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TECHNICAL SPECIFICATION FOR SUPPLY OF RECIPROCATING COMPRESSOR PACKAGE FOR LPG OFFLOADING

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1.0 SCOPE OF SUPPLY

A complete, skid-mounted, electrically driven 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. The package shall be fully assembled, wired, tested, and ready for connection to site power, process piping, and the main plant control system.

2.0 BASIC DESIGN DATA

- **Service:** LPG Vapour Recovery / Tanker Offloading
- **Drive:** Electric Motor with V-belt Drive
- **Power Supply:** 525V AC, 3-Phase, 50Hz
- **Area Classification: Zone 2** (As per IEC 60079 / SANS 60079 standards). Gas Group IIA, Temperature Class T2 (Vendor to verify applicable T-class for application)
- **Mandatory Compliance:** All electrical design, equipment, and installation shall comply with the **Occupational Health and Safety Act (85 of 1993), Driven Machinery Regulations**, and the latest editions of the following South African National Standards (SANS):

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- **SANS 10108 & SANS 60079 Series:** Hazardous area classification & Ex equipment.
- **SANS 10142-1:** Low-voltage electrical installations (Wiring Code).

3.0 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 protection types (e.g., Ex nA, Ex ec, Ex d) 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.

4.0 ELECTRICAL / CONTROL SYSTEMS REQUIREMENTS

4.1 Electric Motor

- **Manufacturer:** WEG or approved equal of equivalent quality and certification.
- **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**.
- **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.

4.2 Control & Local Panel (Motor Starter Panel)

- **Construction:** Stainless Steel (Grade 316 or 304) or 3CR12 with a durable powder coat finish. Material selection 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 **Ex d (Flameproof)** or utilize **Ex e (Increased Safety)** components as appropriate for a Zone 2 installation. Certification documentation is mandatory.
- **Internal Components:**
    - **Main Isolator:** A lockable, load-breaking isolator switch, rated for the motor 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:**
        - **E-Stop:** Mushroom head, **RED**, with latching and lockable function in the tripped position.
        - **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
    - **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 d or Ex e cable glands**. Internal terminal blocks shall have 20% spare capacity. A dedicated, labelled **earthing bar** shall be provided.

4.3 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.
- **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.**
- **Binary Inputs (to Package, 24V DC):**
    - **External Interlock:** One common permissive signal -System Ready (External Interlocks Cleared), Loss of 24V DC = Trip/Prevent Start.
- **Binary Outputs (from Package, Volt-Free Contact):**
    - Motor Running (NO contact)
    - Motor Stopped (NC contact)
    - Common Alarm (NO contact)
    - Trip/Shutdown Alarm (NO contact)
    - Four-way Valve Position (e.g., NO=Load, NC=Unload)
- **Analog Outputs (from Package, 4-20mA):**

- Liquid Trap Level
- Discharge Pressure
- Discharge Temperature

(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.

4.4 Protection & Monitoring

The control system shall monitor and provide alarms/trips for the following via the control panel interface 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)

5.0 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 (FAT) Procedures & Reports.
- **Manuals:** Comprehensive Operating, Maintenance, and Parts Manuals.

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6.0 GENERAL

- 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.
- **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 requirements.

7.0 APPENDIX

- 51KR101 COMPRESSOR / MOTOR DATASHEET -**to be completed by vendor**