

STEEL



4.1

MECHANICAL TESTING OF STEEL

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HYDRAULIC UNIVERSAL TESTING MACHINES "F 060/U - F 060"

The F 060/U essentially comprises a pair of vertical columns and an inversion frame supported by a hydraulic ram by means of a spherical seating.

The load measuring cell is housed inside the hydraulic ram piston. This technique, which is used only on Universal Machines of this quality, ensures concentricity of the load measuring unit and the load application mechanism, therefore errors arising from transversal forces and bending moments associated with non symmetrical or poorly located samples are eliminated.

Given the class of this machine it was decided to position the guides for the flexure devices directly in the mobile crosshead in order to reduce preparatory operations for these tests to a minimum; the guides and the roller bearers are not so much accessories to be installed from time to time as required but are rather permanent fixtures which remain in position.

It is for this reason that there are structurally dimensioned blocks on the crosshead - to allow flexure tests with loads up to the maximum capability of the ram.

The standard tension heads are closed in order to avoid any possible deformation caused by excessive stress; grip wedge drive is further facilitated by electrically controlled hydraulic cylinders.

The lower tension head is operated electrically.

The power pack which contains the motor, the hydraulic pumps and the oil tank, also houses the electro-distribution valves and the flow regulation valve "Moog" along with the associated operation and feedback equipment.

The data processing and control systems are all located in one group in a specially designed console.

The machine is programmed to perform tests with automatic adjustment of the stress/strain parameters.

A manual override facility is also provided.

The test measurements are displayed in real time and memorized automatically.

Upon completion the results can be:

- saved on disc for future processing;
- printed on paper;
- processed and displayed in graph format;
- processed for generating certificates and graphs

The software supplied with the machine serves for testing the tensile, compressive and flexural characteristics of metals.

Diameters of between 5 to 50 mm can be accommodated (round bars) as well as rectangular samples with 3 to 40 mm (thickness), 60 mm (width). A loading rate in the elastic field can be selected between 5 and 30 N/mm²/s. F 060 complete with relevant grips, can test also wire strands, diameter 0.5 and 0.6 inches.

The results indicate:

- **the lowest yield stress or max. stress at which stress/strain ratio remains constant**
- **the tensile stress value**
- **the peak percentage elongation value**
- **automatic change from LOAD control to ELONGATION control, in the moment of yield stress**



Samples with diameters from 16 to 30 mm are acceptable for compression testing; the loading rate must be selected from 2 to 15 N/mm²/s. Max capacity 600 kN.

The test can be programmed to stop automatically upon the detection of a prescribed percentage deformation; the results indicate proportional tension deviation.

For flexural testing the loading rate can be selected from 0.1 to 5 N/mm²/s.

The test can be stopped when a given deflection or load is reached; additional differed measurements are permitted with a constant load.



F 060/U - AD 205/A - AD 205 - F 030/E

600 kN UNIVERSAL TESTING MACHINE F 060/U**Specifications:**

- Class 1 machine as per UNI EN ISO 6892/1, UNI EN ISO 7500/1, ASTM A 370
- Maximum loading capacity: 600 kN
- Piston stroke: 400 mm
- 700 mm specimens length
- Maximum distance between tension heads (including piston travel): 915 mm
- Electrically-operated lower head: 500 mm travel
- Maximum clearance between compression plates: 390 mm
- Maximum clearance between flexure bearers: 1100 mm
- Maximum deflection in flexure: 180 mm
- Maximum span between bending rollers: 180 mm
- Hydraulically-driven grip wedges
- Load measuring instruments: 1000 kN extensometric cell, (linearity/hysteresis $\leq \pm 0,1\%$ F.S.)
- Deformation measurement instrument: electric optical device, resolution 0.001 mm
- Data acquisition unit
- Personal computer complete with 15" monitor and printer
- Processing system for checks, machine feedback and data processing
- Complete with accessories for routine tests

DIMENSIONS:

- Machine: 1190 x 1050 x 3540 (h) mm
weight: 2700 kg.
- Hydraulic power unit: 600 x 600 x 1010 (h) mm
weight: 270 kg.
- Control console: 650 x 700 x 2000 (h) mm
weight: 170 kg.

PACKED DIMENSIONS:

- 1300 x 1200 x 1600 (h) mm. Weight: 900 kg
- 1400 x 500 x 800 (h) mm. Weight: 800 kg
- 1000 x 1000 x 1300 (h) mm. Weight: 900 kg
- 2400 x 600 x 500 (h) mm. Weight: 500 kg
- 1020 x 920 x 1360 (h) mm. Weight: 320 kg
- 920 x 800 x 2150 (h) mm. Weight: 250 kg

The machine (structure) is transported disassembled

MAX. HEIGHT WITH PISTON EXTRACTED: 3940 mm

POWER SUPPLY:

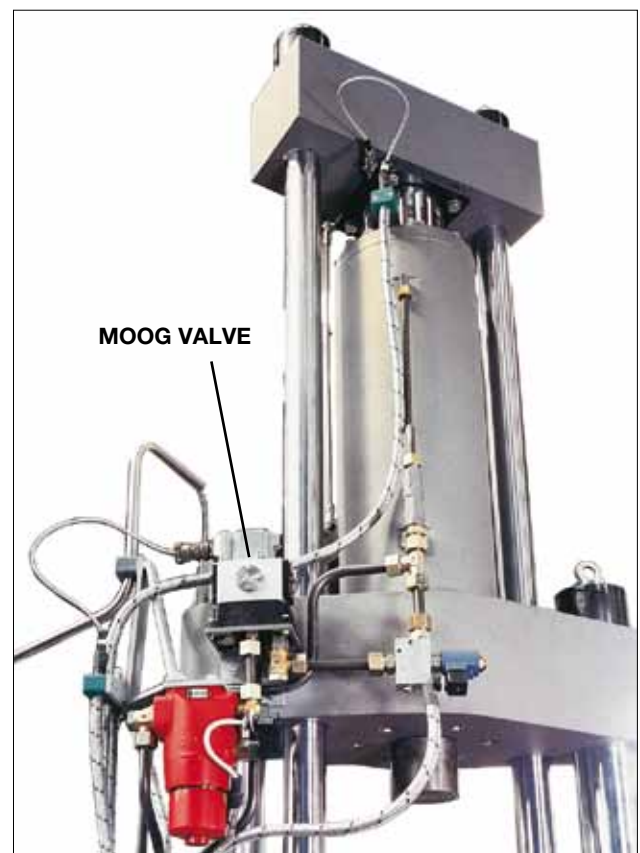
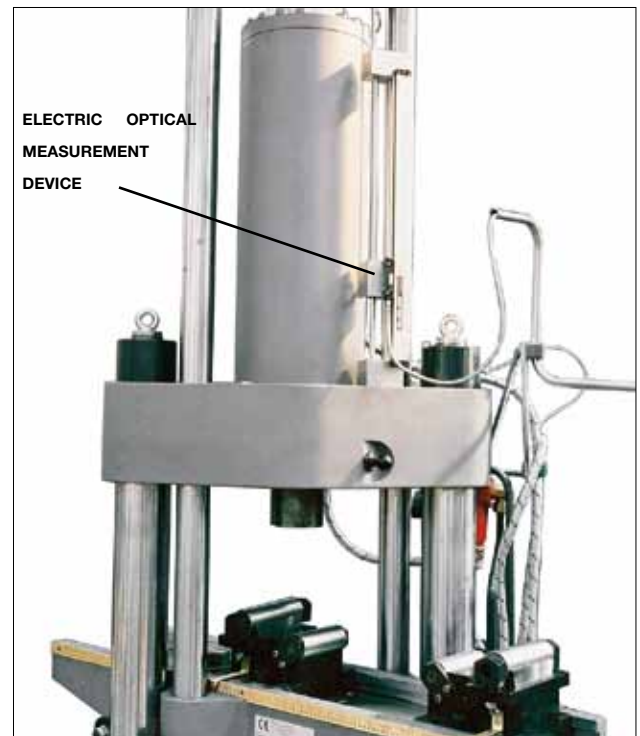
- Hydraulic power unit: 380 V, 50 Hz, 3-phase, 4000 W
- Control console: 220 V, 50 Hz, 1-phase, 1000 W

Series Fittings:

- Grips for round bars: 3 sets for diameters of: 5-15, 15-32 e 32-50 mm
- Grips for flat bars: 2 sets for thicknesses of 0-22 and 20-42 mm
- Grips width: 60 mm
- Compression plates: 2 with diameter of 105 mm; 2 with diameter of 215 mm (1 fitted with ball seating)
- Flexural devices: 2 fixed load bearers with support rollers, 1 articulated load bearer
- Bending devices: 1 mandrel, diameter 25 mm

EXTENSOMETERS (OPTIONAL):

- F 030/E** Precision electronic extensometer, 5 mm travel
- F 031/E** Precision coaxial extensometer, 50 mm travel

**SPARE PARTS FOR F 060/U:**

- | | |
|-----------------|--|
| F 062/T1 | Kit of 4 grips for round bars \varnothing 5-15 mm |
| F 062/T2 | Kit of 4 grips for round bars \varnothing 15-32 mm |
| F 062/T3 | Kit of 4 grips for round bars \varnothing 32-50 mm |
| F 062/P1 | Kit of 4 grips for flat bars \varnothing 0-22 mm |
| F 062/P2 | Kit of 4 grips for flat bars \varnothing 20-42 mm |



F 060 - F 030/E

600 kN UNIVERSAL TESTING MACHINE WITH FACILITY FOR TESTING ALSO WIRE STRANDS F 060

Specifications:

- Class 1 machine as per UNI EN ISO 6892/1, UNI EN ISO 7500/1, ASTM A 370
- Maximum loading capacity: 600 kN
- Piston stroke: 400 mm
- Specimens length: 700 mm
- Maximum distance between tension heads (including piston travel): 915 mm
- Electrically-operated lower head: 500 mm travel
- Maximum clearance between compression plates: 390 mm
- Maximum clearance between flexure bearers: 1100 mm
- Maximum deflection in flexure: 180 mm
- Maximum span between bending rollers: 180 mm
- Hydraulically-driven grip wedges
- Load measuring instruments: 1000 kN extensometric cell, (linearity/hysteresis $\leq \pm 0,1\%$ F.S.)
- Deformation measurement instrument: electric optical measurement device, resolution 0.001 mm
- Data acquisition unit
- Personal computer complete with 15" monitor and printer
- Processing system for checks, machine feedback and data processing
- Complete with accessories for routine tests



DIMENSIONS:

Machine:	1190 x 1000 x 3850 (h) mm weight: 3200 kg.
Hydraulic power unit:	780 x 880 x 1250 (h) mm weight: 260 kg.
Control console:	600 x 820 x 1935 (h) mm weight: 180 kg.

PACKED DIMENSIONS:

1300 x 1200 x 1600 (h) mm.	Weight: 1100 kg
1400 x 500 x 800 (h) mm.	Weight: 1000 kg
1000 x 1000 x 1300 (h) mm.	Weight: 900 kg
2700 x 600 x 500 (h) mm.	Weight: 600 kg
1020 x 920 x 1360 (h) mm.	Weight: 320 kg
920 x 800 x 2150 (h) mm.	Weight: 250 kg

The machine (structure) is transported disassembled

MAX. HEIGHT WITH PISTON EXTRACTED: 4250 mm

POWER SUPPLY:

Hydraulic power unit: 380 V, 50 Hz, 3-phase, 4000 W
Control console: 220 V, 50 Hz, 1-phase, 1000 W

Series Fittings:

- Grips for round bars: 3 sets for diameters of: 5-15, 15-32 e 32-50 mm
- Grips for flat bars: 2 sets for thicknesses of 0-22 and 20-42 mm
- Grips width: 60 mm
- Compression plates: 2 with diameter of 105 mm; 2 with diameter of 215 mm (1 fitted with ball seating)
- Flexural devices: 2 fixed load bearers with support rollers, 1 articulated load bearer
- Bending devices: 1 mandrel, diameter 25 mm

EXTENSOMETERS (OPTIONAL):

F 030/E	Precision electronic extensometer, 5 mm travel
F 031/E	Precision coaxial extensometer, 50 mm travel
F 033/E	Precision electronic extensometer for wire strands, 50 mm travel



SPARE PARTS FOR F 060:

F 061/T1	Kit of 4 grips for round bars \varnothing 5-15 mm
F 061/T2	Kit of 4 grips for round bars \varnothing 15-32 mm
F 061/T3	Kit of 4 grips for round bars \varnothing 32-50 mm
F 061/P1	Kit of 4 grips for flat bars \varnothing 0-22 mm
F 061/P2	Kit of 4 grips for flat bars \varnothing 20-42 mm

ACCESSORY FOR F 060:

F 061/15	Kit of 4 grips for wire strands \varnothing 15,2 mm
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F 060/EV

600 kN TENSILE TESTING MACHINE**ADAPTABLE TO UNIVERSAL USE****F 060/EV****Specifications:**

- Maximum loading capacity in both operating directions: 600 kN
- Piston stroke: 620 mm
- Hydraulically driven grip wedges
- Load measuring instruments: electronic bi-directional load cell (tension/compression type), 1000 kN capacity. Its small dimensions have enabled it to be positioned directly on the mobile head to give optimum precision. The special model is designed for highly dynamic application (class 1, EN 10002-3, UNI EN ISO 376)
- Deformation measurement instrument: electric optical measuring device, accuracy 0.001 mm, stroke 670 mm
- Central processing system for checks, machine feedback loop and data processing: PC and 15" monitor and printer.
The machine is programmed to carry out tests and automatically adjust the stress/strain parameters.
- Complete with accessories for routine tests

The F 060/EV has a twin-column structure, the hydraulic ram provides direct drive to the upper tension/compression crosshead. This simple design solution has the advantage of considerably limiting the machine's overall vertical dimensions and thus permitting its installation in establishments with limited headroom (approx. 3 m).

The standard heads are o-shaped because this minimalizes their deformation when subjected to stress; the gripping wedge drive is servo-assisted by internal hydraulic cylinders; the control is electric.

The power pack, in addition to the motor, the double hydraulic pump and the oil tank, contains electro-valves for distribution and the "Moog" flow regulation valve with the relative operation and feedback equipment.

In addition to the testing speed there is also a rapid approach for the high speed movement of the tension/compression head. The electronic equipment and the controls are grouped together in a special console.

Test measurements are displayed in real time and automatically memorized.

On the completion of tests the data can be:

EXTENSOMETERS (OPTIONAL):

F 030/E	Precision electronic extensometer, 5 mm travel
F 031/E	Precision coaxial extensometer, 50 mm travel

**LOAD CELL**

For tensile tests, it may be used for diameters from 8 to 30 mm and for flat bars with 3 to 40 mm (thickness), 60 mm (width). The loading rate in the elastic field must be selected from 5 to 30 N/mm²/s.

The results indicate:

- **the lowest yield stress or max. stress at which stress/strain ratio remains constant**
- **the tensile stress value**
- **the peak percentage elongation value**
- **automatic change from LOAD control to ELONGATION control, in the moment of yield stress**

DIMENSIONS:

Machine:	800 x 525 x 2750 (h) mm Weight: 1540 kg.
Control console:	600 x 820 x 1935 (h) mm Weight: 180 kg.
Hydraulic power unit:	780 x 880 x 1250 (h) mm Weight: 260 kg.

PACKED DIMENSIONS:

2920 x 860 x 1200 (h) mm.	Weight: 1700 kg.
920 x 1020 x 1360 (h) mm.	Weight: 320 kg.
760 x 920 x 2450 (h) mm.	Weight: 250 kg.

MINIMUM HEADROOM REQUIRED: 3 m

POWER SUPPLY:

Hydraulic power unit:	380 V, 50 Hz, three phase, 3000 W
Control console:	220 V, 50 Hz, single phase, 1000 W

Series fittings:

- Grips for round bars:
 - 3 sets for diameters of 5-15, 15-32 and 32-50 mm
- Grips for flat bars:
 - 2 sets for thicknesses of 0-22 and 20-42 mm
- Grips width: 60 mm.

SPARE PARTS FOR F 060/EV:

F 062/T1	Kit of 4 grips for round bars \varnothing 5-15 mm
F 062/T2	Kit of 4 grips for round bars \varnothing 15-32 mm
F 062/T3	Kit of 4 grips for round bars \varnothing 32-50 mm
F 062/P1	Kit of 4 grips for flat bars \varnothing 0-22 mm
F 062/P2	Kit of 4 grips for flat bars \varnothing 20-42 mm



F 100/EV - F 030/E

1000 kN TENSILE TESTING MACHINE**ADAPTABLE TO UNIVERSAL USE****F 100/EV****Specifications:**

- Maximum loading capacity in both operating directions: 1000 kN
- Piston stroke: 950 mm
- Max specimen length: 1000 mm
- Hydraulically driven grip wedges
- Load measuring instruments: electronic bi-directional load cell (tension/compression type). Special model for highly dynamic applications (class N. 1 - EN 10002-3 UNI EN ISO 376). Its small dimensions have enabled it to be positioned directly on the mobile head to give optimum precision
- Deformation measurement instrument: electric optical measurement device - accuracy 0.001 mm - 1020 mm travel
- Central processing system for checks, machine feedback loop and data processing
- Automatically adjust the stress/strain parameters
- Personal computer and printer
- Complete with accessories for routine tests

N.B.: the electronic, precision extensometer (5 mm - 0.001 resolution) is optional and it is suggested to perform the static modulus of elasticity test and to obtain, directly, the test graphs on the computer.

The F 100/EV has a four-column structure, the hydraulic ram provides direct drive to the upper tension/compression crosshead. This simple design solution has the advantage of considerably limiting the machine's overall vertical dimensions and thus permitting its installation in establishments with limited headroom (approx. 3.5 m).

The standard heads are o-shaped because this minimalizes their deformation when subjected to stress; the gripping wedge drive is servo-assisted by internal hydraulic cylinders; the control is electric.

The power pack, in addition to the motor, the double hydraulic pump and the oil tank, contains electro-valves for distribution and the "Moog" flow regulation valve with the relative operation and feedback equipment.

In addition to the testing speed there is also a rapid approach for the high speed movement of the tension/compression head. The electronic equipment and the controls are grouped together in a special console.

Test measurements are displayed in real time and automatically memorized.

On the completion of tests the data can be:

- **saved on disc for future processing**
- **printed on paper**
- **processed and displayed in graph format**
- **processed for the printing of certificates and graphs**

EXTENSOMETERS (OPTIONAL):

F 030/E	Precision electronic extensometer, 5 mm travel
F 031/E	Precision coaxial extensometer, 50 mm travel
F 033/E	Precision electronic extensometer for wire strands, 50 mm travel

**LOAD CELL**

The software supplied with the machine is for tensile, flexure and compression testing. For tensile tests, it may be used for diameters from 8 to 50 mm and for flat bars with 3 to 40 mm (thickness), 80 mm (width). The loading rate in the elastic field must be selected from 5 to 30 N/mm²/s.

The results indicate:

Machine:	770 x 880 x 3390 (h) mm weight: 3100 kg.
Control console:	600 x 820 x 1935 (h) mm weight: 180 kg.
Hydraulic power unit:	780 x 880 x 1250 (h) mm weight: 260 kg

PACKED DIMENSIONS:

3750 x 1100 x 1480 (h) mm.	Weight: 3600 kg.
1100 x 1000 x 1500 (h) mm.	Weight: 320 kg.
920 x 800 x 2150 (h) mm.	Weight: 250 kg.

MINIMUM HEADROOM REQUIRED: 3.5 m

Hydraulic power unit: 380 V, 50 Hz, three phase, 4000 W
Control console: 220 V, 50 Hz, single phase, 1000 W

- Grips for round bars: 3 sets for diameters of 5-15, 15-32 and 32-50 mm. The grips for round bars are very long (150 mm) and allow testing of wire strands using specific accessories (F 101/T12 - F 101/T15)
- Grips for flat bars: 2 sets for thicknesses of 0-22 and 20-42 mm
- Grip width: 80 mm

SPARE PARTS FOR F 100/EV:

F 101/T1	Kit of 4 grips for round bars \varnothing 5-15 mm
F 101/T2	Kit of 4 grips for round bars \varnothing 15-32 mm
F 101/T3	Kit of 4 grips for round bars \varnothing 32-50 mm
F 101/P1	Kit of 4 grips for flat bars \varnothing 0-22 mm
F 101/P2	Kit of 4 grips for flat bars \varnothing 20-42 mm



F 030/E



F 031/E



F 033/E

ANTI-SLIDING
TOOLS

GRIPS



PRECISION ELECTRONIC EXTENSOMETER

PRECISION EXTENSOMETER

F 030/E

This instrument, which is applied directly on the sample, enables net elongation to be measured during tensile test. Quick clamping. It is used in conjunction with an extensometric, bridge-type transducer with 5 mm travel.

Measurement base is 50 mm.

Two extensions are supplied to extend measurement base to 100 and 200 mm.

Range: min. \varnothing 3 mm - max. \varnothing 30 mm.

Accuracy of 0.001 mm.

DIMENSIONS: 65 x 120 x 150 (h) mm.

WEIGHT: 500 g.

PRECISION COAXIAL EXTENSOMETER

F 031/E

Coaxial extensometer for tensile tests up to failure complete with precision transducer applied directly on the sample for measurement of net deformation.

Its telescopic, coaxial type construction enables the instrument to be left in position until failure of the specimen is obtained.

The precision transducer has a 50 mm travel and sensitivity of 0.002 mm. Measurement base is 250 mm.

For specimens having diameters from 6 to 30 mm.

DIMENSIONS: dia. 100 x 300 (l) mm.

PRECISION COAXIAL EXTENSOMETER

FOR WIRE STRANDS

F 033/E

Applied directly on the sample enables net elongation to be measured. The coaxial, telescopic design allows the extensometer to be left positioned up to sample failure. Complete with precision transducer 50 mm travel and a sensitivity of 0.01 mm.

Measurement base is 600 mm.

DIMENSIONS: dia. 100 x 650 (l) mm.

TESTS ON WIRE STRANDS

UNI 7676

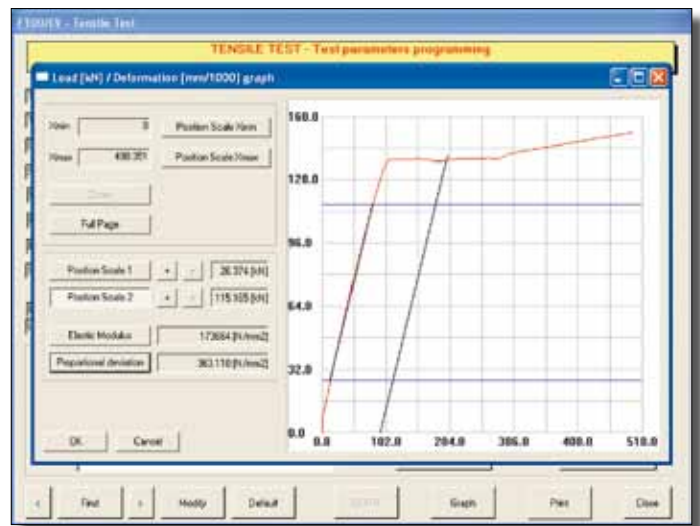
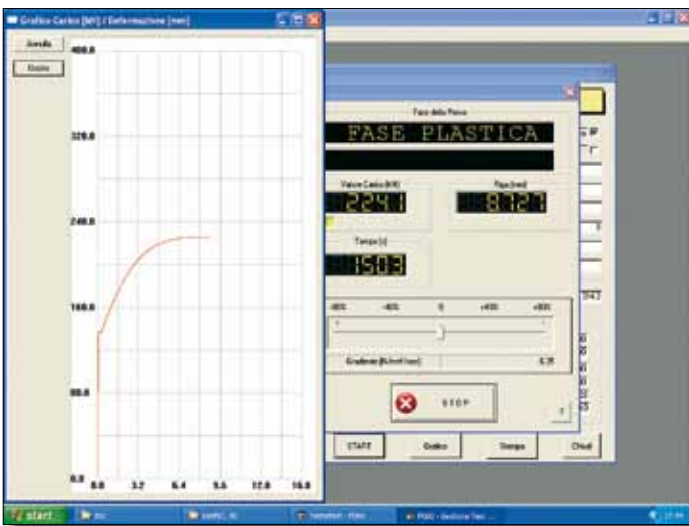
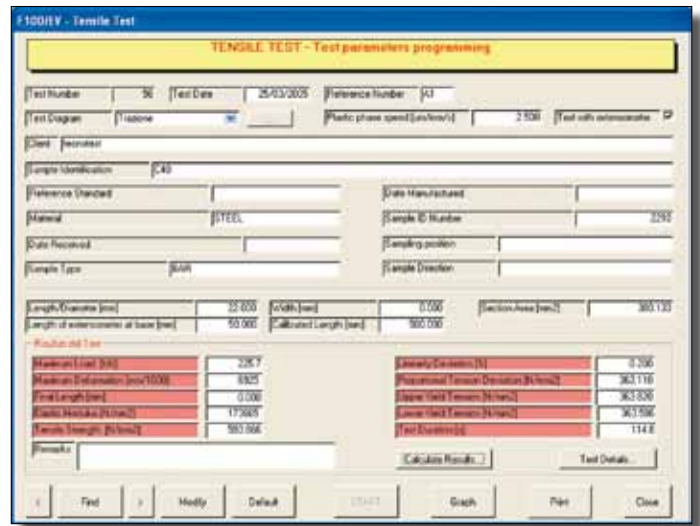
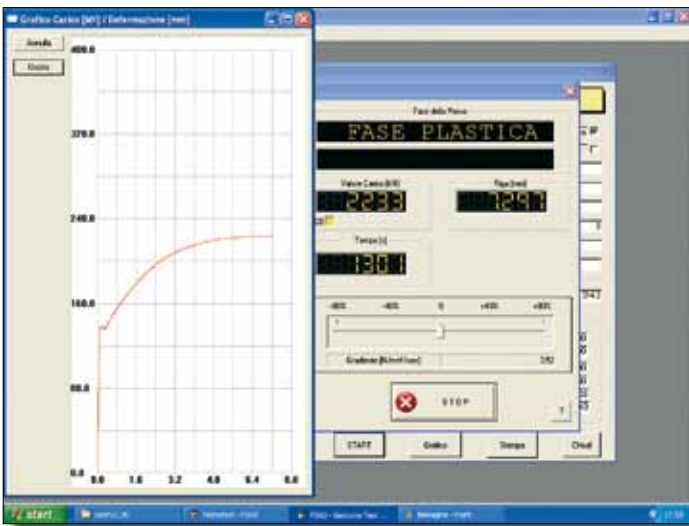
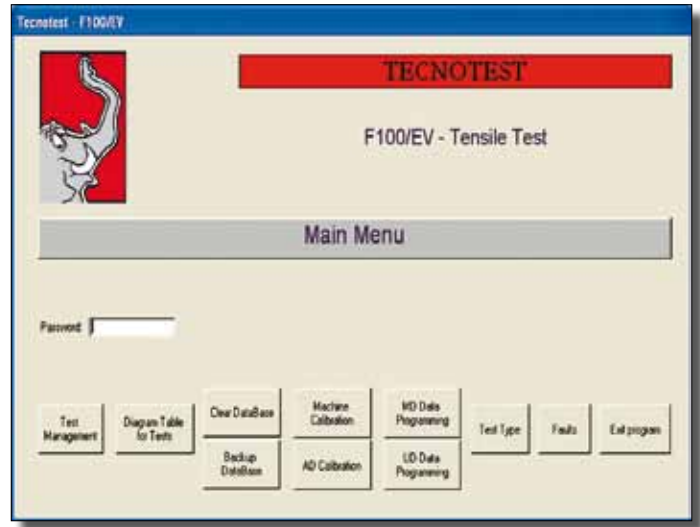
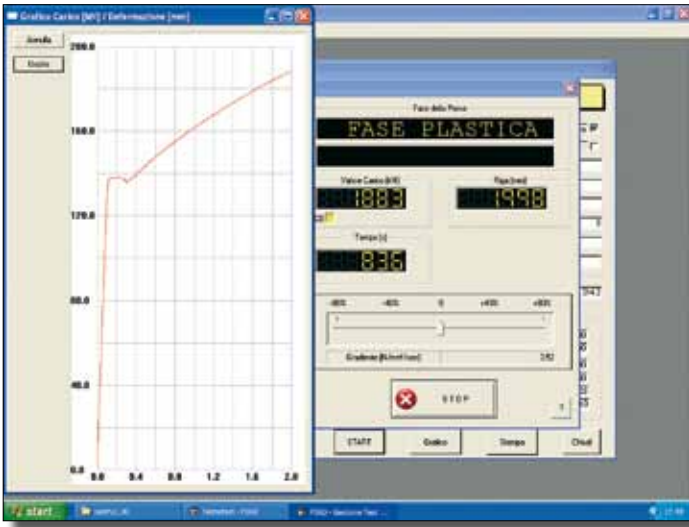
The F 060 is equipped with tensile heads suitable for accommodating the special grips for wire strands \varnothing 12.5 and 15.2 mm (0.5" and 0.6"). A series of grips are available complete with anti-sliding tools.

ACCESSORIES (SUPPLIED UPON REQUEST):

F 101/T12 Kit of 100 anti-sliding tools
(15 x 200 mm) for wire strands
dia. 12.5 mm

F 061/15 Kit of 4 grips for wire strands
dia. 15.2 - 12.5 - 15.9 mm

F 101/T15 Kit of 100 anti-sliding tools
(20 x 200 mm) for wire strands
dia. 15.2 - 15.9 mm



F 060/EV AND F 100/EV: ACCESSORIES FOR COMPRESSION, FLEXURAL TESTING AND BENDING TESTS

The tensile machine is pre-set for accepting accessories for compression and flexural tests. Calibration, moreover, is performed both in tensile and compression modes. It must be pointed out however that the machine, once equipped with all accessories, still cannot be deemed as comparing equally with the F 060/U. The F 060/U in fact has all the accessories already set into position so that the passage from one test to another is immediate, whereas with the F060/EV the various accessories have to be assembled as needed, and this involves having to move considerably large weights. It is therefore necessary to have a small crane available for movement of such weights.

ACCESSORIES NEEDED FOR EACH TEST:

F 100/E1 Tool bearing element for F 100/EV

This device, which is attached to the upper head, provides a rapid attachment for the compression platens, the flexure bearers and the bending mandrels.

F 060/E1 Upper tool bearing element for F 060/EV

F 100/E9 Lower centering element for F 100/EV

F 060/E9 Lower centering element for F 060/EV

F 100/D Distance piece for placing the tool bearing elements
F 100/E1 - F 060/E1

COMPRESSION TEST: MAX 1000 kN

F 100/E3 Pair of platens Ø 215 mm

In alloy steel, with thermally hardened surfaces; the upper platen is fitted with a ball seating.

ACCESSORIES FOR THE VARIOUS TESTS:**FLEXURAL TEST ON STEEL SPECIMENS**

F 100/G Small crane for lifting and placement of bearing cross-beam F 100/E4

F 100/E4 Support bearing cross-beam for FLEXURE and bending tests

To be positioned on the lower head, allows the assembly of supports for flexure and cold bending tests.
Maximum load: 60 kN

F 100/E8 Pair of supports with double floating and rotating rollers Ø 50 mm

F 100/MF Upper mandrel with rotating roller Ø 50 mm

BENDING TEST ON STEEL SPECIMENS

F 100/G Small crane for lifting and placement of bearing cross-beam F 100/E4

F 100/E4 Support bearing cross-beam for flexural and BENDING TESTS

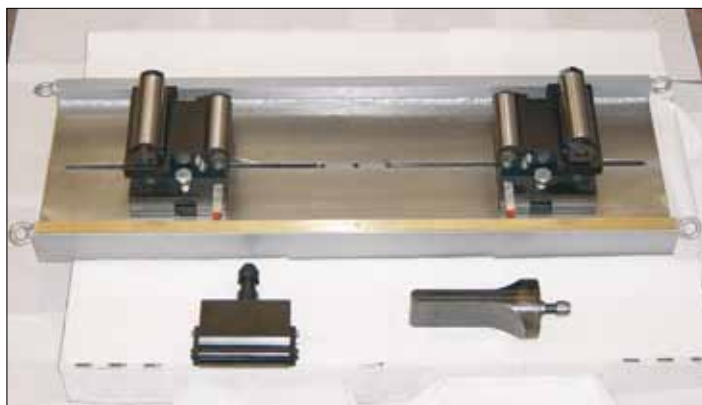
To be positioned on the lower head, allows the assembly of supports for flexural and cold bending tests.
Maximum load: 60 kN

F 100/E8 Pair of supports with double floating and rotating rollers Ø 50 mm

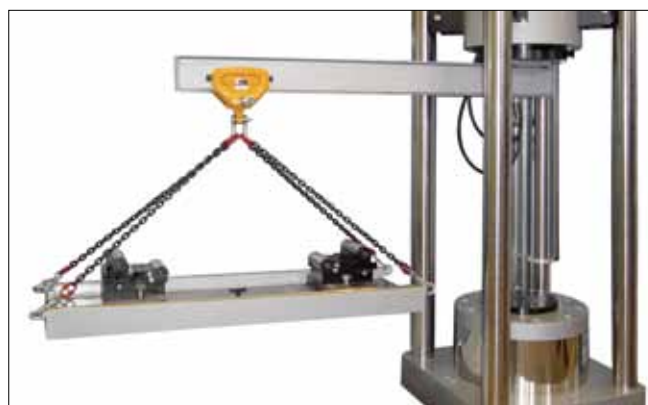
F 100/MP Upper mandrel Ø 25 mm

Note:

Mandrels, bearers and supports of different dimensions and special grips may be supplied upon request.



F 100/MF - F 100/MP - F 100/E4 - F 100/E8



F 100/G



F 100/E3



F 100/E9

F 100/E1

METROLOGICAL LOAD CELLS FOR TENSILE TESTING MACHINE CALIBRATION

Used in calibration operations as reference cell: bidirectional for U.T.M. (compression/tension) and complete with the ball-joint for compression usage.

Supplied with a calibration Certificate issued by an independent accredited Laboratory.

On request, a SIT certificate may be supplied according to: ISO 376 (class 1) - EN 10.002-3 (class 1) ASTM E74 (class A).

Stainless steel made. Electric lead 5 m.

Accuracy class: 1 (EN 10002 - 3 and ISO 376)

DIMENSIONS: dia. 230 x 250 (h) mm.

WEIGHT: 36 kg.

METROLOGICAL LOAD CELL 750 kN

CAPACITY WITHOUT READOUT UNIT AP 031

METROLOGICAL LOAD CELL 1000 kN

CAPACITY WITHOUT READOUT UNIT AP 033

TENSILE GRIPS FOR AP 031 E AP 033 AP 033/T

High resistance steel: connection threading M 80 x 2 - 70 mm long.

OFFICIAL "SIT" CERTIFICATE (ITALY) - CLASS 1

AP 031/CC	Compression
AP 031/CT	Tension
AP 031/CB	Compression/tension

Load cells AP 031 and AP 033 need to be coupled with a signal processor suitable for the required accuracy class.

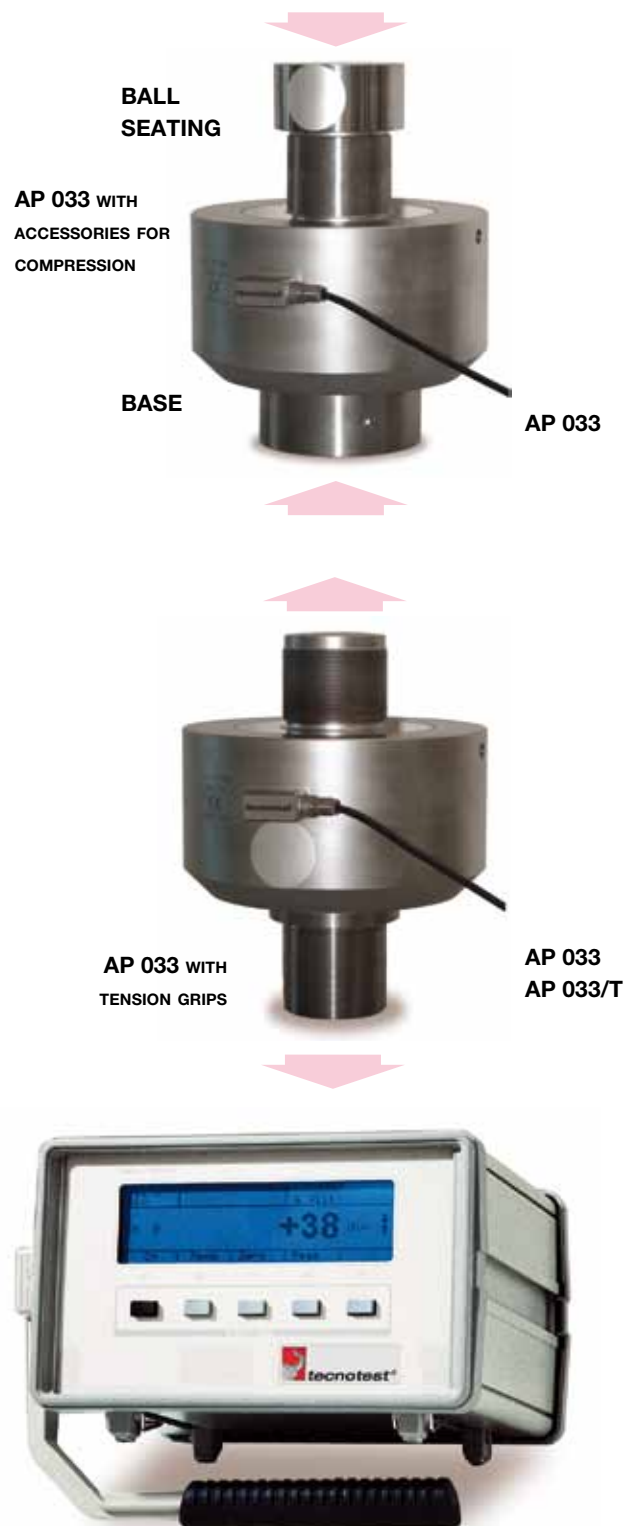
A microprocessor-controlled amplifier for obtaining the best results (resolution 200,000 digits) is suggested such as the model illustrated (AP 048).

Its carrier frequency is 440 Hz (preferable to the usual a.c. power).

Various important functions are provided and the remote control via RS 232 interface is a standard device.

NOTE:

Universal testing machines F 060/U and F 060 may be calibrated using a column type load cell for compression of 600 kN capacity. We recommend model AP 038/06 with readout unit AP 045 or AP 048 (see page 393, section 5.4.1).



AP 048



F 050/TC



MACHINE FOR TENSILE TEST 500 kN AND COMPRESSION TEST 2000 kN

F 050/TC

The machine carries out compression tests on concrete specimens (on cylindrical specimens of max. 16 cm diameter and on cubes measuring 15 and 20 cm/side) as well as tensile tests on metals (for round bars 6 to 25 mm in diameter and flat bars measuring max. 50 x 15 mm). Tests on steel are limited to measuring tensile strength only on steel rebars for reinforced concrete, up to 22 mm diameter, whereas stress/strain analysis (for characterization of metals, combining strength and deformation) may only be obtained using machines of a higher grade.

The structure is in welded elements of steel and therefore extremely rigid in all three directions.

This characteristic, together with the special oil-bath ball seating, ensures that the machine can pass the stability test that uses a cell with four extensometric bridges in compliance with BS 1881 and DIN 51220.

The console houses the hydraulic electro-pumps, the valves and the commands: of particular interest is the special capacity regulator which enables the load rate to be selected from a wide range.

A winch is supplied as standard to enable operations, such as the positioning of the heavy test accessories, to be carried out by a single operator.

SPECIFICATIONS:

- max. tensile test load: 500 kN (0.01 kN divisions)
- max. compression test load: 2000 kN (0.1 kN divisions)
- piston stroke: 100 mm - span between the columns: 280 mm
- load measuring instrument: 2 electric transducers in conjunction with digital display unit EUROTRONIC (nominal resolution 500.000 points)
- automatic regulation of the load/tensile rate with pacer
- grip holders, for specimens 300-350 mm
- grips (in 4 pieces) with interchangeable wedges:
 - for round bars with diameters from 6 to 9 mm, from 10 to 15 mm, from 16 to 25 mm
 - for flat bars max. width 50 mm, (thickness: 1 to 15 mm)
- Platens, spacing pieces and ball seating to test cylinders dia. 15x30 cm and 15-20 cm cubes.
- Lifting winch for ball seating

POWER SUPPLY: 220 V, 50 Hz, single phase; 1200 W

MACHINE DIMENSIONS: 900 x 500 x 1550 (h) mm.

WEIGHT: 700 kg.

CONSOLE DIMENSIONS: 500 x 500 x 1200 (h) mm.

WEIGHT: 100 kg.

Accessories:

F 050/TC can be equipped with extensometers: F 030/C - F 030/E.

Note 1: the extensometer F 030/C can be useful in an educational laboratory, where it is not necessary to obtain stress/strain data simultaneously and continuously. Otherwise, the F 030/E is needed, with connection to the third channel of Eurotronic, together with a PC connection via RS 232 serial port, and with the data acquisition software AD 050/001.

Note 2: the above mentioned extensometers are to be manually removed at the end of the elastic phase (when the load does not raise proportionally to the strain) to avoid damage during specimen failure.

AD 013/B02	Printer, 24 column, provides a printout of test report on thermal paper
F 030/C	Mechanical extensometer with dial gauge (5 mm travel - 0.001 mm) 50 mm measurement base
F 030/E	Precision extensometer. This instrument, when applied directly on the sample, enables net elongation to be measured during tensile test. Quick clamping. It is used in conjunction with an extensometric, bridge-type transducer with 5 mm travel. Measurement base is 50 mm. Two extensions are supplied to extend measurement base to 100 and 200 mm. Range: min. \varnothing 3 mm - max. \varnothing 30 mm. Accuracy of 0.001 mm. DIMENSIONS: 65 x 120 x 150 (h) mm; WEIGHT: 500 g.
AD 050/001	Software package, for transmission of test data to a PC



F 030/C



F 030/E

X-Y GRAPH RECORDER**AD 205**

Used in combination with F 030/E in order to obtain highly accurate stress/strain graphs should a cartesian graph having two variable need to be drawn in real time.

It uses millimetric paper, A4 format (210 x 297 mm) and a finely pointed fibre tip pen.

The paper is kept still electrostatically. X and Y axes each have 14 measurement (amplification) ranges; 0.05, 0.1, 0.2, 0.5, 1, 2 V/cm, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20 mV/cm.

Selection is via a switch.

Zero may be positioned at any point in the useful recording area.

Accuracy: 0.25%, \pm 10 μ V

OPERATION: 220 V, 50 Hz, single phase

DIMENSIONS: 382 x 387 x 160 (h) mm.

WEIGHT: 7 kg.



AD 205

EUROTRONIC AD 200

HARDWARE FEATURES

- 24 VDC power (supplied with mains adaptor 110/220 V)
- 320 x 240 pixel backlit display complete with energy save feature
- 4 Channels which may be set at 2 mV/V, 3 mV/V, 7 mV/V or 10 VDC: each channel has a resolution of 500000 points
- 24 Button keyboard, including a numeric keypad, for quick test selection and easy data input, more practical than the minimalistic models with fewer buttons
- 8 Digital inputs
- 8 Digital outputs
- 2 Pulse width modulation output (PWM) for stepper or brushless motor control
- 2 Analog outputs (12 bits – 0/10 Volts) for closed-loop feedback control
- 1 Serial RS-232 port and 2 serial RS-485 ports for transmitting data to a PC in real time or at the end of test
- 1 Slave USB port for transmitting data to a PC or for uploading software upgrades or custom modifications to software in use
- 1 Master USB port for connecting to a USB data stick
- 1 Ethernet port or Wi-Fi port for data transmission or remote control

The Eurotronic is one of the few instruments (if not the only one) in the market to have a numeric keypad for data input. To enter a number there is no need to call up the number required by first scrolling up or down using arrow keys, as it is sufficient to input it via the numeric keypad.

SOFTWARE FEATURES

- Selectable languages: Italian, English, Spanish, French, Portuguese, Russian (Cyrillic alphabet), Polish and Rumanian. All test pages are translated, including those sent to PC or printer
- Selectable units of measurement: kN, N, lbf, tonnes, kgf, mm, in. The instrument automatically converts values in one unit of measurement to another without any need for recalibration
- Display of test graph in real time
- Transmission to PC to test data in real time with data time scan selection (1 datum per second, 2 data per second, 5 data per second, 10 data per second, 1 datum every 10 seconds)
- Tests performed are stored in an archive
- Archive with scroll index for tests performed: it is possible to send to a PC test results only or all test data foreseen, time/load/displacement, for subsequent processing in graph format
- Clock and calendar with daylight saving hour foreseen
- Memorizes for each test: time, user ID, sample parameters and serial number, test results
- Special functions, protected by password, for verification of functioning of keyboard, A/D inputs, inputs and outputs

ACCESSORIES

AD 200/ETH	Ethernet port
AD 200/WFI	Wi-Fi port

NB: Implementation of any one of the optional ports (not both) is possible only at the time the AD 200 is ordered, not once delivered, so choice of port must be specified, if required, on ordering.

CALIBRATION

Tecnotest has taken special care as usual to ensure that maximum readout accuracy of its calibration function is guaranteed.

The calibration function is obviously protected by a password. Calibration is performed over 11 programmable points from zero to full scale of the instrument under calibration.

The procedure is particularly simple and designed so that there is no need for calculation of coefficients, to enter them by hand or to repeat procedures on a trial and error basis.

In practice, the user is invited to explore the entire readout scale, then to press a key when the sample dynamometer indicates exactly 0, 10%, 20%.....90%, 100% relative to full potential of the machine.

The instruments suggests memorizing 11 points equally distributed along the readout scale, but these may be modified as desired : for example, it may be decided to memorize points 0, 1%, 5%, 10%, 20%.....80%, 100% of full scale thus guaranteeing, thanks to the 500000 divisions available, high precision even at very low loads. All these operations are extremely simple and quick to perform thanks to the unit's function keys and numeric keypad.

TEST SCREENS

- Manual mode
- Compression test on cubes, cylinders, blocks
- Flexural tests with 3 or 4 point loading
- Tensile test
- Block pavers test
- Marshall test
- CBR test
- Indirect tensile test for asphalt
- Unconfined test
- Failure under controlled loading
- Failure under controlled test speed

For each test previous considerations are valid (see software features)



AD 200

IMPACT STRENGTH TEST

ASTM E 23 BS 131 ISO TC/7 EURONORM 7/55 UNI EN 10045-1 UNI EN 10045-2

The impact strength test (or resilience test) consists in the measuring of the force required to break a conventional test piece with a blow.

Essentially the machine is a pendulum with an impact block; the test piece is positioned on the trajectory in correspondence to the point of equilibrium, the force of the blow is obtained via the potential energy of the pendulum and the degree of a rotation that it can compute during its ascent.

These norms allow two different lay-outs for the pendulum/sample/anvil group; in the Charpy test set-up the test piece is positioned with one end on each shoulder of the anvil and the pendulum strikes it in the centre; in the Izod test set-up the test piece is held rigidly by a clamp and the pendulum strikes the overhanging part.



4.1.3 IMPACT STRENGTH TEST

TECNOTEST



PENDULUM STRENGTH TESTER

(Charpy method)

F 040/S

Specifications:

- Weight of frame: \div 400 kg
- Reference planes parallel to rotational axis (tolerance less than 2/1000)
- Clearance between rests: $40 + 0.2/0$ mm
- Corner radius of rests: $1 + 0.5/0$ mm
- Angles of inner parts of rests: $11^\circ \pm 1^\circ$
- Angle at apex of striking edge: $30^\circ \pm 1^\circ$
- Point radius at striking edge notch: $2 + 0.5/0$ mm
- Max. thickness of striking edges: 16 mm
- Angles between supports and rest planes: $90 \pm 0.1^\circ$
- Nominal potential energy: 300 J
- Energy dispersed in empty semi-rotation by mechanical and aerodynamic pull: <1 J
- Mechanical pendulum slowing device: belt variety
- Mechanical pendulum lifting device: with reduction unit
- Quick positioning device for positioning the test piece from outside the safety guard
- Measuring instrument: electric rotation sensor with digital reading device; automatic memorization of maximum value
- Maximum difference between indicated and effective energy: < 0.1 J
- Complete accident-prevention guard in Lexan/aluminium
- Dimensions: 223 x 65 x 215 (h) cm
- Weight: 490 kg
- Power supply for the measuring device: 220 V, 50 Hz, single phase.

The machine has a massive frame in cast iron; the elements are mechanically worked with great precision; the readout device does not present noticeable friction or moments of inertia. Provided as standard for the prevention of accidents is a conveniently-located test piece positioning device enabling operations to be carried out without opening the sliding panel incorporated in the safety guard in Lexan.

Accessory:

F 040/1 STRIKER FOR IMPACT STRENGTH
According to ASTM E 23

SET FOR TESTING AT LOW TEMPERATURE **F 040/5**

This set comprises a device for the formation of solid CO₂ in tablets, digital thermometer (-60 +400°C) complete with probe, tongs and a insulated tub in stainless steel (150 x 150 x 170 mm) for the cooling bath (350 x 350 x 370 mm). The CO₂ bottle (with suction tube) must be obtained from suppliers of compressed gas by the user.

PACKED DIMENSIONS: 400 x 400 x 800 (h) mm
WEIGHT: 22 kg

DIGITAL THERMOMETER: -200 +650°C **DB 840**

Resolution 0.1° C. Large LCD display.
Accuracy $\pm 0.05^\circ$ C.
Complete with immersion probe -50 + 400°C.



F 040/5

BENDING AND STRAIGHTENING TEST

EN 15630-1 ASTM A 615 D.M. September 2005

This test is specifically for round steel bars for concrete, the aim is to verify that their ductility is sufficient for cold formatting operations.

The test involves bending the sample to a pre-specified angle and partly straightening it to see if any fractures or cracks are formed. The bending and re-straightening angles, the radius of the tools and the distances between the supports are all dependant on the diameter of the sample, the type of surface and the quality of the steel.

BENDING AND STRAIGHTENING

TESTING MACHINE

F 013

Specifications:

- Maximum ram load strength: 160 kN
- Piston stroke: 550 mm
- Thrusting head precision guide
- Distance between the rollers adjustable from 75 to 580 mm
- Hydraulic valve for speed adjustment
- Pressure check gauge
- Safeguard device in polycarbonate
- Bench with shelves for accessories

POWER SUPPLY: 220 V, 50 Hz, single phase, 1500 W

DIMENSIONS: 1650 x 700 x 1150 (h) mm.

WEIGHT: 350 kg.

The F 013 is distinguished by its high-precision mechanical machining capabilities: the end of the stem is tightly held in the axis by a guide with dovetail coupling in order to avoid distortion and dangerous buildups of elastic energy in the thrusting device; guide, roller bearing element and ram are bolted to the same machined beam.

The motor and the hydraulic components are sized for continuous working. The replacement of the tools presents no difficulty.

The series fittings comprise two roller couples (diameter 50 mm and diameter 100 mm). Mandrels and, when required, mandrel supports can be selected from those listed on the following pages.



F 013



TOOLS FOR F 013

MANDREL SUPPORTS

These elements are only required for mandrels with diameters between 10 and 96 mm; in particular:

F 013/PM1	MANDREL SUPPORT	diameter 10-20 mm
F 013/PM2	MANDREL SUPPORT	diameter 24-50 mm
F 013/PM3	MANDREL SUPPORT	diameter 54-96 mm

MANDRELS

F 013/010	MANDREL	diameter 10 mm	F 013/110	MANDREL	diameter 110 mm
F 013/012	MANDREL	diameter 12 mm	F 013/112	MANDREL	diameter 112 mm
F 013/015	MANDREL	diameter 15 mm	F 013/125	MANDREL	diameter 125 mm
F 013/016	MANDREL	diameter 16 mm	F 013/128	MANDREL	diameter 128 mm
F 013/018	MANDREL	diameter 18 mm	F 013/132	MANDREL	diameter 132 mm
F 013/020	MANDREL	diameter 20 mm	F 013/140	MANDREL	diameter 140 mm
F 013/024	MANDREL	diameter 24 mm	F 013/144	MANDREL	diameter 144 mm
F 013/025	MANDREL	diameter 25 mm	F 013/150	MANDREL	diameter 150 mm
F 013/028	MANDREL	diameter 28 mm	F 013/160	MANDREL	diameter 160 mm
F 013/030	MANDREL	diameter 30 mm	F 013/176	MANDREL	diameter 176 mm
F 013/032	MANDREL	diameter 32 mm	F 013/180	MANDREL	diameter 180 mm
F 013/036	MANDREL	diameter 36 mm	F 013/192	MANDREL	diameter 192 mm
F 013/040	MANDREL	diameter 40 mm	F 013/200	MANDREL	diameter 200 mm
F 013/042	MANDREL	diameter 42 mm	F 013/220	MANDREL	diameter 220 mm
F 013/044	MANDREL	diameter 44 mm	F 013/224	MANDREL	diameter 224 mm
F 013/048	MANDREL	diameter 48 mm	F 013/240	MANDREL	diameter 240 mm
F 013/050	MANDREL	diameter 50 mm	F 013/250	MANDREL	diameter 250 mm
F 013/054	MANDREL	diameter 54 mm	F 013/256	MANDREL	diameter 256 mm
F 013/056	MANDREL	diameter 56 mm	F 013/260	MANDREL	diameter 260 mm
F 013/060	MANDREL	diameter 60 mm	F 013/280	MANDREL	diameter 280 mm
F 013/064	MANDREL	diameter 64 mm	F 013/288	MANDREL	diameter 288 mm
F 013/066	MANDREL	diameter 66 mm	F 013/300	MANDREL	diameter 300 mm
F 013/070	MANDREL	diameter 70 mm	F 013/312	MANDREL	diameter 312 mm
F 013/072	MANDREL	diameter 72 mm	F 013/320	MANDREL	diameter 320 mm
F 013/075	MANDREL	diameter 75 mm	F 013/336	MANDREL	diameter 336 mm
F 013/078	MANDREL	diameter 78 mm	F 013/340	MANDREL	diameter 340 mm
F 013/080	MANDREL	diameter 80 mm	F 013/360	MANDREL	diameter 360 mm
F 013/084	MANDREL	diameter 84 mm	F 013/384	MANDREL	diameter 384 mm
F 013/090	MANDREL	diameter 90 mm	F 013/400	MANDREL	diameter 400 mm
F 013/096	MANDREL	diameter 96 mm			
F 013/100	MANDREL	diameter 100 mm			
F 013/108	MANDREL	diameter 108 mm			

Mandrels to be selected according to EN 15630-1

Code	Mandrel diameter (mm)	Specimen diameter (mm)	Mandrel support code
F 013/020	20	5	F 013/PM1
F 013/024	24	6	F 013/PM2
F 013/032	32	7	F 013/PM2
F 013/040	40	8	F 013/PM2
F 013/056	56	10	F 013/PM3
F 013/064	64	12	F 013/PM3
F 013/096	96	14	F 013/PM3
F 013/112	112	16	not necessary
F 013/128	128	18	not necessary
F 013/132	132	20	not necessary
F 013/140	140	22	not necessary
F 013/180	180	24 - 26	not necessary
F 013/200	200	28	not necessary
F 013/224	224	30 - 32	not necessary
F 013/320	320	34 - 38	not necessary
F 013/336	336	40	not necessary

Mandrels to be selected according to ASTM A 615, A 615M

Code	Mandrel diameter (mm)	Specimen diameter (mm)	Mandrel support code
F 013/032	32	9.5	F 013/PM2
F 013/044	44	12.7	F 013/PM2
F 013/065	65	15.9	F 013/PM3
F 013/096	96	19.1	F 013/PM3
F 013/112	112	22.2	not necessary
F 013/128	128	25.4	not necessary
F 013/200	200	28.7	not necessary
F 013/224	224	32.3	not necessary
F 013/250	250	35.8	not necessary

Mandrels to be selected according to D.M. September 2005 (Italy)

Code	Mandrel diameter (mm)	Specimen diameter (mm)	Mandrel support code
F 013/024	24	6	F 013/PM2
F 013/032	32	8	F 013/PM2
F 013/040	40	10	F 013/PM2
F 013/048	48	12	F 013/PM2
F 013/060	60	12	F 013/PM3
F 013/070	70	14	F 013/PM3
F 013/080	80	16	F 013/PM3
F 013/144	144	18	not necessary
F 013/160	160	20	not necessary
F 013/176	176	22	not necessary
F 013/192	192	24	not necessary
F 013/200	200	25	not necessary
F 013/260	260	26	not necessary
F 013/280	280	28	not necessary
F 013/320	320	32	not necessary
F 013/340	340	34	not necessary
F 013/400	400	40	not necessary

4.1.4 BENDING TESTS

TECNOTEST



F 055/S

TEST BAR TRACING MACHINE

F 055/S

The particular configuration of the tracing peaks and the special system of blocking test bars allow to trace steel reinforcing bars with deformed surface (having bead ribs) used in concrete structures. In a single pitch, 30 tracing marks are effected and equidistant 20 mm from each other.

Safety cover. The machine is completely automatic.

Max length of tracing: 500 mm.

Gripping capacity for round and flat bars: 0 to 60 mm.

Tracing pitches: 5 - 10 - 20 mm.

Accuracy of tracing: $\pm 0.1\%$.

POWER: 220 V, 50 Hz, single phase, 500 W.

DIMENSIONS: 650 x 200 x 200 mm.

WEIGHT: 50 kg approx.

MANUAL TEST BAR TRACING MACHINE

F 055/SM

Hand operated test bar tracing machine comprising a drum in which tracing peaks are inserted. Multiple trace marks are made on the kit bar on winding by hand the crank which turns the drum. Three pitches may be obtained (20 - 10 - 5 mm) by re-positioning the drum at set positions.

WEIGHT: 50 kg



F 052 - F 052/M

BENCH MODEL CUT-OFF MACHINE

F 052

Motor : 0.8 hp. Speed: 38 rpm.

Maximum cutting capacities: 70 mm for round bars,

60 square bars, 100x50 mm for flat bars.

Blade diameter: 200 mm .

Head inclinable up to 45 degrees for oblique cuts.

Test-piece-securing grip: maximum opening 102 mm.

Cooling circuit with pump and tank.

POWER SUPPLY: 380 V, 50 Hz, 3 phase, 600 W.

DIMENSIONS: 570 x 660 x 600 (h) mm.

WEIGHT: 67 kg.

F 052/A BENCH MODEL CUT-OFF MACHINE

Identical to the model F 052 but: with 230 V, 50 Hz, single-phase power supply.

F 052/M TABLE IN STEEL PLATE FOR F 052

F 018



F 018/2

ALTERNATE BENDING TESTING MACHINE

F 018

UNI 5294-78

A hand-operated machine for testing steel bars and drawn wire, of diameter 4 to 10 mm, also steel band and/or plating of maximum thickness 3 mm and maximum width 20 mm. To avoid any negative effects arising from mechanical wear of material, the hardness number of the grips is about 60 points HRC.

The distance "h" between the upper generatrix of the radius supports and lower face of the control device can be altered, in accordance with standard requirements between 50 and 100 mm. Bending count is effected by means of a mechanical strike counter which is reset to zero at the start of testing.

An effective bar blocking system ensures perfect alignment of the bar with respect to the control grips and to the rotating axis of the mechanical arm, by which means of the alternate bending tests are performed. Grips and collets are to be ordered apart.

DIMENSIONS: 600 x 200 x 500 mm.

WEIGHT: 50 kg.

Accessories and spare parts

F 018/1 Kit of 11 grip pairs
Radius: 1 - 1.25 - 1.75 - 2.5 - 3.75 - 5
- 7.5 - 10 - 15 - 20 - 25

F 018/2 Kit of 7 hardened collets
Diameter: 2 - 2.5 - 3.5 - 4.5 - 7 - 9 - 11 mm

