NEOMETRIX

Test Rig For OBIGGS

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 Test Rig for OBIGGS represents a fully integrated, turnkey solution engineered specifically to validate and certify On-Board Inert Gas Generating Systems under the most demanding conditions. Purpose-built for both military and transport aircraft platforms, this ground-station fixture reproduces in-flight bleed-air characteristics with exceptional fidelity—simulating pressures from 0.5 to 12 bar, temperatures up to 300 °C, and humidity transients, all under controlled dynamic flow profiles. Such replication allows engineers to stress-test membrane modules and downstream plumbing exactly as they would operate at altitude, ensuring every system component—from hollow-Fiber bundles to control valves—meets stringent performance thresholds.

Key performance metrics are rigorously assessed:

Membrane Integrity: Long-duration soak and pressure-cycling tests verify that Fiber sheaths and potting materials resist embrittlement, swelling or delamination over thousands of operating hours.

Inert-Gas Purity: Continuous sampling across the flow path ensures that nitrogen-enriched air remains above 90 % concentration throughout ramp, soak and purge sequences.

Dynamic Response: High-speed data capture (up to 10 Hz) characterizes system rise and fall times, enabling fine-tuning of control algorithms to minimize overshoot and ensure rapid recovery following transient events.

Leak Tightness: Helium-assisted leak detection down to parts-per-million levels validates all seals, welds and fittings, preventing undetected permeation that could compromise in-flight safety.

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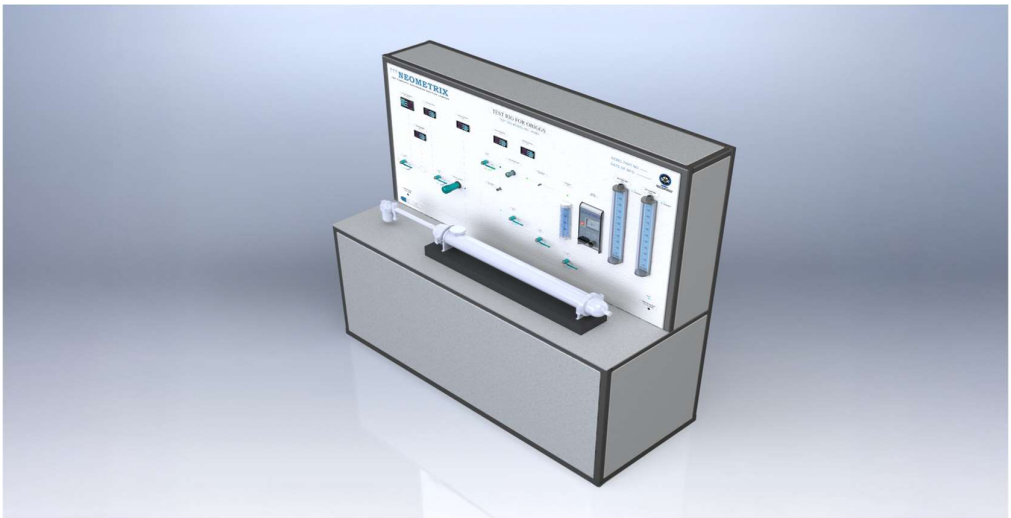


Purpose & Applications:

1 Why Fuel-Tank Inerting?

In-flight fuel-tank ullage zones contain volatile fuel-air mixtures that become explosive if oxygen content exceeds approximately 12 % by volume. Natural and man-made ignition sources—lightning strikes, static buildup during refuelling, combat damage or electrical arcing—pose a serious detonation risk. The OBIGGS solution mitigates this hazard by continuously displacing oxygen with high-purity nitrogen, effectively breaking the fire triangle (fuel + oxidizer + ignition source) and delivering passive, reliable protection throughout all phases of flight.

2 OBIGGS Operation

- Bleed-Air Extraction: High-temperature, high-pressure air is drawn from the engine compressor section (200–300 °C, 4–7 bar) to feed the system.
- Air Pre-Treatment: A multi-stage filtration train and shell-and-tube heat exchanger scrub particulates, oil aerosols and moisture to ISO 8573-1 Class 1.1.1 standards, safeguarding downstream membranes.
- Membrane Separation: Hollow-fiber bundles selectively allow oxygen and water vapor to permeate, yielding a continuous stream of nitrogen-enriched air (NEA) with $\geq$ 90 % purity.
- Ullage Inerting: NEA is metered into the fuel-tank ullage at a controlled flow rate, maintaining O_2 levels below 10–12 % under diverse flight regimes.
- Permeate Management: Oxygen-rich permeate is either vented safely overboard or routed back to a low-pressure return manifold for further processing or energy recovery.

System Architecture:

1 Air Supply & Regulation

At the frontline of the rig's pneumatic system is an 8 bar(g) inlet delivering up to 1 000 LPM of filtered bleed air. A dual-stage regulator arrangement—PR-1 (0.5–12 bar, 3 500 LPM) and PR-2 (0.5–7 bar, 1 600 LPM)—ensures stable downstream pressure across all test profiles. Four bi-stable ball valves (–0.95→+30 bar, 15 mm ports) provide rapid isolation or cross-over capabilities, while inline pressure transducers feed data back to the PLC for closed-loop control.

2 Flow Control & Measurement

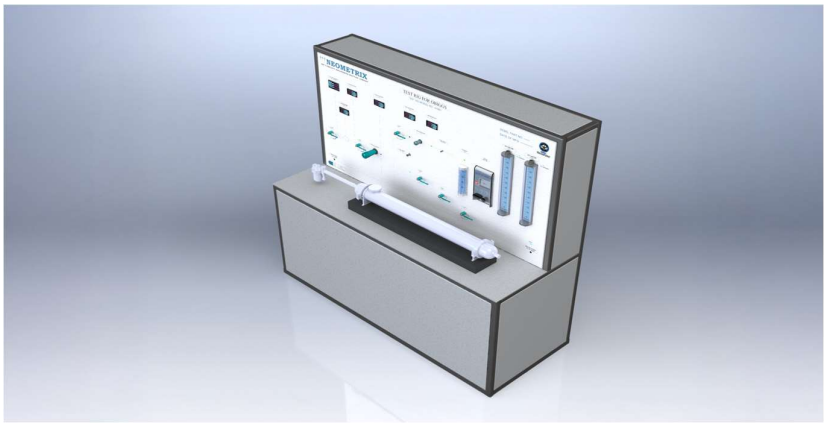
Manual needle valves permit precise sweep-rate profiling between 1 and 10 bar, enabling slow ramp tests or rapid step changes. Mass flow meters—FM-1 for coarse flows (0–100 LPM), FM-2 for mid-range (50–500 LPM) and FM-3/4 for micro-flows (94–944 ccm)—all feature ±2 % full-scale accuracy and feed real-time volumetric data to the SCADA system.

3 Oxygen Analysis

A Servomex MiniMP 5200 paramagnetic analyzer provides continuous O_2 concentration readings from 0 to 100 %, with an accuracy of ±0.02 % and T_{90} response under 15 seconds. Automated zero/span routines, combined with onboard pressure and temperature compensation, guarantee measurement reliability throughout extended test campaigns.

4 Control & Data Acquisition

Central control resides in a Siemens S7-1200 PLC, interfaced via a 10.1″ HMI touchscreen for intuitive profile setup and status monitoring. A Windows 10 PC running custom SCADA software scripts test sequences, visualizes live trends and archives data at rates up to 10 Hz. Export functionality to CSV, PDF or XML formats streamlines certification reporting and off-line analysis workflows.



Technical Specifications:

Category	Specification
Pneumatics	Inlet: 8 bar(g) @ 1 000 LPM NTP Filtration: ISO 8573-1 Class 1.1.1 PR-1: 0.5–12 bar, 3 500 LPM PR-2: 0.5–7 bar, 1 600 LPM
Valves & Fittings	On/Off Valves: 4× 15 mm bi-stable ball valves (–0.95→+30 bar) Needle Valves: 2× 1–10 bar adjustment Push-in fittings, 8 mm/12 mm tubing
Flow Measurement	FM-1: 0–100 LPM ±2 % F.S. FM-2: 50–500 LPM ±2 % F.S. FM-3/4: 94–944 ccm ±2 % F.S.
Gas Analysis	Analyzer: Servomex MiniMP 5200 (paramagnetic) Range: 0–100 % O2 Accuracy: ±0.02 % O2 T90: < 15 s
Control System	PLC: Siemens S7-1200 HMI: 10.1" TFT touchscreen Software: Custom SCADA (test sequencing, data export)
Data Logging	Sampling Rate: 1–10 Hz Storage: Local SSD; USB backup Export: CSV, PDF, XML
Electrical	Supply: 230 VAC ±10 %, 50 Hz, 2 kW Protection: RCD, MCBs, E-stop EMC: Complies with EN 55011, EN 61326
Mechanical	Frame: Powder-coated 304 SS Dimensions: 1 200×800×1 600 mm (L×W×H) Weight: ~320 kg Mobility: Lockable castors
Environmental	Operating: +10 °C to +50 °C (optional chamber: –20 °C to +60 °C) Humidity: 10–90 % RH non-condensing

Safety Features	E-stop, over-pressure relief valves @ 16 bar, safety interlocks Leak-down alarm
Compliance	CE (EMC, LVD), MIL-STD-810G (shock/vibration/temperature), ISO 9001:2015
Documentation	IQ/OQ/PQ protocols, FAT/SAT templates, calibration certificates
Training & Support	2-day on-site training; 12-month warranty (extendable to 36 months); annual maintenance contracts available

Mechanical & Environmental Design:

Encased in a robust 304 stainless-steel chassis with tamper-proof panels and quick-release latches, the rig is built to withstand harsh aerospace maintenance environments. All external surfaces receive a corrosion-resistant powder coat rated to IP54, protecting against dust, splash and salt spray. Mobility is provided by heavy-duty swivel castors with integrated brakes, allowing precise positioning on shop-floor or hangar aprons. Internal electronics and pneumatics benefit from forced-air ventilation, while an optional environmental chamber can subject the rig to temperatures from –20 °C to +60 °C for stress testing. Service access is simplified via color-coded tubing, clearly labeled ports and removable access panels, minimizing downtime during maintenance or calibration activities.

Operational Workflow

Setup & Calibration: Technicians perform single-point hookups for bleed air and 230 VAC power. The rig's SCADA automatically executes analyzer zero/span routines and a five-minute leak-down test at 10 bar, verifying system integrity before live testing.

Test Sequencing: Engineers define complex profiles—pressure ramps in 0.5 bar increments, flow sweeps from 50 to 500 LPM, and temperature cycles—directly via the HMI or imported from pre-configured SCADA scripts.

Real-Time Monitoring: Live trending of inlet pressure, differential pressure across membranes, volumetric flow and O_2 concentration is displayed graphically, with audible and visual alarms for threshold deviations or detected leaks.

Reporting & Analysis: Upon sequence completion, the system auto-generates certification-ready reports—complete with plots, statistical summaries and pass/fail indicators—and archives raw data in user-selectable CSV, PDF or XML formats for deeper analysis in MATLAB, Python or other tools

Safety, Compliance & Quality:

Safety interlocks and emergency-stop circuitry immediately isolate pneumatic and electrical supplies in the event of fault conditions. Over-pressure relief valves set at 16 bar, combined with automatic leak alarms, prevent unsafe pressure buildup. Full compliance with CE (EMC/LVD), MIL-STD-810G environmental testing, ISO 8573-1 pneumatic cleanliness and ISO 9001:2015 quality standards ensures both regulatory acceptance and reliable operation. A complete documentation package—including IQ/OQ/PQ protocols, FAT/SAT templates, material/certification traceability and comprehensive user and maintenance manuals—accompanies each rig.

Installation, Training & Support:

Neometrix provides end-to-end support: onsite factory commissioning validates system performance against customer specifications, followed by two days of hands-on training covering operation, maintenance and safety procedures. Standard warranty is 12 months, extendable up to 36 months, and annual maintenance contracts offer preventive calibration, software updates and priority spare-parts provisioning. For remote sites, secure VPN access enables real-time diagnostic support and software patching, ensuring minimal downtime and maximum uptime for critical aerospace certification and maintenance operations.