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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 7500 running hours (without repair or rebuild of the wear area) for project coal as per Annexure-II, having ash content of about 8.68% - 48.2% & 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 segments for 500 MW or above capacity 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 7500 hrs. (without repair or rebuild of the wear area) with typical high ash Indian coal as given in Annexure I or with the project coal specified in Annexure-II prior to date of techno-commercial bid opening. End user certificate for satisfactory performance shall be furnished 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.
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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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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.

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Documentary evidences/confirmation for the above shall be submitted.

3.0 MATERIAL CODE: See Table

4.0 QUANTITY REQUIRED PER MILL

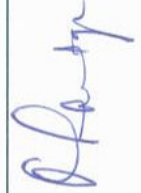
- 1) 3 Nos. Grinding Rolls.
- 2) 1 set of matching Bull Ring Segments.

5.0 MANUFACTURING PROCESS AND QUALITY PLAN:

- 5.1** 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.

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7.0

GUARANTEES:

Wear Life: The minimum guaranteed wear life shall be 7500 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. In case of short fall, supplier shall make one to one replacement of grinding elements to meet the guaranteed wear life.

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 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 metallic boxes set wise to prevent Corrosion and damage during transit. Machined/ Ground 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. 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	BA9735044013
02	HP-1103	Bull ring segment set HP 1103	16111001564	BA9735044021

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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
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 Groove 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

FUEL ANALYSIS - COAL

DESCRIPTION (Source / Type)	UNIT	Design coal 50% Ind+50% Imp	100% Indian Coal	100% Imported Coal
PROXIMATE ANALYSIS				
Fixed carbon	%	35.00	25.31	44.70
Volatile matter	%	25.60	16.49	34.62
Moisture	%	11.00	10.00	12.00
Ash	%	28.40	48.20	8.68
Total	%	100.0	100.0	100.0
HHV	kcal / kg	4375	3000	5750
LHV	kcal / kg			
Ash	kg / 10 ⁶ kcal	64.9	160.7	15.1
ULTIMATE ANALYSIS				
Carbon	%	45.40	32.39	60.36
Hydrogen	%	2.50	1.54	3.49
Sulphur	%	0.70	0.81	0.58
Nitrogen	%	1.10	0.67	1.47
Oxygen (difference)	%	9.90	6.39	13.42
Moisture	%	11.00	10.00	12.00
Ash	%	28.40	48.20	8.68
HARD GROVE INDEX				
		49	98	49
ASH CHARACTERISTICS (Oxidizing Atmosphere)				
IT - Initial deformation temp.	°C	1402	>1450	1234
ST - Softening temp. H = W	°C	>1450	>1450	1270
HT - Hemispherical temp. H = W / 2	°C	>1450	>1450	1321
FT - Fusion temp.	°C	>1450	>1450	1388
ASH CONSTITUENTS				
A - S O ₂	%	53.22	59.72	43.74
A - Al ₂ O ₃	%	25.53	26.60	24.46
B - Fe ₂ O ₃	%	8.96	9.17	8.77
B - CaO	%	4.25	0.42	8.08
B - MgO	%	2.29	1.05	3.53
B - Na ₂ O	%	0.44	0.09	0.78
B - K ₂ O	%	0.84	1.09	0.58
A - TiO ₂	%	1.5	1.55	1.45
P ₂ O ₃	%	0.89	0.14	1.63
SO ₃	%	2.08	0.17	3.98
Base / Acid Ratio				
Fe ₂ O ₃ / CaO Ratio				
Chloride	%			

Note: Coal Analysis considered is same as that of Kothagudem 1 X 800 MW (Cont. No. 1810) as per MOM between BHEL and TSGENCO dated 05/05/2015.

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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 fineness	Pulverised coal	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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