SANTAM

Materials Testing Equipment

SAF-250B
With Hydraulic
Wedge Grips

Axial Fatigue Testing Machine
SAF-Series

SANTAM

UNITED REGISTRAR OF SYSTEMS
URS
ISO 9001
UKAS
MANAGEMENT
SYSTEMS
043

SAF-10
with Hydraulic Wedge Grips

SAF-50
with Hydraulic Wedge Grips

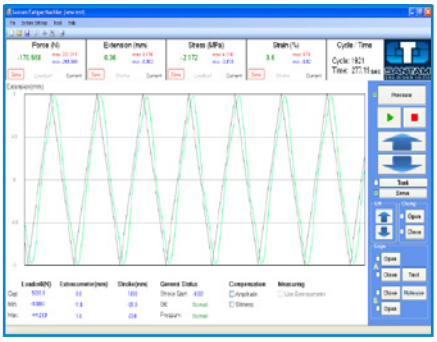
SAF-100
Heating & Cooling Chamber

SAF-600
with Hydraulic Wedge Grips

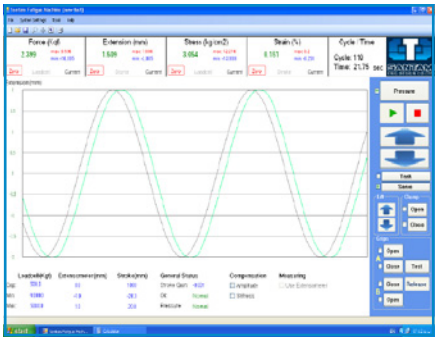
SAF-2000
with Hydraulic Wedge Grips

Features

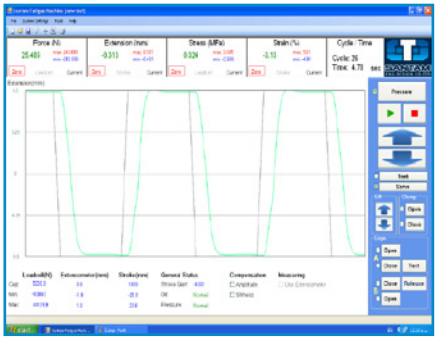
- Meet to ISO 14242 & ASTM E1942 standards
- Servo Hydraulic Actuator Operation type
- High precision dynamic loading application with various amplitude controls on Force, Extension, Strain, and Stress based on all types of fatigue wave forms i.e. Sinusoidal, Square, Triangular, Saw-Tooth and desired patterns or desired wave forms
- Applying Fatigue loads on high frequencies (up to 100Hz based on linear speed of actuator)
- Equipped Interface with DSP Technology, 5 KHz operation frequency and force, displacement and strain (Extensometer) control all in close loop control at 5 KHz
- High accuracy low profile dynamic load cell to reduce lateral forces error effects
- Non-contact electronic linear encoder installed on the jack (Resolution 0.001 mm for whole of stroke)
- Powerful software with instantaneous and Real Time control ability in various tests and relative processing
- Usage of all parts, measuring tools and controlling devices for long term testing
- Hydraulic crosshead lifting system and manual (or Hydraulic) clamping locking
- Capable of carrying out various static tests
- Interchangeable Grips, Fixtures, Extensometers & thermal chambers
- Effective cooling system prolonging the oil operation life time



Triangle Tensile & Compression Test Graph



Sinusoidal Tensile & Compression Test Graph



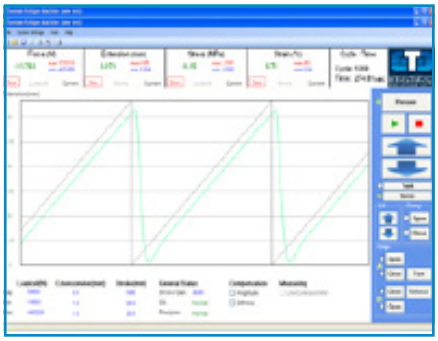
Square Tensile & Compression Test Graph

Application

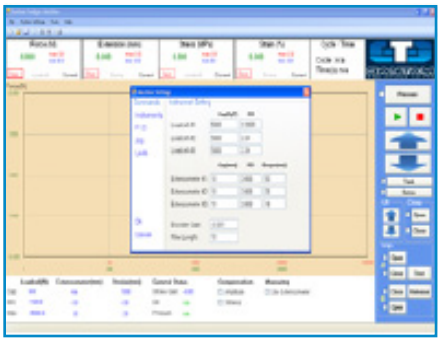
SAF series testing machines have a wide application range in Research and Quality Control purposes for Fatigue, Endurance and Parts Lifetime tests. Dynamic tests, determination of durability & performance of materials and components, Fatigue Endurance limit of materials, Crack generation, Crack growth,… could be carried out by SAF series testing machines

Common materials testing with the SAF series are **:**

Metals
Springs
Road & building materials
Assembled products
Structural Materials
Dampers
Automotive Parts
Aerospace Parts
Composites
Concrete
Rock Mechanics



Ramp Tensile & Compression Test Graph



PID Adjustment Menu

Extensometer Cross Flexture ECF10

Dynamic Tensile Grip

Self-aligned Compression Platens

High Response Servo Valve

Hydraulic Clamp of Crosshead

Descriptions

Materials testing under dynamic loading need high response system in mechanics, electronic, instruments and software. For high load (more than 10kN), high response closed loop servo hydraulic systems are suitable for this purpose. The system may act in one, two or multi direction. SANTAM introduce Axial Fatigue Testing Machines (SAF series) for one direction dynamic loading (Tension & Compression) based one high response digital closed loop servo hydraulic system. SAF series systems consist of main sections as Load Fame, Actuator, Controller, Hydraulic Power Pack & Software

Load Frame

SANTAM SAF series have robust load frame with high degree of stiffness in order to reduce deflection error in the test results. The machines have hydraulic crosshead lifting and clamping (SAF-10 & SAF-50 have manual clamping due to cost effect) which the user could adjust and fix desirable vertical room of the test section. In the SAF-xxxx models, actuator is installed on the crosshead which the load cell is connected to the actuator while in the SAF-xxxxB, actuator is installed on the lower block which the load cell is located under the crosshead. SAF-xxx models have the advantage that installation of the sample and parts for testing would be simple while SAF-xxxxB have the advantage that the error of grips and fixture inertia during test (with frequency more than 5 Hz and/ or high amplitude) would be minimum and negligible

Actuator

Use of high speed and heavy duty special sealing and precise manufacturing of the parts, SAF actuators could work with nominal load for long time testing. Use of high response hydraulic Servo Valve (MOOG) on the actuator, allows the machine to act very fast and follow the set points very rapidly. The actuator consists of digital non contact linear encoder (IP67) which could measure the position for whole of the stroke with 0.001 mm resolution. To prevent rotation of the rod during the test, all SAF actuators have Anti-Rotation mechanism to satisfy pure axial loading. Linear Speed of the actuator is depends on the oil flow rate feed from the power pack and is a main parameter for extreme of the machine performance (Test Amplitude and Frequency limitation)

Controller

SAF Controller actually is an integrated signal conditioner and digital controller based on DSP technology. All of measuring instruments from Load cell (Force), Load frame (Position) and Extensometer (Strain) are carried out by high response amplifiers and all of machine commands and faults are handled by the system. The SAF Controller connected to the PC via LAN (1000 Mbps). The controller can control all selected measuring signals (Force or Position or Strain) in the controller closed loop with update rate 5 kHz. This feature allows the machine to follow the set points (wave form generation set points) very precise. Analogue measuring (Force, Strain) resolution is 1/ ±32.000 of F.S. of the instrument. PID parameters for each measuring signal (both for Static and Dynamic modes) could be changed and adjusted fully Real Time and the operator could see the machines response of changing of the parameters upon input them

Hydraulic Power Pack

It is designed for long time working with nominal pressure (200 Bar continuous). For this purpose, the system uses high pressure oil filtering (5µ), special oil inter cooling (plate type heat exchanger), heavy duty pump (Piston type), separated electrical panel, … . The system needs proper water supply in order to cooling of the oil. Type of the power pack is categorized by its maximum oil flow rate and facility to action of crosshead Lifting & Clamping and Hydraulic Grips control. Oil low pressure & high temperature faults are detected from the power pack and handled with the software

Software

Main feature of the SAF software are:

- Designed to define and apply periodic load generation of the actuator for long (time testing (many cycles
- Cycle shape type: Sine, Triangle, Square, Ramp, Trapezoidal, User Pattern (define cycle (Time base or Phase base
- Cycle amplitude defining: Force , Stress, Extension, Strain
- Cycle frequency defining: 0.01 ~ 100 Hz
- Full Real Time response, instant action for any Cycle and PID parameters changing
- Common Static test Tensile, Compression & Bending test modes

Technical Specifications

Model Specifications	SAF-10	SAF-50	SAF-100	SAF-250	SAF-250B	SAF-600	SAF-1000	SAF-2000
Capacity (kN)	10kN	50kN	100kN	250kN	250kN	600kN	1000kN	2000kN
Distance Between Columns (mm)	420	500	600	680	680	720	800	Width 40 & Length 700
Distance Between Grips (mm)	350	250	400	550	550	600	650	650
Distance Between Blocks(mm)	700	700	800	1250	1000	1300	1400	1400
Lifting Type of Moveable Block	Hydraulic Jack	Hydraulic Jack	Hydraulic Jack	Hydraulic Jack	Hydraulic Jack	Hydraulic Jack	Hydraulic Jack	Hydraulic Jack
Locking Type of Moveable Block	manual	manual	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic
Actuator Stroke	100	100	150	150	150	150	150	150
Linear Speed 20 Liter/min	500(mm/sec)	100(mm/sec)	50 (mm/sec)	20 (mm/sec)	20 (mm/sec)	8(mm/sec)	5 (mm/sec))	2.5(mm/sec
40 Liter/min	1000(mm/sec)	200(mm/sec)	100 (mm/sec)	40 (mm/sec)	40 (mm/sec)	16(mm/sec)	10(mm/sec)	5(mm/sec)
Displacement Resolution (µm)	1	1	1	1	1	1	1	1
Dimension (Height×Width×Length) (mm)	690 × 600 ×1650	800 × 600 ×750	900 × 800 ×2500	1200 × 900 ×2850	1200 × 900 ×2850	1350 × 1100 ×3100	1500 × 1100 ×3200	1200 × 900 ×2200
Rough Weight (Kg)	250	450	14500	1700	1700	2200	2800	7000
Power Supply 3 phase, 380 Volts, 50 Hz	7.5kw,16A	7.5kw,17A	15kw,32A	15kw,32A	15kw,32A	15kw,32A	15kw,32A	15kw,32A

Commom Specifications

Common Technical Specifications (Frame Load)

- Equipped with Loading Double-acting Jack (Actuator) with equal compression loading surfaceUsing hardened & polished chrome Bar in Machine›s main Shafts
- Equipped with Crosshead hydraulic lifting to adjust constant Stroke of Machine-Including Clamping System of upper Block (Manual or Hydraulic) & its hydraulic motion on Machine›s guides to place Crosshead in required location
- Including Electrical Hydraulic Pump with relative hydraulic valves, inter cooler,-accumulator, Servo Hydraulic Valve & ….. & necessary parts
- Using sophisticated plate thermal transfers with high efficiency to cool oil-system via water & keeping constant temperature of Oil within Test to prevent the Changes of its Viscosity so that Test operation to not be influenced by this issue & keeping stability of Test until it is ended
- Using Electrical Protection against phase Cut-off, over voltage, overload, short circuit and temperature-dependent and oil-pressure protection system

Force Measurement

- Load cell: Dynamic tensile & Compression operation (Diaphragm Type)
- Standard: ISO 7500 ,EN 10002.2 DIN 51221, ASTM E-4
- Accuracy: 0.5% read value up to 1.5 of load cell capacity
- (Resolution: ±1/32000 of load cell capacity (Tensile & Compressiuon)
- Showing force with various units on Monitor based on SI, BS & MKS Systems (optional)
- Protection against overloading
- Capable of changing load cell (up to final capacity of Machine)
- Automatic identification of Load Cell

Displacement Measurement

- Actuator displacement which is measured through linear magnetic non contact sensor. including protection degree IP67 & showing resilience against vibration (up to 30gr) & frequency 2KHz
- Capacity of the total displacement of Actuator
- Measurement resolution of displacement: 1Micron (total displacement stroke)
- Displacement measuring accuracy better than 50 Micron (in 100mm)
- Displaying displacement with different units on monitor based on SI, BS & MKS Systems (optional)

Strain Measurement

- Short stroke Extensometer connection (High Resolution) based on Strain Gauge
- Standard: ASTM E83 , BS 3846 ، EN 10002-4 , ISO 9513
- Accuracy: 0.5% read value (accuracy class B)
- Resolution: ±1/32000 of Extensometer capacity
- Displaying strain on monitor based on percent & other relative units
- Automatic identification of Extensometer

Grips, Fixtures & accessories

- Hydraulic Fatigue Grips to clamp flat & round specimens
- Constant & self-aligned compression test's Grips

4-point bending Grips & 3

- Various fixtures to do dynamic Tests
- Furnace & cooling chamber

Computer Hardware

- Various industrial & trading Computer
- Data processing P4 (or higher), at least (RAM) 4GB, HDD, DVD ROM 120 GB
- At least 3 slots PCI & two ports USB
- Monitor SVGA

Computer software

- Operation system Microsoft Windows 2000,NT,XP, Win 7
- Full computerized control of Actuator, Hydraulic Grips, crosshead dis-placement system & clamping system
- Speed, situation, force & Strain control
- Stiffness Compensation of Machine & compensation of dynamic Grip & load cell weights & removing relative failures to acquire real & precise results
- Capable of automatically correcting amplitude failures so that real value to set value (Set Point) within Test through the option Amplitude
- Virtual keyboard included in software & two external keyboards to sepa-rately control Actuator, Machine›s hydraulic grips & height change of Crosshead & Clamping system
- Displaying force, displacement, stress, strain, cycle number & time with (various units on Monitor based on SI, BS & MKS Systems (optional
- Saving & reporting of Test›s data
- (The option calibration, force (load cell) & strain (Extensometer
- Fault alarming for temperature & oil pressure in case of exiting adjusted value
- Test Graph
- Instant curves of the cycles: Force, Displacement, Stress & Strain
- Simultaneously displaying defined cycles (Set Points) & real curve (Feed-back) to see response & compare & setting PID coefficients or changing test condi-tions & observing its results
- Test adjustment :
- Selecting Loading Shape, control type, amplitude, frequency, offset (pre-loading). Noise amplitude, Machine stop conditions & cycle number
- Entering the limitations of Max& Min of loading, displacement & strain for security & avoiding the exit of Machine from certain interval during test
- (Adjusting PID control coefficients (separately for each control condition
- Capability to change adjustment & Test conditions such as amplitude change, frequency, & PID control coefficients even within doing test & on-line obser-vation of response
- Saving & printing test results after finalizing test
- Specimen adjustment :
- Entering initial length, Grips distance & cross section (diameter for round & tube sections) or width, thickness, weight, length & cross section
- Curve adjustment for sampling method
- Determining various intervals for cycles & determining sampling rate (separately for each interval) for saving data so that all data can be saved in crucial cycles & in unimportant cycles to prevent data increasing less sampling will be done
- Print adjustment :
- (Complete result printing (colors & various areas

Working environment conditions

- Humidity 10-90% without condense
- Temperature 10-30 °C (Working)
- Dust free
- Machine Installation on foundation
- Filtered water cooling system suitable for connecting to heat transfer is needed
- The temperature of water cooling system should be maximum 24°C with minimum 2 x Power Pack oil flow rate

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