



Computerised

# Universal Testing Machine



*Mastering the fine art of testing*



# UNIVERSAL TESTING MACHINE

## COMMON FEATURES OF UNIVERSAL TESTING MACHINE

### APPLICATION

Universal Testing Machines have a wide range of applications. A number of materials & metals in different forms & shapes can be tested for a variety of tests like Tension, Compression, Transverse, Bend Re-bend, 180° Bend, Shear, Brinell, Pull-out, etc. Special attachments are also available for testing of Flat belts, Chain links, Wire ropes, Nut-bolts, etc.

### CONSTRUCTION

#### ■ Loading frame

The base has a hydraulic cylinder at its center, and two main screws at both ends. The middle cross head is mounted on screws through main nuts. The middle cross head can be moved up or down with a speed of 400 mm/min through chain transmission and geared motor to adjust the initial tensile / compression clearance. On the piston rests an assembly of upper, lower crosshead and two columns. The individually lapped cylinder piston assembly ensures smooth transfer of force with minimum friction.

#### ■ Hydraulic system

Hydraulic circuit consists of hydraulic power pack having a directly driven radial plunger pump, which gives a continuous non pulsating flow of oil pressure upto 210 bar. Oil filter, Oil strainer, Air breather, Oil level Indicator, Drain plug are provided on the power pack. A pressure compensated needle type flow control valve is provided to control the oil flow to cylinder thereby achieving desired piston speed. Infinitely variable speeds can be obtained with the help of valves.

#### ■ Electrical system

A separate switch box and electrical panels are provided. Both the hydraulic pump motor and the geared motor have interlocks. Limit switches are provided to stop the hydraulic pump motor if the load increases beyond the machine capacity or if the piston stroke is exceeded.

## ANALOGUE CONTROL PANEL

#### ■ Load measuring system

The oil pressure in the main cylinder is transferred to the small dynamometer cylinder. The dynamometer piston is kept rotating at a slow speed to ensure dynamic friction condition. The piston exerts a force proportionate to the pressure on the hanger connected to one arm of the pendulum, through an auto range selecting lever system. This force deflects the pendulum. The range selection can be effected by simply turning a knob, provided outside of the panel. An effective damping arrangement is provided to ensure slow return of the pendulum after sudden fracture of the test specimen.

#### ■ Load indicating arrangement

The pendulum lever pushes rack which slides over two pulleys. The rack movement is proportionate to the load. A pinion in engagement with the rack rotates and moves the pointer fixed to its shaft. The pointer moves over a large dial indicating the load. A window type dial is provided for easy and clear change of the load range.

#### ■ Recording System

A continuous roll type load elongation recorder is provided for plotting a load - elongation graph. Load is plotted by the horizontal movement of the rack. Elongation is plotted on the vertical axis and is equal to the movement of the main piston. Elongation ratio of 1:2 & 1:5 can be obtained.

#### ■ Accuracy and calibration

All measuring ranges of the machine are calibrated within an accuracy of  $\pm 1\%$  from 20% to 100% of each range as per IS : 1828 and BS : 1610.





# Analogue Universal Testing Machine



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# Analogue Cum Computerised Universal Testing Machine



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## COMPUTERISED CONTROL PANEL

### ■ Load measuring system

The oil pressure in the main cylinder is also transferred to an electronic pressure transducer which gives a proportionate signal to the Data Acquisition Unit. Both, the motor for hydraulic operation and cross head motion, are controlled by push buttons and they have interlocks to prevent simultaneous working of the motors. The electrical panel is fixed on the control panel. Displacement measurement is carried out by means of a Rotary Encoder. Encoder signal is fed to the Data Acquisition Panel to get displacement in mm. Fully protected and enclosed (dust proof) high precision Sensors and Encoders are used for Load and Elongation measurement.

### ■ Features of Data Acquisition Unit

- Attractive and elegant Aluminium panel is provided for heat dissipation.
- A Micro-controller based data acquisition system for data acquisition and indication.
- 4 Lines x 20 Characters LCD display for displaying Load & Crosshead travel values.
- Simplicity in reading because of digital (LCD) display.
- Membrane keyboard for data entry.
- Auto-detection of over-load, over-travel & specimen break. On detection of any of these conditions, the hydraulic motor is automatically switched off.
- Load is indicated with resolution of 0.005% of machine capacity for the entire measuring range (in other words, with a resolution of 0.02 kN for 400 kN capacity machine, Model : TUE-C-400).
- Elongation is indicated with a resolution of 0.01 mm.
- Tare Load and Reset Elongation facilities available.

### ■ Features of 'WinUTM Software'

- Dot NET based software suitable for Windows XP Service Pack-2, Vista or Windows 7 operating system.
- The WinUTM Software can run a variety of mechanical tests, recall data from previous test and prepare test report.
- Menu driven software for easy of use.
- Test reports and graphs can be sent directly to the printer via parallel port or USB Port of PC.
- Storage and retrieval of test parameters.
- Specific software for Tensile, Compression, Shear, Bend, Torsteel (TMT) & other tests.
- The Load and Crosshead travel values will be displayed continuously during the test with the on-line graph (Load Vs Crosshead travel).  
If Extensometer \* is used during the testing, then Load, Elongation and Extension values will be displayed with two independent graphs (Load Vs Crosshead Travel & Load Vs Extension).
- User can choose different options for on-line graph. Eg. : Load Vs Time, Crosshead travel Vs Time, Stress Vs Strain, etc. The graphs are auto scaled graphs.
- Zooming and magnification of required portion of graph is available.
- Point tracing facilities are available as added features.
- Different units can be selected for Load and Elongation - Load in kN, kg, lb and Displacement in mm, inches.
- User defined break detection facility.
- Load is indicated with a resolution of 0.005% of machine capacity for the entire measuring range of 2% to 100% of machine capacity.
- Elongation with a resolution of 0.01 mm.
- Provision of auto-zeroing of Elongation at set pre-load.
- Tare Load and Reset Elongation facility.



- Auto-detection of over-load, over-travel and specimen break. On detection of any of these conditions, the hydraulic motor is automatically switched off.
- Large storage capacity for storing data on the computer as per the hard-disc capacity of PC.
- Provision for calculations of parameters such as Load and Elongation at yield, Peak load at break, Yield stress, Ultimate stress, etc. The parameters like Young's modulus, Modulus of Resilience, Strain values in %, Percentage of Elongation, % Reduction in cross-section area, are user selectable. .
- Test conditions, test input data & test results are stored in a specific file based on a unique file structure.
- Built-in facility for printing the test results and test graph from PC. A printer copy of consolidated test results conducted on a particular date can also be obtained. Graphs of Load Vs Crosshead travel, Load Vs Time, Crosshead travel Vs Time, Load Vs Extension, Stress Vs Strain, etc are available.
- User can add or remove the material type with its shape, customer name, etc.
- User defined printable report generation, which enables to study the behavior of the material.
- User can replay the complete test which is already conducted. Also user can transfer the total test data to excel sheet for further analysis.
- After completion of the test, user can view the graph in different units, i.e. in kN, kg, lb, etc.
- Special reports as per customers requirement can also be generated at an extra cost.
- Special optional software for : Extensometer, Shear test, Bend test, Bend Re-bend test, Nut-bolts test, Pull-out test (1-Sensor & 3-Sensor), Brinell test, Rubber testing, Textile product testing, Wire Mesh testing, etc can be given at an extra cost.
- Following extra facilities (at an extra cost) will be provided in the software -
  - a) Statistical Analysis, b) Statistical Report, c) Compare graph facility, d) Graph super imposition.
 Statistical Analysis : Calculates minimum value, maximum value, Mean value, Variance, Standard Deviation.  
 Statistical Graphs : Water fall diagram, Mean Deviation, Frequency Distribution, Skew Diagram, Histogram.
- If an Electronic Extensometer \* is used, software prompts the user to remove the extensometer. Two graphs i.e. Load Vs Crosshead travel (CHT) and Load Vs Extension will be parallely displayed on PC in on-line test mode. Both the graphs are auto scaled and stored independent of each other.  
 (Important Note : \* Electronic Extensometer, Model : FEE-5 can be offered at extra cost).

### ■ Optional Accessories

- Pull out test sensors can be connected either 1No. or 3Nos.
- Digital Vernier or Digital Micrometer can be directly connected to the system for measurement of diameter, width, thickness, etc.

### ■ Accuracy and Calibration

All our Electronic / Computerized Universal Testing Machines are closely controlled for sensitivity, accuracy repeatability and calibration during every stage of manufacturing. Every Machine is then calibrated over each of its measuring ranges in accordance with the procedure laid down in BS:1610-1992 & IS:1828-1991. All our machines comply with Grade A of BS:1610-1992 & Class 1 of IS:1828-1991. An accuracy of  $\pm 1\%$  of indicated load value is guaranteed from 2% to 100% of the maximum load capacity of the machine.

*Every Computerized Universal Testing Machine is supplied without Computer, UPS and Printer. It is to be procured by Customer. But we supply with requisite software, conditioning system and the interfaces.*

*Machine ordered with the computer are supplied with computer and its operating system at an extra cost.*

#### **Minimum specifications of Computer, required for Computerized UTM -**

*Any latest generation computer pre-loaded with genuine windows operating system (Windows-XP service pack-2 or Windows-7 or Windows-Vista) with serial port (RS-232). Also the computer should have Anti-Virus protection.*



## Sample Test Report with Graph

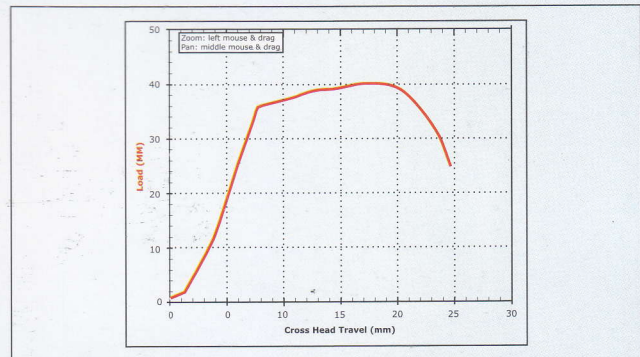
### COMPANY NAME

Company Address

### Tensile Test Report

Machine Model : TUE-C-100	TestFile name : sts10mm_Tensile.Utm
Machine Serial No. : 2010/36	Date : 05/01/2011
Customer Name : XYZ	Customer Address : ABC
Lot Number :	Test Type : Tensile
Order Number :	Heat Number :
<b>Input Data</b>	<b>Output Data</b>
Specimen Shape : Solid Round	Load At Yield : 34.85 kN
Specimen Type : Mild Steel	Elongation at Yield : 7.660 mm
Specimen Description :	Yield Stress : 443.723 N/mm2
	Load at Peak : 39.515 kN
Specimen Diameter : 10 mm	Elongation at Peak : 18.460 mm
Gauge length for % Elog. : 100 mm	Tensile Strength : 503.119 N/mm2
Pre Load Value : 0 kN	Load at Break : 24.535 kN
Max. Load : 100 kN	Elongation at Break : 24.660 mm
Max. Elongation : 150 mm	% Reduction Area : 0.00 %
Specimen C S Area : 78.54 mm2	% Elongation : 10.00 %

Load Vs Crosshead travel



Tested By systemAdmin

## ANALOGUE CUM COMPUTERISED CONTROL PANELS

- Both Analogue and Computerized control panels are provided together which work exactly same as per described above for Analogue and Computerized control panels.
- The direction control valve is provided which directs oil flow either to Analogue control panel or Computerized control panel. One can use one system at a time.
- When order is placed for Analogue cum Computerized Universal testing machine, both the control panels with direction control valve will be supplied (Computer, UPS, Printer & Computer table is not in our scope of supply. It is to be procured by customer).

## SERVO COMPUTERIZED CONTROL PANEL

(WITH LOAD RATE AND STRAIN RATE CONTROLS)

### ■ Fetures

- All the features / software / accuracies mentioned for Computerized Control Panel.
- Electronically controlled sophisticated imported pressure and flow control valves along with the dedicated controller are used and they are controlled in closed loop with PID looping.
- Load accuracy as high as  $\pm 1\%$  of indicated load value.
- Variable load rates and strain rates can be selected through computer to suit the wide range of materials.
- The Data Acquisition system (DAS) supplied with the machine can be connected to any new generation computer (PC or Laptop) using USB port.

### ■ Principle of Operation

Here Pressure Control valve and flow control valve are controlled by electronic circuitry in closed loop system to get the desired Loading Rate and Straining Rate.

Following control modes are available -

- Standard manual Control.
- Load Rate Control Mode.
- Strain Rate Control Mode.
- Load Hold Mode.
- Load Rate and Strain Rate in single test (one at a time).

Control Range 5% to 100% per minute.

Control Tolerance  $\pm 5\%$ .





# Servo Computerised Universal Testing Machine



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Load is applied by hydrostatically lubricated Ram. Main cylinder pressure is transmitted to the Pressure Transducer housed in control panel. The Pressure Transducer generates the proportional signal corresponding to load created by Ram and is given to Electronic control panel (DAS Panel). Simultaneously, the optical digital Rotary Encoder fitted on the straining unit (Lower Crosshead) gives the mechanical displacement (Crosshead Travel).

### ■ Electronic Control Panel (DAS System)

- It is equipped with 32 bit Micro-controller for basic Universal testing machine operation and close loop servo control for controlling and executing the LOAD RATE and STRAIN RATE control operations.
- Panel is having USB Port for interfacing with PC.
- Maximum of  $\pm 5,00,000$  counts resolution can be provided to display the load value (optional).

#### Loading Rate

Control Range : 5% of 100% of machine capacity.

Accuracy :  $\pm 5\%$  of Loading rate selected

Loading Rate		
Machine Capacity	Minimum	Maximum
100 kN	5 kN / min	200 kN / min
200 kN	10 kN / min	400 kN / min
400 kN	15 kN / min	800 kN / min
600 kN	25 kN / min	1200 kN / min
1000 kN	40 kN / min	2000 kN / min

#### Straining Rate

Control Range : 5% of 100% of Ram speed

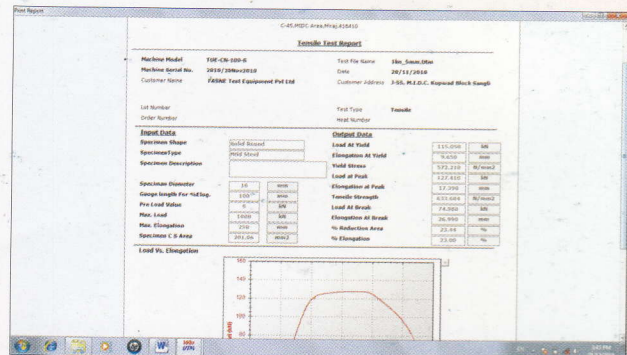
Accuracy :  $\pm 5\%$  of Straining rate selected

Straining Rate		
Machine Capacity	Minimum	Maximum
100 kN	2 mm / min	300 mm / min
200 kN	1.5 mm / min	150 mm / min
400 kN	1.5 mm / min	150 mm / min
600 kN	1 mm / min	100 mm / min
1000 kN	0.5 mm / min	80 mm / min

Typical Graph with Electronic Extensometer



Upper Part of Test Report



Every Computerized Universal Testing Machine is supplied without Computer, UPS and Printer. It is to be procured by Customer. But we supply with requisite software, conditioning system and the interfaces.

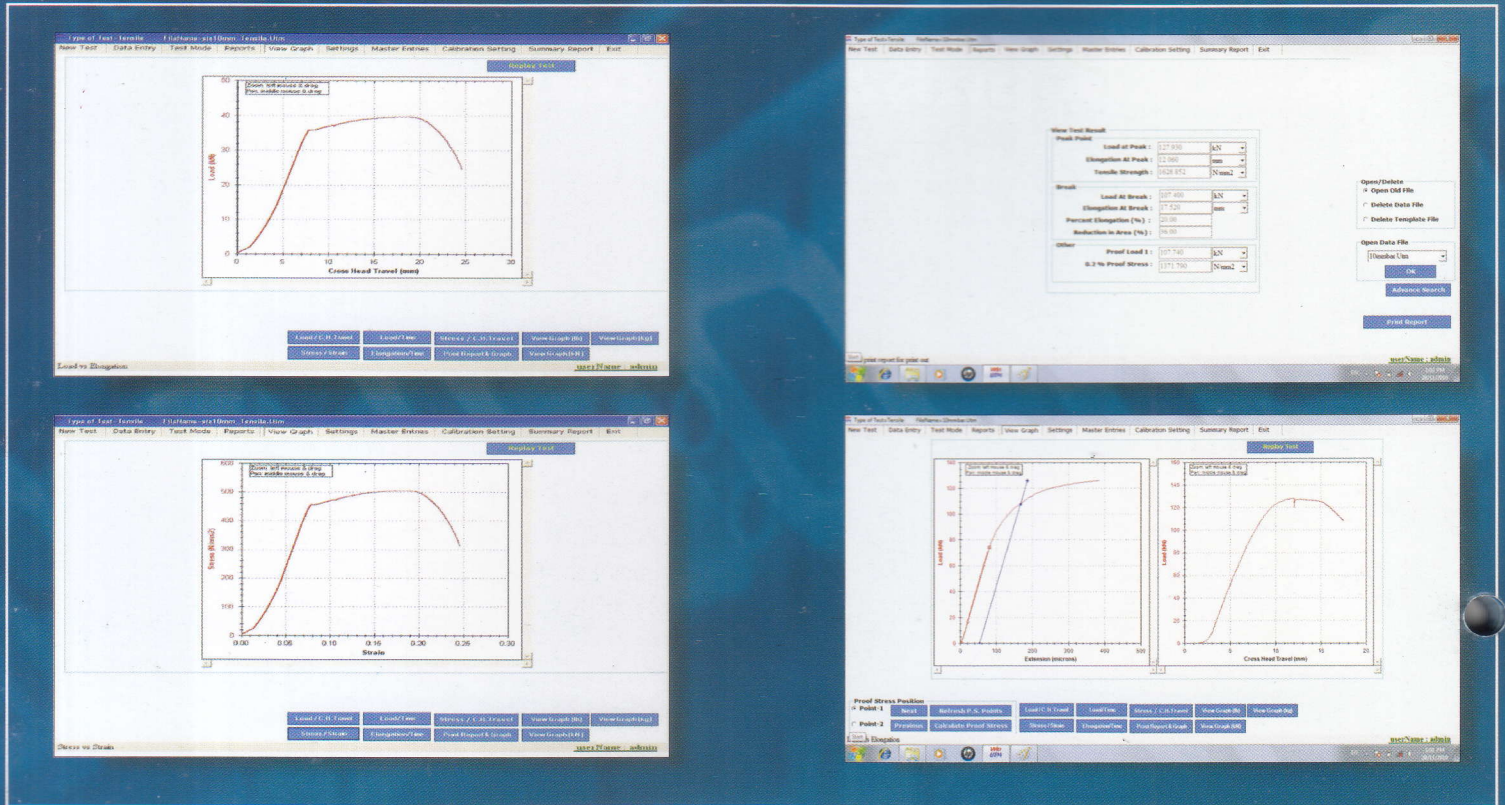
Machine ordered with the computer are supplied with computer and its operating system at an extra cost.

#### Minimum specifications of Computer, required for Servo Computerized UTM -

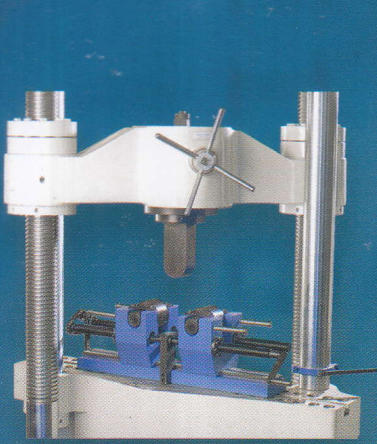
Any latest generation computer pre-loaded with genuine windows operating system (Windows-XP service pack-2 or Windows-7 or Windows-Vista) with USB port. Also the computer should have Anti-Virus protection.



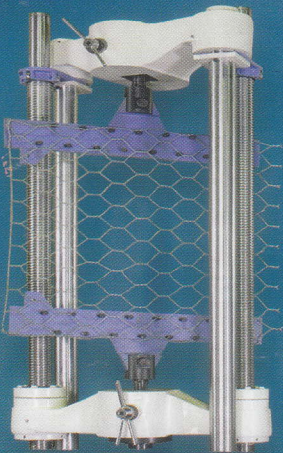
# Screen Shots of 'WinUTM Software'



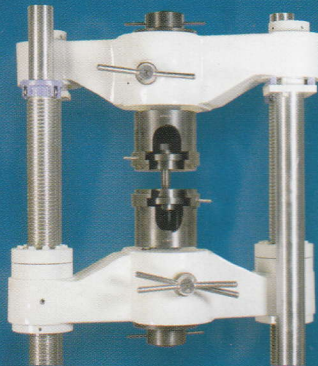
## Special Attachments of Universal Testing Machine (Extra Accessories)



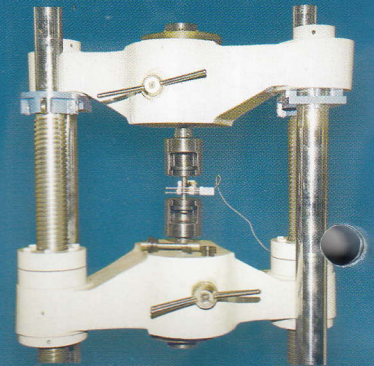
Bend Re-Bend Test Attachment



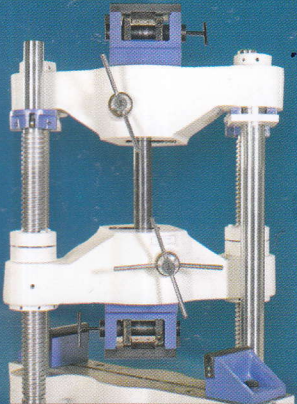
Wire Mesh Testing Fixture



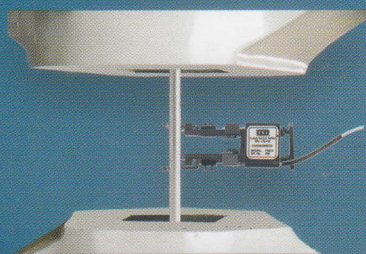
Special Attachment For Short Specimens/ Nut-Bolts



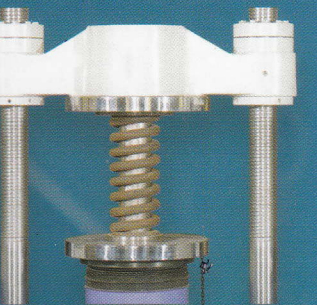
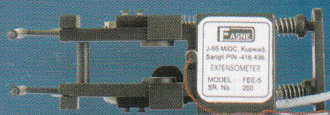
Shouldered Test Attachment



Pull-out Testing Fixture



Electronic Extensometer (Model: FEE-5)



Special Attachment For Compression Spring



## TECHNICAL SPECIFICATION FOR ANALOGUE VERSIONS

MODELS	TUN-100	TUN-200	TUN-400	TUN-600	TUN-1000	TUN-2000
Measuring Capacity (kN)	100	200	400	600	1000	2000
1'st Range (kN)	0-100	0-200	0-400	0-600	0-1000	0-2000
Least Count (kN)	0.2	0.4	0.8	1	2	4
2'nd Range (kN)	0-50	0-100	0-200	0-300	0-500	0-1000
Least Count (kN)	0.1	0.2	0.4	0.5	1	2
3'rd Range (kN)	0-25	0-50	0-100	0-120	0-250	0-500
Least Count (kN)	0.05	0.1	0.2	0.2	0.5	1
4'th Range (kN)	0-10	0-20	0-40	0-60	0-100	0-200
Least Count (kN)	0.02	0.04	0.08	0.1	0.2	0.4
Over all dimensions approx. (mm) (L x B x H)	1950 x 800 x 1900	2000 x 800 x 2000	2100 x 850 x 2100	2200 x 900 x 2400	2350 x 1000 x 2700	3000 x 1100 x 3600
Weight approx (kg)	1400	1500	2150	3200	4300	9500

## TECHNICAL SPECIFICATION FOR COMPUTERISED & SERVO COMPUTERISED VERSIONS

MODELS	TUE-C-100	TUE-C-200	TUE-C-400	TUE-C-600	TUE-C-1000	TUE-C-2000
	TUE-C-100 (SERVO)	TUE-C-200 (SERVO)	TUE-C-400 (SERVO)	TUE-C-600 (SERVO)	TUE-C-1000 (SERVO)	TUE-C-2000 (SERVO)
Measuring Capacity (kN)	100	200	400	600	1000	2000
Measuring Range (kN)	0-100	0-200	0-400	0-600	0-1000	0-2000
Least Count (kN)	0.005	0.01	0.02	0.03	0.05	0.1
Load Range in kN with accuracy of measurement + 1%	2 to 100	4 to 200	8 to 400	12 to 600	20 to 1000	40 to 2000
Resolution of Piston Movement (mm)	0.01	0.01	0.01	0.01	0.01	0.01
Over all dimensions approx. (mm) (L x B x H)	1950 x 800 x 1900	2000 x 800 x 2000	2100 x 850 x 2100	2200 x 900 x 2400	2350 x 1000 x 2700	3000 x 1100 x 3600
Weight approx. (kg.)	1300	1400	2000	3000	4000	9000

## TECHNICAL SPECIFICATION FOR ANALOGUE CUM COMPUTERISED VERSIONS

MODELS	TUE-CN-100	TUE-CN-200	TUE-CN-400	TUE-CN-600	TUE-CN-1000	TUE-CN-2000
Measuring Capacity (kN)	100	200	400	600	1000	2000
Analogue System						
1'st Range (kN)	0-100	0-200	0-400	0-600	0-1000	0-2000
Least Count (kN)	0.2	0.4	0.8	1	2	4
2'nd Range (kN)	0-50	0-100	0-200	0-300	0-500	0-1000
Least Count (kN)	0.1	0.2	0.4	0.5	1	2
3'rd Range (kN)	0-25	0-50	0-100	0-120	0-250	0-500
Least Count (kN)	0.05	0.1	0.2	0.2	0.5	1
4'th Range (kN)	0-10	0-20	0-40	0-60	0-100	0-200
Least Count (kN)	0.02	0.04	0.08	0.1	0.2	0.4
Computerised System						
Measuring Range (kN)	0-100	0-200	0-400	0-600	0-1000	0-2000
Least Count (kN)	0.005	0.01	0.02	0.03	0.05	0.1
Load Range in kN with accuracy of measurement $\pm$ 1%	2 to 100	4 to 200	8 to 400	12 to 600	20 to 1000	40 to 2000
Resolution of Piston Movement (mm)	0.01	0.01	0.01	0.01	0.01	0.01
Over all dimensions approx. (mm) (L x B x H)	2300 x 800 x 1900	2350 x 800 x 2000	2450 x 850 x 2100	2550 x 900 x 2400	2700 x 1000 x 2700	3400 x 1100 x 3600
Weight approx. (kg.)	1450	1550	2200	3300	4450	9700



## COMMON SPECIFICATION FOR ALL VERSIONS

MODELS						
Analogue	TUN-100	TUN-200	TUN-400	TUN-600	TUN-1000	TUN-2000
Computerised	TUE-C-100	TUE-C-200	TUE-C-400	TUE-C-600	TUE-C-1000	TUE-C-2000
Servo Computerised	TUE-C-100 (SERVO)	TUE-C-200 (SERVO)	TUE-C-400 (SERVO)	TUE-C-600 (SERVO)	TUE-C-1000 (SERVO)	TUE-C-2000 (SERVO)
Analogue Cum Computerised	TUE-CN-100	TUE-CN-200	TUE-CN-400	TUE-CN-600	TUE-CN-1000	TUE-CN-2000
Measuring Capacity (kN)	100	200	400	600	1000	2000
Max. Tensile Clearance at fully decended piston position (mm)	50-700	50-700	50-700	50-800	50-850	50-900
Max. Clearance for Compression Test (mm)	0-700	0-700	0-700	0-800	0-850	0-900
Distance between columns (mm)	450	500	500	600	750	850
Piston Stroke (mm)	150	200	200	250	250	300
Max. straining speed at no load (mm/min)	300	150	150	100	80	45
Power Supply	3 Phase, 415 Volts, 50Hz, AC					
H.P. (Total)	1.5	1.5	2.5	2.5	4.0	6.5

## STANDARD ACCESSORIES FOR ALL VERSIONS

MODELS						
Analogue	TUN-100	TUN-200	TUN-400	TUN-600	TUN-1000	TUN-2000
Computerised	TUE-C-100	TUE-C-200	TUE-C-400	TUE-C-600	TUE-C-1000	TUE-C-2000
Servo Computerised	TUE-C-100 (SERVO)	TUE-C-200 (SERVO)	TUE-C-400 (SERVO)	TUE-C-600 (SERVO)	TUE-C-1000 (SERVO)	TUE-C-2000 (SERVO)
Analogue Cum Computerised	TUE-CN-100	TUE-CN-200	TUE-CN-400	TUE-CN-600	TUE-CN-1000	TUE-CN-2000
Pair for compression plate dia (mm)	120	120	120	120	160	220
<b>Tension Test Jaws</b>						
For Round Specimen dia (mm)	10-20	10-20	10-25	10-25	10-30	20-40
For Round Specimen dia (mm)	20-30	20-30	25-40	25-40	30-50	40-60
For Round Specimen dia (mm)	-	-	-	40-55	50-70	60-80
For Flat Specimen Thickness (mm)	0-10	0-10	0-15	0-15	0-22	0-22
For Flat Specimen Thickness (mm)	10-20	10-20	15-30	15-30	22-44	22-45
For Flat Specimen Thickness (mm)	-	-	-	-	44-65	45-70
Max. width of Flate Specimen (mm)	50	50	65	70	70	90
<b>Transverse Test</b>						
Adjustable Roller Support of width (mm)	150	150	150	160	160	200
Diameter (mm)	30	30	30	50	50	70
With Max. adjustable clearance (mm)	450	500	500	600	800	900
Punch tops of radius (mm)	6	6	12	16	16	30
Punch tops of radius (mm)	12	12	16	22	22	40

We can also supply: Range of Hardness Testers (Brinell, Vickers, Rockwell), Tensile, Torsion, Fatigue, Impact, Spring and Balancing Machines.

FSA reserves the rights to change the above specifications due to constant improvements in design