

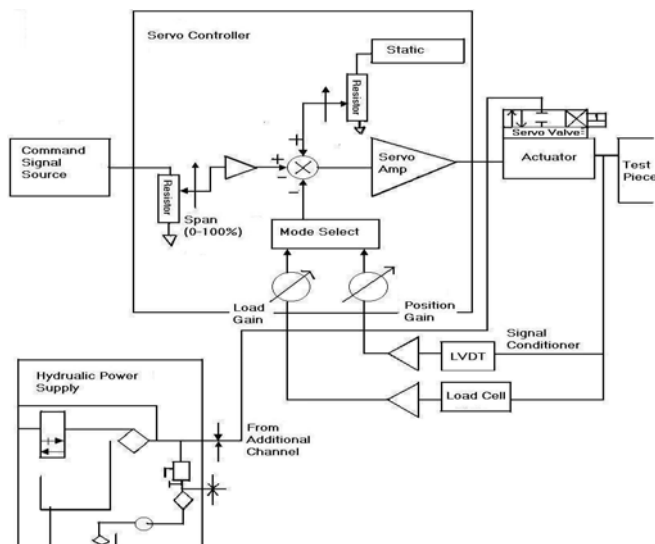
## Servo-Controlled Endurance Testing Machine (Capacity-Ranges from 200-1000kN)



Heico Servo Controlled Machine is capable of carrying out Static & Cyclic endurance tests. It is a fully computerized system and will be provided with manual adjustments to set the fixtures and samples.

The precise control of frequency and displacement in this machine is electronically controlled via the hydraulic based servo controlled close loop system.

A signal equivalent to frequency and amplitude is created in a function generator which is fed to the P.I.D. controller. Machine response signal is also fed to the P.I.D. controller. The error signal between the two signals creates differential pressure resulting in the movement of the actuator corresponding to programmed frequency and amplitude thereby completing the close loop



The system is supplied mainly in following components.

- 1 Loading Unit with fitted Actuator and Servo Valve
- 2 Hydraulic Power Supply
- 3 PC based Control System and Control Software
- 4 Transducers

## 1. LOADING UNIT WITH HYDRAULIC LIFT

Loading units is free standing units. It has a base and a cross head with fitted actuator along with servo valve. Cross head moves along the two pillars. Two hydraulic rams are provided for lifting of the cross head. Hydraulic locks are provided to lock the cross head at any position to suit the sample height. Controls are provided for lifting and lowering of the middle crosshead. Arrangement is also provided for locking of the crosshead at any desired position. Base of the frame will have T-slots to place the fixtures for different rubber components. Manifold is provided at the base for proper distribution of oil to the actuator and hydraulic-lock.

### Technical Specifications-

Capacity Range	:	200kN-1000kN
Horizontal clearance	:	450mm (Minimum)
Vertical clearance	:	400mm (Minimum)
Vertical cross head adjustment	:	200-4000mm
Capacity of the Actuator	:	200kN-1000kN
Testing stroke length	:	0-200mm ( $\pm$ 100mm)

### Actuator with servo valve

Actuator is a linear motion device, which gives a controlled motion either on stress basis or strain basis. It is a precision piece of equipment which follows the command from the wave generator through the servo valve. It is an equal area ram and piston with surface finish of 0.2 microns. End plates have metallic seals for side thrust. Servo valve is fixed to the actuator. These valves are high performance two stage valves with a pressure drop of @ 70 bars.

### Technical Specifications-

Type	:	Double Acting
Load carrying capacity	:	200kN-1000kN
Stroke length	:	200mm
Operating Pressure	:	180Bars
In built Displacement sensor	:	200mm ( $\pm$ 100mm)

## 2. HYDRAULIC POWER PACK

Hydraulic power supplies are compact in design and are suitable for the supply of required flow and pressure for the actuation of the actuator. It has an oil tank of adequate capacity, vane type pump powered by a three phase motor. It includes all the accessories like pressure line filter, return line filter, oil level, relief valve, pressure gauge, Bye pass valve in case of clogging of the filter etc. Anti vibration mountings are provided as standard along with the HPS.

A suitable water cooled heat exchanger (Shell and tube type) would be provided for cooling of the hydraulic oil. Temperature controller is provided to prevent overheating of the hydraulic beyond 50°C.



### Technical Specifications

Flow of the pump	:	50 lpm
Operating pressure	:	180Bars
Type of pump	:	Vane/Gear type
Capacity of the oil tank	:	200 litres
Power rating of the motor	:	30 HP
Heat exchanger capacity	:	15480 kcal/hr
Pressure line filter	:	3 microns
Return line filter	:	10 microns
Hoses	:	5 meter long
Electrical Cable	:	15meter long

All accessories like, pump pressure gauge, level gauge, pressure-line filter, return line filter, digital temperature controller are provided as standard along with the system.

System will be supplied with necessary cable and fittings for the operation of the machine. Total machine operates on **440 ± 10% VAC, 3 phase** supply.

### NOTE

1. Power connection equivalent to **400 ± 10% VAC**, 50 Hz, 3Phase, 60 Amp and single phase 220VAC, 15Amp, 50Hz is to be provided by the consignee.
2. Cooling Tower to maintain the oil temperature is not supplied as standard with machine and is quoted separately

## 3. PC BASED CONTROL SYSTEM AND CONTROL SOFTWARE

Control system provides the digital servo control, Ramp generation, different waveforms (Sine, Square & Triangular) for the machine, data acquisition, hydraulic control etc. for the continuous operation of the system.

### **(a) Signal Conditioning & Controlling Unit**

HEICO servo controller basically consists of signal condition unit and controlling unit. Signal conditioning unit receives the output signal from the various transducers (Load cells and Displacement Transducers) and amplifies and process that signal as per the requirement and transfer it to computer through connecting cables where it is accepted by the data acquisition system. The out put from the signal conditioning unit for each transducers ranges from 0-5V. The controlling unit controls the operation of the machine either on Stress basis or Strain basis.

It consists of dedicated servo-controller card that gives the desired processed signal through the P.I.D controller to the servo valve to operate either in strain mode or stress mode. It also sends the signal to computer and accepts the command from the software to operate in desired manner. The parameters like rate of loading for machine, safety limits for load & displacement can initially be programmed through the software. The programming facility is given to operate the system in **STATIC MODE** from **0.1mm/sec -1mm/sec. in displacement control** mode or **0.1kN/sec-5 kN/sec in load** control mode. In **DYNAMIC MODE** the cycling can be done at a frequency from **0.1Hz-10Hz**.

(Note: - With the increase in frequency the amplitude (stroke) tend to decrease. However, **Performance curve** is attached for ready reference)

### **(b) Dedicated Computer for Controlling and Data acquisition**

System is provided with dedicated computer with built in data acquisition card and wave generator. Broad specifications of the computer & Data Acquisition Card are given below.

#### **Computer**

Intel P-IV Dual Core Processor,  
1.8 Ghz or Higher, 160 GB HDD,  
2 GB RAM, DVD R/W drive,  
Key Board, Optical Mouse,  
17" TFT Screen,  
Deskjet Colored Printer  
UPS 1KVA

#### **Data acquisition card**

The PCI Bus advanced data acquisition card provides the following advanced features

- 32 bit PCI- bus
- 16-bit Analog Input resolution
- Auto Scanning Channel selection up to 16 channels
- Up to 100 KHz A/D Sampling Rates
- 16 Single ended Analog Input channels
- Bipolar Input signals
- Programmable gain of x1, x2, x4, x8, x16
- Input range: +/-10V, +/-5V, +/-2.5 V, +/-1.25V, +/-0.625V
- One 12-bit Monolithic multiplying Analog Output channel
- 16 Digital Output and 16 Digital Input channels

- 4 extended Digital Input and Digital Output channels on the 37 - pin connector
- 3 Independent programmable 16-bit down counters.
- Three A/D Trigger modes: Software Trigger, Programmable Pacer Trigger and External Pulse Trigger
- Pre-trigger control
- Internal DC-to-DC converter for stable Analog power source.

## CONTROL SOFTWARE

Control software is the integral part of the system for precise controlling, operation & Data Acquisition and analysis.

### Salient Features

- Windows based user friendly software
- High speed Data Acquisition card with 100 kHz sampling rate and 16-bit resolution acquires data from the signal conditioning and controlling unit
- Create and define test set-ups and data acquisition
- Independent Control test operation Static/Dynamic
- Two modes of testing i.e. Load and Displacement which can be set from the control unit
- Four different types of loading can be given to the sample- sine, triangular, square and Ramp signal.
- Different types of loading parameters can be given to the sample- Base, amplitude and frequency.
- Programmable rate of loading in static mode for the machine in both load as well as displacement.
- Shows number of cycles on screen
- Stores the number of cycles in the Endurance test
- Computer/Software programmable Safety Limits for each channel
- Independent Taring of each channel
- Facility to hold the machine and restart the loading during the test.
- Online monitoring of the data of all channels simultaneously
- Online plotting of Load v/s Displacement, Load v/s Time & displacement v/s Time
- Storing of data of each channel in user defined file/directory
- Storing of data of each channel in user defined file/directory that can be directly opened in Excel and Analysis Software
- Machine can go as high as 10Hz (10 cycles/second) and as low as 0.1Hz. (Higher amplitude can be achieved at lower frequency and amplitude decreases with the increase in frequency. **Performance curve** is attached for ready reference).
- To analyze the test result Analysis software is given which shows different type of graph and data i.e. load Vs displacement graph, load Vs time graph, displacement Vs time graph for statistical analysis.

## 4. TRANSDUCERS

The electronic transducers are fitted in the machine for accurate measurement of the Load and deformation. The detailed specifications of the transducers are given below.

### 1. Load Cell

It is a strain gauge based type Low profile Universal (Tension & Compression) load cell with full wheat-stone bridge configuration. Structure of the load cell is such that it can be loaded both in tension and compression over few million numbers of times. It has Alloy tool steel, electroless nickel plated structure for outstanding corrosion resistance.

#### Technical Specifications-

Capacity	:	200kN-1000kN
Make	:	Adi-Artech
Full Scale Output	:	2.0 mV/V
Zero Balance	:	$\pm 1\%$ of FS
Safe Overload(FSO)	:	150%
Non-Linearity	:	$< \pm 0.050\%$ of FS
Hysteresis	:	$< \pm 0.050\%$ of FS
Non-Repeatability	:	$< \pm 0.020\%$ of FS
Excitation Voltage	:	10 Volts DC
Operating Temperature	:	$-20^{\circ}\text{C}$ to $+70^{\circ}\text{C}$
Protection Class	:	IP67

### 2. Displacement Transducer

The variation in strain, deflection etc is measured with help of Micropulse Linear Transducer. Salient feature of Micropulse Transducer:

- Very high resolution, repeatability and linearity.
- Immunity to shock, vibration, contamination and electrical noise.
- An absolute output signal.
- Automatic signal regulation.
- 2 kHz update rate

#### Technical Specifications-

Range	:	200mm
Make	:	Gefran/Balluff
Full Scale Output	:	10.0 Volts
Independent Linearity	:	$\pm 0.02\%$ of FS
Repeatability	:	$< 0.01\text{mm}$
Hysteresis	:	$< 0.01\text{mm}$
Pressure Withstand	:	Up to 600 Bars
Excitation Voltage	:	24 Volts DC
Sampling Rate $f_{\text{Standard}}$	:	2kHz
Operating Temperature	:	$-30^{\circ}$ to $+75^{\circ}\text{C}$
Protection Class	:	IP67