



**SUPPLY OF PARTS/SPARES, DELIVERY,  
REPAIR, TESTING, CALIBRATION AND  
COMMISSIONING OF 1 X GAS BAKE  
OVEN AND 1 X ELECTRICAL OVEN FOR  
ROTATING MACHINES BUSINESS.**

**ROTATING MACHINES DEPOT, 150 EEL  
ROAD, UMBILO INDUSTRIAL, UMBILO.**

**REFERENCE No: OPS\_RM\_DBN\_ SPEC\_136**

**Revision 0**

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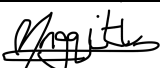


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## 1. INTRODUCTION

### 1.1 Basic Operation

A varnish burn-out oven is used in industrial processes to remove varnish, resin, or other insulating coatings from electrical equipment, typically from windings of electric motors, transformers, and generators.

#### 1.1.1 Burn-Out Process

**Controlled Heating:** The industrial gas burner (first) gradually increases the oven's temperature, preventing sudden thermal stress on the components. This controlled approach helps maintain the integrity of the components during the burn-out process.

**Varnish Combustion:** As the temperature rises, the varnish or resin on the windings decomposes and burns off. The combustion produces gases and particulates, managed through the oven's exhaust and ventilation systems.

#### 1.1.2 Water Circulation Tanks and Spray Jets

**Neutralize or Capture Byproducts:** The spray can neutralize harmful fumes or capture particulates, which can then fall into the water tank and be filtered out.

#### 1.1.3 Afterburner (Secondary Combustion Chamber)

**Purpose of the Afterburner (second - industrial gas burner):** The afterburner, also known as a secondary combustion chamber, heats the vented gases to approximately 700°C to 800°C. This high temperature ensures complete combustion of any remaining volatile organic compounds (VOCs), breaking them down into less harmful substances like carbon dioxide (CO<sub>2</sub>) and water (H<sub>2</sub>O).

### 1.2 Process Flow

**Initial Burn-Out:** During the initial phase, varnish and other coatings are burned off the components inside the oven.

**Gas Venting:** The exhaust system directs the gases released from the burn-out process to the afterburner.

**High-Temperature Combustion:** In the afterburner, the gases are heated to approx. 700°C, ensuring complete combustion of volatile gases.

**Emission Control:** The treated gases are then either released into the atmosphere through a filtered exhaust system.

This specification is for the:

#	TASK	REQUIRED
1	Design	✓
2	Manufacture	✓
3	Assess	
4	Structural Drawings	
5	Supply	✓
6	Delivery , repair, install	✓
7	Documentation	✓
8	Testing	✓
9	Calibration	✓
10	Training	✓
11	Commissioning	✓

Of the specified:

#	ITEM	REQUIRED
1	Supply of parts/spares, delivery, repair, testing, calibration and commissioning of 1 x gas bake oven and 1 x electrical oven for Rotating Machines Business.	✓
2	Submission of project completion documents.	✓

## 2. SITE INSPECTION

- 2.1 All prospective contractors shall be required to undertake a compulsory site inspection to fully acquaint themselves with all aspects involved.
- 2.2 Arrangements to visit the site and confirmation of the date and time of the site inspection shall be made with Transnet Engineering Contract Manager.
- 2.3 The site inspection certificate shall be completed and countersigned by the contract Manager on the day of the visit and must be submitted with the tender documents.

## 3. INFORMATION REQUIRED

- 3.1 Offers will not be considered unless full particulars and sufficient literature are provided at the tendering stage to enable Transnet Engineering Technical Officers the opportunity to assess each technical offer properly.
- 3.2 Prospective Contractors will complete the relevant questionnaire in full and must indicate whether their offer complies with each item of the specification
- 3.3 Should there be insufficient space for furnishing full details; contractors shall provide the additional details in their covering letter. The additional details shall be numbered in accordance with the applicable clause specified in the specification.
- 3.4 As prospective contractors are considered to be experts in their field, they are obliged to identify any shortcomings, such as omissions or sub-standard requirements, to the completeness of this specification. These must be brought to the attention of Transnet Engineering at tender stage with alternatives to address these shortcomings. However, each offer shall be quoted for separately.

## 4. TECHNICAL REQUIREMENTS

The following regulation and codes must be complied with:-

- **The Occupational Health and Safety Act – Act 85 of 1993.**
- **SANS 17025 : 2005 General requirements for the competence of testing and calibration laboratories.**

- 4.1 Except where otherwise provided for in the specification, all equipment offered will comply with the requirements of the relevant standard specifications of the SABS, if published, otherwise with the relevant standard of the British Standards Institution in force at the time of tendering.

- 4.2 Where equipment offered complies with the recognized standards of the country of manufacture and not specifically with the standards required by this specification, such equipment will be considered at the discretion of Management. In this case, tenders shall state fully all respects in which the equipment departs from the standard laid down in this specification.
- 4.3 The successful tender will at the conclusion of the installation provide a document along the lines “that the installation complies with national/international requirements and that all selected /designed items are compliant with Act 85 of 1995 and SABS practices applicable to the installation. The equipment has been commissioned/ calibrated and employees as specified have been trained and found competent to operate the plant.”

## 5. SPECIFIC REQUIREMENTS

**Any person with the intention of tendering shall ensure that the information below is complied with.**

### 5.1 Operating Environment

- Indoors – workshop environment.

### 5.2 Scope of works for repairing the gas bake oven.

<u>Item no.</u>	<u>Requirements</u> This specification covers the minimum requirements.
5.2.1.1	Supply materials and spare parts/ components, delivery, repair and ensure the proper operation of the controlled heating system, exhaust and ventilation management, water circulation tanks, spray jets and the afterburner system.
5.2.1.2	The objective for this project is to repair 2 off bake ovens to ensure its effective functioning to remove varnish, resin, or other insulating coatings from electrical equipment, such as windings of electric motors, transformers, and generators.
<b>5.2.2</b>	<b>Controlled Heating System</b>
5.2.2.1	• Check the temperature control systems for accuracy and reliability. Ensure the burner operates smoothly, with even heat distribution.
5.2.3.2	Repair and replacement <ul style="list-style-type: none"> <li>• Replace the primary gas burner, including Ancillary piping, ensure that it is capable of gradually increasing the oven's temperature without causing thermal stress.</li> <li>• Replace the temperature control systems to maintain consistent and controlled heating.</li> <li>• Replace the insulation material for heating chamber.</li> </ul>
5.2.3.3	<u>Testing and verification</u> <ul style="list-style-type: none"> <li>• Perform a series of controlled heating cycles to verify the burner's performance and the integrity of the components during the burn-out process.</li> </ul>

<u>Item no.</u>	<u>Requirements</u> This specification covers the minimum requirements.
<b>5.2.4</b>	<b>Exhaust and Ventilation Systems</b>
5.2.4.1	<ul style="list-style-type: none"> <li>• Evaluate the condition of the exhaust ducts and fans. Inspect for blockages, corrosion, or leaks.</li> <li>• Check the ventilation system to ensure efficient removal of combustion gases and particulates.</li> </ul>
5.2.4.2	<u>Repair and replacement</u> <ul style="list-style-type: none"> <li>• Replace exhaust ducts and fans as required. Ensure the ventilation system operates efficiently, with no leaks or blockages.</li> <li>• Replace gas Detector and Alarm System.</li> <li>• Replace the ventilation Louvers.</li> </ul> <u>Exhaust Fan Specifications</u> Operating Conditions: <ul style="list-style-type: none"> <li>• Temperature: 700°C to 800°C continuous operation</li> <li>• Airflow: 500 - 1000 m³/h</li> <li>• Static Pressure: 900 - 1800 Pa</li> <li>• Fan Type: High-temperature axial or centrifugal fan</li> <li>• Construction Material: Stainless steel or heat-resistant alloys</li> <li>• Voltage: Supply: 380V/400V (3-phase), 50 Hz</li> <li>• Motor: Industrial-grade, rated for high-temperature operation</li> <li>• Safety &amp; Compliance: Must comply with SANS 10087 and relevant local regulations, Over-temperature protection integrated into motor.</li> </ul>
5.2.4.3	Testing and verification <ul style="list-style-type: none"> <li>• Conduct airflow and emissions tests to ensure the exhaust and ventilation systems are functioning as required, with all harmful gases safely vented.</li> </ul>
<b>5.2.5</b>	<b>Water Circulation Tanks and Spray Jets:</b>
	<ul style="list-style-type: none"> <li>• Test the spray jets for proper operation, ensuring even distribution and effectiveness in neutralizing fumes.</li> </ul>
5.2.5.1	<u>Repair and replacement</u> <ul style="list-style-type: none"> <li>• Replace or repair any corroded or leaking parts in the water circulation system.</li> <li>• Clean the spray jets, replacing any that are malfunctioning, to ensure they neutralize or capture particulates effectively.</li> </ul>
5.2.5.2	Testing and verification <ul style="list-style-type: none"> <li>• Test the water circulation tanks and spray jets during operation to confirm they effectively neutralize or capture byproducts.</li> </ul>
<b>5.2.6</b>	<b>Afterburner System:</b>
5.2.6.1	<ul style="list-style-type: none"> <li>• Verify the afterburner's temperature control to ensure it reaches the necessary 700°C to 800°C range.</li> </ul>
5.2.6.2	<u>Repair and replacement</u> <ul style="list-style-type: none"> <li>• Replace the secondary gas burner in the afterburner chamber. Ensure it can maintain the required temperature for complete VOC combustion.</li> <li>• Test the afterburner's performance to confirm it is breaking down VOCs into less harmful substances effectively.</li> </ul> Install new the Afterburner Gas Burner (LPG, 50-150 kW), Temperature Sensors (Type K Thermocouples), Exhaust Ducting (SS, 150-300mm, insulated) and Combustion Air Fan (High-temperature, SS). Repair the Refractory-Lined Combustion Chamber (700-800°C).

<u>Item no.</u>	<u>Requirements</u> This specification covers the minimum requirements.
5.2.6.3	<u>Testing and verification</u> <ul style="list-style-type: none"> <li>• Measure the temperature in the afterburner chamber to ensure it reaches and maintains 700°C to 800°C.</li> <li>• Test the emissions from the afterburner to verify that VOCs are being fully combusted and reduced to safe levels.</li> </ul>

## 5.2.7 Specifications

<u>Item no.</u>	<u>Requirements</u> This specification covers the minimum requirements.
5.2.7.1	<u>Exhaust Fan Specifications</u> Operating Conditions: <ul style="list-style-type: none"> <li>• Temperature: 700°C to 800°C continuous operation</li> <li>• Airflow: 500 - 1000 m³/h</li> <li>• Static Pressure: 900 - 1800 Pa</li> <li>• Fan Type: High-temperature axial or centrifugal fan</li> <li>• Construction Material: Stainless steel or heat-resistant alloys</li> <li>• Voltage: Supply: 380V/400V (3-phase), 50 Hz</li> <li>• Motor: Industrial-grade, rated for high-temperature operation</li> <li>• Safety &amp; Compliance: Must comply with SANS 10087 and relevant local regulations, Over-temperature protection integrated into motor.</li> </ul>
5.2.7.2	<b>Gas Detector and Alarm System Specification</b> The system must be capable of detecting LPG leaks and triggering an alarm in case of dangerous gas concentrations, ensuring the safety of personnel and equipment. <p><b>Gas Detector Specifications</b></p> <u>Detection Type</u> <ul style="list-style-type: none"> <li>• <b>Gas Type:</b> LPG (Liquefied Petroleum Gas), which primarily consists of propane and butane.</li> <li>• <b>Detection Principle:</b> Catalytic bead or infrared (IR) sensor technology for reliable and accurate detection of LPG.</li> <li>• <b>Detection Range:</b> 0 to 100% LEL (Lower Explosive Limit) for LPG.</li> </ul> <p><b>Alarm Thresholds:</b></p> <ul style="list-style-type: none"> <li>• <b>First Stage:</b> 10% LEL (early warning).</li> <li>• <b>Second Stage:</b> 20% LEL (critical alarm).</li> </ul> <u>Sensor Features</u> <ul style="list-style-type: none"> <li>• <b>Operating Temperature:</b> The sensor should function reliably in ambient temperatures ranging from -10°C to 50°C (standard for indoor installations).</li> <li>• <b>Mounting Height:</b> LPG is heavier than air, so the detector should be mounted near the floor (or at low points) where LPG is likely to accumulate.</li> <li>• <b>Response Time:</b> &lt; 10 seconds to ensure rapid detection and response.</li> <li>• <b>Power Supply:</b> 24V DC or 230V AC, depending on the facility's power setup.</li> </ul> <u>Construction and Durability</u> <ul style="list-style-type: none"> <li>• <b>Ingress Protection (IP) Rating:</b> IP65 or higher for protection against dust and water ingress in an industrial environment.</li> <li>• <b>Housing Material:</b> Corrosion-resistant material, such as stainless steel or ABS plastic, to withstand industrial conditions.</li> </ul>



Item no.	<u>Requirements</u> <b>This specification covers the minimum requirements.</b>
	<ul style="list-style-type: none"> <li>• <b>Explosion Proof:</b> If the system is installed in a hazardous zone, it should be ATEX certified (or equivalent) for explosion protection.</li> </ul> <p><b>Alarm System Specifications</b></p> <p><u>Audible Alarm</u></p> <ul style="list-style-type: none"> <li>• <b>Sound Level:</b> The alarm must have a minimum sound output of <b>85 dB</b> at a distance of 1 meter to ensure it is heard over ambient noise in the industrial environment.</li> <li>• <b>Adjustable Volume:</b> The sound level should be adjustable to suit different areas of the facility.</li> <li>• <b>Tone Types:</b> Multiple alarm tones (pulsing, steady) to distinguish between different alarm stages (warning vs. critical).</li> </ul> <p><u>Visual Alarm</u></p> <ul style="list-style-type: none"> <li>• <b>Alarm Lights:</b> Bright <b>LED strobe lights</b> with distinct flashing patterns for different alarm stages.</li> <li>• <b>Color Coding:</b> <ul style="list-style-type: none"> <li>o <b>Yellow Light:</b> Pre-alarm (10% LEL).</li> <li>o <b>Red Light:</b> Critical alarm (20% LEL).</li> </ul> </li> <li>• <b>Visibility Range:</b> The visual alarm should be visible from at least 50 meters in all directions.</li> </ul>
5.2.7.3	<p><b>Control Panel</b></p> <ul style="list-style-type: none"> <li>• <b>Display:</b> LCD/LED display for real-time monitoring of gas concentrations, system status, and alarms.</li> <li>• <b>Interface:</b> User-friendly interface with clear alarm status indicators.</li> <li>• <b>Reset and Acknowledge Buttons:</b> Manual reset and alarm acknowledgment buttons for operators.</li> <li>• <b>Connectivity:</b> The system should support integration with building management systems (BMS) or SCADA systems via Modbus, 4-20mA, or RS-485 for remote monitoring.</li> </ul>
5.2.7.4	<p><b>System Integration and Controls</b></p> <p><u>Emergency Shut-Off Integration</u></p> <ul style="list-style-type: none"> <li>• <b>Automatic Shut-Off:</b> The system should be capable of automatically activating an emergency LPG shut-off valve when gas concentrations exceed a critical threshold (e.g., 20% LEL).</li> <li>• <b>Manual Shut-Off:</b> A manual shut-off button should also be available at the control panel for operator intervention.</li> </ul> <p><u>Gas Detector Test and Calibration</u></p> <ul style="list-style-type: none"> <li>• <b>Calibration Interval:</b> The system should be capable of regular calibration (every 6-12 months), either manually or automatically.</li> <li>• <b>Self-Diagnostics:</b> The gas detection system should have built-in diagnostics to alert operators of sensor faults, wiring issues, or the need for recalibration.</li> </ul>
5.2.7.5	<p><b>Power Supply</b></p> <ul style="list-style-type: none"> <li>• <b>Primary Power Source:</b> The system should be powered by the facility's main supply (230V AC or 24V DC).</li> <li>• <b>Battery Backup:</b> The system should include an uninterruptible power supply (UPS) to ensure continued operation for at least 4-6 hours in case of a power failure.</li> </ul>

<u>Item no.</u>	<u>Requirements</u> This specification covers the minimum requirements.
5.2.7.6	<b>Installation Requirements</b> <u>Detector Placement</u> <ul style="list-style-type: none"> <li>• <b>Detector Locations:</b> Gas detectors should be placed at: <ul style="list-style-type: none"> <li>o The base of the oven.</li> <li>o Near the LPG piping.</li> <li>o Around the burner area and any other potential leak points.</li> <li>o Near the control panel and main entrance for monitoring.</li> </ul> </li> </ul> <b>Alarm Placement</b> <ul style="list-style-type: none"> <li>• <b>Audible/Visual Alarm Locations:</b> The alarms should be positioned at key areas, such as: <ul style="list-style-type: none"> <li>o The entrance to the room housing the varnish burn-out oven.</li> <li>o The control room for operator awareness.</li> <li>o Critical points along the LPG line for early warning.</li> </ul> </li> </ul>
5.2.7.7	<ul style="list-style-type: none"> <li>• The gas detection and alarm system must comply with the following standards: <ul style="list-style-type: none"> <li>o <b>SANS 10087:</b> Safety requirements for the handling, storage, and distribution of LPG.</li> <li>o <b>EN 60079</b> (or equivalent): For explosion-proof equipment.</li> <li>o <b>IEC 61508:</b> Functional safety for control systems.</li> <li>o <b>ATEX</b> (or equivalent): Certification for gas detectors in explosive environments, if required.</li> </ul> </li> </ul>
5.2.7.8	<b>Tank Capacity</b> <ul style="list-style-type: none"> <li>• Volume: 500 to 1000 liters capacity, depending on the amount of water required to neutralize fumes and particulates during the burn-out process.</li> <li>• Tank Design: Cylindrical or rectangular tank with baffles to ensure efficient water flow and particulate separation.</li> </ul> <b>Material</b> <ul style="list-style-type: none"> <li>• Material: 316 stainless steel for corrosion resistance and durability in a harsh industrial environment.</li> <li>• Wall Thickness: 3 to 5 mm thick walls to withstand pressure from the water circulation and potential mechanical impacts.</li> </ul> <b>Inlet and Outlet</b> <ul style="list-style-type: none"> <li>• Inlet: Sized to match the water supply line, typically 1" or 1.5" diameter.</li> <li>• Outlet: Fitted with a filtration system to trap particulates and prevent them from being recirculated.</li> <li>• Overflow Drain: An overflow drain should be provided to ensure excess water can be safely discharged.</li> <li>• Water Circulation Tank Specifications.</li> </ul>
5.2.7.9	<b>Water Jet Specifications</b> <u>Jet Type</u> <ul style="list-style-type: none"> <li>• Spray Type: Fine mist or atomizing spray jets to maximize the surface area for contact with fumes and particulates.</li> <li>• Spray Angle: 60° to 120° spray angle, depending on the tank design and the coverage required.</li> <li>• Flow Rate: 1-10 liters per minute (L/min) per jet, adjustable depending on the system requirements.</li> </ul>

<u>Item no.</u>	<u>Requirements</u> <b>This specification covers the minimum requirements.</b>
	<ul style="list-style-type: none"> <li>• Number of Jets: 6-10 jets distributed evenly throughout the system for uniform coverage.</li> </ul> <p><u>Material</u></p> <ul style="list-style-type: none"> <li>• Material: Stainless steel (316 or higher) for corrosion resistance in a high-temperature and humid environment. This is essential given the potential exposure to corrosive gases and water.</li> <li>• Nozzle Type: Anti-clog nozzles to prevent blockages from particulates in the water.</li> <li>• Connection: 1/2" NPT or BSP threaded connections for easy integration with the existing piping system.</li> </ul> <p><u>Pressure Requirements</u></p> <ul style="list-style-type: none"> <li>• Operating Pressure: The jets should operate efficiently within a pressure range of 2 to 5 bar (30 to 70 psi).</li> <li>• Pressure Regulation: The system should include a pressure regulator to maintain consistent water pressure across all jets.</li> </ul>
5.2.7.10	<p><b>Water Filtration System</b></p> <ul style="list-style-type: none"> <li>• Type: A multi-stage filtration system, including a coarse filter for larger particulates and a fine filter for smaller particulates.</li> <li>• Filter Media: Replaceable cartridge filters or washable metal mesh filters, depending on the system requirements.</li> <li>• Flow Rate: The filtration system should handle the full flow rate of the circulation system, typically 5-10 m<sup>3</sup>/h</li> </ul>
5.2.7.11	<p><b>Pump Specifications</b></p> <p><u>Pump Type</u></p> <ul style="list-style-type: none"> <li>• Type: Centrifugal pump capable of circulating water through the spray jets and the filtration system.</li> <li>• Flow Rate: The pump should have a flow rate of 5 to 10 m<sup>3</sup>/h, depending on the number of jets and the overall system demand.</li> <li>• Head Pressure: The pump should be able to maintain a head pressure of 15-20 meters to ensure proper jet performance.</li> </ul> <p><u>Material</u></p> <ul style="list-style-type: none"> <li>• Material: 316 stainless steel or equivalent corrosion-resistant material to ensure durability.</li> <li>• Impeller: Stainless steel impeller for long-lasting performance and resistance to wear.</li> </ul> <p><u>Motor</u></p> <ul style="list-style-type: none"> <li>• Power: 0.75 to 1.5 kW motor, depending on the system size and flow requirements.</li> <li>• Voltage: 380V/400V (3-phase), 50 Hz, or 230V (single-phase), depending on the facility's power availability.</li> <li>• Efficiency: High-efficiency motor (IE3 or better) to reduce energy consumption.</li> </ul>

<u>Item no.</u>	<u>Requirements</u> This specification covers the minimum requirements.
5.2.7.12	<p><b>Control and Monitoring</b></p> <p><u>Control Panel</u></p> <ul style="list-style-type: none"> <li>• Automatic Control: The water jets should be controlled automatically based on the oven's operational state. The control panel should be integrated with the overall control system (SCADA or PLC) of the oven.</li> <li>• Manual Override: A manual control option should be available for maintenance and troubleshooting.</li> <li>• Indicators: The control panel should display key parameters such as pump status, pressure, and flow rate.</li> </ul> <p><u>Pressure Monitoring</u></p> <p>Pressure Gauges: Install pressure gauges before and after the pump to monitor the water pressure throughout the system.</p> <ul style="list-style-type: none"> <li>• Pressure Switches: High and low-pressure switches should be integrated to protect the system from overpressure or loss of pressure.</li> </ul> <p><u>Water Level Monitoring</u></p> <ul style="list-style-type: none"> <li>• Float Switches: The tank should be equipped with float switches to monitor water levels and trigger alarms if the water level drops too low.</li> <li>• Automatic Refill: An automatic refill system connected to the water supply should be integrated to maintain the water level in the tank.</li> </ul> <p><b>Installation Requirements</b></p> <p><u>Piping</u></p> <ul style="list-style-type: none"> <li>• Piping Material: Stainless steel or PVC (schedule 80) for the water supply lines to resist corrosion.</li> <li>• Pipe Diameter: 1" to 1.5" diameter pipes, depending on the system flow requirements.</li> </ul> <p><u>Mounting</u></p> <ul style="list-style-type: none"> <li>• Jet Mounting: The spray jets should be securely mounted inside the exhaust duct or oven area where the fumes and particulates are captured. Ensure even distribution for complete coverage.</li> <li>• Tank Location: The water tank should be located close to the oven but positioned safely to avoid exposure to high heat.</li> </ul>
5.2.7.13	<p><b>Afterburner Burner Specification</b></p> <p><u>Burner Type</u></p> <p>Type: High-temperature gas burner (capable of operating with LPG).</p> <ul style="list-style-type: none"> <li>• Burner Power: 50 to 150 kW, depending on the required heat load to maintain 700°C to 800°C in the afterburner.</li> <li>• Burner Control: Modulating burner for precise control of temperature and fuel consumption.</li> </ul> <p><u>Fuel Type</u></p> <ul style="list-style-type: none"> <li>• Fuel: LPG (Liquefied Petroleum Gas).</li> <li>• Fuel Consumption: Should be rated to match the heat load required to maintain 700°C to 800°C. For example, a 100 kW burner may consume 7-10 kg of LPG per hour depending on efficiency.</li> </ul> <p><u>Burner Efficiency</u></p> <ul style="list-style-type: none"> <li>• Efficiency: Minimum 85% efficiency to ensure optimal fuel consumption and heat output.</li> </ul>

<u>Item no.</u>	<u>Requirements</u> This specification covers the minimum requirements.
	<p><b><u>Afterburner Combustion Chamber Specifications</u></b></p> <p><b><u>Chamber Size</u></b></p> <ul style="list-style-type: none"> <li>• Dimensions: The combustion chamber should be appropriately sized to accommodate the gas flow and allow sufficient residence time for complete combustion. Typical residence time is 0.3 to 1 second.</li> <li>• Volume: 1-2 m<sup>3</sup> depending on gas flow rate and residence time requirements.</li> </ul> <p><b><u>Material</u></b></p> <ul style="list-style-type: none"> <li>• Material: Refractory-lined stainless steel (316) or heat-resistant alloy capable of withstanding continuous operation at temperatures up to 1000°C.</li> <li>• Refractory Lining: High-temperature refractory brick or ceramic fiber insulation with a thickness of 50 to 100 mm, depending on the heat retention required.</li> </ul> <p><b><u>Insulation</u></b></p> <ul style="list-style-type: none"> <li>• Insulation: The chamber should be lined with high-temperature insulation, such as ceramic fiber blankets or refractory bricks, to prevent heat loss and ensure thermal efficiency.</li> <li>• Insulation Thickness: 75-100 mm of ceramic fiber or refractory material.</li> </ul>
	<p><b><u>Control System</u></b></p>
5.2.7.14	<p><b><u>Temperature Control</u></b></p> <ul style="list-style-type: none"> <li>• Temperature Sensors: The system should include Type K thermocouples for monitoring the temperature inside the combustion chamber.</li> <li>• Control Panel: The afterburner should be integrated with the oven's control system (SCADA or PLC) for automated control, including burner modulation, temperature regulation, and fault monitoring.</li> <li>• Display: A digital display for monitoring real-time temperatures, fuel consumption, and system status.</li> </ul> <p><b><u>Safety Controls</u></b></p> <ul style="list-style-type: none"> <li>• Flame Failure Detection: The burner should be equipped with flame detection (e.g., UV or ionization sensor) to shut off the fuel supply in case of flame failure.</li> <li>• Over-Temperature Protection: An over-temperature cut-off should be integrated to protect the system from exceeding safe operating temperatures.</li> <li>• Automatic Shut-Down: In case of critical failure (e.g., fuel supply issue, flame failure, over-temperature), the system should shut down automatically and activate an alarm.</li> </ul> <p><b><u>Emission Control</u></b></p> <ul style="list-style-type: none"> <li>• VOC Destruction Efficiency: The afterburner must achieve a minimum of 98-99% destruction efficiency for VOCs.</li> <li>• Emissions Monitoring: The system should include provisions for monitoring emissions of CO, NO<sub>x</sub>, and VOCs to ensure compliance with environmental regulations.</li> <li>• Compliance: The afterburner must comply with local environmental standards for industrial emissions.</li> </ul>

<u>Item no.</u>	<u>Requirements</u> This specification covers the minimum requirements.
5.2.7.15	<p><b>Oven Door Multi-Layer Insulation System Specifications</b></p> <p>A multi-layered system using a combination of ceramic fiber blankets, calcium silicate boards, and a refractory brick lining would provide the necessary thermal resistance, mechanical durability, and safety for the oven door. Regular maintenance of the insulation and sealing systems to extend the oven's lifespan and improve operational safety.</p> <p><b>Layer 1: Hot-Face Insulation (Primary Layer)</b></p> <ul style="list-style-type: none"> <li>• Material: Ceramic Fiber Blanket</li> <li>• Temperature Rating: Up to 1260°C (2320°F).</li> <li>• Thickness: 25-50 mm.</li> <li>• Density: 96-128 kg/m<sup>3</sup> (preferred for industrial oven use).</li> <li>• Thermal Conductivity: 0.15 W/m·K at 800°C.</li> <li>• Properties: <ul style="list-style-type: none"> <li>o Low thermal conductivity to reduce heat transfer.</li> <li>o Resistant to thermal shock.</li> <li>o Non-combustible and lightweight.</li> <li>o Easy to install and cut to fit door panels.</li> </ul> </li> <li>• <b>Installation Method:</b> Ceramic fiber blankets will be layered over the inner side of the oven door, providing direct exposure to high temperatures.</li> </ul> <p><b>Layer 2: Backup Insulation (Secondary Layer)</b></p> <ul style="list-style-type: none"> <li>• Material: Calcium Silicate Board</li> <li>• Temperature Rating: Up to 1000°C (1832°F).</li> <li>• Thickness: 25-50 mm (depends on insulation requirements).</li> <li>• Density: 220-350 kg/m<sup>3</sup>.</li> <li>• Thermal Conductivity: 0.12 W/m·K at 800°C.</li> <li>• Properties: <ul style="list-style-type: none"> <li>o Good mechanical strength for structural support.</li> <li>o Excellent thermal insulation properties with low thermal conductivity.</li> <li>o Lightweight and easy to handle during installation.</li> </ul> </li> <li>• <b>Installation Method:</b> Calcium silicate boards will be placed behind the ceramic fiber blanket as a backup insulation layer to enhance thermal efficiency and reinforce structural integrity.</li> </ul> <p><b>Layer 3: Outer Protection (Exterior Shell)</b></p> <ul style="list-style-type: none"> <li>• Material: Stainless Steel Sheet (316 or 304 Grade)</li> <li>• Temperature Rating: Stainless steel can handle surface temperatures up to 500°C.</li> <li>• Thickness: 2-4 mm, depending on structural needs.</li> <li>• <u>Properties:</u> <ul style="list-style-type: none"> <li>o Corrosion-resistant, durable, and long-lasting in industrial environments.</li> <li>o Provides a protective outer layer for the door, ensuring a cool-to-touch external surface.</li> <li>o Mechanical protection for the underlying insulation layers.</li> </ul> </li> <li>• <b>Installation Method:</b> Stainless steel sheeting will serve as the outermost layer to shield the insulation and provide a robust structural surface. It also acts as a radiation barrier, reducing heat dissipation.</li> </ul>

<u>Item no.</u>	<u>Requirements</u> This specification covers the minimum requirements.
	<b>High-Temperature Gasket Material</b> Material: Woven Fiberglass or Ceramic Fiber Rope Gasket <ul style="list-style-type: none"> <li>• Temperature Rating: Up to 1000°C (1832°F).</li> <li>• Diameter: 10-25 mm, depending on the door's groove and sealing requirements.</li> </ul> <u>Properties:</u> <ul style="list-style-type: none"> <li>o High resistance to temperature and thermal cycling.</li> <li>o Excellent sealing properties, ensuring airtight closure to prevent heat loss.</li> <li>o Flexible and durable to withstand repeated opening and closing.</li> </ul> <ul style="list-style-type: none"> <li>• Installation Method: The gasket material should be installed in a continuous groove along the edge of the oven door. When the door is closed, the gasket will compress, creating an airtight seal.</li> </ul>
5.2.7.16	Testing and commissioning
5.2.7.17	Submission of list of parts, part numbers, with the details of brands and model numbers.

### 5.3 Scope of works for repairing the electrical bake oven

<u>Item no.</u>	<u>Requirements</u> This specification covers the minimum requirements.	<u>Qty</u>
5.3.1	Supply, delivery and installation of the following:	
5.3.2	32A, 4 Pole Fuse Link Isolator	1
5.3.3	Isolator Panel - 3CR12 Stainless Steel – Powder Coated	1
5.3.4	HMI - 7inch, 7"W Easy Touch Panel, Ethernet model	1
5.3.5	Programmable Logic Controller (PLC), Ethernet, Logic controller. 16 inputs/outputs. 7 relay outputs. 100-240 VAC Including PLC I/O, interface components	1
5.3.6	Digital Input Card – 32 Channel, Discrete input module, 32 inputs (HE10) 24 VDC	1
5.3.7	Digital Output Card – 32 Channel, Discrete output module 32 outputs transistor NPN	1
5.3.8	Analogue Input Card – 8 Channel, 8 analog inputs (screw) 24Vdc	2
5.3.9	Analogue Output Card – 4 Channel, Analog output module, 4 outputs (screw) 24 VDC	3
5.3.10	5 port Unmanaged Network Switch, Contact 5 Port Ethernet Switch	1
5.3.11	Surge Protection for Analogue Inputs	12
5.3.12	24VDC Power Supply Unit	1
5.3.13	Motor Starter Circuit Breaker (Motor circuit breaker, 3P, 1-1.6 A, thermal magnetic, screw clamp terminals)	3
5.3.14	Contactors, 3P(3 NO), AC-3/AC-3e, 0 to 440V, 6A, 230VAC 50/60Hz coil	3
5.3.15	Control Panel - 3CR12 Stainless Steel – Powder Coated	1
5.3.16	Selector Switch, metal. black. ~22. 3 positions. stay put. 2 NO	3
5.3.17	Terminals	100
5.3.18	Thyristor Switching Module, 36kvar	2
5.3.19	Contactors 160A, 80KW	1



<b>Item no.</b>	<b>Requirements</b> <b>This specification covers the minimum requirements.</b>	<b>Qty</b>
5.3.20	Main MCCB 250A, Fuse Switch Disconnecter, 4 Pole	1
5.3.21	Red Sounder Beacon, Surface Mount Electronic Sounder, 9 → 28 V dc, 102dB at 1 m, IP65, DC, 32-Tone	1
5.3.22	Current Transformer, 250/5 RING CT 32mm	3
5.3.23	Power Meter, 110 - 400 VAC, Panel mount multi-function meter	1
	<b>Field Equipment</b>	
5.3.24	Temperature Probe 400 °C (Sensor, 6mm Dia, 250mm Long, 4 Wire, G1/2, +650°C Max)	3
5.3.25	Motor (Circulation fan, 0,55kW, 4 Pole, 400V)	1
5.3.26	Centrifugal Pump (water circulation - 0,75kW)	2
5.3.27	Solenoid Valve, 3/4inch, 24VDC, 2 port(s) , NC, 24 V dc	2
5.3.28	Level Sensor - 300mm depth (Guided Radar Level Radar, 0-10 V, 4-20 mA Output, Vertical, PBT Body)	1
5.3.29	Isolator 16A, 3Pole (3P Pole Panel Mount Isolator Switch - 16A Maximum Current, 5.5kW Power Rating, IP65)	3
5.3.30	Heater Elements, 1m, 3kW Tubular heater 8X2300 380V 3000W C/W CRIMP ON BUSH M-SHAPE	18
5.3.31	150mm Wide cable tray with covers - Light duty galvanized	1
5.3.32	Nickel-plated brass glands and shrouds	40

#### 5.4 List of cables to be replaced

<b>Item no.</b>	<b>Requirements</b> <b>This specification covers the minimum requirements.</b>	
5.4.1	high-temperature stainless steel braided cable (for PT00 sensor)	5m
5.4.2	high-temperature stainless steel braided cable (for PT00 sensor)	5m
5.4.3	high-temperature stainless steel braided cable (for PT00 sensor)	5m
5.4.4	4 core Nitrile trailing cable (for a motor)	5m
5.4.5	4 core Nitrile trailing cable (for a pump 1)	5m
5.4.6	4 core Nitrile trailing cable (for a pump 2)	5m
5.4.7	4 pair dekaron individual and overall screen (Gas burner 1 control )	5m
5.4.8	4 pair dekaron individual and overall screen (Gas burner 2 control )	5m
5.4.9	2 pair dekaron individual and overall screen (Water tank limit switch)	5m
5.4.10	2 pair dekaron individual and overall screen (Cooling water solenoid)	5m
5.4.11	2 pair dekaron individual and overall screen (Inlet water solenoid)	5m
5.4.12	4 core Nitrile trailing cable (Gas burner 1 power)	5m
5.4.13	4 core Nitrile trailing cable (Gas burner 2 power )	5m
5.4.14	4 core PVC, SWA, PVC (Main power cable)	7m

#### 5.5 Supply and delivery

- The equipment shall be supplied and delivered at Rotating Machines Depot, Umbilo Industrial, Umbilo.

#### 5.6 Calibration

- The measuring instruments shall come with valid calibration certificates.



- No equipment will be accepted by TE without the satisfaction of the conditions above.
- Each measuring instrument shall be tested and calibrated. Valid calibration certificates shall be submitted to the Project Manager.
- The period from date of calibration and date of submission of calibration certificates shall not be greater / older than 1 month.
- The calibration certificates shall bear the SANAS logo and laboratory accreditation number.

#### 5.7 Testing

- All tests to be done on site.
- Additional tests can be ordered by Transnet Engineering.

#### 5.8 Completion and handover

- A testing period of 1 month (744 hours for 24/7 shifts and 248 hours for 8 hour shifts).
- No equipment will be accepted by TE without the satisfaction of the conditions above.

5.8.1	<p><b>On completion, the contractor shall supply the following documents in 1 set of PDF files in a USB memory stick and 3 sets of hard copies.</b></p> <p><b>Operation</b> Operation Manual</p> <p><b>Maintenance</b> Maintenance Manual Greasing Intervals with Locations Oil checking intervals with locations Trouble shooting guide and solutions Critical Spares List</p> <p><b>Electrical</b> Electrical Schematics Electrical parts lists (including manufacturer and supplier part numbers). Details of PLC Programme</p> <p><b>Mechanical</b> Mechanical Assembly drawings Mechanical Parts Lists (including manufacturer and supplier part numbers).</p> <p><b>Training</b> The contractor to provide training on how to safely operate, service and maintain the repaired bake ovens. The training shall be comprehensive on the subjects of operation, technology, programming, repair, service and maintenance.</p>
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#### 5.9 Warranty

- The warranty period shall be 24 months.
- The contractor shall undertake to repair all faults due to bad workmanship and/or faulty materials during a period of 24 months, calculated from the date that the completed plant installation is accepted by TE.
- Any latent defects that become apparent during the warranty period shall be rectified to the satisfaction of TE at the cost of the supplier.
- The supplier shall agree to replace at his/her cost any defective items discovered within the guaranteed period.

**Note:** All work to be completed in each respect by suitably qualified person.

## **6. OTHER INFORMATION RELATED TO THE SCOPE**

- 6.1 This specification states the minimum requirements relating to the work and in no way absolves the contractor from responsibility for sound engineering practice. Any omissions or sub-standard requirements of this specification must be brought to the attention of Transnet Engineering at tender stage and optional prices for addressing such omissions must be provided.
- 6.2 Any matter relating to this work, which requires a decision from Transnet Engineering shall be presented to the Project Manager in charge.
- 6.3 All offers shall be completed in every respect with this specification. Only completed tenders shall be considered
- 6.4 The Technical Officer reserves the right to have the proposal checked independently by a third party.
- 6.5 Tenders must allow for monthly progress and clarification meetings on site initially and after commissioning for defect meetings when required. A meeting will be held after issuing of the tender to establish the exact scope and magnitude of the contract. No tender will be considered unless it has this Certificate signed by the Engineer or his representative.

## **7. HEALTH AND SAFETY REQUIREMENTS**

- 7.1 All equipment whether detailed in this specification or not shall comply with the requirements of the Occupational Health and Safety Act 85 of 1993 as amended and all other applicable legislation including specific set of regulations and local authority bylaws where applicable.
- 7.2 All the necessary safety equipment such as guards over rotating equipment shall be supplied and the equipment shall comply fully with all the requirements of the South African Occupational Health and Safety Act, Act 85 of 1993 and all other applicable legislation including specific set of regulations and local authority bylaws where applicable.

## **8. SPECIALIST SUB-CONTRACTORS**

- 8.1 Only specialist sub-contractors who have previously successfully completed work of the type and extent specified in this document should be engaged. The tenderer shall provide the technical officer with sufficient proof of having suitable experience regarding the design and manufacturing of similar equipment. To this end, complete and detailed reference list shall be submitted with the tender. Reference list shall include addresses as well as contact person who may be visited for inspection of the equipment during the adjudication period.
- 8.2 The tender shall submit a complete list of proposed sub-contractors and suppliers of major components with his tender.
- 8.3 The tenderer shall be prepared to commit themselves in writing to the technical officer with an adequate, experienced and stable project team for the duration of the contract.
- 8.4 Transnet Engineering will not consider any Tenderer's offer that, in the sole opinion of Transnet Engineering, does not have adequate experience in the design and manufacture of such equipment.

- 8.5 Contractors shall do the installation simultaneously with other contractors on-site busy with other work and shall plan work that it integrates with other work performed.

## 9. EQUIPMENT

- 9.1 The required items shall be complete in all respects.
- 9.2 Tenderers shall supply a list of all materials proposed as well as the addresses of the local support companies.

## 10. GENERAL REQUIREMENTS

Operation will be in the following conditions:

Altitude	Sea level
Ambient temperature	0°C to 45°C
Relative humidity	50% to 100%
Atmosphere	Heavy saline

## 11. DEFINITIONS AND ABBREVIATIONS

**CLIENT** Transnet Engineering Durban

**TECHNICAL OFFICER:** Project Manager, Transnet Engineering Durban

**CONTRACTOR** Contractor appointed under this specification document

## 12. GENERAL

- 12.1 The successful tenderer will be subjected to a workshop inspection by Transnet Engineering, to ensure that the facilities are to the satisfaction of the Transnet Engineering in terms of the quality control and equipment capabilities for manufacturing such type of equipment.
- 12.2 The tenderers shall guarantee that the rating and size etc. of the equipment offered, will be adequate to perform the duties required.

## 13. PENALTY CLAUSES

- 13.1 Due to the criticality of this project, penalties will be levied for late deliveries.