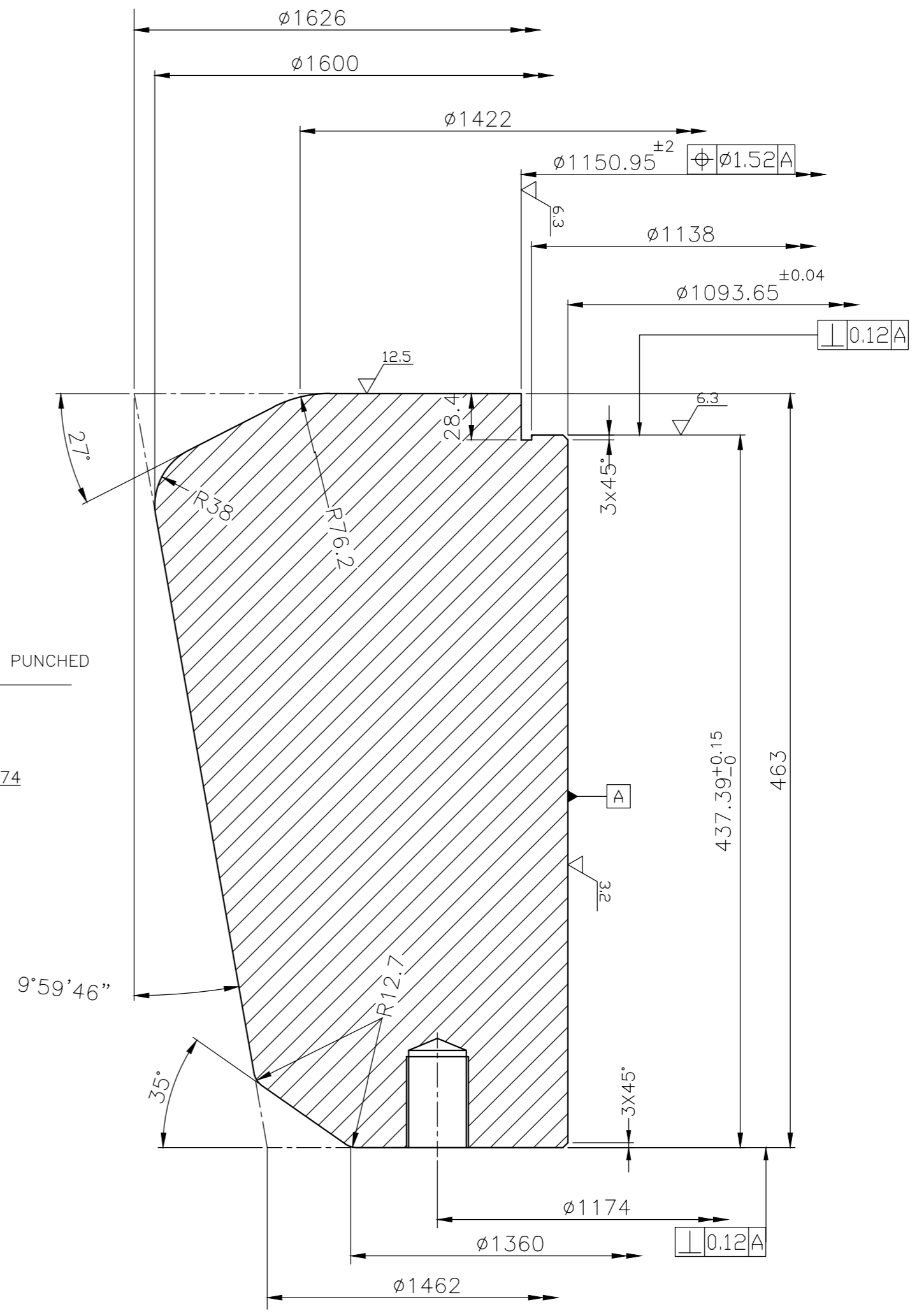


SCALE 1:4

AIAE ROLLER IDENTIFICATION NUMBER TO BE PUNCHED AT FINAL STAGE ON TOP & BOTTOM FACES

8 TAPPED HOLES EQUISPACED  
1.5"-6UNC X 63.5mm DEEP ON PCD 1174

$\phi 1.27$  S P139.7 BA M  
0.25 B



ENLARGED DETAIL: X

RAW MATERIAL WT/PC: 3374.0

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

- REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.
- CHAMFER M/CD. SHARP EDGES 1.2 TO 1.0 AT 45°.
- INTERNAL M/CD. CORNER RADII 1 TO 0.7
- 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 HP 1023-1103- COAL MILL  
NAME OF CUSTOMER/PROJECT

	BHARAT HEAVY ELECTRICALS LIMITED HYDERABAD	NAME	SIGN.	DATE	NO.OF VAR.
		DRN.	BGK	10.03.12	
		CHD.	AMAN		
		APPD.	S.G		

DEPT. PULV ENGG. CODE 446	UNTOI. DIMS. GR. Ø/M/Y		SCALE 1:5	WEIGHT (KG) 3155.0	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
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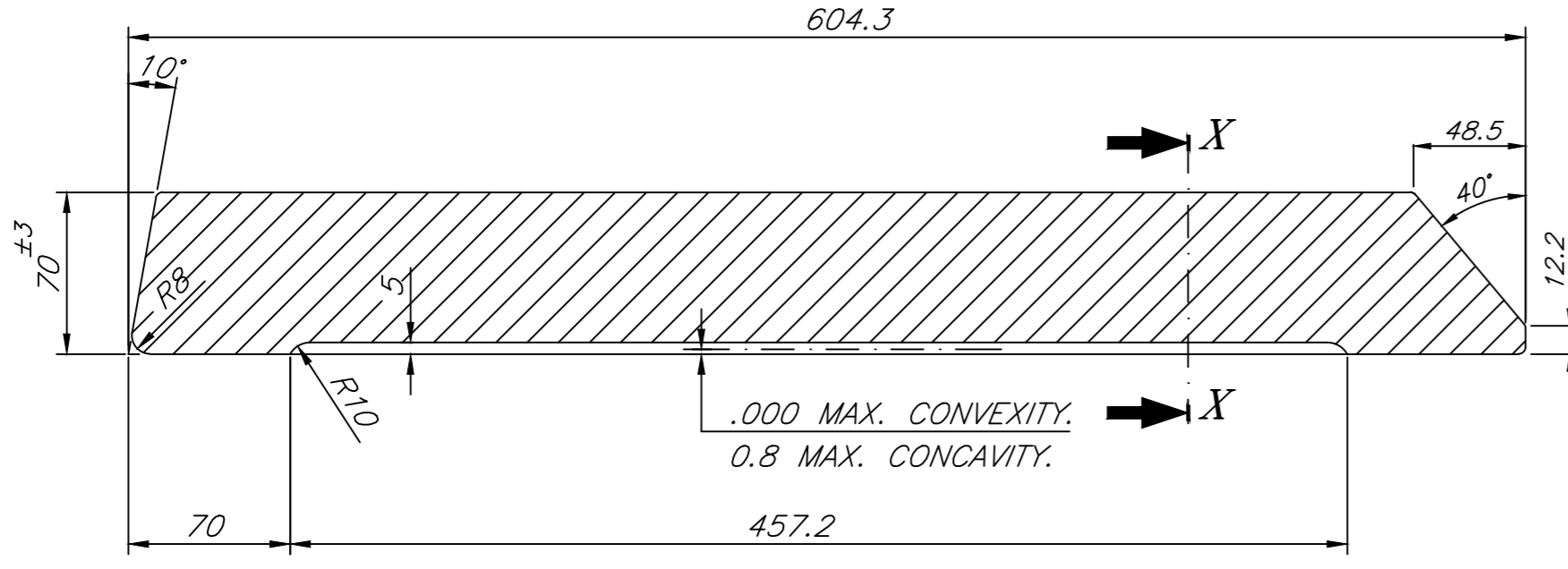
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	SHEET NO. 01	NO OF SHEETS 01

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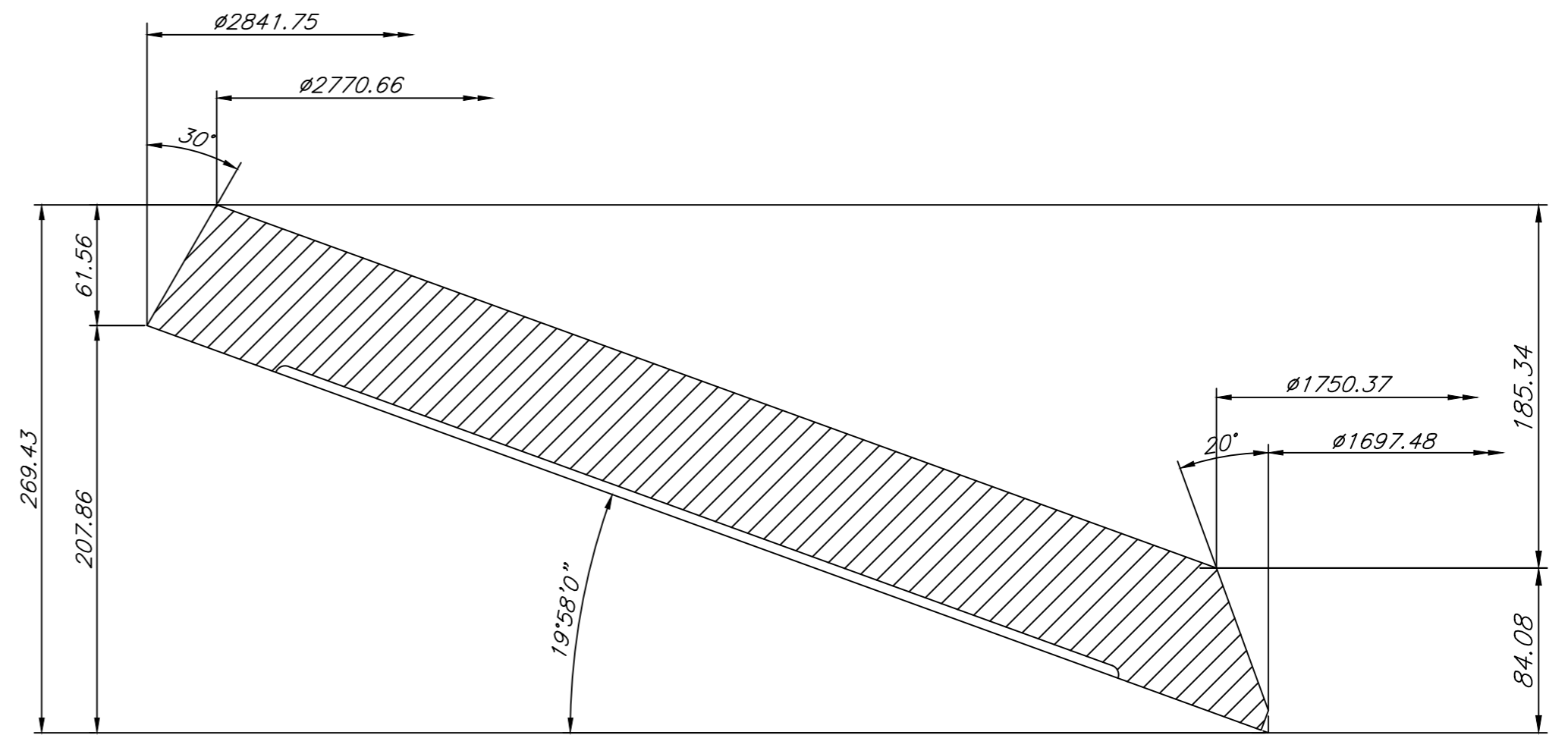
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(ALL DIMENSIONS ARE IN mm)

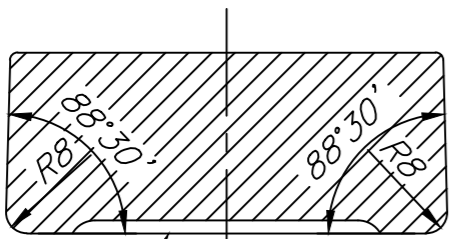
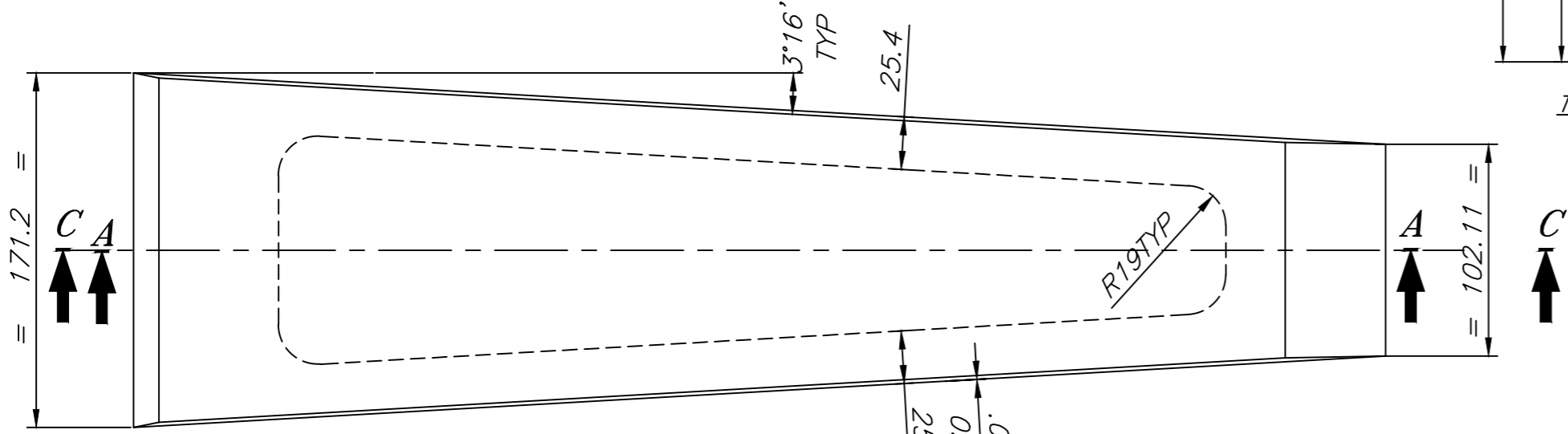
DRG. NO. 2-61-110-02904



SECTION A-A



TRUE ORIENTATION & GAGE DIM'S SECTION:-C..C



SECTION X-X

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	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.

- REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.
- CHAMFER M/CD. SHARP EDGES 1.2 TO 1.0 AT 45°.
- INTERNAL M/CD. CORNER RADII 1 TO 0.7
- 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				NAME OF CUSTOMER/PROJECT			
BHARAT HEAVY ELECTRICALS LIMITED HYDERABAD				DRN.	R.RANJAN	DATE	26.6.09
				CHD.	A.SURIN	DATE	26.6.09
				APPD.	S.GHATGE	DATE	26.6.09
DEPT. PULV. ENGG. CODE	446	UNTO. DIMS. GR.	ø/M/ø	SCALE	1:2.75	WEIGHT (KG)	42.2
TITLE				REF. TO ASSY DRG.		ITEM NO.	NO.OF ITEMS
BULL RING SEGMENT PLAIN				DRAWING NO.		REV.	
				2-61-110-02904		00	
				SHEET NO. 01		NO OF SHEETS 01	

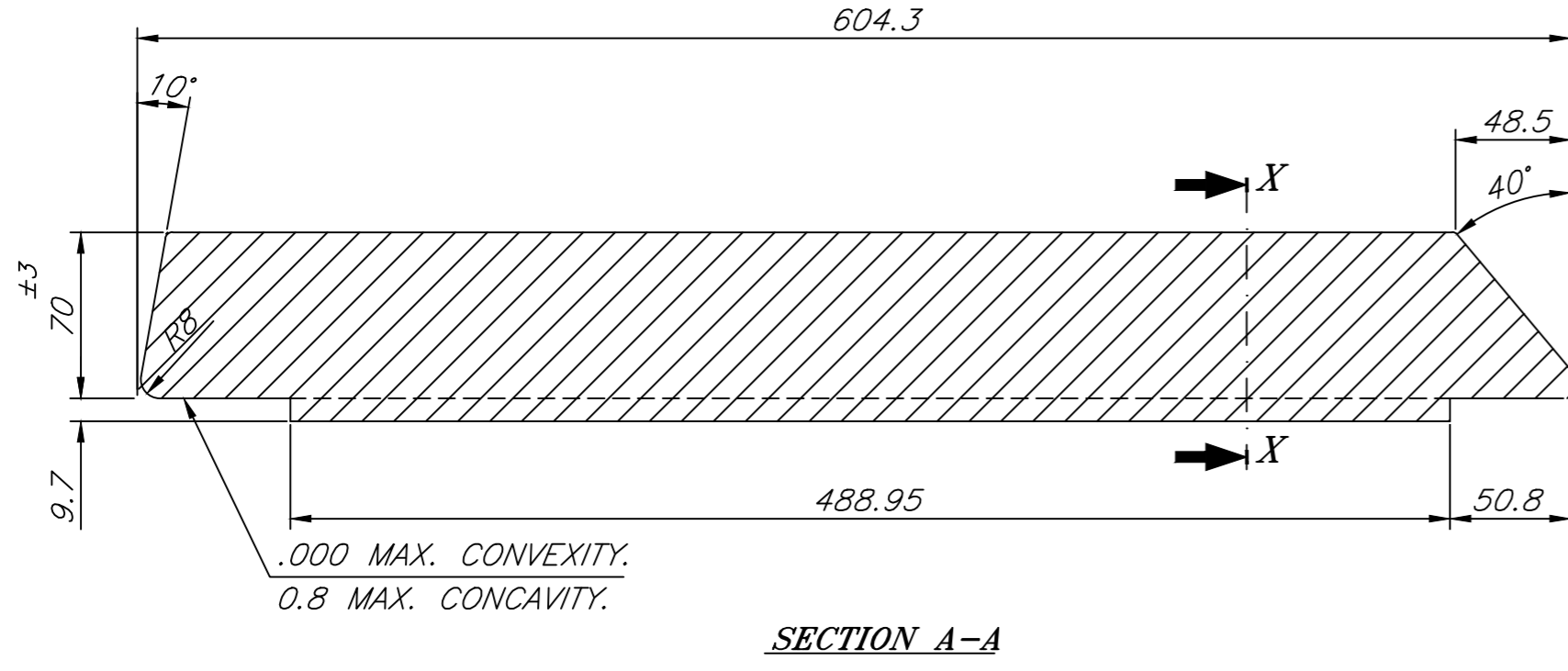
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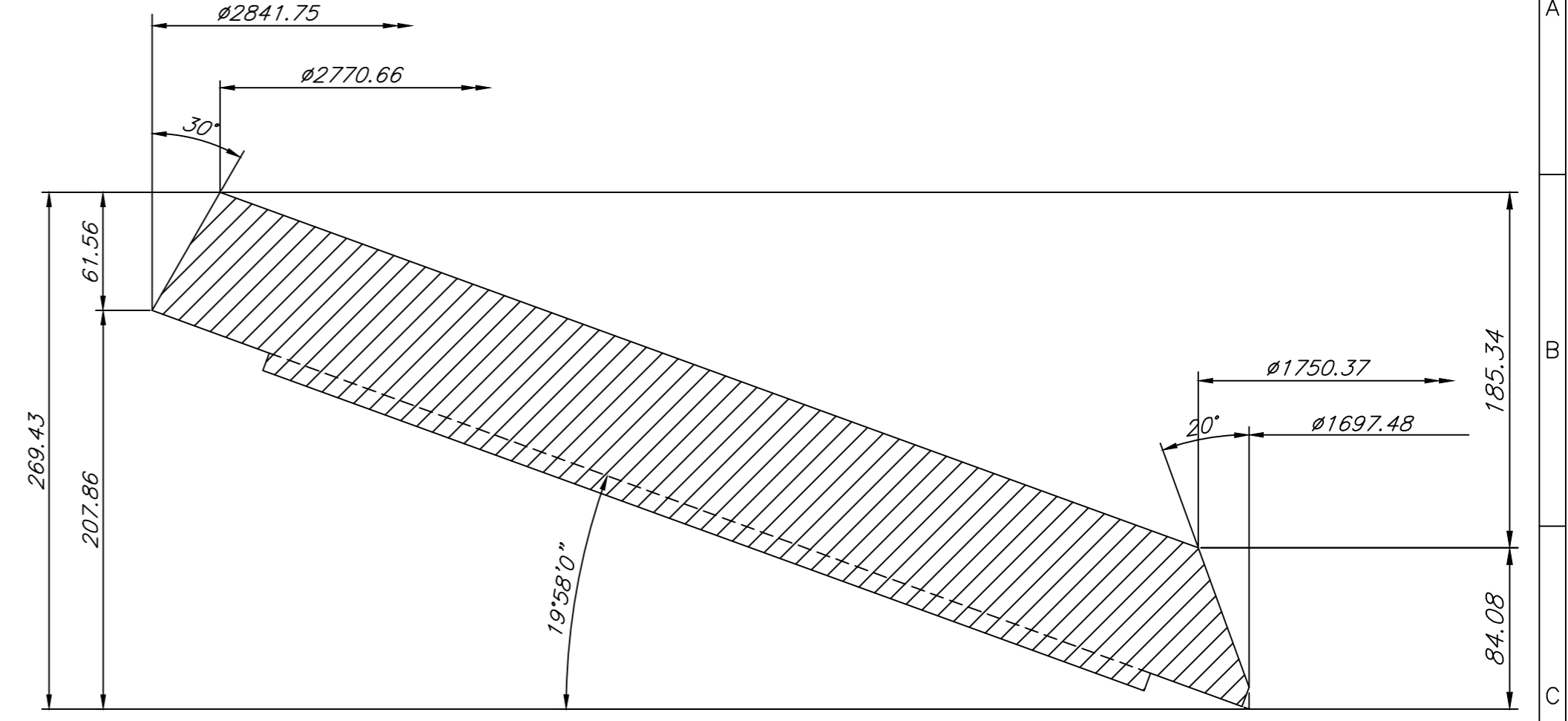
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(ALL DIMENSIONS ARE IN mm)

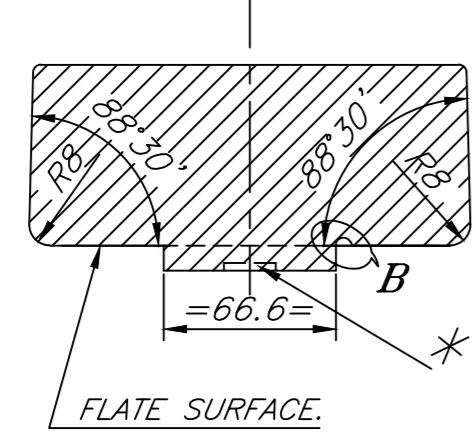
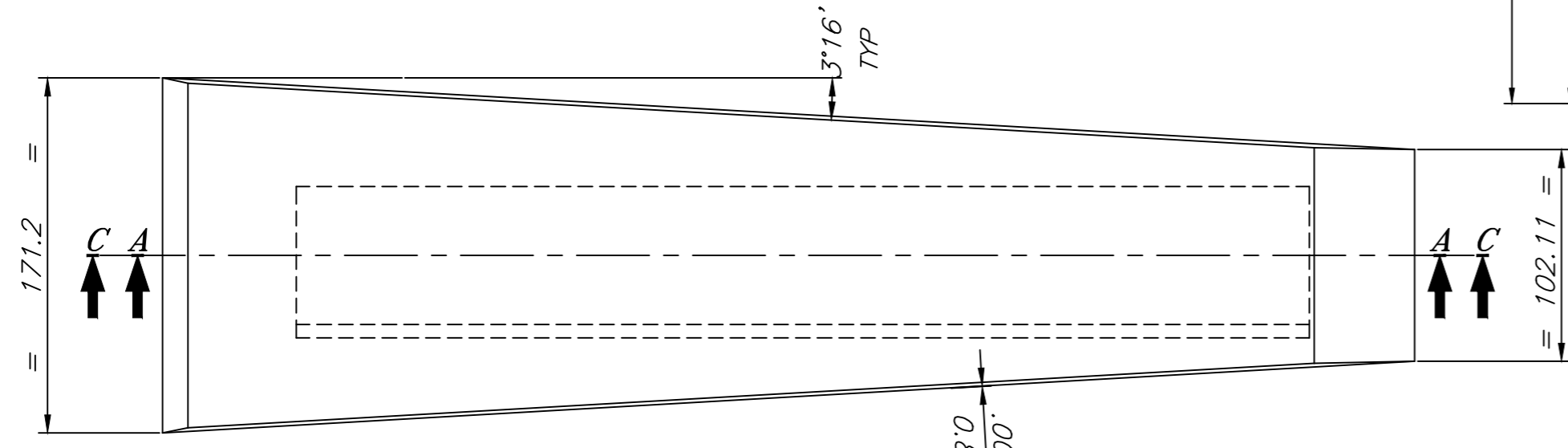
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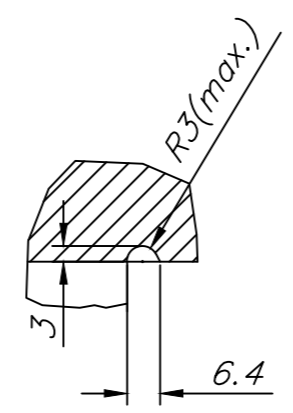
SECTION A-A



TRUE ORIENTATION & GAGE DIM'S SECTION:-C..C



SECTION X-X



DETAIL B

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	

- THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.
- REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.
  - CHAMFER M/CD. SHARP EDGES 1.2 TO 1.0 AT 45°.
  - INTERNAL M/CD. CORNER RADII 1 TO 0.7
  - 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  
NAME OF CUSTOMER/PROJECT

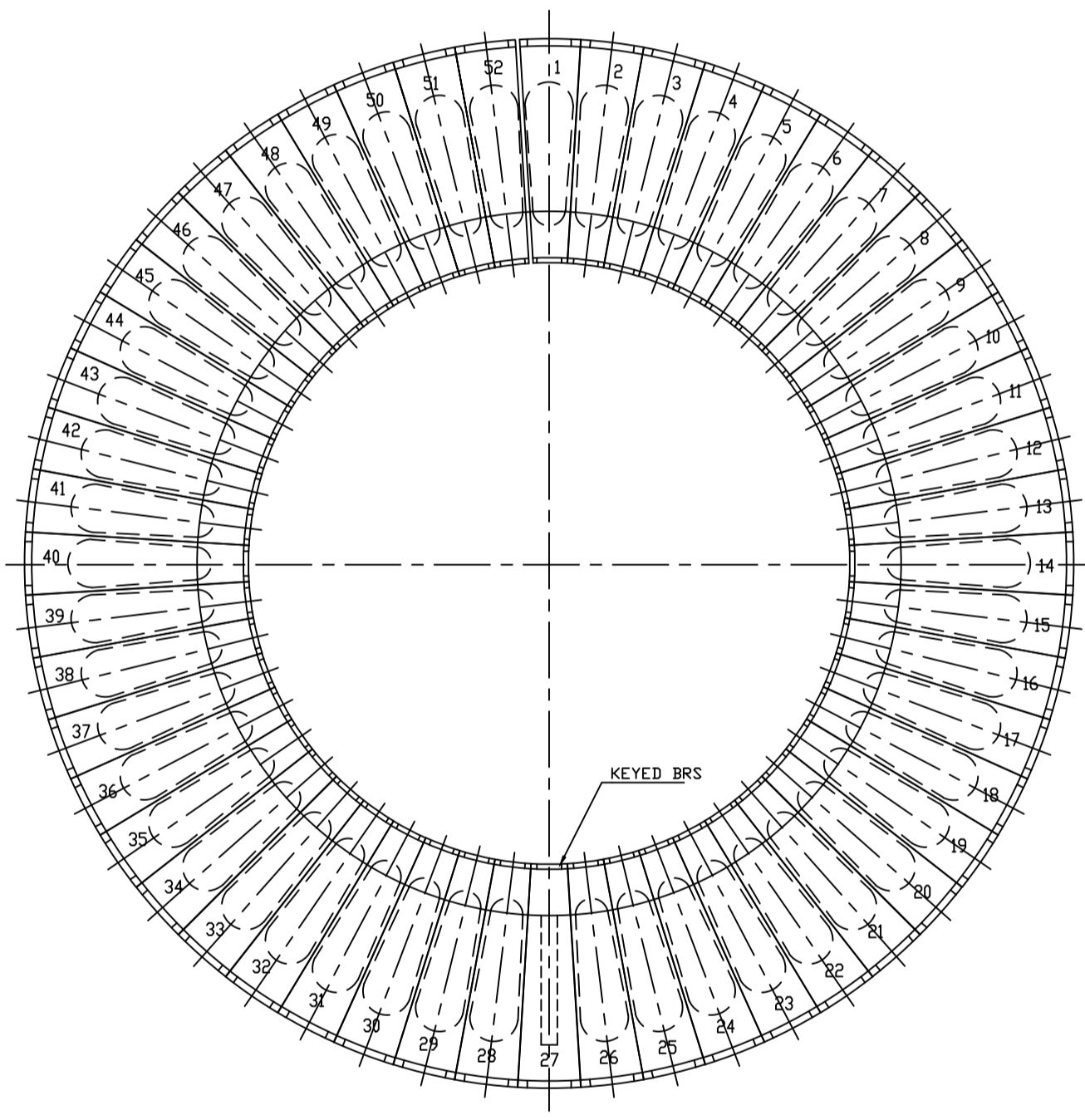
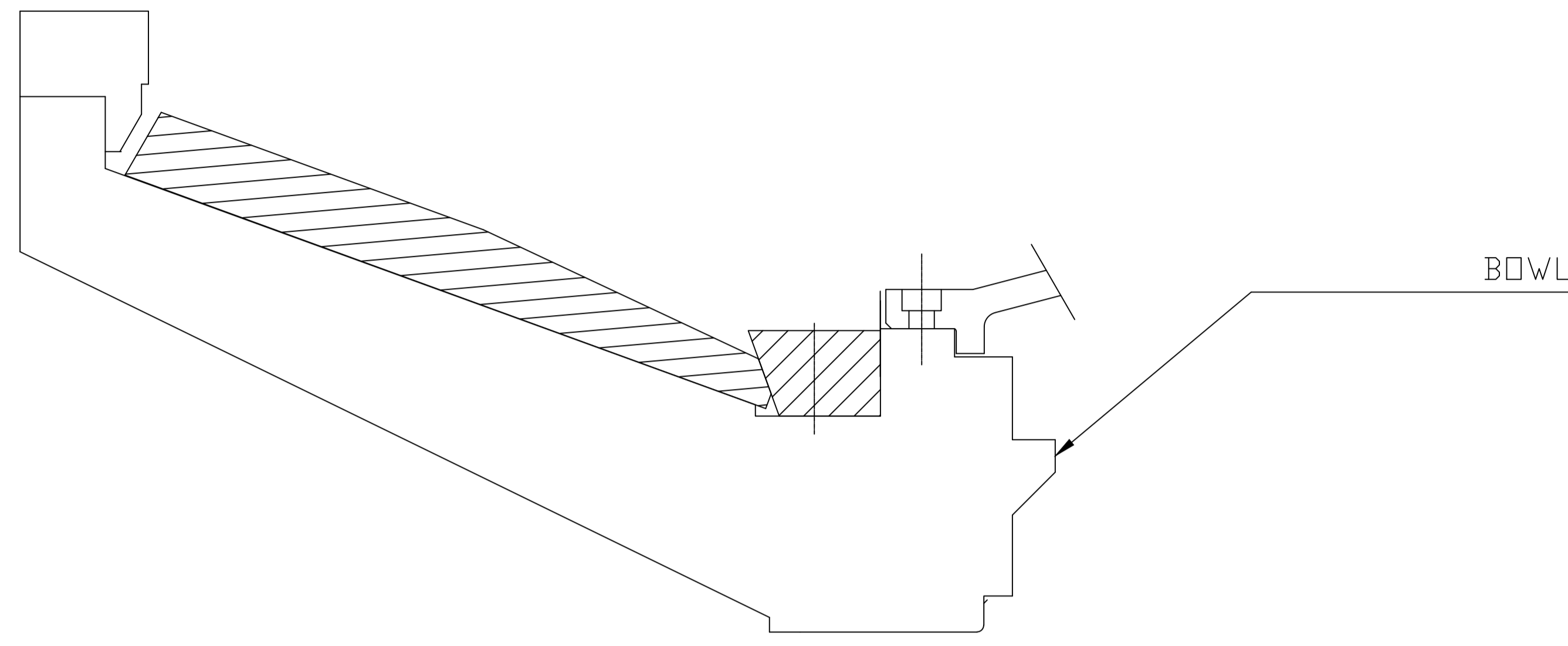
	NAME	SIGN.	DATE	NO.OF VAR.
	BHARAT HEAVY ELECTRICALS LIMITED	R.RANJAN	26.6.09	
	HYDERABAD	A.SURIN	26.6.09	
		S.GHATGE	26.6.09	

DEPT. PULVY ENGG. CODE 446	UNTO. DIMS. GR. 4/M/Y	SCALE 1:2.75	WEIGHT (KG) 42.2	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS
TITLE			DRAWING NO.		REV.	
BULL RING SEGMENT KEYS			2-61-110-02905		00	
			SHEET NO. 01		NO OF SHEETS 01	

REV.	DATE	ALTERED CHD.	APPD.	REV.	DATE	ALTERED CHD.	APPD.	REV.	DATE	ALTERED CHD.	APPD.
ZONE				ZONE				ZONE			

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DRG. NO. 1-61-110-01564



**NOTES:-**

01. TOTAL NUMBER OF BULL RING SEGMENTS SHALL BE 52 Nos. (51 Nos. PLAIN & 1 No. KEYED BRS).
02. IN THE ASSEMBLED CONDITION OF BRS THE GAP BETWEEN SIDE FACES SHOULD BE LESS THAN 1.6 MM. THE GAP IS TO BE CONTROLLED TO LESS THAN 0.8 MM. OVER A LENGTH OF 75 MM. AT BOTH INNER AND OUTER DIAMETERS OF ASSEMBLY.
03. ALL THE SEGMENTS SHOULD BE ASSEMBLED AND MATCHED AS A SET IN CHECK BOWL & NUMBERED SERIALLY
04. REQUIRED QTY. OF QUATER AND HALF SEGMENTS CAN BE USED.
05. M.S SHIMS OF THICKNESS 3.2 MM, 12 MM, 16MM & 18 MM WILL BE SUPPLIED WITH EACH SET.
06. THE BULL RING SEGMENTS SHOULD BE IN LEVEL WITH EACH OTHER WITHIN 3 MM.
07. AFTER ASSEMBLY OF 52 SEGMENTS, FINAL "ZERO"(0) GAP TO BE ENSURED.
08. B R SEGMENT PLAIN 2-61-110-02904 (51 NOS).
09. B R SEGMENT KEYED 2-61-110-02905(1 NO).

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	

THE FOLLOWING CONDITIONS APPLY EXCEPT OTHERWISE STATED.				TYPE OF PRODUCT				
1. REF. TO HY0230261 FOR UNSPECIFIED TOLERANCES.				NAME OF CUSTOMER/PROJECT				
2. CHAMFER M/CD. SHARP EDGES 1.2 TO 1.0 AT 45°.				BHARAT HEAVY ELECTRICALS LIMITED HYDERABAD				
3. INTERNAL M/CD. CORNER RADII 1 TO 0.7				DRN.	R.RANJAN	SIGN.	DATE	NO.OF VAR.
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.				CHD.	A.SURIN		26.6.09	
				APPD.	S.GHATGE		26.6.09	
DEPT. PULV ENGG. CODE 446	UNTO. DIMS. GR. $\phi$ /M/F	SCALE NTS	WEIGHT (KG) 1:2.75	REF. TO ASSY DRG.	ITEM NO.	NO.OF ITEMS		
TITLE BULL RING SEGMENT ASSEMBLY				DRAWING NO. 1-61-110-01564		REV. 01		
				SHEET NO. 01		NO OF SHEETS 01		

REV.	DATE	ALTERED CHD.	APPD.	REV.	DATE	ALTERED CHD.	APPD.	REV.	DATE	ALTERED CHD.	MTT	APPD.
01	24.11.14							E,6			POINT 07 IN THE NOTE CHANGED.	SG

INVENTORY NO. SIGN. AND DATE REF. DRG. NO. COMPUTER FILE NAME 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