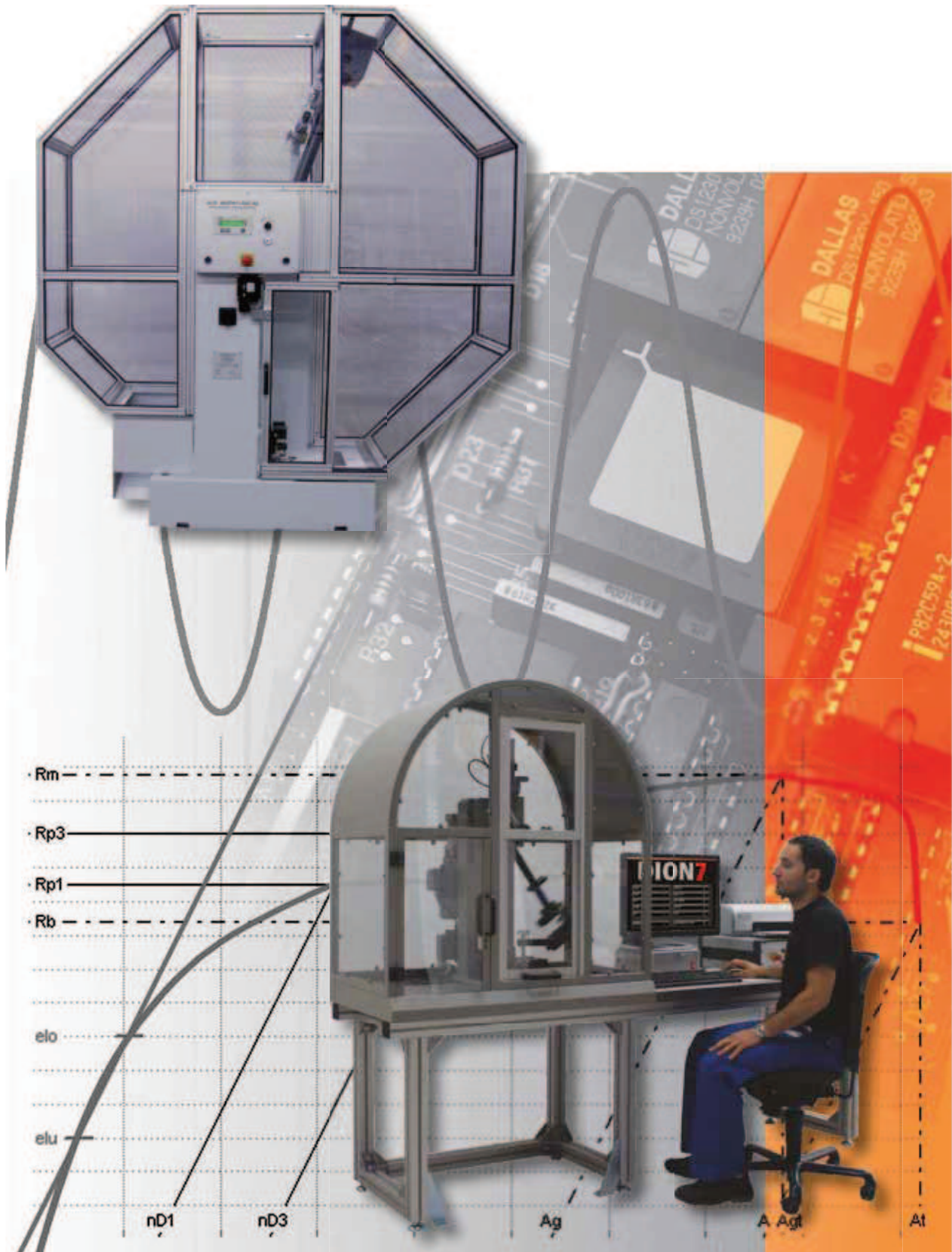


Pendulum Impact Testers



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Impact Testing

according to relevant international Standards

In service many structural components are subjected to high loading rates or must survive high loading rates during accident conditions.

Therefore high strain rate fracture testing is of interest and components must be designed against crack initiation under high loading rates or designed to arrest a rapidly running crack. Dynamic fracture can occur under a rapidly applied load, such as that produced by impact or by explosive detonation. Most common quality tests include methods such as the Charpy impact test and the Izod impact test. Further less common tests are the impact tension, puncture, explosive bulge test, the Robertson test, the Esso test and the Nayy tear test.

The **Charpy Impact Test** which was developed in 1905 by French scientist Georges Charpy is the most common test and widely applied in industry since it is easy to prepare and conduct and results can be obtained quickly and cheap. The specimen in the Charpy test is supported on both ends and is broken by a single blow from a pendulum that strikes the middle of the specimen on the opposite side of the notch. The specimen breaks at the notch and the pendulum passes between the two parts of the anvils. The height difference between the height of fall minus the height of rise give the amount of energy absorption involved in deforming and breaking the specimen. The use of additional instrumentation (typically an instrumented striker) allows a standard Charpy impact machine to monitor the load-time response of Charpy V-notch specimen deformation and fracturing.

The range of products w+b offers for Charpy Impact Tests are units with fixed impact work and velocity, sophisticated modular impact testers with adjustable impact work and velocity which are expandable with instrumented strain gauged striking edge with high speed data acquisition system, deformation measurement or patented laser opto-electronic-measuring-system for deflection (bending) and crack opening measurement for the experimental determination of the intensity of stress, K_{ID}/K_{IC}-factor with ultra high speed ADC board for data acquisition.

The methods for Charpy testing of steels are specified in several standards including the most common used:

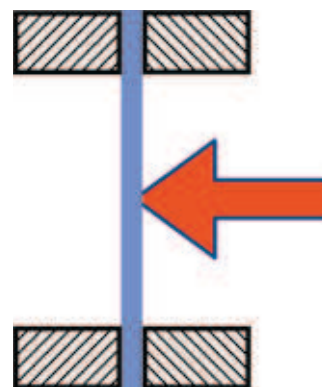
- ASTM E23: Standard Test Method for Notched Bar Impact Testing of Metallic Materials
- EN 10045: Charpy Impact Test of Metallic Materials
- ISO 148: Steel-Charpy Impact Test (V-Notch)
- ISO 83: Steel-Charpy Impact Test (U-Notch)

Relevant standards for the calibration of the Impact Testers are:

- ASTM E23: Standard Test Methods for Notched Bar Impact Testing of Metallic Materials
- EN 10045-2: Method for the verification of Impact Testing Machines
- ISO 148-2: Verification of Test Machines

The **Izod Impact Test** which was named after the English engineer Edwin Gilbert Izod who described it in the 1903 address to the British Association is an ASTM standard method of determining impact strength using a specimen with a V-notch that is similar to the Charpy V-notch specimen. The difference is, that the specimen is gripped at one end only that allows the cantilevered end to be struck by the pendulum. These methods allow that several notches can be made in a single specimen and the ends broken off one at a time. Other types of specimen include round ones. The disadvantage is the required time to clamp the sample exclude low-temperature testing. W+b offers Izod Pendulum Impact Testers as well as related Izod fixtures so that the Charpy Impact Tester can be used for both Charpy and Izod testing.

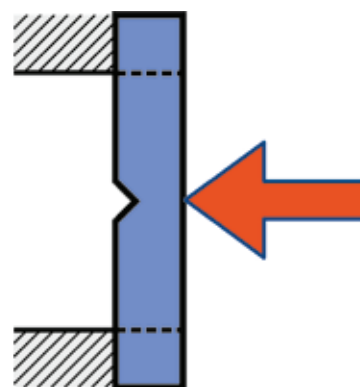
The method for Izod testing of steels is specified in ASTM E23: Standard Test Method for Notched Bar Impact Testing of Metallic Materials.



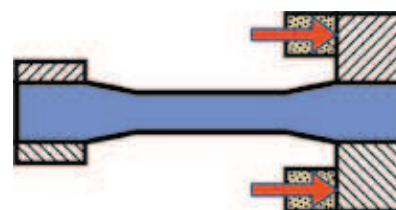
Puncture



IZOD



CHARPY



Tension

Content - Section H

Machine Type	Capacity Range	Page
Pendulum Impact Testers		
Series PH <small>Version CHV 200</small>	150 - 450 Joule	116
Series PH	150 - 450 Joule	118
Series PH	up to 50 Joule	120
Series PH - P	up to 50 Joule	122
Measuring System	LOEMS	124

w+b offers a wide range of pendulum impact testers from 0.5 to 750 Joules designed to fully comply with ASTM E23, EN10045-2 and ISO 148 covering Charpy, IZOD and Impact Tensile Tests. This versatile and reliable machines are available with constant or adjustable impact work for non-instrumented and instrumented tests or with patented laser opto-electronic measuring system. We offer a variety of related products including sample preparation, sample cooling and impact tester verification accessories completing the laboratories requirements.

Sophisticated series of modular Impact Testers expandable with instrumented strain gauged striking edge with high-speed data acquisition system, patented laser opto-electronic-measuring-system for deflection (bending) and crack opening measurement for the experimental determination of the intensity of stress, KID / KIC-factor with ultra high speed ADC board for data acquisition.



Series PH CHV200
150 - 450 J



Series PH
150 - 450 J



Series PH
up to 50 J



Series PH - P
up to 50 J

Extendable Pendulum Impact Tester

Series PH Version CHV 200 300 - 450 Joule

Versatile, extendable Pendulum Impact Tester with adjustable energy/velocity designed for non-instrumented or instrumented tests according to Charpy, IZOD or Impact Tensile Tests. This easy to use impact tester is available in the energy range from 150 to 450 Joule and fully comply with EN 10045-2, ASTM E23, ISO 148 and ISO 83.

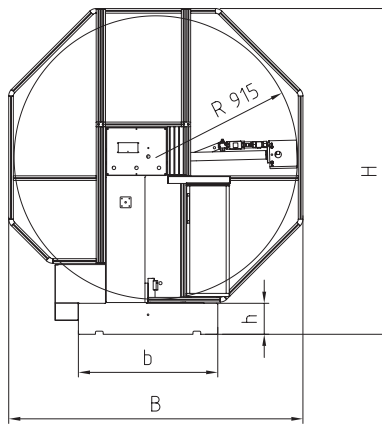
Features

- Versatile unit with easy changeable energy range with 150 or 300 Joule hammer or add-on weights for 450 Joule
- Safety lock to hold the pendulum in its raised position
- Vibration free release of pendulum
- Easy sample mounting by pliers or by automatic sample centering
- Electric break that stops the pendulum on its highest position on the return swing for most productive testing
- Motorized pendulum return to the latched starting position
- 4-digit digital display for direct absorbed energy reading
- Optional automatic hammer recognition
- Step-less adjustable energy/velocity allows Charpy, Izod or Impact Tensile Tests to be performed from 20%-100% of energy range and impact velocity from 2.6 m/s to 5.5 m/s
- Safety guard with interlock so that the test can not be started unless the guard is fully closed
- The guard can be fully opened for maintenance or cleaning
- Save two-hand or automatic pendulum release when the door is closed for low temperature tests (<5 sec)
- Easy exchangeable strikers (EN or ASTM) and anvils
- Stiff and low-vibration two-column design
- Low friction bearings for maximum accuracy
- Ergonomically sample tray
- Interface to PC to run w+b Impact Software for custom configuring, calculation, statistical evaluation, reporting and exporting of tests and results
- Extendable with instrumentation package with strain gauged striker, optional deformation measurement, ultra-high speed data acquisition system and data analysis software. The laser opto-electronic-measuring-system for deflection (bending) and crack opening measurement for the experimental determination of the intensity of stress, KID/KIC-factor can also be attached.

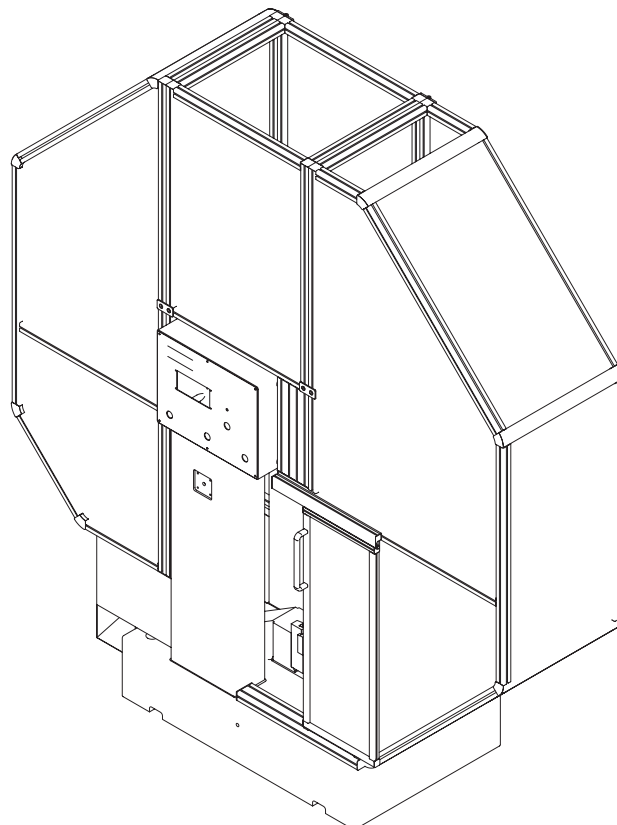


Specifications

- Data Output** RS 232 for connection to PC and data acquisition software
- Weights** Different hammers weights are available to suit the different tests and the international standard.
- Power Requirements** 3 x 400 V, 50 Hz. Others upon request.



Type PH		300	450
Max. Impact Work	Joule	300	450
Available Hammer Weights	Joule	150, 300	150, 300, 450
Impact Velocity	m/sec	2.6 - 5.5	2.6 - 5.5
Angular of Descent	°	52.19 - 160	52.19 - 160
Width (B)	mm	1900	1900
Depth (T)	mm	950	950
Height (H)	mm	2050	2050
Concrete Base Width (b)	mm	900	900
Concrete Base Depth (d)	mm	450	450
Concrete Base Height (h)	mm	200	200
Weight	kg	900	900



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Universal Pendulum Impact Tester Series PH 150 - 450 Joule

The resilience test allows determining the fragility or resistance that opposes a material to the break. To realise the test is employed the pendulum of fall that measures the existing residual energy after the break – the difference between the total energy developed by the machine and the absorbed by the material.

Sophisticated series of modular Impact Testers expandable with instrumented strain gauged striking edge with high-speed data acquisition system, patented laser opto-electronic-measuring-system for deflection (bending) and crack opening measurement for the experimental determination of the intensity of stress, KID / KIC-factor with ultra high speed ADC board for data acquisition or pre-conditioning chambers with semi or fully automated specimen-feeding system.

Features

- Rigid U (Box) Frame avoiding secondary swinging
- High accuracy
- Charpy pendulum hammer for 150, 300 or 450 Joules potential energy including striking edge, anvils and specimen supports
- Electronic high resolution angle-transducer (encoder) and interface board for PC with connecting cable
- Centring device for correct positioning of CHARPY specimens
- Electro-mechanical safety release mechanism of the pendulum
- Electro-magnetic brake for the pendulum
- Motorised hammer lifting system including electro-magnetic release
- Stops for fast and repeatable exchange of anvil block
- Set of anvil blocks with supports to ISO EN, ASTM, DIN, ISO-V and ISO-U specimens 55 x 10 x 10 mm
- Quick attachment kit for specimens 55 x 5 x 10 mm or others
- Ergonomic design for sitting or standing operation
- Safety guard with remote control and safety door. Beside of the big sliding doors which only must be opened for cleaning the safety guard is equipped with an additional small sliding door which can easily be opened to load the specimen quick on the centring device
- w+b Software Package for rapid and productive testing and specialised evaluation. With fully automated test runs and daily checking procedure.
- Automatic data storage
- Calculation of absorbed energy in Joule and Test report print out according customer requirements
- Statistical evaluation with histogram and graphics
- ASCII export of data
- Alternative with digital readout instead of the advanced Software package



Standard Accessories

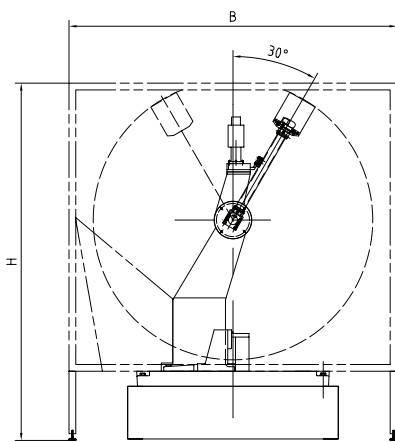
- **Specimen Centring Device** for correct positioning
- **Small Sliding Door** for quick and easy specimen loading on centring device.

Specifications

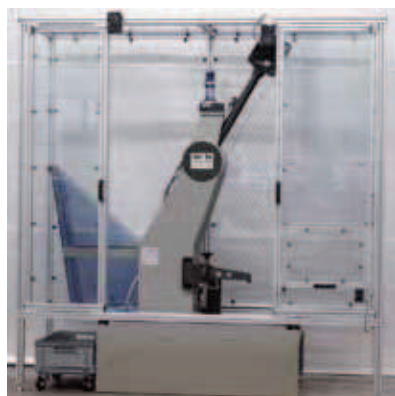
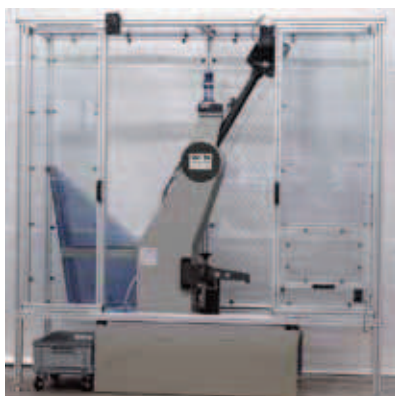
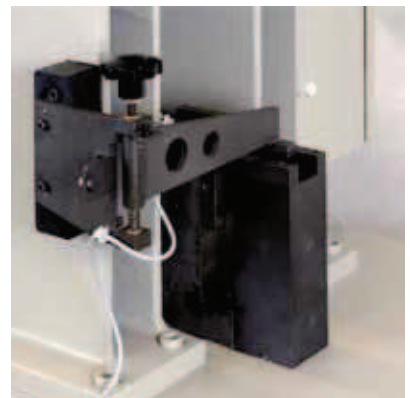
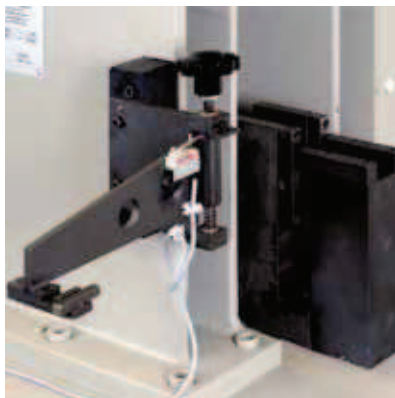
Data Output RS 232 for connection to PC and data acquisition software

Weights Different hammers weights are available to suit the different tests and the international standard.

Power Requirements 3 x 400 V, 50 Hz. Others upon request.



Type PH		150	300	450
Max. Impact Work	Joule	150	300	450
Available Hammer Weights	Joule	150	150, 300	150, 300, 450
Impact Velocity	m/sec	5.5	5.5	5.5
Angular of Descent	°	150	150	150
Width	mm	2400	2400	2400
Depth	mm	850	850	850
Height	mm	2300	2300	2300
Weight	kg	1020	1050	1350



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Table-Top Pendulum Impact Tester Series PH up to 50 Joule

Versatile, extendable Table Top Pendulum Impact Tester designed for non-instrumented or instrumented tests according to Charpy, IZOD or Impact Tensile Tests. This easy to use impact tester is available in the energy range up to 50 Joule and fully comply with EN 10045-2, ASTM E23, ISO 148 and ISO 83.

Features

- Ergonomically Table Top design
- Versatile unit with easy changeable energy range
- Safety lock to hold the pendulum in its raised position
- Vibration free release of pendulum
- Easy sample mounting by pliers or by automatic sample centering
- Electric break that stops the pendulum with Motorized pendulum return to the latched starting position
- Safety guard with interlock so that the test can not be started unless the guard is fully closed
- The guard can be fully opened for maintenance or cleaning
- Test start through software or automatic pendulum release when the door is closed for low temperature tests (<5 sec)
- Easy exchangeable strikers (EN or ASTM) and anvils
- Stiff and low-vibration design
- Low friction bearings for maximum accuracy
- Ergonomically sample tray
- Interface to PC to run w+b Impact Software for custom configuring, calculation, statistical evaluation, reporting and exporting of tests and results
- Extendable with instrumentation package with strain gauged striker, optional deformation measurement, ultra-high speed data acquisition system and data analysis software. The laser opto-electronic-measuring-system for deflection (bending) and crack opening measurement for the experimental determination of the intensity of stress, KID/KIC-factor can also be attached.

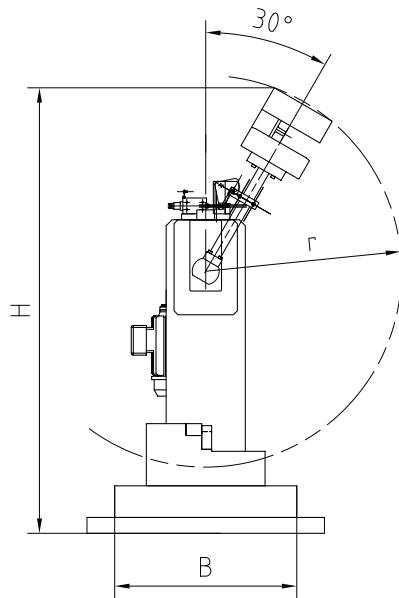


Specifications

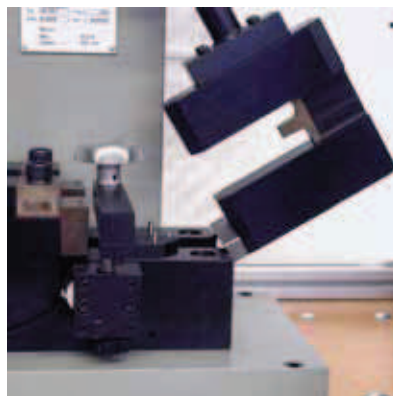
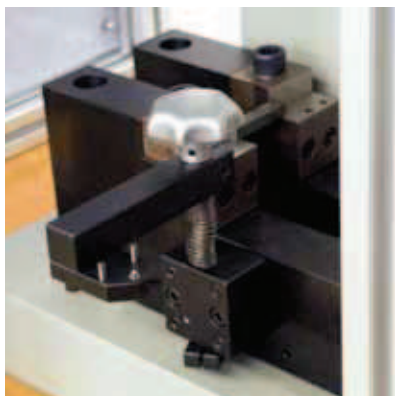
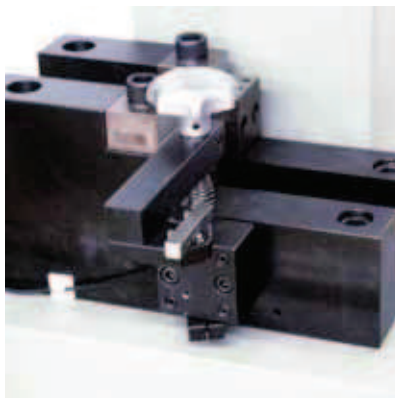
Data Output RS 232 for connection to PC and data acquisition software

Weights Different hammers weights are available to suit the different tests and the international standard.

Power Requirements 3 x 400 V, 50 Hz. Others upon request.



Type PH		25	50
Max. Impact Work	Joule	25	50
Available Hammer Weights	Joule	5, 7.5, 10, 25	5, 7.5, 10, 25, 50
Impact Velocity	m/sec	3.8	3.8
Angular of Descent	°	150	150
Width	mm	500	500
Depth	mm	550	550
Height	mm	1100	1100
Weight	kg	600	770



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Plastic Pendulum Impact Tester

Series PH - P up to 50 Joule

Advanced Pendulum Impact Tester determines the energy required to break or rupture specimens of plastics or ceramics. The apparatus conforms to all of the international test standards including ASTM D256, ISO 179 and 180 for Izod, Charpy Testing, ASTM D1822 for Tension Impact Testing and other recognised standards.

The design utilises advanced dedicated microprocessor technology for simplicity, ease of operation, high accuracy and repeatability of results.

This apparatus is extremely versatile and allows impact velocities from 1.5 m/s up to 3.8 m/s combined with variable weight hammers to give an impact energy range up to 50 Joules. A special impact energy diagnostic programme has been included to assist the

operator to select the correct size of Hammer for the Standard and material being tested.

The SCADA Software enables the Tester to be controlled via the PC. SCADA allows the use of recipes to upload frequently used test parameters and combine them with a operating strategy which ensure the procedures are correctly carried out. The test parameters and operating results can be displayed on screen, printed and/or archived as standard CSV files

in which can be viewed or manipulated in Excel.

The apparatus also offers a Self Calibration procedure for bearing resistance and windage.

Standard features include advanced dedicated microprocessor control, Touch membrane Alpha / Numeric keypad for data entry, LCD display for sequence logic menu auto prompt selection, Yes / no mode selector, RS232 output with data transfer lead, Specview "Scada" software to allow PC control of Tester and real-time viewing of results, Self-calibration procedure, Results downloaded to PC for spreadsheet analysis, Metric units of measure, Ability to store User Names and Material Types, Recipe Manager to store and upload data, High resolution positional encoder, Variable pendulum velocity, Solenoid pendulum release with audible pre-warning, Levelling device, Full safety guarding electrically inhibiting operation when not closed, Fully traceable certificate of calibration, Product user manual, CE mark of conformity.

Optional accessories available: variable Weight Hammers for Izod, Charpy or Tension Impact, Izod, Charpy or Tension Impact Clamps & Vices, Special clamps, fixtures and hammers for component testing, Guard Enclosure.

Complies with Standards: ISO 180, ISO 179, DIN 51222, BS 2782: Part 3: Method 359, BS 2782: Part 3: Method 350, ASTM D5942, ASTM D5941, ASTM D256, ASTM D1822



Specifications

- Data Output** RS 232 for connection to PC and data acquisition software
- Weights** Different hammers weights are available to suit the different tests and the international standard.
- Power Requirements** 230 V, 50 Hz. Others upon request.

Type PH		25	50
Max. Impact Work	Joule	25	50
Available IZOD Hammer Weights	Joule	1, 2.75, 5.5, 11, 22	1, 2.75, 5.5, 11, 22
Available CHARPY Hammer Weights	Joule	0.5, 1, 2, 4, 5, 7.5, 15, 25	0.5, 1, 2, 4, 5, 7.5, 15, 25, 50
Impact Velocity	m/sec	1.5 - 3.8	1.5 - 3.8
Angular of Descent	°	30 - 165	30 - 165
Width	mm	950	950
Depth	mm	850	850
Height	mm	600	600
Weight	kg	115	130

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Patented Laser Opto-Electronic Measuring System LOEMS

Force, deflection (bending) and crack opening measurement or experimental determination of the intensity of stress, K_{ID} and K_{IC} factor with ultra high speed (8 channels at 2.5 MHz, one channel 20 MHz) ADC board for data acquisition. Including software package for research purposes.

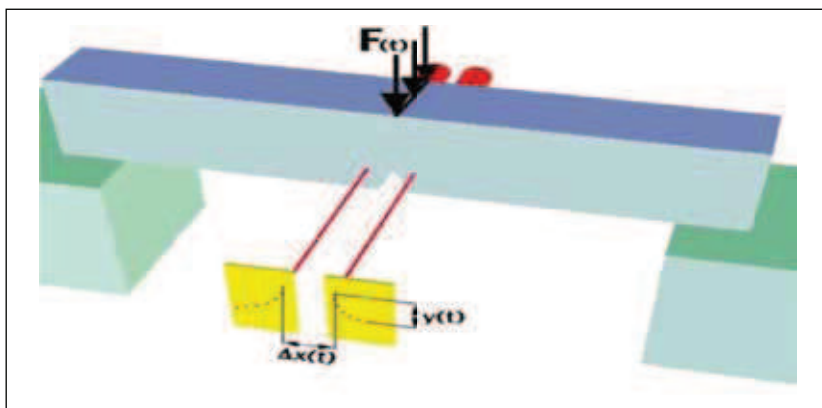
The determination of the factor of intensity of distortion KIC or KID in dynamics requires the measurement of the crack opening displacement (COD) according to the applied force.

While the measurement of these two parameters, force and particularly COD, poses no problems under normal test conditions, (ambient T° and slow distortion), it is not the case when the conditions become extreme, as in the case of a shock test with an impact pendulum where the use of a precision extensometer is not possible.

In order to measure the distortion during a shock test, an optical method without contact is required, permitting measurement of distortion directly on the specimen during the rupture (test time about 300 μ s) not only in the direction of application of the force (deflection) but also in the transversal sense (COD).

A high-speed acquisition card (20 MHz, 8 channels) ensures a very precise sampling range.

The principle of the method consists of drilling two very fine holes 10 mm apart at the level of the crack of the specimen, which has no influence whatsoever on the state of dis-



Principle of the method

- F Force
- Y(t) Deflection
- X(t) COD

tortion at the level of the crack.

A laser beam of a diameter greater than that of the holes drilled in the specimen illuminates these holes.

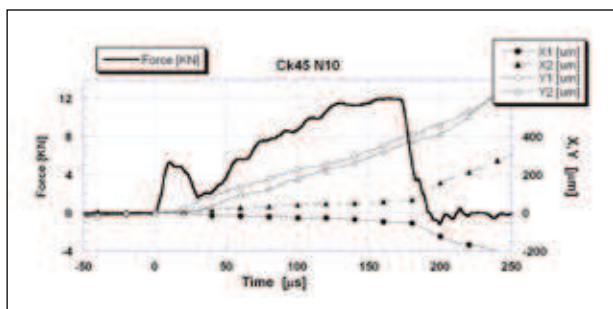
At the moment of shock, the specimen is distorted. The holes are displaced within the illuminated area, which causes a displacement of the luminous spot emerging from the specimen onto photosensitive cells PSD _Dual axis (Position sensitive displacement) positioned under the specimen.

These cells emit an electronic signal, depending on the location of the luminous spot, which is recorded by the acquisition card.

It is possible then to measure the distortion of the specimen simultaneously with the measurement of the applied force with distortion gauges.

From the value of COD and the theory of linear mechanics of the rupture, it is possible to determine the KID.

X1, Y1 displacement of Hole 1
X2, Y2 displacement of Hole 2
with pendulum impact tester Series PH



Xi COD
Yi Deflection
with pendulum impact tester Series PH

