



**PRODUCT STANDARD
PULVERISERS
HYDERABAD**

Product
STD no.

BA35054

Rev No. 00

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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 10000 running hours (without repair or rebuild of the wear area) for project coal as per Annexure-II, having ash content of about 36% - 46% & 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.

2.0.1 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 to at least two different sites. Supplied grinding rolls and bull ring segments should have 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 prior to date of techno-commercial bid opening. End user certificate for satisfactory performance shall be furnish for the above supplies.

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.

2.1 Manufacturing facilities and proven process:

2.1.1 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



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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 2.0.1.

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.

2.1.2 ANY OTHER PROCESS FOLLOWED & MEETING 2.0.1

In case the bidder is having a manufacturing process different from 2.1.1, 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

2.1.3 **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.**

2.2 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 w.r.t 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.



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5.0 MANUFACTURING PROCESS AND QUALITY PLAN:

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

6.0 INSPECTION:

- 6.1** The inspection of items will be as per the approved Quality plan.
- 6.2** 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.
- 6.3** The overall dimension of the grinding roll and bull ring segments shall be as per BHEL drawing.
- 6.4** 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.
- 6.5** 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.

7.0 GUARANTEES:

Wear Life: The minimum guaranteed wear life shall be 10000 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.

- 7.1** The supplier shall give back to back guarantee for wear life of grinding elements as per terms and conditions of applicable contract clauses given in Annexure IV- which gives calculation for replacement of grinding elements as part of Mill Warranty Shortfall Part Settlement.



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7.2 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.

7.3 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.

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.



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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	BA9735054019
02	HP-1103	Bull ring segment set HP 1103	16111001564	BA9735054027

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ANNEXURE – I

TYPICAL COAL ANALYSIS (INDIAN COAL):

Parameter	Unit	Coal Analysis Data (as available)					
		Coal 1	Coal 2	Coal 3	Coal 4	Coal 5	Coal 6
Proximate Analysis (as recd)							
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
Hard Grove Index		45	47	60	50	47	42
Abrasion Index (YGP)	mg steel/ kg coal	85	80	80	80	80	80
Ash Analysis (as recd)							
Silica (SiO ₂)	%	64.86	62.4	59.79	59.54	62.5	59.6
Alumina (Al ₂ O ₃)	%	23.8	27.31	25.36	29	27.3	30.75
Iron Oxide (Fe ₂ O ₃)	%	6.52	4.96	7.2	6.42	4.9	6.5
Balance	%						

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ANNEXURE – II

V.II/Amend-1/Analysis
TABLE-I

PROXIMATE ANALYSIS OF COAL (As received Basis)					
Sl. No.	Description	Symbol	Design Coal	Worst Coal	Best Coal
1	Total Moisture	TM%	15.00	18.00	12.00
2	Ash	A%	40.00	46.00	36.00
3	Volatile Matter	VM%	19.00	18.00	22.00
4	Fixed Carbon	FC%	26.00	18.00	30.00
ULTIMATE ANALYSIS (As Received Basis)					
1	Carbon	C%	29.73	23.08	37.32
2	Hydrogen	H ₂ %	3.70	3.54	3.92
3	Nitrogen	N ₂ %	1.80	1.45	1.60
4	Oxygen (by difference)	O ₂ %	8.66	6.70	8.32
5	Sulphur.	S%	0.50	0.60	0.40
6	Carbonates	CO ₃ %	0.58	0.60	0.40
7	Phosphorous	P ₂ %	0.03	0.03	0.04
8	Total Moisture	TM%	15	18	12
9	Ash	A%	40	46	36
10	Total	%	100	100	100
11	Gross Caloric Value (as received basis)	GCV Kcal/Kg	3300	2800	4000
12	Hard grove index	HGI	55	50	60
13	YGP index	mg/Kg	95	110	80

V.IIA/Amend-1/S-XII : 1

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TABLE-II

ASH ANALYSIS					
Sl. No.	Description	Symbol	Design Coal	Worst Coal	Best Coal
1	Silica	(SiO ₂)%	59.79	61.80	56.80
2	Alumina	(Al ₂ O ₃)%	25.36	26.50	23.20
3	Iron Oxide	(Fe ₂ O ₃)%	7.20	6.50	10.00
4	Titania	(TiO ₂)%	1.20	1.00	1.60
5	Phosphoric Anhydride	(P ₂ O ₅)%	2.60	1.90	3.00
6	Lime	(CaO)%	0.88	0.60	1.60
7	Magnesia	(MgO)%	0.55	0.40	1.00
8	Sulphuric Anhydride	(SO ₂)%	1.20	0.50	1.40
9	Alkalies (by diff.)	(Na ₂ O+K ₂ O)%	1.22	0.80	1.40
ASH FUSION RANGE (Under reducing atmosphere)					
1	Initial Deformation Temperature	IDT ^o C	1100	1100	1100
2	Hemispherical Temperature	HT ^o C	1300	1250	1350
3	Flow Temperature	ET ^o C	1400	1400	1400

V.IIA/Amend-1/S-XII : 2

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ANNEXURE-III

TYPICAL MILLS CAPACITY 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 on 4 mills for the following conditions.

The Bidder shall guarantee a capacity output not less than the offered value, at each mill outlet, with coal fineness of not less than 70% through 200 mesh and not less than 98% through 50 mesh screen, when grinding coal having specified grindability index, total moisture content including surface moisture, etc. Bidder shall guarantee that the above capacity will be maintained and demonstrated with the originally installed grinding elements in nearly worn-out condition as mutually agreed for the purpose of ascertaining wear life of any of the wear parts or when pulveriser grinding elements have successfully completed the specified guaranteed hours of operation whichever is earlier. During the above-mentioned operating period of the mill, manufacturer's operation instructions will be followed and mill will be operated with the specified range of coal 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 grindability and surface moisture vary from those given above, the pulveriser measured capacity shall be corrected using the capacity correction curves furnished by the Bidder along with the offer. HGI vs. grindability factor curve shall be furnished for HGI variations up to a value above which the capacity remains constant.

Capacity guarantee shall be conducted on all the mills. However, should the results of test as conducted above indicate that deficiency in capacity guarantee is observed in case of one or two mills only and that Owner is further, convinced that such deficiency does not occur out of reasons attributable to mill manufacture and supplier, Owner may waive off the requirement of demonstration of capacity guarantee for such mills only.

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ANNEXURE-IV

COAL PULVERISER WEAR PART WARRANTY

1. The Bidder shall guarantee the wear life of all wear parts of the mill when grinding the specified range of coals. For this purpose the wear parts shall be defined as those parts of the mill which are in contact with coal or coal dust and are likely to wear out during the operation of the mill. The guarantee shall be demonstrated on each mill during the guarantee trial period (GTP) commencing after establishing successful operation of the mill continuously for a period of not less than 24hours at or near its guaranteed rated capacity. The guarantee trial period shall end as soon as the wear parts have completed their actual wear life or the guaranteed wear life (whichever is earlier) in at least 50% of pulverisers or minimum of five(5) coal pulverisers whichever is higher. The establishment of the guarantee will be based on actual total hours of operation of the mill regardless of the specified range of coal or fuel loading.
2. Minimum Guaranteed Life for grinding elements shall be as indicated in the Cl. 7.0 Page 4 of 12 of BHEL Standard BA35054.
3. The mill wear parts shall be considered to have passed their guaranteed operating life when they have demonstrated their capability to meet the full load rated capacity of the mill at the rated power consumption at the end of the guarantee trial period. In case any of the wear parts has worn out to such an extent that either the normal and safe operation of the mill is jeopardised if it is not replaced/repared or its continued use may lead to exposure or wear of other parts which are not meant for the purpose, that part shall be deemed to have completed its life for the purposes of checking the short fall in wear life even if there is no reduction in mill rated capacity and rated power consumption shall be as quoted by the Bidder when grinding the coal having parameters specified in Annexure-2 and achieving the grind fineness of not less than 70% through 200 mesh and 99% through 50 mesh.
4. The vendor shall provide to the Employer/ Owner so as to compensate for the shortfall in wear life for a plant life of 05 years as has been established. At the end of the GTP, if it is found that any of the wear parts have achieved life of < 50% of guaranteed wear life, the contractor shall replace the wear parts free of cost and commence the GTP again till such time the wear parts are able to achieve wear part life higher than 50% of guaranteed wear life. For wear life between 50% and 100% the compensation to the owner shall be as explained in clause 5 of this section.
5. **Compensation for shortfall in guaranteed/warranted wear life:**
Bidder shall compensate the Owner for the shortfall in wear life for each type of wear parts separately for plant life of 05 years. For the purpose of ascertaining the wear life achieved following method shall be adopted.

The wear life of each set of wear parts/elements shall be recorded for each pulveriser. The average wear life of 50% of pulverisers or minimum of five (5) coal pulverisers whichever is higher to have completed the GTP shall be considered as wear life achieved by the wear parts/element as applicable.

For wear parts/elements that do not fulfill warranty requirements, vendor shall compensate the Employer separately for each type of wear parts for a plant life of 05 years. For example should



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an individual wear part have a warranty shortfall of "H" hours then the bidder shall compensate the owner by handing over as many wearing components calculated below:

$$\frac{(H \times \text{No. of such wearing element in each pulveriser} \times \text{no. of pulveriser} \times 25)}{\text{Guaranteed wear life}}$$

Should the bidder desires to compensate the owner in monetary terms, subject to owners consent, the landed cost at site of as many wearing compents as calculated above, for each type of components may also be offered.

6. Pulveriser Warranty Shortfall Part Settlement (SPS) Procedure (With example)

For all wear parts of each vertical coal pulveriser:

S. No.	Description	Procedure	Example
1	Guaranteed wear life of wear part	(say X hours)	X= 15000 hours
2	Total life achieved by a particular wear part during GTP (say X1 hours by the original installed parts)		X1 = 13000 hrs
3	Shortfall "H" Hours	$H = X - X1$	i.e. 2000 hrs
4	Compensation for shortfall	as per formula	$= (2000 \times 3 \times 8 \times 5) / 15000$ i.e. 16 nos. (to be rounded off to the nearest whole number, in case 0.5 or higher, rounded off to next higher number)

Wear Life during GTP, to be considered for pulveriser wear part warranty shall be as arrived at from the station record for each pulveriser, and as corrected for variation in YGP index of the coal being fired during GTP. For this purpose the coal YGP shall be the average tested value during GTP. The Vendor shall collect the coal samples and get them tested for YGP index at recognized, Employer's approved test lab, periodically. (The frequency of sampling and testing shall be mutually agreed between Contractor & Employer). The YGP index testing shall be done as per the specified BS standard. A jointly signed record shall be maintained during GTP.

Definitions:

Employer	WBPGL
Contractor	BHEL
Vendor	Agency supplying Grinding Elements to BHEL as per BA35054

