

## **TECHNICAL SPECIFICATION FOR SUPPLY OF RECIPROCATING COMPRESSOR PACKAGE FOR LPG OFFLOADING**

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## **1. SCOPE OF SUPPLY**

A complete, skid-mounted, electrically driven LPG reciprocating compressor package for LPG offloading from road tankers. The package shall include the compressor, driver, all ancillary systems, and a fully integrated control panel with motor starting and control systems interface, pressure safety valve and air cooler. The package shall be fully assembled, wired, tested, and ready for connection to site power, process piping, and the main plant control system.

In addition to supply, the vendor shall include Instrument Function testing, commissioning, Training (Maintenance and Operator) and Site Acceptance testing (SAT). Maintenance of compressor should be handed over to PetroSA maintenance team. The compressor maximum discharge flow to be 50m<sup>3</sup>/hr.

Final approval is required prior to procurement of any major equipment (compressor, motor, panel, instruments).

The successful vendor is responsible for ensuring the entire package meets all stated South African regulatory and certification standards.

## **2. APPLICABLE STANDARDS**

Please ensure that the compressor package proposed for offloading LPG (Liquefied Petroleum Gas) from a road tanker into a storage tank complies with the following mandatory standards and certifications.:

- Occupational Health and Safety Act (85 of 1993), Driven Machinery Regulations,
- SANS 10108 Classification of hazardous locations (zoning) for installations handling flammable gases.
- SANS 60079 Series: Electrical apparatus for explosive atmospheres (including selection, installation, inspection, and maintenance of Ex-certified equipment).
- SANS 10142-1: Low-voltage electrical installations (Wiring Code).

### **Required Certifications (to be supplied with the package):**

- Ex certificate for all electrical components located in hazardous areas (ATEX / IECEx / IA certificate).
- Pressure Equipment Regulations (PER), Pressure Equipment Directive (PED) or relevant pressure equipment certification in accordance with SANS 347 (if applicable).
- Manufacturer's test reports and compliance declaration for the compressor package.

### **3. HAZARDOUS AREA CLASSIFICATION REQUIREMENTS**

All electrical and instrumentation equipment, including the compressor skid, control panel, junction boxes, cable glands, and switches, shall be certified and suitable for use in a Zone 2 hazardous area. The selected Ex protection types shall be clearly stated and certified by an approved body. All equipment must comply with IEC 60079 series and relevant SANS standards.

The complete package must possess valid Certificates of Conformity from a South African Accredited Inspection Authority (IA).

IA certification is a condition for delivery and final payment.

Vendor to verify applicable ratings for the specific motor / instrumentation / compressor system configuration.

Area Classification: Zone 2

Gas Group: IIA

Temperature Class: T2

### **4. ELECTRICAL / CONTROL SYSTEMS REQUIREMENTS**

#### **4.1 Basic Electrical Design Data**

Service: LPG Vapour Recovery / Tanker Offloading

Drive: Electric Motor with V-belt Drive

Power Supply: 525V AC, 3-Phase, 50Hz

Bidders are requested to indicate:

PetroSA will provide 525 Vac, 50 Hz power supply to the LPG compressor skid.

- Bidders to confirm whether the Instrumentation Panel and/or Motor Starter Panel require any additional or alternative auxiliary power supplies (e.g., 230 V AC, 110 V AC, 24 V DC, etc.) beyond the 525 V AC input.
- If additional supplies are required, specify the voltages and loads and indicate whether these will be derived within the vendor's scope or to be provided by PetroSA.
- Confirm that the proposed motor is rated for 525Vac  $\pm$ 10%, or that its operating range includes 525Vac.

- Indicate the total load requirement to the skid (kW rating) and whether this is 3 phase or 3 phase + neutral arrangement.

#### **4.2 Electric Motor Technical specifications**

- Manufacturer: WEG
- Efficiency: Minimum IE2 (High Efficiency)
- Enclosure: TEFC (Totally Enclosed Fan Cooled) or appropriate for the duty and environment.
- Insulation Class: Minimum Class F, with Class B temperature rise.
- Protection: IP55 minimum.
- Certification: Must be Ex certified for Zone 2. The motor nameplate shall clearly show the hazardous area certification mark.
- Local Certification: Must possess a valid South African Inspection Authority (IA) Certificate. Ex Certification documentation is mandatory.
- Drive Configuration: The reciprocating compressor shall be driven by the Vendor specified electric induction motor via a V-belt drive system.
- Motor Starting Capability: The motor, starter, and drive system shall be sized to ensure reliable starting of the compressor under unloaded conditions (with the compressor's unloading mechanism, e.g., the four-way valve, in the unload position) across the full specified range of suction pressures and gas compositions.
- V-Belt Specification: Belts shall be antistatic (conductive) type to prevent the accumulation of static electricity and shall be certified as suitable for use in the specified Zone 2 hazardous area. Belt material and construction shall be oil-resistant where exposed to the environment.
- Belt Guard: A fully enclosed, robust belt guard shall be provided. The guard shall be constructed of non-sparking material (e.g., painted mild steel, aluminum with non-sparking coating) and designed to allow for safe ventilation while preventing access to moving parts during operation. The guard shall be easily removable for maintenance.

### **4.3 Local Control Panel (Motor Starter Panel Section)**

- Construction: Stainless Steel (Grade 316 or 304) or 3CR12 with a durable powder coat finish. Material selection is subject to final approval based on corrosion resistance requirements.
- Environmental Rating: IP65 minimum, suitable for outdoor installation.
- Hazardous Area Certification: The assembled panel enclosure and its internal arrangement shall be certified for a Zone 2 installation.
- Local Certification: Must possess a valid South African Inspection Authority (IA) Certificate. Ex Certification documentation is mandatory.
- The Motor / Instrumentation Panel shall be equipped with the following Components (as a minimum):
  - Main Isolator: A lockable, load-breaking isolator switch, rated for the full load current (FLC) and short-circuit capacity.
  - Motor Starter: Direct-On-Line (DOL) as required by motor size. Starter shall include:
    - Contactor: Rated for frequent LPG duty.
    - Overload Relay: Solid-state, adjustable, with phase loss protection. Set point adjustable from 100-125% of motor FLC.
    - Short-Circuit Protection: Current-limiting circuit breakers
  - Control Devices:
    - Start/Stop Pushbuttons: Guarded or flush-mounted as appropriate.
    - Trip Reset Button.
  - Indications: LED pilot lights with engraved legends:
    - Green: Power On
    - Green: Motor Running
    - Red: Motor Stopped
    - Amber: Motor Tripped
  - Internal Wiring: All wiring shall be numbered, routed in trunking, and use tinned copper conductors. Separate compartments or segregation shall be provided for AC power, DC instrument power, and signal wiring.

- Termination: External power and signal cables shall terminate in certified ex-rated cable glands. Internal terminal blocks shall have 20% spare capacity. A dedicated, labelled earthing bar shall be provided.

#### **4.4 Local Control Panel (Instrumentation & Control System Interface section)**

- Power Supply: All instrumentation and control signals within the package shall be powered from 24V DC.
- Signals: All analog signals to/from the main plant control system shall be 4-20mA, All binary (discrete) signals shall be volt-free contacts (dry contacts) for outputs.
- Vendor to specify whether the local control system is based on Relay logic or a PLC. Note: PetroSA has standardized on Rockwell PLC systems.
- Junction Box: A dedicated, Zone 2 certified multi-pin junction box (JB) shall be mounted on the skid for all external signals to the plant DCS/ESD. This JB shall be the demarcation point between package and plant cabling. Internal wiring from the control panel to this JB is within the vendor's scope.
- All instrumentation shall have isolation and vent valves.
- All instruments shall be with NPT threads.
- All process impulse lines and fittings from tapping points to gauge board shall be ½" NPT.
- **The following binary signals (voltage free contacts) to interface with the PetroSA Control Systems:**
  - Binary Output to PetroSA – Compressor Running Status (51ML3020)
  - Binary Output to PetroSA – General Trip (51XA3022)
  - Binary Input from PetroSA – ESD Status (51XL3011). External Interlock: One common permissive signal -System Ready (External Interlocks Cleared), Loss of 24V DC = Trip/Prevent Start.
- **Local Indication of ESD Status**

The ESD Status signal (tag 51XL3011) shall be indicated on the local control panel via a green LED-type pilot light. The pilot light shall be fitted with an engraved legend clearly identifying the function.

Green: ESD Healthy  
Red: ESD Tripped

- **The following Analogue signals (24v, 4-20mA) to interface with the PetroSA Control Systems:**

- Compressor Suction Pressure (51PT3001)
- Suction K.O Drum Level (51LT3001)
- Compressor Discharge Pressure (51PT3002)
- Compressor Discharge Temperature (51TT3001)

(Note: If transmitters are not supplied by vendor, the required tapping points in the process lines should be provided. Final approval shall be obtained before the procurement of any instruments associated with the package.

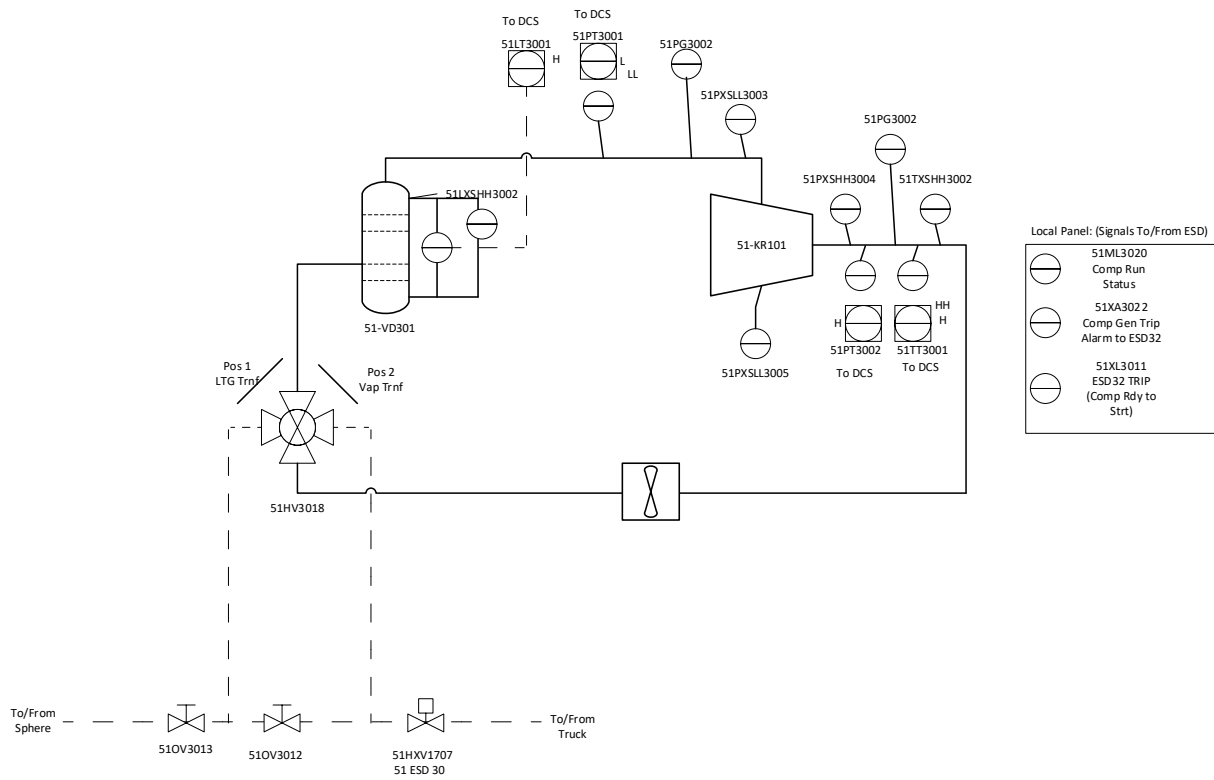
- **Local Pressure gauges:**

- Compressor Suction Pressure
- Compressor Discharge Pressure

- **Protection & Monitoring**

The compressor control system shall monitor and provide alarms/trips for the following via the local control panel including LED pilot lights (amber) with engraved legends, audible horn, and control buttons.:

- Lube Oil Pressure Low (Alarm & Trip)
- Cooling Water Pressure Low (Alarm & Trip)
- Cooling Water Temperature High (Alarm)
- Liquid Level in Knock-Out Pot High (Alarm & Trip)
- Gas Suction Pressure Low (Alarm & Trip)
- Gas Discharge Pressure High (Alarm & Trip)
- Gas Discharge Temperature High (Alarm & Trip)
- Motor overload (Alarm & Tripped)



Control System Schematic

## 5. MECHANICAL REQUIREMENTS AND SPECIFICATIONS

### 5.1 Knock-Out Drum (Suction Pot)

A knock-out drum shall be provided as an integral part of the compressor skid. The purpose is to prevent liquid LPG carry-over from entering the compressor.

#### Design and Construction:

Parameter	Requirement
Service	LPG vapour with possible liquid carry-over
Design pressure	2400 kPa (min) / Vendor to state
Design temperature	-45°C to 65°C (min range)
Material of construction	Carbon steel (ASTM A516 Gr 70 or equivalent) suitable for LPG service
Corrosion allowance	3 mm (minimum)
Internal volume	To be sized for adequate liquid holdup (vendor to calculate based on expected liquid carry-over). Minimum 50 litres recommended.
Drain connection	1" NB valve at bottom (manual drain valve supplied)
Inspection openings	Manway or blind flange for internal inspection
Hydrostatic test	Per design code – certificate required

The knock-out drum to be designed for full vacuum service.

**Design Code:** The knock-out drum shall be designed, manufactured, tested, and stamped in accordance with:

- ASME Section VIII Division 1 (preferred), or
- EN 13445 (PED), or
- An equivalent internationally recognised pressure vessel code acceptable to PetroSA.
- A valid South African Pressure Equipment Regulation (PER) certificate from an Approved Inspection Authority (AIA) shall be provided for the vessel.

**5.2 Piping within skid:**

- Material: Carbon steel for LPG service
- Wall thickness: Minimum Schedule 40, or higher if required for pressure rating
- Fittings: Forged steel (ASME B16.11 or B16.9), 3000# or 300# flanges as appropriate
- Welding: Full penetration, 100% visual inspection; random radiography per code
- All flanged connections: 300# ANSI raised face, with spiral wound gaskets (316L/graphite) and B7 studs/2H nuts

**6. CIVIL WORKS REQUIREMENTS (PETROSA RESPONSIBILITY)**

The skid package shall be designed to allow installation on a simple reinforced concrete foundation to be provided by PetroSA. To enable PetroSA's civil engineer to design the foundation, the vendor shall provide the following information as part of the tender submission (preliminary) and final detailed submission after order placement:

Required data (preliminary with tender):

Item	Data Required
Overall skid dimensions (L × W × H)	millimetres (mm)
Total operating weight (including all equipment, piping, oil, gas, but excluding foundation)	kilograms (kg)

Item	Data Required
Total erection weight (max lifting weight during installation)	kilograms (kg)
Number and location of support points (skid feet)	drawing or sketch
Anchor bolt diameter, length, projection, and material (if supplied by vendor)	millimetres / grade
Anchor bolt hole sizes and locations (centre-to-centre dimensions)	millimetres / tolerance
Maximum static load per support point (operating and erection)	kN
Maximum dynamic load (if any – e.g., from compressor reciprocating forces)	kN or statement of negligible
Vibration isolation requirement (anti-vibration pads, spring mounts, etc.)	vendor to state if required
Minimum foundation strength requirement (if known)	MPa or “E” concrete grade
Skid top of steel elevation (distance from bottom of skid feet to top of skid beams)	millimetres
Utility connection points (electrical, instrument, process) and their approximate distances from skid edge	millimetres

**Civil scope split:**

- Vendor responsibility: Provide all above data, supply anchor bolts if specified, provide levelling shims (if required), indicate any grouting requirements.

- PetroSA responsibility: Design and construct the reinforced concrete foundation, provide anchor bolt embedded templates if bolts are not supplied loose, prepare foundation surface, grout skid after alignment.

The vendor shall ensure the skid can be aligned and levelled using standard jacking screws or shims on a flat concrete foundation with anchor bolts cast in.

## **7. DRAWINGS AND DOCUMENTATION**

The vendor shall submit for approval and supply as-built copies of all listed documents, including but not limited to:

- Layout: General Arrangement of Compressor Skid, Foundation Plan, Panel.
- Electrical: Single Line Diagram, Control Circuit Schematics, Detailed Wiring & Termination Diagrams, Panel Layout, Interconnection Diagrams.
- Instrumentation: Loop Diagrams for all instruments, Instrument Index & Data Sheets.
- Certification: Copies of Ex certificates, IA certificates, SANS compliance certificates,
- Factory Acceptance Test / Site Acceptance Test: Copies of FAT & SAT Procedures & Reports.
- Manuals: Comprehensive Operating, Maintenance, and Parts Manuals.
- Spare parts List: The bidder is to provide a spare parts list, highlighting critical spares
  - Confirm whether spare parts are held locally within South Africa (e.g., Johannesburg, Cape Town, Durban).
  - Provide details of any authorized local representative or agent, including:
    - Company name
    - Contact person
    - Contact details
    - Scope of support (spares, maintenance, technical support, etc.)
  - If not available locally:

- Provide contact details of authorized agents and expected lead times for delivery to site

Documentation to be supplied by vendor for the knock-out drum:

- GA drawing with all nozzle locations and dimensions
- Material test certificates (MTCs) for shell, heads, and nozzles
- Welding procedure specification (WPS) and welder qualifications
- NDE reports (RT/UT, MT/PT as applicable)
- Hydrostatic test certificate
- ASME U-stamp or equivalent certification
- South African PER compliance certificate

**Spare Parts Interchangeability Record (SPIR):** The vendor shall provide a complete SPIR listing all mechanical, electrical, and instrument components with:

- Manufacturer name and model/part number
- Recommended stock quantity for 2 years of operation (including commissioning spares)
- Any alternative interchangeable parts
- Lead time for replacement parts

## **8. TENDER DOCUMENTATION DELIVERABLES**

- Piping & Instrumentation Diagram (P&ID): A preliminary P&ID of the skid showing all equipment, piping (with line sizes and materials), valves, instrumentation (with tag numbers), and control loops. This must be submitted with the tender.
- General Arrangement drawing highlighting all the key components of the compressor skid package.
- Motor Datasheet: It is a mandatory requirement that bidders complete the Motor Datasheet provided and submit it as part of the tender documentation.
- Compressor Datasheet: It is a mandatory requirement that bidders complete the Datasheet provided and submit it as part of the tender documentation.
- Electrical & Instrumentation Declaration of Compliance

Bidders are required to submit a formal declaration regarding compliance with all the technical specifications stipulated, where the Bidders proposal deviates from the technical specifications provided:

- A detailed, itemized list of deviations, including:
  - Description of each deviation
  - Technical justification
  - Proposed alternative solution
- Delivery: Vendor to quote two delivery options:
  - Normal delivery (weeks from order)
  - Expedited delivery (weeks from order, with additional cost if any)

## **9. SITE ESTABLISHMENT**

Bidders are to make allowance for the following site requirements:

- PetroSA site induction training and safety requirements for personnel entry and hazardous area work.
- Medical screening and Fitness certificates for personnel

## **10. COMMISSIONING**

The Bidder shall provide commissioning and site start-up support for the complete LPG reciprocating compressor package, including verification of mechanical, electrical, instrumentation, and control system performance.

### **10.1 Commissioning scope (minimum)**

Commissioning support shall include (as applicable):

- Pre-commissioning checks:
- Functional testing:
- Control system interface testing:
- Performance checks:
- Defect rectification:
- Handover:

## **10.2 Commissioning deliverables**

- Commissioning plan and schedule (for PetroSA approval)
- FAT reports (if already completed prior to shipment) and SAT/commissioning test forms
- As-built documentation updates reflecting field changes
- Commissioning checklist and sign-off sheet
- Commissioning completion report stating tested items and outcomes

## **11. TRAINING**

The vendor shall provide training to PetroSA personnel to ensure safe operation, routine maintenance, and troubleshooting of the compressor package and its control system.

### **11.1 Training scope**

Training shall cover at minimum:

- Safe start-up and shutdown procedures for the package
- Explanation of control panel functions, indicator lights, alarm/trip behavior, reset/acknowledgement logic
- Understanding unload/load operation
- Overview of protections and monitoring functions (lube oil pressure, cooling water pressure/temp, suction/discharge pressure/temp, liquid level knock-out, overload/trip, if applicable)
- Interface overview (junction box demarcation, plant signals analog/binary mapping)
- Recommended maintenance schedule and procedures (including belt inspection/replacement guidance)
- Basic troubleshooting workflow (fault finding steps using indications/alarms)

## **12. COMMISSIONING & TRAINING AS TENDER PRICING ITEMS**

PetroSA requires that bidders clearly price for the following in addition to supply of the LPG compressor package:

- Commissioning support (number of site days / rates)
- Training

- Site & Medical Induction

### 13. COMMERCIAL REQUIREMENTS

A mandatory bid clarification meeting will be held (date and time to be advised separately). All bidders are required to attend to raise technical and commercial queries regarding this specification.

To assist procurement, vendors shall provide the following commercial breakdown:

Item	Description	Amount (ZAR excl VAT)
1	Compressor skid (complete as per scope)	
2	Commissioning spares	
3	Site commissioning & training (3 days incl. travel/accommodation)	
4	Optional: expedited delivery (if different from normal)	
5	Total (excl VAT)	



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#### **14. APPENDIX**

- COMPRESSOR PACKAGE DATASHEET
- MOTOR DATASHEET