NEOMETRIX

Cryogenic Liquid Medical Oxygen Storage Tank

Product Catalog

www.neometrixgroup.com

About us:

Neometrix Defence Celebrating 20 Years of Excellence! For the past two decades, Neometrix Defence has maintained its position as a premier provider of advanced test benches and rigs.

Our accreditation by the Directorate General of Aeronautical Quality Assurance, India (DGAQA) and Defence Research & Development Organization, India (DRDO) underscores our commitment to upholding the highest international defence industry standards.

Counting the Indian Air Force/Army/Navy, Ministry of Defence, Hindustan Aeronautical Limited, and DRDO among our esteemed clientele, we are recognized for delivering state-of-the-art solutions and unwavering performance reliability.

Strengths & Capabilities:

Neometrix Defence is a powerhouse of engineering brilliance, proudly serving every Indian Air Force station and partnering with the Indian Army, Navy, Railways, BARC, NPCIL, and ISRO. With a team of over 100 elite engineers and visionary founders from IIT Kanpur and IIT Delhi, we harness cutting-edge technology to set the gold standard in mechanical engineering.

We Don't Just Meet Industry Demands – We Define Them!

- We have established our presence in all Air Force stations across India. With the Indian Air Force as our leading customer, we are dedicated to upholding the highest standards of excellence in the aerospace industry.
- Our extensive clientele extends beyond the defence industry, including projects with the Indian Army, Navy, Railways, BARC, NPCIL, ISRO, and more. In essence, we excel in all aspects of mechanical engineering!
- Our team comprises over 100 graduate engineers, supported by a cutting-edge manufacturing site equipped with state-of the-art machinery, enabling us to meet the highest Engineering standards.
- The founders of our company are distinguished graduates from IIT Kanpur and IIT Delhi, bringing extensive expertise and a wealth of engineering knowledge to Neometrix Defence.

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Introduction:

The CRYO-10KL/20KL-V-Oxygen represents the latest evolution in bulk cryogenic storage, purpose-built to deliver uninterrupted, high-purity liquid oxygen for the most demanding applications. At its heart lies a 20 000 L ± 5 % stainless-steel inner vessel, fabricated from SS-304 and assembled with orbital-welded seams to guarantee hermetic integrity even under repeated thermal cycling. That vessel is nested within a carbon-steel outer shell, epoxy-coated to shield against corrosion—together forming a double-wall "jacket" whose annulus is evacuated to ≤ 100 µm Hg warm and charged with perlite under vacuum. This combination of vacuum insulation and high-performance fill maintains stored LOX at –196 °C with daily boil-off losses below 0.45 % of nominal volume, minimizing both product waste and onsite replenishment frequency.

Precision engineering to EN 13458-2, ASME VIII-1, and PED 2014/68/EU ensures that every structural weld, safety relief, and pressure-retaining component exceeds global pressure-vessel standards. The tank's compact vertical profile reduces footprint requirements, allowing installation in constrained plant layouts or adjacent to existing medical-gas manifolds without major civil works. For rapid commissioning, dual fill/withdrawal ports support both pump-assisted and gravity-feed transfers; quick-connect hydraulic and vacuum interfaces enable vacuum-jacketing and pressurization equipment to be hooked up in minutes rather than hours.

Purpose & Applications:

Medical & Hospital Oxygen

Centralized LOX storage is the backbone of modern hospital gas-delivery systems. The CRYO-10KL/20KL-V enables bulk supply to multiple wards via a single tank, feeding central pipeline outlets for intensive-care ventilators, anaesthesia machines, and oxygen concentrators. Redundant dual relief valves and burst discs safeguard patient safety during peak-flow scenarios—such as trauma admissions or surgical suites—while integrated purity sampling ports allow on-the-fly verification to pharmaceutical-grade standards.

Semiconductor Manufacturing

Advanced wafer-fabrication processes—PECVD, RTP oxidation, and deep reactive-ion etching—demand oxygen of < 1 ppb moisture and particulate. The CRYO-20KL's stainless-steel wetted parts, orbital-welded manifolds, and electropolished internal surfaces prevent contamination, while the pressure-building coil provides regulated vapor at 2–17 bar for mass-flow controllers. Its compact footprint allows installation in clean-room peripheries, and real-time boil-off monitoring integrates with fab SCADA systems for seamless process control.

Industrial & Metal Fabrication

Oxy-fuel applications—from shipbuilding to heavy fabrication—require sustained high-pressure vapor flow. Equipped with a star-finned coil rated for up to 600 LPM at 350 bar, the CRYO-20KL eliminates the need for external vaporizers. Operators benefit from plug-and-play gas-delivery modules with inline filters and regulators, reducing filth-induced downtime. The tank's design withstands harsh yard environments, with epoxy-coated outer shell and seismic anchoring options ensuring uninterrupted operation in all climates.

Aerospace & Research

Static-fire test stands, rocket-motor development, and cryogenic material studies rely on reliable LOX supply near test rigs. The CRYO-20KL's modular skid packages allow relocation between stands, while comprehensive data-logging of pressure, temperature, vacuum, and flow underpins detailed post-test analysis. Its minimal heat-ingress and low boil-off extend test campaigns without frequent top-ups, reducing logistical complexity at remote facilities.

System Architecture:

1 Double-Wall Pressure Vessel

- Inner Vessel: SS-304 cylinder (X5 CrNi 18-10) with orbital-welded, full-penetration seams for zero-leak integrity.
- Outer Shell: Carbon-steel S355J2 with epoxy finish, designed for atmospheric protection and structural support.

2 Vacuum Insulation & Fill

- Evacuation: Annulus pumped down to ≤ 100 µm Hg warm, monitored by a thermocouple-type vacuum gauge.
- Insulation Medium: Perlite under vacuum; optional upgrade to 3M™ Glass Bubbles reduces thermal conductivity by up to 35 %.

3 Pressure-Building Coil & Vapor Delivery

- Star-Finned Coil: Stainless-steel tube with extended fins, immersed in LOX to vaporize liquid directly
- Filter & Regulator Module: Includes 0.2 µm coalescing filter, pressure regulator with gauge, and manual isolation valve.
- Selector Valve: Three-way full-bore valve to switch between coil circuit and relief network for maintenance isolation.

4 Cryogenic-Rated Valves & Piping

- Long-Stem Globe Valves: Cryogenic service valves with extended stems to keep packing above cold zones.
- Orbital Welding: All stainless-steel manifolds welded for leak-free joints; no threaded connections in wetted paths.

5 Instrumentation & Integration

- Level Measurement: Differential-pressure transmitter with three-valve manifolds plus local level-gauge tubes.
- Pressure Indication: Bourdon-tube gauge and optional 4-20 mA digital transducer for SCADA.
- Sampling Port: ¼″ SS port with valve for purity checks and analytical hookups.
- Documentation: Complete P&ID, 3-D CAD, and spare-parts BOM provided.

Technical Specifications:

Parameter	Specification
Nominal Capacity	10 000 L, 20 000 L ± 5 %
Materials	Inner – SS-304; Outer – Carbon Steel S355J2 (epoxy-coated)
Working Pressure (Inner)	Up to 17 bar gauge
Design Temperatures	Inner: –196 °C to +40 °C; Outer: –20 °C to +55 °C
Boil-off Rate (NER)	≤ 0.45 %/day (perlite insulation)
Annulus Vacuum	≤ 100 µm Hg (warm)
Insulation Medium	Perlite (standard); 3M™ Glass Bubbles (optional)
Relief Devices	Dual spring-loaded safety valves; dual burst discs; manual selector valve
Fill / Withdrawal	Top & bottom fill valves; liquid withdrawal check-valve; gas draw-off via coil
Instrumentation	DP-level transmitter; Bourdon gauge; thermocouple vacuum gauge; sampling port

Mechanical & Environmental Design:

The outer shell's epoxy-coated S355J2 steel provides robust protection against atmospheric corrosion, while the inner SS-304 cylinder resists cold embrittlement and maintains ductility at cryogenic temperatures. Footprint and load-bearing anchor templates are provided to design a concrete foundation capable of withstanding static (tank + LOX) and dynamic (seismic) loads.

Cryogenic–mechanical seals employ a multi-layer arrangement: double-lip polyurethane dynamic seals backed by PTFE rings, with HNBR static O-rings at all flanges. This ensures zero leakage under pressures of 720 bar and temperatures to –196 °C. Vacuum jacketing includes demountable access ports for resealing after maintenance.

Environmental resilience extends to site conditions from –20 °C Arctic labs to +55 °C desert installations. Thermal cycling tests—repeated fill/evacuation over 200 cycles—validate that neither perlite settlement nor seal fatigue degrades performance over a 20-year design life.

Operational Workflow

Site Preparation & Foundation

– Place footprint template; pour reinforced concrete pad; install anchor bolts per drawing.

– Verify levelness (< 5 mm over tank diameter) and cure time (minimum 14 days).

Installation & Hookup

– Position tank; torque anchor bolts; connect vacuum pump to annulus port; evacuate to ≤ 100 µm Hg.

– Flush fill/withdrawal lines with dry nitrogen to purge moisture; install leak-checked cryogenic hoses.

Commissioning

– Fill with LOX at controlled rate (≤ 200 L/min) to minimize thermal shock.

– Verify boil-off rate (≤ 0.45 %/day) over a 24 h hold; calibrate DP-level and pressure instrumentation.

Daily Operation

– Monitor DP-level gauge and log vapor withdrawal via coil regulator.

– Inspect vacuum gauge and relief-valve selector weekly; perform sampling port purity check monthly.

Maintenance & Inspection

– Annually: vacuum pump-down and leak check; replace vacuum gauge isolation valve seals.

– Every 5 years: relief-valve bench testing; perlite re-packing if boil-off exceeds threshold.

Safety, Compliance & Quality:

- Pressure Safety: Dual redundancy system with spring relief valves (API 520-compliant) and burst discs; manual selector valve for isolation.
- Certification & Traceability: Each tank laser-etched with serial number; digital dossier includes FEA reports, FAT certificates, component lot numbers, and test logs.
- Quality Assurance: 100% weld inspection via radiography; helium leak detection for inner vessel; hydrostatic test at 1.5× design pressure.
- Compliance Standards: EN 13458, ASME VIII, PED 2014/68/EU, ISO 9001 quality management, ISO 14001 environmental management.
- Emergency Response: Pressure safety training, PSSR documentation, and local authority notification templates provided as part of the delivery package.