



MECHANICAL SPECIFICATION

1988-000-MESPC-0050

for the

DESIGN, MANUFACTURE AND SUPPLY

of

SEWAGE TREATMENT PLANTS

for the

BANFORA GOLD OPERATION

TABLE OF CONTENTS

1.0	Scope of Work
2.0	Standards and Codes
3.0	General Requirements
4.0	Mechanical Requirements
5.0	Electrical Requirements
6.0	Surface Protection
7.0	Assembly and Testing
8.0	Performance Guarantee

ATTACHMENTS

- Duty Specification Sheets
- Supplier Data Sheets

REFERENCES

- General Datasheet - 1988-000-GEDAS-0001 - Site Data Sheet
- General Specification - 1988-000-GESPC-0003 - Technical Information Requirements
- Electrical Specification - BAN-0003-E-TS-005 - Low Voltage Motors
- Electrical Specification - BAN-0003-E-TS-008 - Control Panels and Cubicles
- Electrical Specification - BAN-0003-E-TS-009 - Electrical Equipment Supplied with Packages
- Electrical Specification - BAN-0003-E-TS-011 - Preferred Electrical Equipment
- Mechanical Specification - 1988-000-MESPC-0018 - Mechanical Plant and Equipment
- Transport and Shipping Specification - 1988-000-GESPC-0001 - Packing Instructions
- Transport and Shipping Specification - 1988-000-GESPC-0002 - Documentation and Marking Instructions

0	10/08/2017	ISSUED FOR TENDER	AEW	pe		
REV NO.	DATE	DESCRIPTION OF REVISION	DESIGNED	DESIGN APPR'D	PROJECT APPR'D	CLIENT APPR'D

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1.0 SCOPE OF WORK

This purchase specification comprises all work to be undertaken for the design, manufacture and supply of sewage treatment plants in accordance with the attached Duty Specification Sheets, Supplier Data Sheets and Contract documents.

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:

- Packaged sewage treatment plants complete with:
 - lift station tank
 - submersible sewage grinder pump
 - surge chamber
 - airlift pumps
 - aeration chamber
 - clarifier chamber
 - holding tank
 - chlorine contact chamber
 - GRP grease trap to be installed on the kitchen drain
 - filtration system should consist of filter feed pump, on/off float switch, FRP tank, internal distribution system, gravel, activated carbon and anthracite
 - blowers
 - coagulant dosing system includes dosing pump and tank
 - chlorine dosing system includes dosing pump and tank
 - anti-foam dosing system includes dosing pump and tank
 - rubber diaphragm membrane diffusers
 - grey water disposal tank and pump
 - feed pre-screening system.
- All other necessary pumps, piping, control valves, gauges, meters, etc. to enable the plant to be set-up and operated automatically.
- Design drawings for civil works, excluding earthworks.
- A set of matching suction and discharge flanges bolted to the pump suction and discharge connections and at other mating flanges, if these do not conform to ANSI B16.5.
- A prewired control panel containing all instrumentation and control devices, circuit breakers, motor starters, drive stop / start push buttons and run lights, etc.
- Lighting in all indoor parts of the plant.
- Surface protection.
- All power, control and instrumentation cabling between the control panel, motor starters and field devices integral to the sewage treatment plant.
- Shop assembly and testing.
- Furnishing a field supervisor and/or commissioning engineer at the 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 specification 1988-000-GESPC-0003 - Technical Information Requirements.
- Packaging, transportation and delivery to the nominated delivery point in accordance with the Transport and Shipping Specifications 1988-000-GESPC-0001 and 1988-000-GESPC-0002.

1.2 Work Excluded

Excluded from the Supplier's supply shall be the following:

- Foundations, including any anchor bolts / holding down bolts.
- Supply and installation of all piping external to the sewage treatment plant.
- Supply and installation of all power, control and instrumentation cabling external to the sewage treatment plant.
- Lubricants and greases, other than initial fill quantities applied during shop assembly.
- Unloading at site and erection / assembly into the plant.
- Sludge tank.

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 and documents 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.

2.1 Standards

AS 1657	Fixed platforms, walkways, stairways and ladders - Design, construction and installation
AS 4024 (Series)	Safety of machinery
AS 4041	Pressure piping
AS 4100	Steel structures
ASME B16.5	Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

2.2 Project Specifications

1988-000-GEDAS-0001	Site Data Sheet
1988-000-GESPC-0001	Transport and Shipping Specification - Packing Instructions
1988-000-GESPC-0002	Transport and Shipping Specification - Documentation and Marking Instructions
1988-000-GESPC-0003	Technical Information Requirements
1988-000-MESPC-0018	Design, Manufacture and Supply of Mechanical Plant and Equipment
BAN-0003-E-TS-005	Electrical Specification - Low Voltage Motors
BAN-0003-E-TS-008	Electrical Specification - Control Panels and Cubicles
BAN-0003-E-TS-009	Electrical Specification - Electrical Equipment Supplied with Packages
BAN-0003-E-TS-011	Electrical Specification - Preferred Electrical Equipment List

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 the climatic and atmospheric conditions specified in Site Data Sheet 1988-000-GEDAS-0001.

The treatment plant will be exposed to the elements and cleaned by hosing down.

All materials of construction for this equipment, components and accessories shall be new, suitable for the service and meet the requirements of this Specification and any standards, codes and documents reference herein.

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

4.0 MECHANICAL REQUIREMENTS

The sewage treatment plant shall be designed to meet the maximum effluent discharge levels (biological oxygen demand, suspended solids and nitrogen) nominated in the Duty Specification and fabricated from polyethylene or similar corrosion resistant material.

The lift station tank shall be suitably sized for stilling the various wastewater inflows, either by gravity or pump.

The surge chamber shall:

- be sufficiently sized to maintain a micro-organism population without the need for the addition of proprietary biological products
- be suited to dietary requirements prevalent in West Africa
- include a submerged feed, an internal baffle and a submerged outlet to prevent short circuiting, promote settling and anaerobic digestion.

The aeration chamber shall:

- be sufficiently sized to maintain a micro-organism population without the need for the addition of proprietary biological products
- be fitted with air diffusers or similar and submerged media packs of large surface area to promote biological growth - the air shall be introduced via compressor below the media packs
- be fitted with an internal baffle to prevent short circuiting.

The clarifier chamber shall:

- include a submerged feed and outlet to prevent short circuiting
- be suitably sized and include a submerged feed and outlet to promote scum formation and settling under quiescent conditions
- be fitted with a means of returning the scum and settled sludge to the aeration chamber, thus ensuring that the system is kept 'live' during periods of extended vacancy.

Chlorine, in the form nominated in the Duty Specification, shall be dosed into the chlorine contact chamber, which in turn shall be sized to allow sufficient contact time to ensure that the bacteria are killed.

Chemical dosing systems shall facilitate ease of handling, effective storage, with simple single person change-over facilities. Chemical storage shall be within building structures with purpose designed racks or drums with bunding to contain spillage. Storage shall be sufficient for 30 days plant operation at peak capacity.

The plants shall include bypass capacities so that in conditions such as component failure, electrical supply failure, and routine maintenance or during extreme hydraulic inflow conditions, there is no risk of plant overflow. It shall also be the case that during such extreme conditions basic levels of wastewater treatment may still be achieved.

Sludge from each plant will discharge into a below ground tank (by others) which will periodically be emptied by vacuum truck. Tank will provide 90 days storage.

The disposal chamber shall house the disposal pumps. The number and size of the disposal pumps shall be as nominated in the Duty Specification. The pump(s) shall be fitted into the chamber on guides such that it is possible to remove the pump(s) and associated discharge piping without the need to enter the tank. The pump design shall feature all conveniences for maintenance, assembly, disassembly and installation, such as lifting lugs, etc. The impeller fixing system shall be designed to retain the impeller when the pump is subjected to short periods of reverse rotation. The pump performance curve shall have a continuously falling characteristic. Drive motors shall be rated for all flowrates and head conditions with duty speed.

The pump discharge piping shall be fabricated from Class 18 UPVC and include suitable shutoff and check valves.

Each chamber shall be fitted with all necessary manholes, inspection hatches, etc. to allow for inspection and occasional removal of accumulated solids via pump (by others).

The sewage treatment plant shall have an in built emergency storage capacity of 24 hours (minimum) to ensure that any problem can be attended to prior to any overflow occurring.

All equipment components shall, where applicable, conform to Mechanical Specification 1988-000-MESPC-0018 as a minimum.

Mechanical components shall be housed in a containerised system where possible.

5.0 ELECTRICAL REQUIREMENTS

All low voltage 3 phase electric motors shall comply with Electrical Specification BAN-0003-E-TS-005 - Low Voltage Motors.

All control panels and boxes shall comply with Electrical Specification BAN-0003-E-TS-008 - Control Panels and Cubicles.

All electrical requirements for mechanical equipment shall comply with Electrical Specification BAN-0003-E-TS-009 - Electrical Equipment Supplied with Packages.

All electrical equipment and instrumentation shall comply with Electrical Specification BAN-0003-E-TS-011 - Preferred Electrical Equipment List.

5.1 Voltages

Unless otherwise specified, all voltages, instrumentation and controls shall comply with the following requirements:

Low Voltage	415 V, 3 phase, 50 Hz, solidly earthed neutral
High Voltage	11,000 V, 3 phase, 50 Hz, non-effectively earthed neutral
Heaters	240 V, single phase, 50 Hz
PLC / DCS Inputs	24 VDC
PLC / DCS Outputs	Voltage free contacts suitable for 24 VDC
Instrument Signals	4 - 20 mA DC fully isolated
Instrument Power Supply	240 V, 50 Hz or 24 VDC via regulated power supply
Instrument Air Supply	700 kPag, free of oil, mist and water
Instrument Actuator Design Pressure	500 kPag minimum, 800 kPag maximum
Temperature measurement up to 300°C	PT100, three wire RTD elements are preferred. 24 VDC loop powered.
Temperature measurement over 300°C	Mineral insulated thermocouples. 24 VDC loop powered.

5.2 Instruments and Controls

The plants shall have sufficient instrumentation to allow the processes to be continuously monitored and managed.

Plant operation shall be fully automated using a PLC based control system. The system shall be capable of identifying operating discrepancies, equipment faults, and initiating alarms when parameters are outside set points.

Instrumentation requirements shall be dependent upon treatment processes but shall be sufficient to continuously measure plant performance with respect to flow rates and totalises, tank levels, dissolved oxygen, MLSS, etc. as applicable. Instantaneous instrument readings and cumulative flow totalises shall be accessible to maintenance personnel via touch screen or a simple to operate key panel.

Set point adjustments shall be limited to authorised personnel, only accessible via a laptop connection or via a password controlled interface panel behind a lockable door.

The control system shall incorporate data logging to record historical plant performance for compliance assessment and for diagnostic investigations. Faults in mechanical components shall initiate automatic change over to an online standby and generation of an alarm condition.

6.0 SURFACE PROTECTION

The equipment called for herein shall be factory finished and painted in accordance with the Manufacturer's standard finish, provided that the Manufacturer's standard finish is compatible with the process fluids. If this is not the case, a suitable alternative shall be proposed.

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

7.0 ASSEMBLY AND TESTING

The Purchaser, 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.

Inspection procedures shall be in accordance with the Manufacturer's standards or as required by specific codes, but shall as a minimum include testing of the control panel. The Supplier shall advise the Engineer accordingly to allow witnessing of these tests.

A copy of all inspection and test reports, including those for materials used, shall be available upon request by the Purchaser.

The equipment shall be completely shop assembled to ensure proper fit of all parts. All 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 shall comply with the Transport and Shipping Specification 1988-000-GESPC-0001.
- Documentation, delivery and shipping package marking of goods shall comply with the Transport and Shipping Specification 1988-000-GESPC-0002.
- Equipment and spare parts identification tags in accordance with 1988-000-GESPC-0002.
- Equipment labels in accordance with 1988-000-MESPC-0018.

All connections, flanges, and openings shall be thoroughly sealed to prevent the ingress of fine dust, moisture, vermin or other deleterious material 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 guarantee the performance of the equipment to meet the requirements specified in the Duty Specification.

DUTY SPECIFICATION SHEET

Equipment Name	Sewage Treatment Plant
Equipment Number(s)	TBC
No. of Units Required	1
Process Description	Raw sewage and wastewater will either gravitate or be pumped to the sewage treatment plant. After treatment the solution will be pumped to the grey water surge tank (by others) and then pumped to the tailings storage dam. The sludge will discharge into a below ground tank (by others) which will be emptied periodically by vacuum truck.
Duty Cycle	Continuous
Duty Requirements	Operations Phase
Plant Feed Stream Parameters	
Capacity	208 m ³ /day (Note 7)
Biological Oxygen Demand (BOD ₅) @ 20°C, mg/L	800
Total Nitrogen, mg/L	140
Total Phosphorus mg/L	30
Solids	Lint loading from clothes washing and will include sanitary products and the like. Some carry-over of greases and fats from kitchen.
Other chemicals	The feed stream contains commercially available cleaning products but does not contain industrial chemicals
Maximum Effluent Discharge Levels	Note 8
Biological Oxygen Demand (BOD ₅) @ 20°C, mg/L	20
Suspended Solids, mg/L	20
Nitrogen, mg/L	10
COD, mg/L	100
Total Phosphorus, mg/L	5
Total Coliforms, MPN/100 mL	200
Faecal Coliforms, MPN/100 mL	10
Sewage Treatment Plant Requirements	
System Type (above / below ground)	Above ground
• Type	Sodium Hypochlorite
• Solution strength, % w/v	12.5
Lime	
• Type	Rock lime putty (blue)
• Concentration	30 - 45%
Polyaluminium Chloride (PAC)	
• Type	PAC aqueous solution
• Concentration	23.5%
Disposal Pumps	
• Number Required	2 (duty / standby) (Note 10)
• Flow Rate, m ³ /h	25
• Discharge Pump Head, m	30
• Discharge Pipe	90 mm OD, PE100, PN10 (by others)
Control Panel	
Voltages	Refer Electrical Requirements
Location, Indoor / Outdoor	Indoor

Notes

1. All motors shall be tropic proofed.
2. The Supplier shall provide complete details to enable evaluation of the bid, including calculations of peak loads.
3. The Supplier shall provide, for performance guarantee purposes, details of proposed testing procedures to demonstrate compliance with the maximum effluent discharge levels stated above.
4. All tanks shall be fitted with roofs.
5. The following equipment and accessories shall be provided:
 - Lighting inside and outside container.
 - Odour control system (as a priced option).
 - Fire detection audio alarm.
 - Standard test kits (as a priced option).
 - Standard PPE.
 - Spares as specified.
 - Wall mounted air conditioner (if equipment specified requires cooling).
 - Safety shower (as a priced option).
6. All equipment such as pumps and control panels shall be fitted inside a standard sea container (Supplier to confirm number of containers required and sizes).
7. The plant shall be capable of operating at inlet flows varying between 25% and 130% of the nameplate capacity (for population loads variance) and maintain compliance with the maximum effluent discharge levels stated above.
8. The parameters shall be measured on a 30-day rolling average. The following parameters represent maximum values and the plant performances shall target effluent values below these specified levels to ensure that the parameters are achieved at all times.
9. Process plant air services (i.e. instrument air and plant air) will not be available for use at the treatment plant.
10. The Supplier can provide an alternative pump configuration e.g. duty / duty / stand-by, to achieve the required flowrate. Stand-by pumps must be included in any alternative arrangement.

SUPPLIER DATA SHEETINFORMATION TO BE
PROVIDED BY SUPPLIER

Equipment Name	Sewage Treatment Plant
Equipment Number(s)	TBC
General	
Manufacturer	
Make / Model	
System Capacity, kL/day	
Maximum Effluent Discharge Levels	
Biological Oxygen Demand, @ 20°C mg/L	
Suspended Solids, mg/L	
Nitrogen, mg/L	
Receival Tank	
Capacity, L	
Dimensions (diameter x height), mm x mm	
Materials of Construction	
Continuous Aeration Tank (CAT)	
Capacity, kL	
Dimensions (diameter x height), mm x mm	
Materials of Construction	
Baffle Fitted, Yes / No	
Decant Aeration Tank (DAT)	
Capacity, kL	
Dimensions (diameter x height), mm x mm	
Materials of Construction	
Baffle Fitted, Yes / No	
Balance Tank	
Capacity, kL	
Dimensions (diameter x height), mm x mm	
Materials of Construction	
Baffle Fitted, Yes / No	
Clarifier	
Capacity, kL	
Dimensions (diameter x height), mm x mm	
Materials of Construction	
Scum Recirculation Fitted, Yes / No	
Settled Solids Recirculation Fitted, Yes / No	
Sludge discharge rate, m ³ /day	
Pump out Chamber (Irrigation Tank)	
Capacity, kL	
Dimensions (diameter x height), mm x mm	
Materials of Construction	
Odour Control System	
Fan	
Filter	

Pump	Feed	Aeration / RAS	Decant	Balance / Sludge	Forwarding		
Manufacturer							
Make / Model							
Duty Point, Flow, m ³ /h @ TDH, m							
Materials of Construction							
• Casing							
• Impeller							
• Macerator							
Pump Speed, rpm							
Pump Motor							
• Motor Size, kW							
• No. of Poles							
Dosing Pumps							
Reagent	Sodium Hypochlorite		Lime	PAC			
Type							
Manufacturer							
Make / Model							
Dosage Rate, L/h							
Motor, Volts / Phase / kW							
Ejectors							
Manufacturer							
Make / Model							
Capacity, Am ³ /h @ m							
Piping							
Control Panel							
Construction							
IP Rating							
Size (H x W x D)							
Equipment Make / Model							
• Contactors							
• Overloads							
• Circuit Breakers (Main)							
• Circuit Breakers (Control)							
• Indicator Lights							
• Pushbuttons							
• Latching Stop Button							
• Relays							
PLC System Make / Model							
Instrumentation Type / Make / Model							
• Float Switches (Sewage Feed Pump)							
• Float Switches (DAT)							
• Motorised Valve							
Air Conditioner							
Safety Shower							