

Technical specifications for Servo Electric Fatigue Testing System

A computer-controlled 100kN Servo Electric Fatigue Testing System under strain, load and stroke control mode. The test system including two column load frame, electromechanical actuator, digital controller, computer control and data acquisition system. The system is capable of conducting test at triangular, trapezoidal and sine wave form under strain or load control according to user.

SCOPE OF SUPPLY:

- 100kN Servo Electric Fatigue system consist of
- Free standing 100kN two column load frame.
- 50kN Servo Electric actuator (Upgradeable to 100kN).
- 50kN Dynamic Loadcell.
- Hydraulic power unit for grip controls.
- Digital electronic controller for controlling the test condition.
- Test builder software for controlling the test parameters at strain, load and stroke control mode.
- Room Temperature LCF grips.
- Room Temperature Axial Extensometers.
- LCF application software in accordance with ASTM E-606 standard.
- Host computer system.

1. Load Frame

- ± 100 kN capacity hard chrome plated two column load frame with a moveable top crosshead with a provision to mount an load cell on it and a fixed bottom crosshead with a provision to mount a actuator on it
- Column spacing: 600 mm
- Vertical daylight: 1200 mm (between crossheads)
- Column diameter: 65 mm
- Load frames are of self-reacting, weather resistant and free from self-induced shocks and vibrations.
- Load frames aligned to high precision and have adequate factor of safety and high stiffness (600 MN/m)
- Load frame is fitted with lifts for automatic crosshead movement and clamps for locking crosshead.
- Touch screen operator control panel facilitates major control operations of the machine along with display of Load and Stroke Values.
- Emergency stop button mounted on load frame to shut off the system in the event of any emergency.
- Distinct frame design makes it work with no extra foundation. The load frame is mounted on Rubber dampers.
- Ergonomic hydraulic piping and electrical cabling for uncluttered access to test job.

2. Servo Electric Actuator

- ±50 kN fatigue rated, high performance servo-electric actuator with digital encoder for position measurement
- Resolution of stroke measurement: 0.1 µm
- Accuracy of stroke measurement: ± 0.5% of read out value
- Total stroke: 150 mm
- Speed range: 0.1 µm/sec to 5 mm/sec
- Threading for inter-connection with load train: M27x2
- High performance servo motor and servo drive for precise actuator movement and control.
- Note: Electronically Upgradeable to 100kN

3. Load Cell

- ±50 kN dynamic capacity load cell.
- Overload capacity:150% of read capacity.
- Precision machined column type design for protection against side load and high stiffness.
- 350 Ohm precision transducer class strain gauges.
- Non-linearity: ±0.05% of full scale
- Accuracy:ISO7500-1 Class 0.5
- Resolution :0.02% of Full-Scale Reading.
- Fatigue life: 10⁹ full stress reversed cycles at loadcell capacity

4. Hydraulic Power Pack

- Contamination insensitive servo-hydraulic power pack of 4 lpm flow
- Operating pressure: up to 210 bar, 1.5 kW system operating on three phase AC supply.
- Variable frequency drive control hardware to achieve required combination of flow and pressure from hydraulic power pack.
- Gear pump (Bosch or equivalent)
- Relief valve to limit system pressure from zero to 210 bar. Safety
- interlocks to trip power pack against temperature over shoot, lower oil level, filter clogging, phase failure and motor overload.
- Remote or local power pack operation.
- 10 micron return line filter with electric interlocks. Pressure transducer for power pack pressure sense and temperature sensor.

5. Single Station Digital Servo Controller

- High performance Digital Signal Processor with
- Resolution of Data Acquisition 24 bit analog, 32 bit digital.
- Servo Loop Control: 40 Bits at 6 kHz.
- Three stage data filtering, oversampling and user selectable digital filters.
- Control Channels - 2.
- Configured channels:
- Encoder Channel - 2 No's
- Load/Strain Channels - 3 No's
- High Level cards - 4 No's
- Digital to Analog Cards - 2No's.

- Digital I/O - 8 No's.
- PLC/PLI cards for the pump controls.
- MTL 32 Firmware for actuator.
- MTL 32 Basic software for actuator

6. Operator Panel:

Tablet based control panel with provision to move the actuator. Thumb wheel for actuator fine movement. Display oil temperature, working pressure and number of working hours. Mounted on column of the system and swivel joint to adjust the tablet based on operator convenient. Emergency shut down button at the convenient position.

7. Enclosure:

Enclosure to house controller and PC without air conditioner. The enclosure is on wheels for easy relocation.

8. External Cables:

Electrical cables for servo valve, encoder, load cell and powerpack control each 5m long between load frame and controller and powerpack.

9. Data Analysis

- Performs cyclic, static, Multi-Step and Time History (custom) waveform testing.
- Test can be done in stroke, load and extensometer control modes.
- Single and multi channel applications
- Display meters for current readouts, maximum and minimum readouts, peak valley readouts, set point and cycle counters.
- Data recording collects time and/or peak-valley data to binary formats. Data is exported to MS

Excel/text format where report generation and graphing can be performed.

- Data reduction options are available in when logging data in realtime or during export of data.
- Report Generator:
- Data playback
- Calculations for cyclic tests: amplitude, area under curve, phase angle, stiffness, modulus, etc.
- Report template in excel format

10. Hydraulic Low Cycle Fatigue Grips

- ±50 kN self aligning hydraulic grips
- Mounting cups for -
- 11L-01: M8 threaded specimens
- 11L-02: M10 threaded specimens
- 11L-03: M12 threaded specimens
- Fatigue rated, zero backlash, light weight and easily mountable without special tool In accordance with ASTM E606 Rated for room temperature operation
- M27 X 2 Threaded adaptors

11. Room Temperature Extensometer

- Gage length: 12.5 mm
- Measuring range: ± 1 mm
- Accuracy: $\pm 0.5\%$ of read out value as per ASTM E83
- Resolution: 0.02% of full scale range
- Excitation: 5 to 10 VDC
- Sensitivity: 2 to 4 mv/V
- Full bridge, 350 ohms strain gauged design
- These extensometers are designed for testing wide range of materials including metals, composites, ceramics and plastics
- These will work in both tension and compression, the dual flexure design makes them very rugged and insensitive for vibrations, which permits higher frequency (from 0.01 Hz to 2 Hz) operation
- Supplied with standard quick attach kit, for easy mounting on the specimen
- Mechanical over travel limits in both direction

12. LCF testing application software as per ASTM E606

- Software to perform LCF Tests under MTL32 environment.
- The user interface contains specimen description, loading parameters, pump controls, test run/stop, graph display, numeric readouts of multiple relevant test parameters.
- Tests can be done in stress control, total strain control and plastic strain control
- Option for multi-step programming
- Online display of unloading modulus, ratio of unloading and loading modulus, K' , n' yield stress, plastic strain, max-min stress and strain.
- Limit settings on Position, load and extensometer
- Option for specimen and furnace temperature data logging
- Test termination conditions: % change in modulus, % change in stress amplitude, % change in peak stress
- Auto data acquisition settings.
- Online graphs of stress vs strain and transients. up to 8 digital sense interlocks
- Offline post processing program to analyze the results in MS Excel.
- Option to save the test profiles.
- Option to remove residual strain.
- Option to add strain to gage length.

13. COMPUTER AND PRINTER:

Desktop PC with Intel i7 or higher Processor as per the following specifications:

- Processor: Intel Core i7-3770 3.4G 8M HD 4000 CPU or higher
- Chipset/Motherboard: Compatible Intel Chipset/Motherboard

- Memory: 4 GB DDR3-1600 DIMM (2x4GB) RAM
- HDD: 1 TB 7200 RPM 3.5 inch HDD
- Input devices: USB Standard Keyboard, USB Optical Mouse
- Compatible Speakers & Headphon
- Optical Drives: Removable CD/DVD Writer
- Monitor: Compatible 24” digital LED Monitor
- Operating System: Windows 8.1 Pro 64 or latest, down gradable to Win7 Pro 64. The original DVD media shall be supplied along with the installation keys.
- I/P Rating: AC Single Phase 230V/50 Hz.
- All the necessary cables shall be supplied 3000 VA UPS for PC and controller

14. Other important items

- Minimum of 3 years of warranty duration & installation and maintenance during the warranty period cost shall be considered to include in the main equipment cost
- Cost of equipment shall be quoted with price break up details for individual assembly's (a, b, c etc.,)
- Training /operations maintenance manual; equipment Software license transfer to IIT Madras with key.
- Delivery period/ duration for Fatigue testing system is **4 months**.
- Vendors/ Bidders should have minimum 10 years of prior experience in the field and should have supplied at least 5 testing system to Educational/ R&D labs in India in the past/ with in house testing and servicing facilities/ should be an OEM / installation certificates / po copy of earlier supplies Data shall be called for along with the bid.