NEOMETRIX

45° Left & Right Movement Durability Test Rig

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 45° Left & Right Moment Durability Test Rig is a high-precision, servo-hydraulic platform engineered for accelerated fatigue testing of components subjected to alternating bending moments. By mounting the Unit Under Test (UUT) at a fixed 45° inclination, the rig replicates real-world stress profiles encountered in steering columns, suspension links, aerospace control arms, and heavy-equipment joints.

Key capabilities include:

- High-Cycle Endurance: Capable of running up to 20 cycles per minute continuously for weeks, generating over 2 million test cycles without interruption.

- Programmable Load Sequences: Customizable load, dwell, and ramp profiles allow reproduction of field-recorded time-history traces (e.g., pothole impacts, steering feedback pulsations).

- Precision Feedback: Integrated 5 kN load cell (±0.1 % FS) and high-accuracy pressure transducers feed back into the control loop, guaranteeing that each cycle adheres to user-defined tolerances.

- Combined with turnkey software, data-logging, and safety features, this rig provides a complete solution for Quality, R&D, and Certification labs aiming to validate component lifetimes far beyond standard bench tests.

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Purpose & Applications:

The rig addresses four primary use-cases:

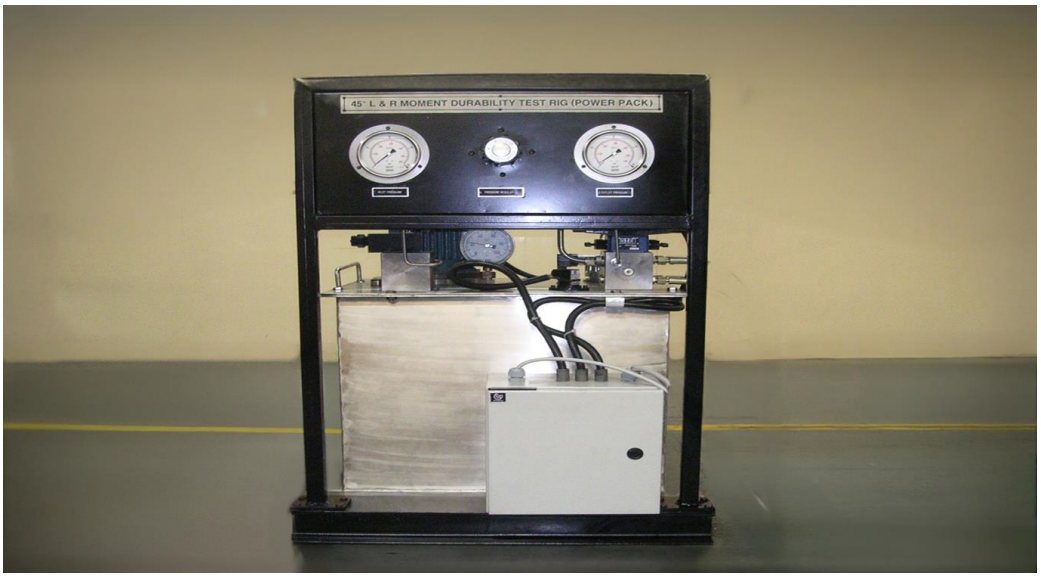
1. Automotive Steering & Suspension Durability
   - Rack-and-Pinion Assemblies: Simulates torsional and bending loads on steering racks to validate backlash limits and wear patterns under extended duty cycles.
   - Universal Joints & Couplings: Alternating load sequences reveal high-stress pivot zones prone to crack initiation.
2. Aerospace Control Linkage Qualification
   - Flight-Control Horns: Fatigue validation under combined bending/torsion per SAE AS D-427, ensuring redundant-load paths remain intact through extreme manoeuvres.
   - Actuator Rod Ends: End¬-of¬lifecycle verification of spherical bearings.
3. Off-Highway Machinery & Industrial Joints
   - Crane Boom Pins: Reproduce heavy-duty bending cycles that occur during load lifting and slewing operations.
   - Mining-Vehicle Linkages: Harsh-environment testing (dust, vibration) can be added via optional enclosures.
4. R&D, Supplier Qualification & Materials Development
   - New Alloy Testing: Compare fatigue lives of carbon-steel vs. advanced high-strength alloys under identical loading conditions.
   - Design Iterations: Rapidly evaluate geometric changes (fillet radius, cross-section) before committing to full-scale prototypes.

System Architecture:

Hydraulic & Mechanical

- Hydraulic Power Unit (HPU):
  - Parker piston pump delivering up to 200 bar, mounted on anti-vibration skid.
  - 150 L SS 304 reservoir with triple-stage (≤5 µm) filtration, in-tank cooler, and oil-level/temperature interlocks.
- Static Vertical Alignment Actuator:
  - 300 mm stroke; positioning accuracy ±0.1 mm.
  - Ball-screw drive and linear guide for zero-backlash movement.
- Dynamic 45° Lateral Actuator:
  - 150 mm stroke, 0–5 kN force; swivel mount held at fixed 45° angle.
  - Low-leakage servo valve (<2 ms response) maintains target load within ±0.5 % throughout each cycle.
- Control & Data Acquisition
  - PLC & HMI: Siemens S7-1500 CPU with WinCC Professional, 10″ touchscreen.
- Software:
  - Drag-and-drop profile editor; import/export road-load CSV traces.
  - Real-time plotting of load, displacement, pressure, and cycle count.
  - Automatic Pass/Fail criteria based on user-set thresholds.

Data Export: CSV, MDF, MATLAB® formats; network or USB transfer.



Technical Specifications:

Parameter	Specification
Bending Moment	300–350 N at 45°
Cycle Rate	0–20 CPM (configurable)
Static Actuator Stroke	300 mm
Dynamic Actuator Stroke	150 mm
Force Capacity	Up to 5 kN
Load Cell	5 kN, ±0.1 % FS
Reservoir Capacity	150 L SS 304
Max. System Pressure	200 bar
Filtration	3-stage, ≤ 5 µm
Ambient Operating Temperature	0–45 °C (optional –40 °C to +100 °C chamber)
Power	415 VAC 3-phase 15 kVA; 24 V DC control power
Data Rate	1 kHz/channel

Mechanical & Environmental Design:

- Frame: Robust four-column welded steel, stiffness > 10 kN/mm to prevent deflection under peak loads.
- Fixtures: Quick-release universal mounting plate accommodates UUTs up to 50 kg with ±125 mm lateral and vertical adjustability.
- Guards & Enclosures: IP 54 powder-coated panels with safety interlocks; optional clear-polycarbonate doors for visibility.
- Mobility & Footprint: Lockable castors allow repositioning; compact layout of 1.2 m × 1.0 m × 2.0 m (L×W×H)..

Operational Workflow

Initial Setup:

- Level and anchor frame; connect hydraulic lines and power.
- Automated zero-span calibration of load cell and transducers.

Profile Definition:

- Use HMI to build load vs. time sequences or import CSV traces.
- Specify dwell times, ramp rates, and cycle count targets.

Test Execution:

- One-touch start; live dashboards display key parameters.
- Alarms trigger on deviations > ±2 % or emergency-stop activation.

Reporting:

- On-completion, generate summarized PDFs with cycle history, max/min loads, and Pass/Fail verdict.
- Raw data archived automatically for FEA correlation and audit trails.

Safety, Compliance & Quality:

- Safety PLC: Dual-channel architecture meeting ISO 13849-1 Cat 3 PL d.
- Hydraulic Relief: Two independent relief valves set at 160 bar; burst-rated hoses per ASME B31.1.
- Electrical Standards: IEC 60204-1 cabinets, UL-listed components, CE EMC/LVD compliance.
- Documentation: Includes IQ/OQ/PQ protocols, FAT/SAT checklists, calibration certificates traceable to national standards.