



PetroSA

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SCOPE OF WORK

ENQUIRY NO: AHT25110

DESCRIPTION: SUPPLY, DELIVER, INSTALL AND COMMISSION NITROGEN GENERATOR INCLUDING TRAINING AT THE PetroSA GTL REFINERY, MOSSEL BAY.

1. INTRODUCTION

The GTL Refinery will be placed under preservation mode with no production until feedstock has been secured. Nitrogen supply from Unit 03 Air Separation Units (ASU) no longer available due to the high operational costs. Therefore, an alternative source of nitrogen generation for the plant will be required.

2. NITROGEN GENERATOR SPECIFICATIONS

A **nitrogen generator** is required to meet nitrogen supply requirements. The nitrogen will be distributed through the low-pressure distribution header to all nitrogen users. The nitrogen generator will use compressed dry air supplied from a centrifugal air compressor. From the compressor the air goes through an air receiver and then to a drier which removes moisture and produces dry air with a dew point of 0 to -25°C¹.It

¹ -25 to 0°C is dew point at operating conditions of 8 barg.

then goes through a filter and is then distributed to the three users: (1) Instrument air, (2) Plant air and (3) Nitrogen generator.

The nitrogen generator will be required to deliver Nitrogen with a purity of 98% Nitrogen at a minimum flow-rate of 1800 Nm³/h^{Note2} and a maximum air/nitrogen ratio of 2.6 at the compressed air inlet conditions of 8 barg and 40°C.

Compressed air will be available at the following conditions:

Compressed air supply conditions	
Pressure	8 barg*
Temperature	40°C
Max dew point	0°C
Design Pressure	10 barg
Design Temperature	60°C

*Note this pressure is upstream of any filter(s) supplied by the nitrogen generator vendor.

- The Air compressor is fixed speed, centrifugal type, qualified as a oil free compressor.
- There is an air dryer (loaded with activated alumina desiccant) upstream of the Nitrogen Generator. There is a filter downstream of the air dryer (upstream of the nitrogen generator) for dust removal.
- Additional filter(s) on the air supply as required to protect the generator e.g. avoid adsorbent contamination is to be provided by the nitrogen generator supplier.
- There is an existing air receiver (1.53 m ID x 4.0 m tangent to tangent length) downstream of the air compressor but note this is upstream of the air dryer. This will even out fluctuations in supply to the air dryer, but if there are significant variations in air demand to the nitrogen generator e.g. due to PSA cycle, then the nitrogen generator supply scope should include suitably sized air receiver(s) upstream of the generator.

The nitrogen supplied from the nitrogen generator must meet the following specification based on the compressed air conditions specified above:

Nitrogen Supply specifications	
Minimum Nitrogen Flow rate at 98% purity	1800 Nm ³ /h ^{Note 2}
Maximum Air/Nitrogen ratio (supplier to specify actual air/nitrogen ratio)	2.6
Nitrogen purity for design case	98%

² Normal conditions is defined as 0°C and 101.3 kPa absolute

- Supplier to specify pressure drop through generator package and final outlet pressure of nitrogen generator. The discharge pressure should not be less than 7.0 barg based on inlet pressure of 8.0 barg.
- Supplier to provide a performance guarantee of nitrogen generator that it will meet minimum 1800 Nm³/hr capacity at 98% purity and a maximum air/nitrogen ratio of 2.6 at the compressed air conditions of 8 barg and 40°C.
- Nitrogen purity target must be continuously monitored and controlled by the nitrogen generator. If Nitrogen purity cannot be attained the system should prevent this being routed to product nitrogen stream.
- Nitrogen demand will vary. Generator should be capable of supplying on-spec nitrogen even at turndown of nitrogen demand. Vendor to provide minimum turndown limitation (if any).
- The design should minimise air consumption, both with varying nitrogen demands, and requirement for venting of off-spec nitrogen.
- Typical purity will be 98% as per rated case (suitable for blanketing & preservation operations). Nitrogen generator must have the flexibility of adjusting the nitrogen purity to a minimum of 95% and maximum of 99.9%. Vendor to specify air/nitrogen ratios and nitrogen capacity, for other purities (95%, 96%, 97%, 99%, 99.5% and 99.9%).
- Supplier to size and provide nitrogen receiver vessel as part of nitrogen generator package. Nitrogen generator package refers to nitrogen generator unit and receiver.
- Design should allow adsorbent to be unloaded and reloaded with fresh adsorbent if it becomes inactive / spent.
- Filter(s) should be provided to remove dust (arising from adsorbent material) if required from the Nitrogen Outlet stream.

3. CONTROL SYSTEM AND INSTRUMENT SCOPE

- The control system shall comprise of all instruments, actuated control valves, integrated controller & logic solver with local Human Machine Interface (HMI).
- The control system, field instruments and actuated valves shall meet industrial standards and be suitable for continuous (24/7) operation. Planned maintenance outage durations and intervals to be supplied by vendor.
- It is to be noted that the plant area at the PetroSA GTL Refinery allocated for the installation and commissioning of the proposed nitrogen generator is not an intrinsically safe classified area.
- The supplier shall confirm if the control scheme is a failsafe design any deviation to be explained in detail by the OEM.
- Supplier to provide detail of actuated valves fail safe position and method of activation for example spring return.

- Valve position switches to be specified and provided as required by the supplier control scheme.
- Dry instrument air (min pressure 600kPa) will be provided for connection to the skid or can be derived internally from the air supply to the generator.
- If required, the instrument air distributed internal to the skid shall be detailed in the Supplier quotation. For information, the PetroSA standard for instrument tubing is 3/8-inch stainless steel. All fittings and tubing are imperial standard and isolation valves for instrument air is provided at each actuated valve.
- Supplier shall specify the proposed control system power requirement.
- Bidder to advise isolation to process envelope for instrumentation.
- Instrumentation ingress protection level to be specified by the supplier.
- Cabinet containing controller to be IP 65, Stainless Steel.
- PetroSA shall issue each instrument and actuated valve with a unique tag number which is to be used throughout the system.
- Individual data sheets are to be supplied with each of the instruments.
- Design documents (connection and wiring schedules, equipment, and panel layouts etc.) shall be provided as part of the supply.
- Calibration certificates to be supplied for each instrument.
- The local controller communication interface to be specified if available.
- The nitrogen generator should be able to be locally and remotely stopped and started.
- The nitrogen generator system, common fault and shutdowns alarms should be displayed on the local HMI.
- The supplier is requested to list (if available) all nitrogen generator control system remote inputs and outputs (I/O) to be hardwired to a DCS or PLC. The supplier should then also indicate if these I/O are 4 to 20 mA, voltage free contacts or 24Vdc

contacts and what signals each I/O represent for example system fault alarm or a nitrogen purity reading etc.

4. ELECTRICAL REQUIREMENTS

- The supplier shall indicate any electrical requirements along with the voltage, Power, Full load current and locked rotor current rating (starter inrush current).
- Power supply will be provided as a single point of supply up to the Nitrogen Generator Plant and terminated to a Main Incomer Moulded case circuit breaker/ Isolator (to be provided as part of the equipment on the skid). The Vendor/Supplier will distribute the power supply at all the required points on the Nitrogen Generator skid.
- Provision shall be made for an earth connection on the skid.
- All electrical equipment shall be earthed in accordance with the manufacturers' requirements.

5. REGULATORY REQUIREMENTS

- Any pressurised equipment shall conform to the requirement of the South African National Standard SANS 347 and PER Regulations.
- The Manufacturer shall include in his initial quotation specific details of all exceptions, deviations, or modifications, to the specified Code and Specifications proposed for Owner/User's written approval. No work shall proceed until Owner/User's written permission has been obtained.
- Design must comply with relevant codes and standards. PetroSA - SPECIFICATION FOR CATEGORY 3 PRESSURE VESSELS, is applicable with the following exclusions, since the unit will run for a maximum of 6 years:
 - 0.5 mm Corrosion Allowance
 - Joint efficiency of 0.85

6. DELIVERY AND PRICING

- Minimising lead time is critical. The nitrogen generator needs to be installed and commissioned by 15 September 2023.
- In Bid the Supplier is to specify the optimised duration (lead time) from the date of order for the following [1] Lead time from order to Ex-works delivery [2] Lead time from order to delivery to Mossel Bay site [3] Lead time from order to completion of installation [4] Lead time from order to completion of commissioning.
- Include in Price for Nitrogen (N₂) generator delivery & transportation to PetroSA Mossel Bay Refinery site.
- Include the exchange rate and foreign currency on the date of the quote been delivered and indicate percentage of local and foreign currency contents.

7. INSTALLATION AND COMMISSIONING

Supplier to install and commission nitrogen generator.

8. TRAINING

Supplier shall provide training to operations and maintenance teams including:

- Start-up / Shut down
- Emergency Shut down
- Operation
- Standard Maintenance
- Control Systems
- Electrical

9. MAINTENANCE

- Supplier to provide commissioning and running SPIR list.

10. GENERAL

- Supplier to provide a Datasheet and technical details of nitrogen generator and ancillary items.
- All drawings and documentation for equipment to be supplied as per END/PR/DRW/001 Engineering Contractor Drawing Supply.
- Operating manual for the nitrogen generator must be included.
- Training of personnel to operate and maintain equipment to be included.
- Any deviations from the scope of work, prescribed standards or specifications shall be highlighted by the supplier in their proposal.