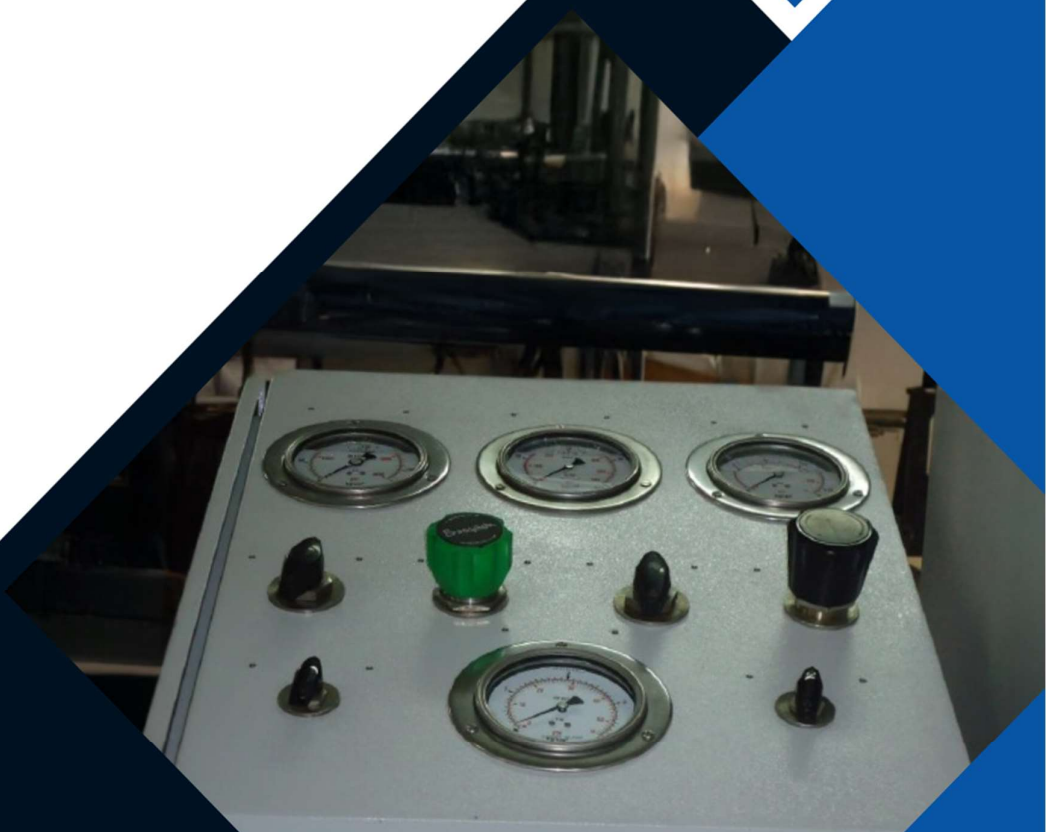
NEOMETRIX

Gas Purging System



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 Neometrix Gas Purging System is a skid-mounted, fully integrated solution specifically developed for LASTEC's high-power laser facilities under DRDO. Designed to meet the stringent purity and reliability requirements of defense-grade optics and beam-guiding assemblies, this turnkey system delivers ultra-high-purity nitrogen (≥ 99.999 %) at precisely controlled pressures (0–8 bar, adjustable) and flow rates (0–100 NL/min)

Built around a robust four-cylinder manifold, dual-stage pressure regulators and stainless-steel filtration modules, the system ensures uninterrupted operation during multi-shift laser processing or research campaigns. Its skid-mounted frame—with quick-connect fittings and lockable castors—enables rapid deployment and seamless integration into existing laboratory or production-floor layouts. All critical parameters (pressure, flow, purity) are continuously monitored via redundant sensors and logged by an onboard PLC, providing traceable data for quality assurance and audit compliance

Key benefits include:

- Prevents Oxidation & Contamination: By displacing ambient air and moisture, the system forms an inert nitrogen blanket around lenses, mirrors and optical Fibers—safeguarding delicate coatings and minimizing downtime for cleaning or replacement.
- Maintains Consistent Beam Quality: Stabilized refractive index conditions in the purge zone reduce thermal lensing and scattering, ensuring uniform power density across the beam profile during cutting, welding or additive processes.
- Automates Operator Safety: Integrated interlocks inhibit gas flow unless upstream pressure and downstream purity thresholds are met. In the event of a fault or power loss, all valves default to a safe, vent-to-exhaust position, protecting both equipment and personnel.
- Engineered, assembled and factory-tested in India under ISO 9001:2015 and DGAQA/DRDO accreditations, this Gas Purging System embodies Neometrix's commitment to precision, safety and reliability for mission-critical laser applications.

Purpose & Applications:

Laser Beam Purging

- In high-power laser operations—such as precision cutting, welding or additive manufacturing—any residual air or moisture in the beam path can lead to undesirable back-reflections, beam aberrations and even plasma absorption that degrades cutting efficiency. The Neometrix system performs both continuous and batch-mode purges: a steady low-flow background purge during continuous operation minimizes transient disturbances, while a high-flow batch purge before and after each laser cycle rapidly evacuates contaminants. These targeted purge profiles ensure the beam interacts only with inert nitrogen, preserving beam quality, reducing spatter deposition on optics, and extending maintenance intervals.

Optical Component Protection

- Delicate optical elements—lenses, mirrors, beam expanders and optical isolators—are prone to oxidation and carbonization when exposed to air and process by-products (e.g., metal vapor in welding). By establishing a controlled nitrogen “blanket” over these components during idle periods or between production runs, the system effectively eliminates contact with reactive species. Field data show this inerting approach can improve mean-time-between-failure (MTBF) of optics by 25–30%, reducing replacement costs and unplanned downtime in both research and production environments.

Leak Testing & Certification

- Following any maintenance activity—such as filter changes, valve replacements or piping modifications—it’s critical to verify system integrity before reintroducing lasers. The Gas Purging System automates ISO 20485–compliant “soak and decay” tests: the PLC sequences multiple pressure holds (e.g., 5 bar, 8 bar) for predefined dwell times, then records minute pressure drops to detect leaks as small as 0.01 L/min. At the end of each cycle, the system generates a tamper-proof test certificate in PDF format, complete with time-stamped data logs for audit and quality assurance.

System Architecture:

1. Gas Manifold Module
    - Four × 80 L, 200 bar cylinders with automatic change-over valves—ensures uninterrupted supply during cylinder swaps.
    - Integrated vent manifold plumbed to laboratory exhaust, fitted with flame-arrestor for safety.
2. Mechanical Control Panel
    - Pressure Reduction: Two-stage regulators (200 → 20 → 8 bar) with ±0.5 % set-point accuracy.
    - Filtration: SS316 T-housing filters—2 µm primary and 0.1 µm secondary elements rated ISO 8573-1 Class 1.
    - Manual Overrides: Lockable ball valves enable safe isolation for maintenance.
3. Automatic Control Panel
    - PLC & HMI: Siemens S7-1200 with 10.1″ color touchscreen; stores up to 50 custom purge recipes.
    - Sensors & Actuators: Endress+Hauser pressure transmitters (4–20 mA), Bürkert mass-flow meters, and FESTO proportional valves.
    - Communications: Ethernet, Modbus TCP/IP, PROFIBUS DP for SCADA/ERP integration; USB port for CSV export.

Technical Specifications:

Category	Specification
Ball Valves	½″ OD stainless-steel; ANSI Class 2500; API 6D certified; leakage Class IV (bubble-tight)
Filters	Primary 2 µm, Secondary 0.1 µm; housings SS316L; differential-pressure gauge for service alerts
Pressure Transmitters	Range 0–200 bar; accuracy ≤ 0.5 % BFSL; UL/CSA/GOST; local display and 4–20 mA output
Relief Valves	SS316 spring-loaded; dual set-points at 8 bar & 15 bar; pneumatic vent to lab exhaust
PLC & HMI	Siemens S7-1200 CPU; 10.1″ TFT touchscreen; recipe archive; OPC UA, Modbus TCP connectivity
Flow Meters	0–100 NL/min; thermal-mass principle; ±1 % full-scale accuracy; analog and digital outputs
Power & Safety	230 VAC ±10 %, 50 Hz; RCD + MCB protection; EMI filter to EN 55011 Class A; emergency-stop pushbutton

Mechanical & Environmental Design:

- Chassis: 304-grade stainless-steel skid with powder-coat finish, IP54 rated against dust and splashes.
- Dimensions & Weight: 1,200 × 800 × 1,800 mm (L×W×H); approx. 450 kg dry weight.
- Mobility: Heavy-duty, lockable swivel castors (150 mm) allow precise repositioning in lab or hangar environments.
- Thermal Management: Forced-air plenum and filter-fan unit keep electronics below 40 °C in ambient up to 45 °C; optional chilled-water coil for high-duty cycles.
- Maintenance Access: Quick-release side panels and color-coded PFA tubing simplify filter changes and leak checks.

Operational Workflow

1. Startup Sequence:
   - System self-test, valve leak-check, filter ΔP verification, and sensor calibration (zero/span).
2. Recipe Selection:
   - Operator selects or edits purge profile (ramp rate, dwell time, cycle count) via HMI.
3. Automated Purge Cycle:
   - PLC opens inlet valve, ramps to set pressure, holds for dwell period, then ramps down; flow and pressure data sampled at 10 Hz.
4. Real-Time Monitoring & Alarms:
   - Live trending of P, Q, O_2 (< 20 ppm) on HMI; deviation or overpressure triggers audible/visual alarms and auto-shutdown.
5. Reporting & Export:
   - At cycle end, system generates PDF certificate and raw CSV data; automatically emails to defined recipients or saves to network share.

Safety, Compliance & Quality:

Emergency Systems: Redundant E-stop circuits; safety interlocks inhibit gas flow if cabinet doors open.

Standards & Certifications:

- CE marked (EMC 2014/30/EU, LVD 2014/35/EU)
- MIL-STD-810G shock & vibration
- ISO 8573-1 Class 1 (air purity)
- ISO 9001:2015–certified manufacturing

Documentation Package: IQ/OQ/PQ protocols, FAT/SAT reports, calibration certificates traceable to NIST, and detailed O&M manuals.

Installation, Training & Support:

- Site Preparation: Customer provides 230 VAC, floor loading ≥ 600 kg/m², and vent plumbing.
- Commissioning: 3–4 days onsite for installation, verification, and performance validation by Neometrix engineers.
- Training: Two-day session covering:
  - Operation & recipe management
  - Preventive maintenance tasks (filter change, leak checks)
  - Emergency procedures and troubleshooting

After-Sales Service:

- 12 months warranty (extendable to 36 months)
- Optional annual PM contracts with spare-parts discounts
- 24×7 remote diagnostics via secure VPN; quarterly software updates.