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SPECIFICATION OF MILL CIRCUIT PUMP

1. INTENT OF SPECIFICATION:

This specification is intended to cover the design, engineering, manufacturing, inspection and testing at manufacturer's works, packing and delivery to site, supervision of erection and commissioning of Mill Circuit Pump along with its accessories complete in all respects.

The bidder shall include other items (if required) not mentioned in this specification which are deemed to be necessary for proper operation of the Mill circuit pump as per the OEM design philosophy.

2. APPLICATION:

This is single stage centrifugal type slurry pump. The pumps shall be designed for continuous operation capable of delivering the rated flow at rated head. The mill circuit pump is used to feed the limestone slurry (mixture of limestone and water) to hydrocyclone in wet ball milling system. The pumps shall be suitable for indoor application. The pumps shall be driven by a motor with VFD.

3. SCOPE OF SUPPLY:

Supplier scope shall include Design, Supply and Supervision of Erecting & Commissioning of mill circuit pump, gear box, coupling, motor, VFD, baseplate, along with associated sub systems. It shall cover complete mill circuit pump unit including sub-systems, start-up spares and special tools and tackles.

3.1 Design includes basic and detail engineering, preparation and submission of engineering drawings, calculations, datasheets, quality assurance documents, field quality plans and storage instructions, commissioning procedures, operation & maintenance manuals and performance guarantee test procedures.

3.2 Supply includes manufacturing, shop floor testing, stage inspections, final inspections, painting, packing & transportation to site.

3.3 Supervision of Erection & commissioning includes supervision of erection & commissioning, supervision of trial operation.

Supplier to clearly specify all terminal points in the GA drawing & P&ID and submit it during proposal to confirm scope of supply.

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4. PROJECT DETAILS :

Project	NTPC KORBA
Medium to be handled	Limestone Slurry
Operating Temperature	65 deg C
Total number of milling systems	2
Total pumps in each milling system	2 (1 working + 1 standby)
Total number of pumps	4

5. SLURRY DETAILS :

Solids (limestone) Concentration (w/w)	49
Density of slurry	1446 Kg/m^3
Operating Temperature of slurry	65 Deg C
Vapour Pressure at Pump(kg/cm2)	0.216
SiO2 Content	4 to 6 g/l
pH	6.0 to 8.0
Limestone slurry particle size	92.40% < 250 micron

6. MILL CIRCUIT PUMP CHARACTERISTICS :

6.1 DISCHARGE HEAD: 60 metres of slurry.

6.2 FLOW RATE OF SLURRY: 291.3 m^3/Hr.

7. WEAR PROTECTION:

7.1 All the pump wear parts in contact with the slurry shall be provided with replaceable rubber/elastomer liners suitable for the fluid handled. The Bidder can also offer a Hi-chrome alloy line pump if the Bidder has previous experience of the same for similar applications. The material used by the bidder shall be proven in previous installations.

7.2 The material and thickness of the liners shall ensure a minimum service life of 2 years before replacement.

7.3 All the wear parts of the pump shall be guaranteed for a minimum wear life of not less than 14000 hrs.

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8. COMPONENTS OF MILL CIRCUIT PUMP:

8.1 PUMP CASING :

8.1.1 The pump casing shall be split type for ease of maintenance and shall be designed such that the impeller and shaft can be withdrawn from the casing without disturbing the main pipework and valves carrying the pumped fluid and also without disturbing/removing the motor.

8.1.2 The casing and flanges shall be designed to withstand the 1.5 times the maximum shut-off pressure developed by the pump under maximum suction pressure condition.

8.1.3 Lifting provision of pump as a whole and individual casing halves should be provided.

8.1.4 MOC of casing: ASTM A216 Grade WCC or equivalent/better.

8.1.5 MOC of casing liner : rubber lined / Hi Chrome Alloy (based on experience)

8.2 IMPELLER :

8.2.1 Impeller shall be closed, semi-closed or open type as specified elsewhere and designed in conformance with the detailed analysis of the liquid being handled.

8.2.2 MOC of impeller: ASTM 532 Grade IIIA (Hi Chrome) with minimum hardness of 650 BHN.

8.3 SHAFT AND SHAFT SLEEVES :

8.3.1 Pump shaft shall be sized to transmit the maximum possible output from the motor.

8.3.2 The pump shaft to be so dimensioned that the maximum permissible torque of the shaft is higher than the maximum transmissible torque.

8.3.3 Pumps shall operate smoothly throughout the speed range up to their operating speeds. The first coupled critical speed must be at least 20% higher than the maximum operating speed.

8.3.4 Shafts shall be conservatively designed to transmit maximum power required and to assure rigidity. Shafts shall be machined and ground to close tolerances and shall be tapered to permit easy assembly & withdrawal of the seals and bearings.

8.3.5 Shaft shall run in high precision heavy duty roller bearings.

8.3.6 No exposed part of the shaft shall come in contact with the medium handled.

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8.3.7 Shaft Sleeve should have this as a guaranteed value/parameter to prevent wear and corrosion of mating surface. Bidder to indicate the diameter in data sheet.

8.3.8 MOC of shaft: Stainless AISI-410 Equivalent or better.

8.3.9 MOC of shaft sleeve : SS 316

8.4 BEARINGS :

8.4.1 Heavy duty bearings, adequately designed for this type of service shall be specified in the enclosed pump data sheet and for long, trouble free operation shall be furnished.

8.4.2 The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation.

8.4.3 Antifriction bearings of standard type shall be provided.

8.4.4 If the bearings are oil lubricated, then proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing lubricating element does not contaminate the liquid pumped.

8.4.5 Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearings assembly.

8.4.6 Bearings shall be easily accessible without disturbing the pump assembly.

8.4.7 A drain plug shall be provided at the bottom of each bearings housing.

8.4.8 The Antifriction bearing of the pumps shall be designed for minimum useful life (L-10) of 25,000 hours of continuous operation (Under the design condition). The thrust bearing will be selected for twice the operating load.

8.5 MECHANICAL SEALS :

8.6.1 Mechanical seals shall be of single type with either sliding gasket or bellows between the axially moving face and shaft sleeves or any other suitable type.

8.6.2 The sealing faces should be highly lapped surfaces of materials known for their low frictional coefficient and resistance to corrosion against the liquid being pumped.

8.6.3 The pump supplier shall coordinate with the seal maker in establishing the seal chamber of circulation for maintaining a stable film at the seal face.

8.6.4 For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure even when the pumps are not operating. Seals shall be fleshless type.

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8.6.5 The pump shall be provided with seals of proven type and shall be designed for minimization of seal water consumption**.**

8.6.6 The seal piping system shall form an integral part of the pump assembly.

8.6 BASE PLATE :

8.6.1 A common base plate shall be provided for pump, gearbox & Motor and the same shall be rigidly constructed, adequately braced and provided with finish pads for mounting the equipment.

8.6.2 Common base plate for pump, gearbox and Motor shall be in the scope of the Supplier.

8.6.3 Base plate must have provision for jacking the driver and driven equipment in both directions of base plate for alignment.

8.6.4 Pump manufacturer is to supply base plate along with Foundation bolt & Nut, shims/spacers, "Taper wedge" and the necessary fastener for Pump and Motor with Base plate.

8.6.5 Base plate must be provided with a trough, material of which must be compatible to pumping liquid. Leaked liquid collected in trough, can be systematically routed to designated point.

8.6.6 Base plate must be stress-relieved for any residual welding stress and certificate to that effect is to be submitted as per inspection requirement

8.6.7 MOC of base plate: Carbon steel IS 2062.

8.7 DRIVE MOTOR :

8.7.1 The pumps shall be driven by electric motor with VFD through belt drives.

8.7.2 Drive unit power rating shall be the maximum of the following requirements :

- 20% margin over the pump shaft input power at the rated duty point.
- 5% margin over the maximum pump shaft input power required within the Range of Operation.

8.7.3 The motor shall be as per IEC: 60034-1 with efficiency class IE3.Degree of protection: IP 55. Insulation class: F (temperature rise limited to class B) applicable for VFD application.

8.7.4 For detailed specification of VFD, refer Annexure-II.

8.8 ACCESSORIES:

8.8.1 Bellows and suitable expanders/reducers including counter flanges matching with suction/discharge pipes shall be provided.

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8.8.2 Pressure Gauges shall be provided at suction & discharge of each pump. Pressure gauges of class 1.6 or better must be used. Pressure instrument for measurement of steady pressure at varying conditions shall operate in a band centered on 60% of its maximum range. Pressure gauges shall have a dial size of 160 mm.

9. TECHNICAL REQUIREMENTS:

9.1 Refer Annexure-I for elevation details of slurry levels in mill circuit tank.

9.2 The offered pumps shall be capable of operating satisfactorily in the entire operating range of the pump. Preferred operating range, 40% to 120% of rated parameters.

9.3 Pump efficiency shall be more than 60% and shaft power consumption (in KW) shall be indicated and guaranteed by bidder.

9.4 In the event of power failure, all the running pumps will be shutdown instantaneously, i.e. at the same time. Pumps discharge valve will close fully in 15 sec. During this time, pump shall be capable of handling the reverse flow.

9.5 Pumps must be carefully selected to ensure that the net positive suction head available under all operating conditions will be more than NPSH (required) with adequate margins.

9.6 Pump should have provision for adjusting the axial clearance between casing and impeller for maintaining the performance at best efficiency when there is wear in between impeller and casing.

9.7 Flow induced vibration due to pressure pulsations shall be avoided by suitable design.

9.8 Allowable limits of foundation vibration shall be indicated in foundation drawing and general arrangement drawings.

9.9 The allowable vibration levels shall be indicated in the inspection procedure at shop and shall be demonstrated. The maximum vibration level shall be within permissible level as per the relevant internationally accepted standard.

9.10 Unless otherwise specified, flanges shall be in accordance with ANSI B16.5 Class 150. Counter flanges along with suitable gaskets and fasteners shall be provided for all terminal points.

9.11 The position of earth lugs shall be shown on the GA and/or outline drawing.

9.12 If the driver/driven equipment train is in the resonance condition or any vibration problems occur, the Supplier shall solve the problems in a timely manner. The Supplier shall have responsibility for vibration control of the equipment train at the site and the unit's satisfactory performance.

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9.13 Motor along with VFD and gear box for Mill Circuit pump shall be in the vendor scope of supply.

9.14 Supervision for commissioning shall be included in this scope. This shall be 7 mandays. This amount to be quoted separately. This will be paid on receipt of site certification for completion of activity.

9.15 Vendor shall furnish technical data as per Annexure II and GA drawings with the offer.

9.16 The modalities of inspection (Stage, Final, In-process) shall be finalized during detail engineering after submission of quality plan (QP). It shall be reviewed by BHEL/end customer and customer approved quality plan shall be followed.

9.17 No negative tolerances on rated flow and rated head are allowed.

10. INSPECTION & TEST REQUIREMENTS:

10.1 UT shall be done on shaft forgings which are greater or equal to 40m.

10.2 MPI, DPT shall be done on Shaft and impeller, DPT on casings to ensure freedom from defects.

10.3 The pump casing shall be hydraulically tested at 200% of pump rated head or at 150% of shut off head, whichever is higher. The test pressure shall maintained for at least half an hour.

10.4 The pump rotating parts shall be subjected to first static balancing and dynamic balancing as per ISO 1940 grade 6.3.

10.5 Noise and vibration shall be measured during the performance testing at shop. Noise level at a distance of 1.0 meter horizontally from the equipment and 1.5m above the operating floor at site shall be less than or equal to 85 dB(A).

10.6 Pumps shall be tested at shop for capacity, head efficiency and brake horse power at rated speed as per relevant/applicable standard.

11. TEST CERTIFICATES:

The following test certificates should be furnished in triplicate along with the consignment:

11.1 Non-Destructive test over and above the material test along with results of the following components:

11.1.1 Mechanical Seal- Manufacturer's recommendation.

11.1.2 MPI, DPT test certificates on Shafts and impeller. UT test certificates on Shafts.

11.1.3 DPT on casings.

11.2 Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.

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12. MANDATORY SPARES :

Supplier to quote for below mentioned mandatory spares with break up price.

Sl.No	DESCRIPTION	QTY	UNIT	MATERIAL CODE
1	Impeller Assembly	4	EA	BA9789264011
2	Casing Liners	1	SET	BA9789264020
3	Seals	4	SET	BA9789264038
4	Bearings	1	EA	BA9789264046
5	Motor	1	EA	BA9789264054
6	Gear Box	1	EA	BA9789264062
7	Motor-Pump Coupling	1	EA	BA9789264070

Supplier shall quote for the "Mandatory Spares Part List", and it will be considered for L1 evaluation. Mandatory spare parts items shall not be mixed with the supply of the main equipment parts. Spares shall be sent in pre-decided lots in containers/secure boxes, distinctly marked in red color with boldly written "S" mark on each face of the containers. The packing shall be sufficient for a minimum of 10 years storage in a dry weatherproof building. All spares shall be strictly inter-changeable with the pump parts. All the mandatory spares shall have same specification and quality plan.

13. PAINTING:

13.1 SURFACE PREPARATION : Power Tool Cleaning to St3 (SSPC-SP3)

13.2 PRIMER COAT: Two coats of epoxy resin based epoxy Zinc phosphate to IS: 13238. DFT- 50 microns/coat.

13.3 INTERMEDIATE COAT : One coat of two component epoxy based intermediate paint pigmented with TiO_2.Total DFT: 100 microns

13.4 FINISH COAT :

13.4.1 One coat of Epoxy based finish paint with glossy finish to IS 14209.DFT- 75 microns.

13.4.2 One coat of Acrylic aliphatic Polyurethane paint to IS 13213 DFT- 25 microns

Total DFT min. 300 microns on external surfaces with colour shade RAL 9002 (Grey white).The mentioned DFT shall be maintain on blasted surface only.

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14. SCHEDULE OF GUARANTEES :

Sl.No	DESCRIPTION	DATA	UNIT
1	Rated capacity of pump	291.3	m^3/Hr
2	Total head at design capacity		m of slurry
3	Guaranteed shaft power consumption at rated capacity & head	Bidder to provide	KW
4	Noise level at a distance of 1.0 meter from the equipment at site and 1.5 m above operating floor	< 85	dBA
5	Maximum vibration (peak to peak amplitude at site)	Bidder to provide	microns
6	Pump Efficiency	> 60	%
7	Life of Pump wear parts including, Casing liners, bearing etc	> 14000	Hrs
8	Scheduled Maintenance (Minor Overhauls): Recommended intervals between maintenance outages	> 25000	Hrs
9	Scheduled Maintenance (Major Overhauls): Recommended intervals between maintenance outages	> 75000	Hrs
10	Equipment Availability in % (avg. target 98%) Continuous for 120 days	Bidder to provide	%

15. PACKING:

The pump shall be packed in closed wooden cases to prevent damages during transit and storage at BHEL. The flanged openings shall be protected properly to prevent entry of foreign matter in to the pump. Rain water should not enter into the internals during storage in the outer yard of power plant.

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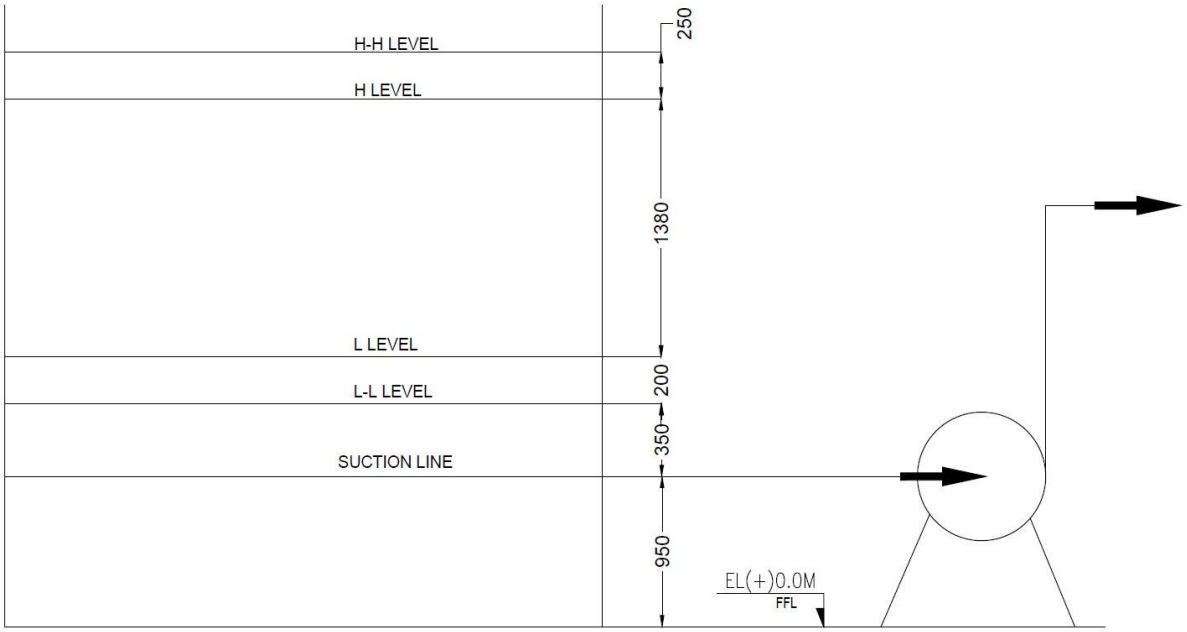
ANNEXURE– I

Mill Circuit Tank Level & NPSH

HH	**Bottom (FFL : 0.00 M) +**	**3130 mm**
H	**Bottom (FFL : 0.00 M) +**	**2880 mm**
L	**Bottom (FFL : 0.00 M) +**	**1500 mm**
LL	**Bottom (FFL : 0.00 M) +**	**1300 mm**
SL	**Bottom (FFL : 0.00 M) +**	**950 mm**



NPSH	SI Unit	Value
NPSH (A)	M of slurry	6

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ANNEXURE–II

SPECIFICATION OF VARIABLE FREQUENCY DRIVE (VFD)

1. General Requirement :

The VFD shall be selected for the motor (refer clause 7.9) which drives the mill circuit pump with variable speed.

2. Application :

The variable speed drive is used to drive the motor of a mill circuit pump in wet ball milling system in an electrical energy-generating power station. The motor drives the pump by means of V belt. A power plant distributed control system provides a signal to the VFD to regulate motor speed. The signal will be 4 to 20 mA DC. The motor and drive will be installed in a power plant application requiring reliable and continuous operation 24 hours per day and 365 days per year with minimal downtime maintenance.

3. Environmental Conditions :

The drive is to operate within an environment with temperatures ranging from 0°C to 50°C. The motor is to operate within an environment with temperatures ranging from 0°C to 50°C. The equipment, motor will be located in an area in which is in dusty environment which will result in the material settling on the equipment. The motor will be installed less than 500 meters from the VFD.

4. Scope of Supply :

4.1 Variable frequency drive to meet specified electrical, control and construction requirements.

4.2 Variable frequency drive with enclosure cabinet with wired local control panel and necessary switchgears. Cabinet shall be of Rittal/ ABB or Siemens make. The cabinet shall have thermostatically controlled air conditioner. The dimension of cabinet shall not exceed 2000 x 800 x700. All the operation & display shall be possible from front door of the panel without opening the door. It should be min. IP54.

4.3 VFD shall be provided with air cooled arrangement.

4.4 Certified drawings.

4.5 The Supplier shall indicate if output line reactors are required to prevent impedance mismatches and potential damage to the motor from voltage spikes. If output line reactors are required, the Supplier must quote them as an option

4.6 It is the supplier's responsibility to ensure the supplied VFD is satisfying all functional requirements as per clause 9.Vendor to include any or all

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accessories/equipment for the same even if not mentioned in this specification.

5. Power and speed requirements :

Vendor shall select the speed range of motor with VFD as per pump functional requirement.

6. Noise Requirements :

The Supplier shall furnish the drive motor to a maximum predicted sound pressure level of 85 dBA, measured 3 ft (1 m) horizontally from the surface of the motor. Allowable sound pressure level applies to one motor with negligible sound contributed by other equipment.

7. Low Voltage Starting:

The motor and drive must be capable of starting without damage to the motor with a supply voltage range of 90 – 110 % of motor nameplate voltage. The motor must also be capable of starting with 80% motor nameplate voltage.

8. Surface Preparation and Paint :

Equipment shall be prepared and painted per manufacturer's standard for a minimum of 10 year power station operating life in a tropical environment. Equipment must arrive at the site with a finished coat.

9. Variable Frequency Drive Requirements :

9.1 The system offered shall be energy efficient, provide very high reliability, high power factor, low harmonic distortion, low vibration and noise. It shall be easy to install with minimum time and expense and no special tools shall be required for routine maintenance.

9.2 The system shall be suitable for the load characteristics and the operational duty of driven equipment. It shall be capable of withstanding the thermal and dynamic stresses and the transient mechanical torques, resulting from short-circuit. Any damage resulting from such a short-circuit or internal fault shall be limited to the component concerned.

9.3 In case of failure of VFD, for any reason, VFD shall have an in-built facility to immediately isolate VFD output and switch-On motor in DOL condition, via a bypass breaker.

9.4 The system shall be either of speed, torque or power controlled as dictated by the driven equipment.

9.5 The system shall be suitable for continuous speed control of the motors in single drive system as per data sheet and soft start feature shall be provided to reduce the disturbances in the electrical system.

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9.6 The drive will vary the frequency of the supplied AC power to control motor speed according to a signal from the plant distributed control system (DCS). A 4 to 20 mA DC signal from the DCS will represent 0 to 100% motor speed .VFD to have facility for user to configure range of speed for 4-20mA input signal.

9.7 The drive motor shall be speed regulated to a speed corresponding to purchaser's 4-20mA reference signal. Upon complete loss of the DCS speed reference signal, the drive shall automatically run at constant speed as determined by the last speed reference available prior to the loss of signal.

9.8 All components of the drive system shall be mounted in an IP-54 enclosure fully accessible from the front.

9.9 The drive shall also include the

9.9.1 Electric Thermal overload protection.

9.9.2 Potential free contacts for local indication in control room for following functions : Supply Healthy, Run, Trip, Stop

9.9.3 4-20 mA signal follower.

9.9.4 Local Control panel, mounted on VFD panel, for user operation, with functions as per clause 12.

9.9.5 Connection for control keypad to be through the cabinet door.

9.9.6 Current limit adjustment 50% to 150% of drive rating

9.9.7 Independent acceleration and deceleration ramps adjustable from 0.1 of a second to 1800 seconds.

9.9.8 Slip compensation to improve speed regulation.

9.10 Power semi-conductors shall be IGBT (Isolated Gate Bipolar Transistor) type. Fast switching SCRs are not acceptable.

9.11 Vendor to select operation / type / quadrant of operation of VFD to be suitable for load / application characteristics.

9.12 The modulating control scheme shall closely approximate actual sine wave current throughout the speed range of the drive.

9.13 The regulator shall be fully digital with microprocessor control of frequency, voltage and current.

9.14 Speed resolution shall be within +/- 1 RPM.

9.15 All drive adjustments and custom programming, configuration etc. shall be capable of being stored in a non-volatile memory.

9.16 The drive shall be designed to protect itself against instantaneous current levels above 200% of its rating. The drive shall continue to operate through instantaneous current spikes below 200%.

9.17 Isolation transformers shall not be used to eliminate possible line converter notching of the input filter. The drive shall not be sensitive to line notching from other drives.

9.18 The drive shall be capable of automatic restart upon power failure or momentary source voltage dips, and restarting into a rotating motor at any speed without tripping.

9.19 The drive shall actively monitor its output current and frequency and shut down the drive if the motor is in a stall condition. A stall condition is defined as

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operating in current limit at or below 10 Hz for 10 seconds. This definition of stall shall be field adjustable to match the application.

9.20 Power capacitor voltage levels shall be discharged below 50 volts within one minute of de-energization or less per NEMA and NFPA standards.

9.21 The input displacement power factor of the drive shall be a minimum of 0.95 at all speeds and loads above 10% load.

9.22 Drive efficiency shall be evaluated and the Supplier shall provide drive efficiency curves for 0% to 100% speed at 25, 50, 75, and 100% rated load. Minimum acceptable efficiency shall be 97% at full load.

9.23 The drive shall be capable of operating with the output open circuited.

9.24 The Total Harmonic Distortion for Voltage and Current Harmonics shall be in line with latest revision of IEEE 519 standard at the supply side of the drive system based on the short circuit capacity of the bus.

10. Drive Protection :

Drive protection functions shall operate independent of the microprocessor control logic and shall include as a minimum:

10.1 Over current protection
10.2 Short circuit protection.
10.3 DC bus under voltage protection.
10.4 DC bus over voltage protection.
10.5 Over temperature protection.
10.6 Ground fault protection.
10.7 Electronic thermal overload monitor.
10.8 Settings for trip / alarm settings shall be user configurable either through software interface / local control panel.

11. Drive Diagnostics :

The drive shall include first fault indication in the protection functions and ability to store 20 successive fault indications in order of occurrence. As a minimum, the following fault indications shall be displayed on the local operator control panel:

11.1 Over current
11.2 Short circuit
11.3 Under voltage or phase loss
11.4 Over voltage
11.5 Over temperature
11.6 Motor Thermal overload

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12. Drive Controls :

12.1 The drive shall be supplied with a local control panel which shall include the following operating functions

12.1.1 Drive Start and Stop

12.1.2 Fault reset

12.1.3 Provision to increase or decrease the local speed reference with accuracy to 1 RPM.

12.1.4 Local/remote selection.

12.2 The local control panel shall include a digital display to monitor the following functions:

12.2.1 Local frequency reference

12.2.2 Motor load calibrated in amps

12.2.3 Output frequency

12.2.4 Output voltage

12.2.5 Remote frequency references

12.2.6 Fault diagnostic messages

12.2.7 Trouble shooting test points

12.2.8 Motor speed

12.3 The local control panel shall be the operator interface for making all drive adjustments. Internal adjustments are not permitted.

12.4 The drive shall also include provisions for the following hard wired inputs and outputs for remote operator controls:

12.4.1 Digital inputs, 24 VDC contacts from plant controls including: 1 Drive start 1 Drive stop 1 Remote control selector 1 Run at present speed.

12.4.2 Digital output relay contacts 5 Amps 125 VDC / 250 VAC rating, 1 Drive off, 1 Drive running, 1 Drive fault.

12.4.3 Analog input for reference signal, 4 to 20 mA.

12.4.4 Analog output signal, 4 to 20 mA and/or 0 to 10 VDC to transmit output frequency and speed.

12.5 The drive is to be factory programmed and wired for:

12.5.1 having the speed ramped as a function of a 4 to 20 mA signal input

12.5.2 any trouble with the drive is to give a dry fault contact

12.5.3 the drive is to get its start and stop signal as an input contact from the DCS.

12.5.4 the drive is to output a signal indicating the motor speed.

12.5.5 the drive is to be programmed for an acceleration ramp of 60 Hz/180 seconds.

12.5.6 the drive is to be programmed for a deceleration ramp of 60 Hz/180 seconds.

12.5.7 the drive is to be programmed so that during a start cycle it will catch and stop a reversed spinning load before it starts it in the correct direction.

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12.5.8 the drive is to be programmed so that if there is a loss of load it will trip and send out a fault signal.

12.5.9 the drive is to be programmed so that if the power (current) exceeds the motor name plate rating for more than 3 seconds, it will trip and send out a fault signal. This shall be configured from LCP.

13. Quality Assurance :

13.1 All work is to be done in accordance to the Manufacturing Quality Plan and so documented.

13.2 All material, components and subassemblies shall be inspected and/or tested for conformance to these specifications and Supplier's engineering and quality assurance specifications.

13.3 The Supplier shall on request make available for review copies of Supplier Quality Assurance Policy, documentation, and records pertinent to equipment purchased.

13.4 The drive is to conform to NEMA, IEEE, UL and IEC standards.

14. Testing :

14.1. Type Test & Routine Tests like, No load tests, Insulation test, Functional test, Rate current test & Visual inspection, etc.

14.2. No load tests includes: Motor shaft voltage & Vibration severity measured at bearing housing, etc.

14.3. Insulation test (vendor to specify with relevant standards).

14.4. During Inspection, any physical damage or non-working of the unit shall be replaced with new units**.**

15. Document submission :

1. Recommended Spare Parts List (motor and drive)
2. Drive Electrical Schematic Drawing
3. Drive Dimensional Drawing
4. Drive Parameter List -Settings
5. Drive Installation, Operation and Maintenance Manual (Electronic pdf format)
6. General Arrangement drawing, Test certificates, conformance certificates.

16. Preservation and Packaging :

16.1 The material is to be preserved for long term storage (two years minimum) without additional onsite preservation activities.

16.2 The motor and drive to be boxed in shrink-wrap covering.

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ANNEXURE–III

MILL CIRCUIT PUMP - BA9789264003

TECHNICAL DATA		
Sl No	Description	Vendor's Compliance/Data
1	Make	
2	Application	Slurry Pump to feed Limestone slurry to Hydrocyclone cluster
3	Capacity (m3/hr.)	
4	Discharge Head (m)	
5	Net Positive Suction Head(Req)	
6	Solids concentration % (w/w)	49
7	Qty (Reqd.)	4
8	Pump Speed	
9	Efficiency (%)	
10	Discharge diameter of the pump (mm)	
11	Suction diameter of the pump(mm)	
12	Impeller diameter (mm)	
13	Impeller type	
14	Impeller Tip Speed (m/sec)	
15	Shaft diameter	
16	Maximum solid particle size (mm)	
17	Mechanical seals	
18	Bearing make and model	
19	Bearing lubrication arrangement	
20	GD2 value at drive shaft end	
21	Motor Make and model	
22	Absorbed Power (kW)	
23	Motor Rating (kW)	
24	RPM of motor	
25	Frame Size of motor	
26	Motor Mounting arrangement	Horizontal
27	Type of Drive	
28	Noise Level dB(A)	
29	MOC of Casing	

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30	MOC of Casing Liner	
31	MOC of Impeller	
32	MOC of Shaft	
33	Total weight of all components	
34	Performance curve	
35	Submission of test certificates	

RECORD OF REVISIONS

REV .NO	DATE	REVISION DETAILS	REVISED	APPROVED

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