Lycopodium

MECHANICAL SPECIFICATION

5004-MS-057

for the

DESIGN, MANUFACTURE AND SUPPLY

of

GYRATORY CRUSHER

for the

AHAFO MILL EXPANSION PROJECT (GHANA)

TABLE OF CONTENTS

ATTACHMENTS

- Duty Specification
- Data Sheets

REFERENCES

- Request for Quotation – RFQ J5004-5002
- Refer to Section 2 - Standards and Code List

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1	13.06.12	REISSUED FOR TENDER				
0	16.02.12	ISSUED FOR TENDER	SRO	MBa/DJT	PS	

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1.0 SCOPE OF WORK

This purchase specification covers the design, manufacture and supply of a gyratory crusher as per the attached data sheets.

All deviations from the requirements of this specification shall be stated in the tender documentation. In the absence of such statements, it shall be understood that all requirements of this specification have been fulfilled without exception.

1.1 Work Included

Work shall include, but not be limited to, the following items:

- Gyratory crusher assemblies, as specified.
- Crusher drive assembly inclusive of electric motor, motor drive base, jack shafts, couplings, etc. and all necessary guards to ensure safe operation.
- Electrical junction boxes.
- Main drive motor liquid resistance starter.
- Packaged lubrication system mounted on a fabricated mild steel base including provision for tramp relief and gap adjustment, complete with a local control panel.
- Hydraulic shell separators.
- Integrated electrical control panel for the lubrication system.
- Crusher hydroset trolley.
- Shop assembly and testing of the gyratory crusher sub-assemblies where practicable.
- Furnishing a field supervisor at job site, if required.
- Any additional instrumentation and devices required to provide a safe, efficient overall operation that ensures equipment and personnel protection.
- Drawings, data and documentation (to be provided with Tender and After Award) as necessary for verification to the Contract requirements and compliance with General Specification DD-001 and DD-003.

1.2 Work Excluded

The following items are specifically excluded from the scope of this specification and will be supplied by others:

- Foundations and/or structural supports, including any grouting and anchor bolts / hold down bolts.
- Electrical control panels except those associated with the lubrication system.
- Motor starters other than for the main drive motor.
- All power, control and instrumentation cabling other than wiring supplied on pre-wired skid mounted packaged equipment and within the Supplier provided control panels.
- Configuration and supply of the PLC system.
- Lubricants and greases, other than initial quantities applied during assembly and testing.
- Unloading at site and erection / assembly into the plant.

2.0 STANDARDS AND CODES

The latest revisions (including all amendments) of those standards and project specifications listed below and/or nominated on the design drawings shall form part of this specification and shall apply wholly or partially as necessary for the execution of the work.

Notwithstanding the standards referenced herein, all work performed and all materials furnished shall conform to the Rules and Regulations of the Statutory Authority having jurisdiction over the work under the Contract, including all referenced documents.

2.1 Standards

The equipment shall comply to the latest edition of the following standards.

AS 2129	Flanges for pipes, valves and fittings
AS 4024.1 (Series)	Safety of machinery
AS/NZS 3000	Electrical installation - Wiring Rules (Australian / New Zealand Standard)

2.2 Project Specifications

5004-DD-001	General Specification - Technical Information Requirements	
5004-DD-003	General Specification - Quality Assurance Requirements	
~~5004-EQ-008~~	~~Electrical Equipment Specification - High Voltage Electric Motor~~	*[1]*
5004-EQ-014A	**Electrical Equipment Specification – Low Voltage Liquid Resistance Starters**	*[1]*
~~5004-EQ-014B~~	~~Electrical Equipment Specification - High Voltage Liquid Resistance Starters~~	*[1]*
5004-ES-001	Electrical Specification - Low Voltage Electric Motors	
5004-ES-002	Electrical Specification - Electrical Control Panels, Distribution Boards and Marshalling Panels	
~~5004-ES-008~~	~~Electrical Specification - High Voltage Electric Motors~~	*[1]*
5004-ES-014	Electrical Specification - High and Low Voltage Liquid Resistance Starters	
5004-ES-020	Electrical Specification - Preferred Electrical Equipment List	
5004-GDS-001	Site Data Sheet	
5004-MS-001	Mechanical Specification - Surface Treatment and Finishes	
5004-MS-018	Mechanical Specification - Mechanical Plant and Equipment	
5004-TS-001	Transport and Shipping Specification – Export Packing Instructions	
5004-TS-002	Transport and Shipping Specification – Export Documentation and Marking Instructions	

3.0 GENERAL REQUIREMENTS

All components shall be capable of operating continuously in an environment containing high concentrations of fine, abrasive dust and at the extremes of ambient temperature specified for the site.

All materials of construction for this equipment, components and accessories shall be new, suitable for the service and meet the requirements of codes as specified under Section 2.0.

The components shall have minimum split sections determined by shipping weight or dimensional limitations for the intended job site.

4.0 MECHANICAL REQUIREMENTS

4.1 Crusher

- A means of tramp relief and adjusting the open side setting shall be provided.

4.2 Crusher Lubrication System

- The use of grease or oil lubricants or a combination of the two is acceptable.
- If a circulating oil system is offered it shall, as a minimum, incorporate the following features:

- Be self contained and fan cooled to ensure that overheating does not occur under the most adverse conditions specified.
- If required provide a thermostatically controlled oil heating system for cold weather operation under at the most adverse condition specified. The heater will be controlled by remote PLC system (provided by others).
- Include a fabricated steel oil reservoir with the following features:
    - Valved drain point.
    - Gasketed inspection cover.
    - Sealed filter with integral strainer.
    - Tank breather connected to a bladder inside the tank.
    - External oil level indicator.
    - Fitted with an oil catch tray to contain 110% of largest oil tank:
- Be fitted with suitable duty and standby hydraulic oil pumps including suitable actuator for variation of pump capacity, flexible couplings, guards and standard foot mounted motors, all assembled onto a common base plate.
- Include a full flow renewable duty and standby, cartridge type filtration system with visual indication of the filter element condition.
- Be fitted with the following minimum levels of instrumentation and protective systems.
    - Adjustable pressure relief valve, if required.
    - Supply oil pressure gauges.
    - A supply oil low pressure switch operating two sets of voltage free contacts of 2A/110 V rating for remote alarm indication and control.
    - Supply and return oil local temperature indicators.
    - A supply oil low flow switch operating two sets of voltage free contact (rated 2A/110 V) for remote alarm indication and control.
    - Return oil temperature switch operating two sets of voltage free contact (rated 2A/110 V) for remote alarm indicator and control.
    - Sight glasses on the lube and MPS tank reservoir.

As a minimum all equipment components shall, where applicable, conform to Mechanical Specification MS-018.

5.0 ELECTRICAL REQUIREMENTS

All gyratory crusher controls and interlocks will be performed by a remote PLC system provided by others.

The operation and control of the gyratory crusher will be performed from a remote control room and SCADA system, provided by others.

The power supply to the main drive motor shall be as nominated in the Duty Specification.

All low voltage, 3 phase electric motors shall comply with Electrical Specification ES-001.

All control panels shall comply with Electrical Specification ES-002.

All high voltage electric motors shall comply with Electrical Specification ES-008.

All electrical equipment / components shall comply with Electrical Specification ES-020.

All wiring shall conform to AS/NZS 3000.

5.1 H.V. Main motors

The main drive motor(s) shall comply with the Electrical Specification ES-008 ~~and Electrical Equipment Specification EQ-008~~. ***[1]***

5.2 Main Motors Secondary Liquid Resistance Starter

The main drive motor(s) shall be design to work with a Secondary Liquid Resistance Starter (LRS) to soft start the crusher while keeping the starting current low.

The LRS shall comply with Electrical Specification ES-014 and Electrical Equipment Specification EQ-014A ~~EQ-014B~~. ***[1]***

5.3 Lubrication Control Panel

The Supplier shall provide an integrated local control panel for the lubrication package, complying with Electrical Specification ES-002.

The panel shall include as a minimum:

- Termination of all instrumentation from the lubrication package / skid.
- Stop / Start push buttons for all lubrication system drives.
- Fault and diagnostic lights for local trouble shooting the lubrication skid equipment.
- All push buttons and other instrumentation terminated in the control panel shall be wired to individual terminals, complying with Electrical Specification ES-002.

All control of the lubrication package will be from remote PLC system provided by others. Wiring from the lubrication control panel to the remote PLC system will be by others.

5.4 Programming

The Supplier shall provide a detailed logic description, in the Purchaser's standard format, of the entire crusher operation and interlocks. The Purchaser will use this logic description to configure the plant PLC to operate the crusher.

The Supplier shall review and approve the final crusher operation PLC logic prior to the installation of the software for the Factory Acceptance Testing (FAT), in LMCL's Mississauga Office, Ontario Canada.

6.0 SURFACE PROTECTION

The equipment called for herein shall be factory finished and painted in accordance with the Manufacturer's standard finish.

Painting and factory finish shall be suitable for outdoor installation and exposure to the elements. Standard colours shall be submitted with proposal for Owners selection.

Any fabricated components, i.e. platework and steelwork, shall be factory finished and painted in accordance with Mechanical Specification MS-001. Wet end components, such as casing, made from cast stainless steel or duplex alloys may be left clean with no extra surface protection.

7.0 ASSEMBLY AND TESTING

Lycopodium or a designated inspection agent shall have access at any time to the work while it is in preparation or progress and the Supplier shall provide proper facilities for such access and inspection.

Equipment shall be completely shop assembled to ensure proper fit of all components including drive guards.

The inspection procedures shall be in accordance with the Manufacturer's standards or as required by specific codes.

A copy of inspection and test reports for materials used shall be available upon request by the purchaser.

Components that must be disassembled for shipment shall be properly match marked.

7.1 Preparation for Shipment

The goods shall be shipped to the nominated delivery point in accordance with the following instructions:

- Packaging and transportation of equipment and materials, to the nominated delivery point, shall comply with the Transport and Shipping Specification TS-001.
- Documentation, delivery and shipping package marking of goods shall comply with the Transport and Shipping Specification TS-002.

All connections, flanges and openings shall be thoroughly sealed to prevent the ingress of fine dust, moisture or other harmful objects into the equipment.

Equipment sensitive to water damage shall be protected to preserve it in a dry state for up to 6 months during transport, storage and installation when subject to heavy, driving rain.

Damage to equipment resulting from inadequate packaging shall be rectified at the Supplier's expense.

8.0 PERFORMANCE GUARANTEE

The Supplier shall provide a performance guarantee for the crusher throughput and product size as nominated in the Duty Specification.

9.0 EQUIPMENT SUPPLY LIST

Scope of supply shall include, but not be limited to, the following equipments:

11-CR-201	Primary Gyratory Crusher No. 2	
11-CR-201-M1	Primary Gyratory Crusher No. 2 – Drive Motor	
11-RS-201	Primary Gyratory Crusher No. 2 - Liquid Resistance Starter.	
11-ZM-204	Primary Gyratory Crusher No. 2 - Lube Pack	
11-ST-202	**Primary Crusher Drive Frame**	***[1]***
~~11-ZM-235~~	~~Hydraulic Shell Separators~~	***[1]***
11-ZM-233	**Primary Crusher Lubrication Oil Cooler**	***[1]***
11-CN-201	Crusher Hydroset Removal Trolley	

DUTY SPECIFICATION

Equipment Name	Primary Gyratory Crusher No. 2			
Equipment Number(s)	11-CR-201			
No. of Units Required	1			
Process Description	ROM ore will be trucked by CAT 785 haul packs from the open pit to the ROM pad and direct tipped to the primary crusher dump pocket. At times, CAT 992 loaders will also be used to tip ore into the dump pocket. Trucks will be capable of tipping into the ROM dump hopper from two (2) sides.			
Duty Cycle	Continuous operation, however, long periods of off-load operation may be experienced due to the cyclic nature of the operation.			
Ore Characteristics				
	Operating	**Design**	**Performance Guarantee (By Vendor)**	
Feed Size Gradation				
• F_{100}, mm	1,300	1,300		
• F_{80}, mm	450	450		
• % minus 100 mm	30% for primary ore	30% for primary ore		
Crushing Work Index, kW h/t	30.3 – 34.2	34.2		
Unconfined Compressive Strength, MPa	99 - 100	100		
Bond Rod Mill Work Index, kW h/t	21.3 - 23.3	23.3		
Bond Ball Mill Work Index, kW h/t	14.2 - 18.3	18.3		
Bulk Density, t/m³	1.1 – 1.7	1.6		
Specific Gravity	2.71 – 2.83	2.78		
Abrasion Index	0.18 - 0.45	0.45		
Moisture Content, %	0 - 5	5		
Process Requirement				
Crusher Throughput				
• Dry, t/h	1,149	1,839		
• Wet, t/h (2.5% moisture)	1,178	1,885		
Product Size				
• P_{100}, mm	300	300		
• P_{80}, mm	140	140		
Mechanical Requirements				
Crusher Type	Gyratory			
Crusher Selection	~~60-110~~ **60-89** Gyratory Crusher or equivalent			***[1]***
Installed Motor Power, kW	+ ~~1,000~~ **600** kW			***[1]***
Starting Method	LRS			
Drive Type	Motor direct coupled to crusher			
Electrical Requirements				
Main Drive Motor Power Supply	~~11 kV~~ **415 V**±10%, 50 Hz ± 2%, 3 ph			***[1]***
Other Motors	415 V ± 10%, 50 Hz ± 2%, 3 ph			
Lubrication Control Panel				
• Voltages (Refer ES-001, ES-002)	120V, 1 ph, 50 Hz			
• Indoor / Outdoor	Outdoor			
• Type (Refer ES-002, Section 7.0)	IP 65 - 316-SS			

Feed Gradation

Size (mm)	Cumulative % Passing
1,300	100
1,000	97
500	84
200	50
100	30
50	17
10	5
1	2

Other

1. The operating figures represent the nominal operating condition. The equipment shall be selected for the design point duty.
2. The main drive motor shall be of the wound rotor type and suitable for connection to a LRS.
3. All liners shall be manganese steel. The Supplier shall provide complete liner details.
4. If the concave liner life exceeds that of the mantle the Supplier shall provide complete details of the oversize mantle liners that will be required to be fitted to ensure the product P_{80} size is maintained after concave liners have worn. The Supplier shall provide liner change out sequence details and estimated liner lives (eg. concave row 1, concave row 2, etc. and mantle).
5. The lubrication unit, will be located a maximum of 20 metres, including 8 metres static lift, from the crusher.
6. All motors shall be tropic proofed.
7. The Supplier shall provide pricing for a spare mantle assembly (Mainshaft included).
8. The Mainshaft Positioning System (MPS) shall include two balance cylinders and associated piping.
9. Data According to PC 5004-PDC-001 Rev. B

AHAFO MILL EXPANSION PROJECT (GHANA)

SUPPLIER DATA SHEET

INFORMATION TO BE SUPPLIED BY VENDOR

Equipment Name	Primary Gyratory Crusher No. 2
Equipment Number(s)	11-CR-201
General	
Manufacturer	
Make / Model	
Performance Characteristics (at Design Condition and New Liners)	
Recommended Open Side Setting, mm	
Recommended Throw, mm	
Rated Capacity at Recommended OSS, tph	
Predicted Product Gradation	
Predicted P_{80}, mm	
Predicted Power Draw, kW	
Installed Power, kW	
Crusher Characteristics	
Min / Max Open Side Setting, mm	
Method of Adjusting OSS	
Min / Max Throw, mm	
Method of Adjusting Throw	
Max Capacity at Recommended OSS, tph	
Power Required to achieve Max Capacity at Recommended OSS, kW	
Eccentric Speed, RPM	
Eccentric Shaft	
• Diameter, mm	
• Materials	
Crusher Bearings	
• Upper Bearing (Spider)	
• Lower Bearing (Hydroset)	
• Drive Shaft	
Liners	
Material	
Brinell Hardness	
Number of Pieces, total	
Weight of Heaviest Piece, kg	
Total Weight of Liners, kg	
Expected Life / Ring, t crushed ore	
Lubrication System	
Manufacturer	
Make / Model	
Type	

Capacity – l/s @ rpm	
Maximum Pressure Rating, MPa	
Lube Pump Motor	
Manufacturer	
Type	
Volt / Phases	
Frame Size	
No. of Poles	
Speed, rpm	
Full load current, Amps	
Rating, kW	
Pump Power / Current Draw	
Hydraulic Oil	
Tank Capacity, l	
Recommended Lubricant	
Heater	
Manufacturer	
Make / Model	
Type	
Voltage, V	
Rating, kW	
Cooling System	
Manufacturer	
Make / Model	
Type	
Rating, kW	
Fan Motor	
Manufacturer	
Type	
Volt / Phases	
Frame Size	
No. of Poles	
Speed, rpm	
Full load current, Amps	
Rating, kW	
Filter	
Manufacturer	
Make / Model	
Type	
Particulate Removal, μm	
Mass, kg	

Instrumentation	
Flow Controller	
Type	
Manufacturer	
Closed Loop Speed Control	
Flow Sensors	
Type	
Manufacturer	
IP Rating	
Level Sensors	
Type	
Manufacturer	
IP Rating	
Pressure Transmitters	
Type	
Manufacturer	
IP Rating	
Thermostats Transmitter(s)	
Type	
Manufacturer	
IP Rating	
Control Panel	
Manufacturer	
IP Rating	
Description / Layout	
Size (H x W x D)	
Equipment Make / Model	
• Indicator Lights	
• Pushbuttons	
• Latching Stop Buttons	
Miscellaneous	
Is the Crusher a Standard Unit? Yes / No	
List of Modifications	
Materials of Main Frame Construction	
Crusher Installed Weight, kg	
Largest Component for Transport, kg	
Largest Component for Installation, kg	
Drive System	
Coupling Type	
Coupling Make / Model	
Crusher Inertia (at Driven Speed), kgm^2	
Drive Motor	
Manufacturer	
Type	

Volt / Phases	
Frame Size	
No. of Poles	
Speed, rpm	
Rated Power, kW	
Locked Rotor Current, A	
Full Load Current, A	
Enclosure	
Insulation Class	
Full Load Efficiency, %	
Full Load Torque, Nm	
Service Factors	
Starting Torque Percent of Full Load, %	
Bearing Type	
Bearing B_{10} Life, hours	
Lubrication Method	
Motor Inertia, kgm^2	

Other

1. To assist the Engineer in evaluating the bid, the Supplier shall also provide:

2. A technical specification for all of the various components that constitute a complete package, i.e. crusher, drive train, lubrication system, cooling system.

3. A P&ID of the proposed lubrication and cooling system.

4. A motor (and ancillary devices) listing for all of the ancillary equipment including:

    - Manufacturer
    - Type
    - Volts / Phases
    - Frame Size
    - No. of Poles
    - Full Load Current, A
    - Rating, kW
    - Motor Terminal Box and Cable Gland Size

5. Details of the proposed painting systems as it applies to each of the various components.

6. A commentary describing the extent of compatibility of the proposed equipment and/or its individual components with other equipment within the Purchaser's Operations.