wallace

a brand of Elektron Technology

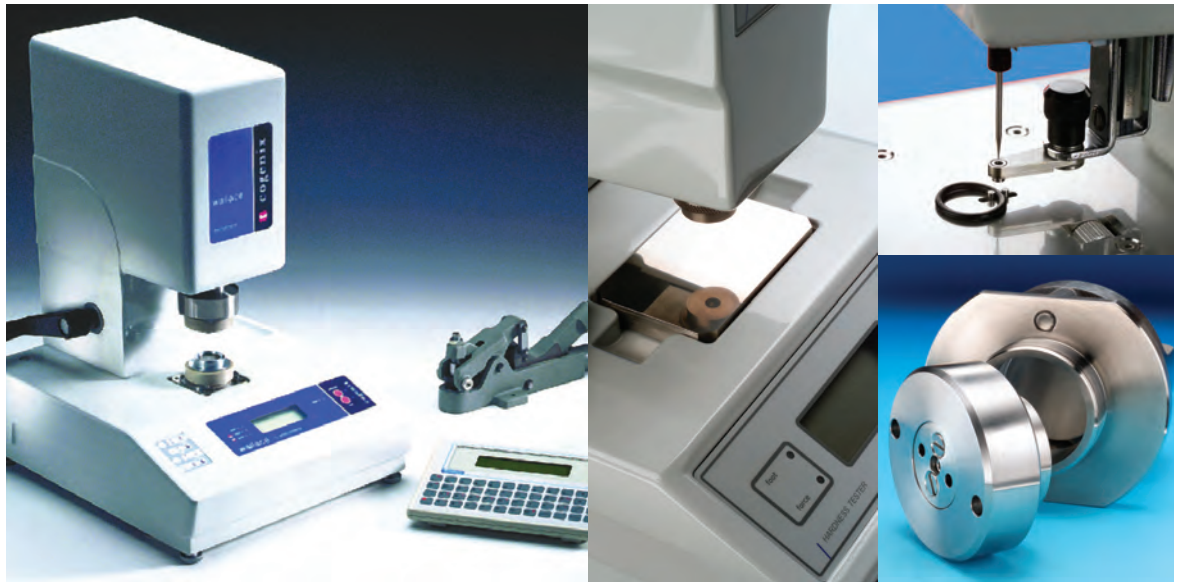
No-one is more instrumental in validating rubber quality.
And here are our products.

Introduction

Wallace have been supplying quality products to the rubber industry for over 65 years. Our thousands of customers extend across the entire rubber supply chain - from natural rubber producers in equatorial countries, to high tech aerospace manufacturers. We design & manufacture a wide range of instruments and test equipment, measuring physical properties such as hardness, plasticity, viscosity, cure, compression and many other characteristics.

Conforming to international testing standards, Wallace Instruments are used by R&D and quality control departments in over 60 countries worldwide. Our international sales are made through a network of dealers and agents who represent Wallace, in the important rubber producing and processing areas of the world. Through this extensive network we provide our customers with a personal service, offering product advice and technical support including maintenance and calibration.

As world markets have developed, we have expanded our international representation so that over 75% of Wallace's production is now exported.



Cogenix Instruments

Until a few years ago, many instruments supplied to the rubber industry were cumbersome and difficult to use. Frequently analogue devices, they required a great deal of operator training and experience to achieve consistent readings.

Wallace therefore introduced a new range of digital instruments under the brand name, *Cogenix*.

For many of these new instruments the *Cogenix* concept incorporates a 'C' frame design which allows the operator easy access from front and sides to safely load and remove samples. By simply pressing the start button, *Cogenix* instruments function automatically allowing accurate, repeatable results to be recorded in less time than traditional models.

Several versions of each model are offered to suit varying needs and budgets - from a basic stand alone instrument to a computer linked model which saves the user hours of tedious data entry by exporting the results directly to a PC for immediate analysis.

Paying particular attention to the appearance of *Cogenix* instruments, our designers have succeeded in achieving a new, distinctive Wallace house style.

Hardness

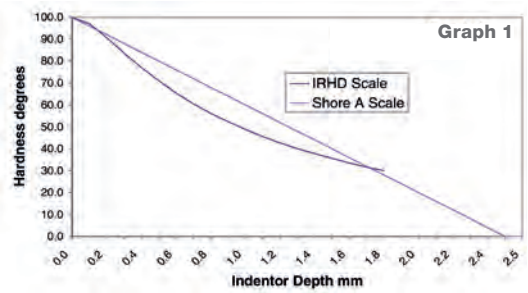
Hardness (resistance to indentation) is one of the most widely measured properties used to characterise rubber, as it is a practical way of determining the degree of vulcanisation.

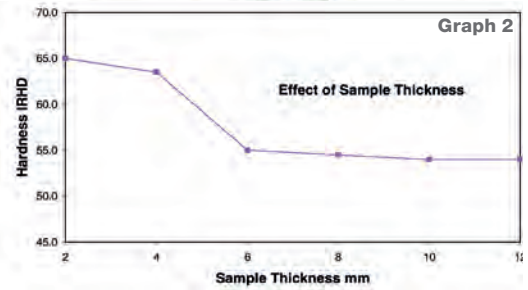
Two measurement scales are in general use – IRHD (International Rubber Hardness Degrees) and the Shore scale. The two test methods use totally different indentor geometries, indentor forces, test time and procedures.

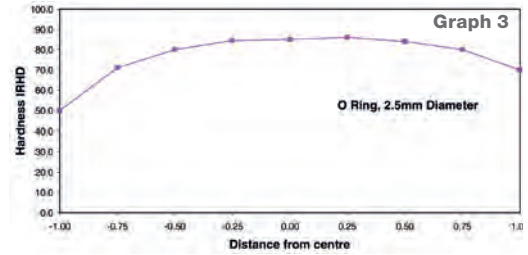
IRHD is used specifically to evaluate rubber whereas Shore has developed into several different scales for testing a wide range of materials - from foam to hard plastics. Two Shore scales are relevant to rubber – 'A' which is used for evaluating rubbers and 'D' for hard rubbers and plastics.

The IRHD hardness tester specifies an indentor with a 2.5mm spherical tip whereas the Shore A instrument uses a 350 cone with a 0.79mm diameter flat tip. The indentor force is applied by a constant load in an IRHD instrument but by a spring in the Shore model. The Shore A scale is linear whereas the IRHD is nonlinear (see graph 1).

Much work has been done to evaluate the relationship between IRHD & Shore A e.g. in 1993 Briscoe & Sebastian concluded IRHD = Shore A + 4° - but they found this varied significantly for different types of rubber.







Micro Hardness Scales

Both IRHD & Shore micro (M) scales have been developed for testing thin/small rubber samples. The original micro scale was IRHD, which was developed in the 1950s and resulted in Wallace's renowned H5 Micro Hardness tester, which was very successful and in production for over 40 years.

For the IRHD micro scale, indentor displacements are deliberately set at $^1/_{6^{th}}$ of the original 'macro' scale and forces at $^1/_{36^{th}}$ This makes results between IRHD micro and macro tests comparable. However, Shore M is not designed as a scaled down version of the Shore A but as a test capable of evaluating hardness of smaller samples. Shore M uses an indentor and spring unrelated to those specified in the A scale, so there is no clear relationship between the two.

Hardness Testing of Thin / Small Samples

The operator should consider procedures carefully to achieve accuracy e.g.

1 By using a macro tester on thin rubber, he/ she may record an unrealistically high value as the instrument measures the effect of the hard table beneath the sample (see graph 2).

2 When measuring an O-ring, he/she should consider using a device that ensures the centre of the ring is directly beneath the indentor. Otherwise a falsely low value may be recorded (see graph 3).

3 When measuring thin rubber, he/she should ensure it is lying perfectly flat on the sample table. Otherwise part of the indentor force will be absorbed flattening the sample, not measuring its hardness, leading to a falsely low result.

4 Micro hardness scales involve very small indentor displacements e.g. for an average rubber, 1 IRHD = .005mm (5 microns). So for best performance and accuracy it is important micro testers are handled carefully, serviced and calibrated regularly.

Bench Mounted or Hand Held?

Bench mounted hardness testers produce the most repeatable and reliable results. Pocket meters, although convenient for outside the laboratory, do rely entirely on the operator's hand pressure and a consistent 900 (vertical) angle of application.

Whether you need bench or hand held, IRHD or Shore, Macro or Micro we are confident you will find the instrument you need from the extensive range of Wallace hardness testers that are featured in this catalogue.

H14 Macro IRHD Hardness Tester

- **One touch, fully automatic operation**
- **Accurate & consistent results**
- **Easy access to sample area**
- **Operator dependency reduced**
- **Range of sample tables**
- **Four models offered**

The Wallace H14 is a digital, bench mounted hardness tester designed for measuring in IRHD the hardness of standard rubber samples.

The robust, 'C' frame design allows the operator easy access from front and sides to safely load and remove samples. The indentor mounting is frictionless and its position sensed by an LVDT providing the instrument with outstanding sensitivity. The adjustable anti-vibration feet reduce the effect of external vibration.

By simply pressing the start button, the instrument functions automatically allowing accurate, repeatable results to be recorded in much less time than traditional models.

As minimal training is required, new operators soon become confident with the H14, achieving consistent readings from the outset.

A range of optional sample tables is available, designed to locate samples of varying shapes and special holding fixtures (*see page 6*).

Keys on the front panel easily adjust the measuring head up and down to suit the sample height.

Once the start key is pressed, the foot descends to secure the sample followed by the indentor, which lowers through the centre of the foot with a primary load of 0.3N to find its datum position. After 5 seconds, in line with the testing standards, the force is increased to 5.7N and applied for a further 30 seconds. At this point the instrument identifies the indentor position and the hardness value is automatically frozen and displayed clearly on the LCD screen. Two LEDs on the instrument's front panel monitor all stages of the test cycle. Four instrument models are offered *(see page 4)*:

H14/1 Basic, stand alone
H14/2 With printer
H14/3 With printer and data input terminal
H14/4 PC controlled

Specification

Dimensions	214 x 255 x 300mm (w x d x h)
Weight	7.5 kg
Resolution	IRHD < 0.1
Indentor shape	Sphere
Indentor diameter	2.5mm
Full range display	1.8mm
Force method	Weight
Foot force	N 8.3
Primary indentor force	N 0.3
Secondary force	N 5.4
Force duration	seconds 5+30
Min. sample thickness	8mm
Standards	BS 903: Pt. A26, DIN 53519, ISO 48, ASTM D 141

Bench Hardness Testers

Wallace offer both macro and micro bench mounted models for evaluating the hardness of rubber in two different measurement scales - IRHD and Shore. The macro models are designed for testing rubber samples over 6mm thick whereas the micro models are suitable for testing thin and small pieces.

H14 Macro IRHD Hardness Tester
H12 Micro IRHD Hardness Tester
H17A/D/O Macro Shore Hardness Tester
H17M Micro Shore Hardness Tester

All these robustly designed models conform to international testing standards. Please refer to pages 3, 5 & 7.

Four Versions Offered

To suit customers' varying needs and budgets, Wallace offer 4 versions for each bench mounted model - from a basic, stand alone version to a computer linked version:

Basic, Stand alone *With Printer* *With Printer & Data Input Terminal*

1 Basic, Stand alone

Features include:
- Touch button, automatic operation
- Visual LED indication of foot & indentor contact
- Digital display with programmable resolution to 0.1 or 0.5 unit
- Built in diagnostics to check instrument's internal settings

2 With Printer

The compact, high speed, 24 character width printer, provides a permanent record of results and instrument settings. The printer keys can be used to set various parameters including:
- Sample identification with auto increasing suffix
- Date & time of test
- Traceability of aborted tests

3 With Printer & Data Input Terminal

The data input terminal contains a 16 character, two line LCD display and QWERTY keypad. It supplies additional information on the operation of the hardness tester and offers the user several new options.

Test parameters are more easily set. Data for operator and sample identification can be entered. The timing of the primary and secondary indentor loads (H12 & H14) can also be pre-set. Other features include:
- Data and time recording and traceability
- Calibration check reminder

4 PC Controlled

The hardness tester is controlled using a personal computer. The Windows compatible Data Collection Software programme (DCS) allows full control over the instrument conditions. Test data may be exported in tab-separated format into word processors, spreadsheets, databases or SPC systems. The printer and PC options may be used simultaneously. Other features include:
- User definable gates with flagged data reporting
- Statistical software package including graphical report generator

HPS Hardness Prediction Software

The HPS software used in conjunction with the Wallace H14 Macro or H12 Micro Hardness Tester dramatically shortens the duration of IRHD tests by accurately predicting the end result. For example, the standard 35-sec test time (5 sec primary load and 30 sec secondary load time) can be shortened by 80% to only 7 seconds (1 sec primary & 6 sec secondary). Wallace HPS offers the user a significant reduction in test cycle time in situations where it is unnecessary to adhere strictly to the standard, for example, when carrying out in-house comparative testing of a large quantity of samples.

H12 Micro IRHD Hardness Tester

- **Tests small / thin samples and 'O' rings**
- **One touch, fully automatic operation**
- **Accurate & consistent results**
- **Easy access to sample area**
- **Operator dependency reduced**
- **Range of sample tables**

The Wallace H12 is a digital bench mounted hardness tester that measures in IRHD the hardness of most rubber samples but in particular it has been designed to accurately test thin sections and small test pieces such as O-rings.

The robust, 'C' frame design allows the operator easy access from front and sides to safely load and remove samples. The indentor mounting is frictionless and its position sensed by an LVDT providing the instrument with outstanding sensitivity. Adjustable anti-vibration feet reduce the effect of external vibration.

By simply pressing the start button, the instrument functions automatically allowing accurate, repeatable results to be recorded in much less time than traditional models.

As minimal training is required, new operators soon become confident with the H12, achieving consistent readings from the outset.

A range of optional sample tables is available *(see page 6),* designed to locate samples of varying shapes and special sample holding fixtures. It includes the O–ring adaptor (H19/ORA) that ensures the centre of the ring is directly beneath the centre line of the indentor.

Keys on the front panel easily adjust the measuring head up and down to suit the sample height. Once the start key is pressed, the foot descends to secure the sample followed by the indentor, which lowers through the centre of the foot with a primary force of 8.3mN to find its datum position. After 5 seconds, in line with the testing standards, the force is increased to 153.3mN and applied for a further 30 seconds. At this point the instrument identifies the indentor position and the hardness value is automatically frozen and displayed clearly on the LCD screen. Four instrument models are offered *(see page 4)*:

H12/1 Basic, stand alone
H12/2 With printer
H12/3 With printer and data input terminal
H12/4 PC controlled

Specification

Dimensions	214 x 255 x 300mm (w x d x h)
Weight	7.5 kg
Resolution	IRHD < 0.1
Indentor shape	Sphere
Indentor diameter	0.395mm
Full range display	0.3mm
Force method	Weight
Foot force	mN 235
Primary indentor force	mN 8.3
Secondary force	mN 145
Force duration	seconds 5+30
Min. sample thickness	mm 1.5
Standards	BS 903: Pt. A26, DIN 53519, ISO 48, ASTM D 141

Test Blocks & Sample Tables

Rubber Hardness Test Blocks are available in 5 scales – IRHD (Macro), IRHD (Micro), Shore A, D and M. They are manufactured from high quality rubber formulated to resist the ageing effects on hardness of temperature and time.

The test blocks are for use as a check to ensure instruments are functioning properly and read correctly. They are not intended as standards with specific hardness values. Test blocks should be returned to Wallace every 12 months for re-calibration. The table below lists the test blocks available.

Sample Tables for Wallace Hardness Testers

These sample tables will suit any of the bench mounted Wallace Hardness Testers including the H12, H14 & H17 models. The tables accurately locate onto precision dowels, so no extra fixings are required.

'V' Groove Tables

For location of solid section extrusions and mouldings. Dimensions, 180mm (w) x 76mm (d)
H19/2 1mm wide 'V' groove
H19/3 4mm wide 'V' groove
H19/4 8mm wide 'V' groove

H19/5 Matrix Table

For precise location of sample holding fixture. Dimensions: 180mm (w) x 76mm (d)
The matrix consists of 126 holes located on 10mm centres. Alternate holes are tapped to accept M3 threaded screws or drilled to 3mm to accept a dowel.

H19/ORA 'O' Ring Holder

To locate the centre of an 'O' ring directly beneath the indentor of Wallace Micro Hardness Testers.

Upon turning the knurled wheel, 2 gear driven pins rise from the surface to locate the 'O' ring. The holder accommodates cross section diameters of between 1 & 5.5mm.

H19/7 Oversized Table

A flat surface for easy positioning of large samples. Dimensions: 300mm (w) x 76mm (d)

Test blocks	Scale	Hardness range	Qty of	Wallace Instrument models
H10	RHD	40-90	6	H1, H2, H3, H14, H15, H25
H11	IRHD Micro	40-70	4	H5, H5A, H5B, H12
H10A	Shore A	20-90	6	H16A, H17A, H26A
H10D	Shore D	30-80	6	H16D, H17D, H26D
H11M	Shore M	40-70	4	H17M

' O ' Ring Holder

H17 Shore Scale Hardness Tester

- **Tests soft and hard materials using different Shore scales**
- **One touch, fully automatic operation**
- **Accurate & consistent results**
- **Easy access to sample area**
- **Operator dependency reduced**
- **Range of sample tables**
- **Four versions offered for each model**

The Wallace range of H17 digital, bench mounted hardness testers, is designed for measuring in Shore scale the hardness of various materials. Four models are offered – the H17A for testing standard rubber, H17O for soft rubber and medium density textiles, H17D for hard rubbers and plastics and H17M for thin / small rubber samples.

The robust, 'C' frame design allows the operator easy access from front and sides to safely load and remove samples. The adjustable anti-vibration feet reduce the effect of external vibration.

By simply pressing the start button, the instrument functions automatically allowing accurate, repeatable results to be recorded in much less time than traditional models.

As minimal training is required, new operators soon become confident with the H17, achieving consistent readings from the outset.

A range of optional sample tables is available, designed to locate samples of varying shapes, sizes and special holding fixtures *(see page 6)*. Keys on the front panel easily adjust the measuring head up and down to suit the sample height.

Once the start key is pressed, the foot descends to secure the sample. In line with the testing standards, once the foot contacts the sample the indentation depth is recorded after a pre-set dwell time, typically 3 seconds. At this point the instrument identifies the indentor position and the hardness value is automatically frozen and displayed clearly on the LCD screen.

Four instrument models are offered *(see page 4)*:

H17/1 Basic, stand alone
H17/2 With printer
H17/3 With printer and data input terminal
H17/4 PC controlled

Specification

Model	H17A	H17D	H17O	H17M
Dimensions width, mm	214	214	214	214
Depth, mm	255	255	255	255
Height, mm	300	360	300	300
Weight, kg	7.5	4.5	7.5	7.5
Resolution	0.1	0.1	0.1	0.1
Indentor shape	35° Cone	30° Cone	½ Sphere	35° Cone
Indentor rad., mm	Flat	0.1	1.19	0.1
Full scale, mm	2.5	2.5	2.5	1.25
Force method	Spring	Spring	Spring	Spring
Max. indentor force, N	8.05	44.45	8.05	0.765
Force duration, seconds	1 or 3	1 or 3	1 or 3	1 or 3
Min. sample thickness, mm	6.0	6.0	6.0 1.25	
Standards	Shore A Scale : BS 903 Pt A57, DIN 53505, ISO 7619, ASTM D2240, JIS 6301			
	Shore O Scale : ASTM D2240, Shore D Scale : ASTM D2240, Shore M Scale : ASTM D2240			

Plasticity

Temperature (°C)	Plasticity number		
102	31.0	30.5	31.0
101	30.5	31.5	31.5
100	31.0	31.0	32.0
99	31.5	31.0	31.5
98	32.0	32.0	32.0
95	32.0	32.5	33.0

Table 1. Effect of platen temperature

Angle of tilt (°)	Plasticity number			
0.00	33.0	32.5	33.0	32.5
0.65	32.0	32.0	32.0	31.5
1.30	31.0	31.0	31.5	31.0

Table 2. Effect of platen parallelism

Rapid plasticity is one of the basic tests used in the natural rubber industry and is the measurement of compression of a specimen of known thickness at a known temperature under a predetermined load for a known time.

The Wallace Rapid Plastimeter, designed to conform to international standards, measures the thickness of a rubber sample to a very high degree of accuracy (±0.001mm). One Wallace Rapid Plasticity unit represents a change in thickness of 0.01mm.

Test Procedure

The size of the test sample (0.4cm^3) is defined by the standard. Before being positioned between the platens, the specimen is placed between 2 pieces of carrier paper to protect the platens from contamination.

The test pre-compresses the sample for 15 seconds to 1mm (at a temperature of 100°C for natural rubber) and then further compresses the sample for 15 seconds under a load of 100N. The plasticity number is a measure of the final sample thickness, reflecting the degree of flow within the sample.

Factors Affecting Results

There are a number of test parameters which can affect the result such as platen temperature, platen parallelism, carrier paper, platen load, test duration, sample positioning and sample preparation. However, results are repeatable, provided all these parameters are controlled.

During development of the P14 Rapid Plastimeter, Wallace engineers carried out detailed investigations on how these factors influenced the test results.

Temperature

Tight temperature control is important *(see table 1)*. The platens of the obsolete Wallace P1 and P12 instruments were steam heated – leading to large temperature variations in many cases. With the current P14 Plastimeter the platens are electrically heated, and can be checked and adjusted accordingly.

Platen Parallelism

Lack of platen parallelism also affects the result *(see table 2)*. This is particularly so when the alternative platen sizes allowed in the standard are used – so the parallelism must be reset every time the platen is changed.

Sample Carrier Paper

The dependence of the result on the sample paper used is important *(see table 3 - see page 10).* Use of the paper recommended by the standard will ensure that results are consistent.

Other sample carriers may be used (after validation) and will produce different, but consistent results. The paper size is also important and if larger sample papers are used, the effect of the heat-shield around the platen can lead to significantly low readings.

Continued on page 10

P14 Rapid Plastimeter Mk V

- **Accurate control of temperature time & load**
- **Semi-automatic setting of 1mm gap**
- **Choice of 3 different upper platens**
- **Choice of 4 models**

The Rapid Plastimeter measures the plasticity of natural or unvulcanised rubber to international testing standards. The instrument may be used in conjunction with the Wallace Ageing Chamber *(see page 14)* to determine the Plasticity Retention Index (PRI) of raw natural rubbers.

The variable temperature model (P14/ VT) characterises the flow behaviour of synthetic rubber compounds as, unlike the other models, its platen temperatures can be varied between 60°C & 180°C. For some applications the P14/VT offers a quick, low cost alternative to a Mooney Viscosity test.

The P14 features an attractive 'C' frame design, providing easy access for the operator when loading and removing samples from between the heated platens. Clear instructions are displayed on the front LCD panel so that the user can have the instrument calibrated and ready for sample testing in seconds.

When the instrument's operating handle is rotated, the test sequence starts automatically. The final thickness of the test piece, expressed in units of 0.01mm, is the plasticity number, which is displayed digitally on the front panel.

Tight control of the sample temperature is fundamental to the validity of the test, so two LEDs on the front panel are illuminated in green, indicating that the upper & lower platen temperatures are within acceptable limits throughout the test.

A 10mm diameter upper platen is fitted as standard with 7.3 & 14mm alternatives supplied loose. Each model is supplied with a hand operated constant volume specimen cutter.(Ref. P1/4)
Four instrument models are offered:

P14/1 Basic, stand alone
P14/2 With printer
P14/3 With printer & data terminal
P14/VT Variable platen temperature with printer & data terminal

The data input terminal contains a 16 character, two line LCD display and QWERTY keypad. It supplies additional information on the P14's operation and offers the user several new options. Test parameters are more easily set. Data for operator & sample identification can be entered. The duration of the conditioning and test load can also be adjusted and pre-set.

Specification

Plastimeter	
Dimensions	300 x 360 x 420mm (w x d x h)
Weight	kg 20
Platen temp. P14/1,2,3	100°C
P14/ VT	60°C - 180°C
Upper platen dia.	10mm (fitted) 7.3, 14 (supplied)
Lower platen dia.	16mm
Test duration, secs.	15 conditioning, 15 load
Compressive load	N 100
Printer	
Characters, per line	24
Paper width	58mm
Dimensions	105 x 195 x 90mm (w x d x h)
Weight	kg 0.63
Data Terminal	
QWERTY keypad	16 character, 2 line LCD display
Dimensions	290 x 150 x 140mm (w x d x h)
Weight	kg 0.495
Specimen Cutter	
Sample thickness	3mm
Sample volume	cm^3 0.4
Dimensions	80 x 335 x 260mm (w x d x h)
Weight	4.0 kg
Standards BS 903: Pt. A59, ISO 2007, ASTM D3194	

Plasticity *Continued from page 8*

Platen Load

The load specified in the standard is 100 ± 1N.

If the load is decreased to 97N the plasticity result will increase by approximately 1.5 units compared to the standard load. Alternatively, if the load is increased to 103N, the result will decrease by a similar amount.

The platen load is accurately applied in the P14 – with a calibrated weight arm applying the load.

Load Duration

Use of the obsolete P1 Plastimeter which is timed manually, can lead to significant errors in the final result - a variation of ±1 second in the time of application of the test force can make a difference to the final result of as much as one plasticity unit. With the P14 the application of the load is timed very accurately by a quartz crystal controlled timer.

Sample Positioning

The operator should take care to place the sample exactly at the centre of the lower platen. A few millimetres deviation from this point does not measurably influence the results. However, once the top platen compresses the edge of the sample (corresponding to about 5mm off centre) the plasticity number drops by about 1 unit. The results will continue to drop as less of the sample is compressed.

Sample Preparation

Because the plastimeter is measuring to an accuracy of ±0.001mm, it is essential that the rubber test sample conforms to the dimensions defined by the standard. All samples should be prepared from a 3mm thick sheet and be cut to a volume of 0.4 ± 0.04 cm^3.

The Wallace constant volume specimen cutter (ref. P1/4), which is supplied with each Plastimeter, conforms to this requirement. But it is very important that this cutter is kept in good condition. Adjusting screws on the cutter allow the cutting faces to be set parallel and the cutting depth maintained at 3mm.

Plasticity Retention Index

The Wallace Rapid Plastimeter was adopted by the Rubber Research Institute of Malaysia for determining the Plasticity Retention Index of Natural Rubber in the Standard Malaysian Rubber (SMR) scheme. It has since been adopted by all other countries producing Technically Specified Rubbers.

The Plasticity Retention Index, PRI is a measure of the resistance of natural rubber to thermal oxidation. The procedure consists of a plasticity test (P_0) on a non-aged specimen, followed by a test (P_{30}) of a specimen that has been aged for 30 minutes at a temperature of 140°C ± 0.2°C.

$$PRI = \frac{\text{Median Value of } P_{30} \text{ results}}{\text{Median Value of } P_0 \text{ results}} \times 100$$

So in addition to a Plastimeter, the PRI test requires an ageing oven, which must control temperature very accurately as research indicates that a temperature variation of ±1°C from the standard 140°C can produce a difference of ±3 PRI units at 50 PRI.

Also a variation in the ageing time of a few minutes will affect the result by a few units, the exact deviation being dependent on the type of rubber. For this reason the test standard specifies an ageing time within close limits (± 0.25 mins) to ensure reliability and repeatability.

It is important in PRI testing to watch out for significant changes in the pattern of results. While they may meet the grade requirement, a move away from the norm is a pointer to other differences in the material.

Table 3. Effect of carrier paper

Paper Type	Plasticity number		
Cigarette paper	36.5	37.0	36.0
Hand towel paper	33.0	35.0	34.0
Hard toilet paper	35.0	37.0	36.5
Wrapper fill	38.0	38.0	36.0
Toilet tissue	46.5	44.0	45.0
Photocopy paper	53.0	43.0	49.0
Tissue paper	52.0	53.0	51.5
Tracing paper	49.0	57.0	52.0
Brown paper	59.5	58.0	57.0
Mylar paper	32.5	33.0	34.0
Cling film	23.0	22.0	23.0

O14 Ageing Chamber

- **Temperature controlled to 140 ±0.2°C**
- **Digital temperature display**
- **Tri-colour LEDs indicate test status**
- **Four chambers with independent timers**

The Wallace Ageing Chamber, O14 ages rubber in accordance with international testing standards. In conjunction with the Rapid Plastimeter, it allows the user to determine the Plasticity Retention Index (PRI) of raw natural rubbers - see notes on page 10.

Housed in a robust steel case, the O14 features an aluminium block with four chambers that carry the drawer units and sample dishes. Heater elements are wrapped around the block and high quality insulation inside the case minimises heat loss.

An air pump with filter, which provide pre-heated air to the chambers, are located on the rear panel for easy service access. Test samples are placed on round foil dishes, which locate in recesses in the drawer units.

When a drawer is pushed in, a timing sequence starts only for that chamber. As the 30 minute ageing process ends, by changing colour, the light next to the drawer reminds the operator when to remove the sample. If the ageing period is exceeded, the light changes to red indicating that the samples should be discarded.

A temperature of 140°C (required by the standard) is maintained by a PID Controller, which continuously displays the chamber temperature. The O14 is protected by a warning system, which is initiated if the correct temperature is exceeded by more than 10°C.

Specification

Dimensions	270 x 490 x 230mm (w x d x h)
Weight	17 kg
Max. power	kW 2.1
Chamber size	50 x 12 x 280mm (w x d x h)
No. heating chambers	4
No. dishes per tray	4
No. samples per tray	12 max.
No. sample per O14	48 max.
Operating temp.	140 ± 0.2°C
Temp. recovery	< 2 mins @ 140°C after sample insertion
Standards	BS 903 Pt. A59, ASTM D3194

P2 Williams Plastimeter

- **Simple, robust instrument**
- **Easy to use**
- **Measurements to 0.01mm**
- **Chambers for testing at elevated temperatures**

The apparatus is widely used for determining the plasticity and recovery of silicones and unvulcanised rubber compounds.

The test consists of compressing a sample of 2.0cm^3 volume between two parallel plates and measuring the compressed height after a specified period.

The plastimeter features two platens, a lower platen that forms the base of the instrument, and an upper platen, which can be conveniently raised and lowered by a handle.

The test commences when the upper platen is gently lowered onto the sample with a force of 49N. The sample height is taken at regular intervals, commonly 3 or 10 minutes using a dial gauge measuring in 0.01mm graduations.

At the end of the test the result is converted to a Williams Plasticity Number by multiplying the sample height by 100.

Specification

Dimensions	150 x 150 x 410mm (w x d x h)
Weight	11 kg
Compression force	N 49.00 0.05
Sample volume	cm^3 2.00 0.02
Standards	ASTM D926

Elevated Temperatures

For measurements at elevated temperatures (normally 70°C or 100°C) the sample is heated in an oven for 15 minutes before undergoing the plasticity test. For this purpose, under model ref. P2/1, Wallace offer a Plastimeter complete with Laboratory Chamber - suitable for temperatures up to 150°C.

Recovery Test

In the recovery test, the height of the sample is measured after it has been removed from the plastimeter and allowed to recover for a specified period.

The Wallace Bench Thickness Gauge (ref. S4) must be used for such measurements as the gauge specification is tightly controlled by the relevant standard.

Accessories

P2/1 Plastimeter with Laboratory chamber
S4/13 Bench thickness Gauge
P2/10 Rotary sample cutter 16mm dia

Viscosity **V3 Mooney Viscometer Mk III**

- **Simple mechanical system producing reliable results**
- **Precise digital temperature control**
- **4 models to suit differing requirements & budgets**
- **Automatic operation and data recording**

The Mk III Mooney Viscometer measures and records the viscosity of natural, synthetic or compounded rubber.

Conforming to international standards, the Mk III is a shearing-disc viscometer in which the rubber sample is compressed pneumatically in a cylindrical chamber formed by cavities in 2 opposing dies.

The viscosity is determined by measuring the torque required to turn the rotor inside the chamber, heated to a set temperature. As the rotor shears the sample, a torque reaction is transmitted through a worm shaft, which deflects a torsion beam. A dial gauge (analogue or digital) measures the beam's displacement.

With its simple mechanical drive system and well-proven design, the Mk III has been in use for many years and has become the benchmark viscometer for thousands of laboratories.

Recent Developments

In May 2000 Wallace purchased the exclusive rights to manufacture the Mark III Viscometer. For selected overseas markets, Wallace have since developed an upgraded Mark III Viscometer, featuring modern control electronics, a safety guard and new PID temperature controllers with digital displays. The well-proven electromechanical features of the original Mark III design remain unchanged.

Four versions are offered:

V3/1 Basic model with analogue dial gauge and no LCD display

V3/2 All digital output including LCD display

V3/3 As V3/2 with 24 column printer

V3/4 As V3/2 with serial port for automatic data transfer to PC

Standard Accessories

Large & small diameter rotor, set of tools

Optional Accessories

Calibration Kit, S1 Specimen Cutting Press *(see page 21)*, air compressor, calibrated butyl rubber for rapid check of viscometer

Specification

LED Screen, (excl. V3/1)	2 line, 20 character back-lit display housed in control panel
Controls	3 sealed switches with integral LED indicators
Gauge, (excl. V3/1)	0.0 - 0.5″ range. 0.0005″ resolution.
Dimensions	510 x 460 x 810mm (w x d x h)
Weight	127 kg
Die heating	By elements to upper and lower platens. 700W per element
Temp. range	80 - 150°C (±0.5°C)
Max. torque	Cut out at 200 Mooney points
Die Closure	By pneumatic cylinder
Air Line Pressure	5.6 bar
Pressure controls	Twin controls for platen closure and test routine
Standards	BS 903 Pt.A58, ASTM D1646, ISO 89, NFT 43 005, DIN 53 523, JIS K6300

Ageing **O7E Multi-Cell Ageing Oven**

- **Temperature range 60 - 250°C**
- **Seven test cells**
- **No migration between cells**
- **Auto timing temperature control**

This cell method of ageing exposes a test sample to elevated air temperatures, allowing its physical properties, such as tensile strength, to be measured and compared with those of an un-aged sample.

Unlike conventional ovens, in the Wallace O7E individual samples are aged in separate cells preventing any contamination from adjacent samples through the migration of volatile products which can be found in many rubber compounds.

The oven consists of a cast aluminium block containing seven cylindrical vertical cells. Avoiding the need for valuable bench space, the O7E is designed as a complete unit with its own stand and castor wheels.

Preheated air at a controlled temperature is pumped from a manifold through a calibrated opening into the bottom of each cell, ensuring even distribution.

To avoid contamination from re-circulation, the air is discharged to the atmosphere through the two covers at the top of each cell.

The test samples are suspended from the inside of the top cover.

Specification

Dimensions	670 x 550 x 870mm (w x d x h)
Weight	103 kg
Max. power	kW 2.1
Number of cells	7
Cell size Diameter	mm 75
Length	mm 305
Temperature range	60 - 250°C
Airflow	ft^3 / hr 1 - 10
Air temperature stability	± 0.2°C
Standards	BS ISO 188

Accurate Temperature & Airflow

The oven includes a PID temperature controller with digital display. The controller is equipped with auto ranging tuning, achieving a very high level of accuracy and stability at the working temperature.

An RS 485 or RS 232C communication option with serial interface is offered, allowing connection to a PC or Data Logger.

Alarms on the controller abort the tests if the temperature goes outside its operating band, as can occur after a mains power failure.

The oven is fitted with thermostats, which will switch off the power supply if the cell temperature exceeds 280°C.

A valve positioned on the top of the control module regulates the airflow, which is measured accurately by a flow meter.

Compression **CSR - Compression Stress Relaxation**

Compression stress relaxation is being increasingly adopted by the aerospace, automotive and construction industries to characterise elastomeric seals.

Seals are used in numerous applications and safety, warranty and product liability issues demand that these essential components operate under compression, without failure for many years, for example, O-rings in pipe joints or seals in aero and automotive engines.

Compression Stress Relaxation, CSR is a measure of the ability of an elastomer to seal efficiently when held in compression over time between two rigid faces. The stress at the interface between the elastomer and the rigid faces is important for efficient sealing and is a function of the modulus of the elastomer and the strain applied.

The CSR Test

In the CSR discontinuous test a sample of the test material is placed in a fixture (jig) and held under a constant compressive strain (typically 25%) between two platens. With the material still in the jig, the counterforce force with which the material pushes back against the platens (the sealing force) is measured using a force measuring instrument. The sample can be aged in various media, such as air, oils, fuels, solvents - at high and low temperatures. After predetermined periods, the specimen, still in the jig, is removed from the medium for a force measurement.

Typically the test samples are small washer type, buttons or O-rings.

Stress relaxation is not a linear phenomenon - typically the force values will decay sharply in the first few hours & days of the test and then level out. So it is strongly recommended that measurements be carried out at logarithmic intervals such as 1 day, 2 days, 4 days, 1 week, 2 weeks, 4 weeks etc.

In general, at any given point in the life of an elastomer, sealing force values go up with an increase in temperature or swelling of the elastomer, and decrease with a decrease in temperature or evaporation of a swelling solvent.

The duration of the test is primarily determined by clear evidence that the force decay has approached a stable value over an extended period.

There are various ways of presenting the data, the most popular being % sealing force retention as shown in figure 1.

Sealing force retention $FR_{(t)}$ after a specified duration of test t, is expressed as a percentage of the initial counterforce and given by the formula:

$$FR_{(t)} = \frac{F_t}{F_0} \times 100$$

where F_0 is the initial counterforce measured and F_t is the counterforce measured after the duration t.

Factors Affecting Test Accuracy

Wallace's experience with customers over many years has shown that there are number of critical factors which must be controlled during CSR testing if accurate, repeatable results are to be achieved.

They are:

1 Accurate and stable ageing temperature.

2 Stable and consistent laboratory temperature when doing the counterforce measurement.

3 Accurate detection of the point at which the counterforce measurement is carried out.

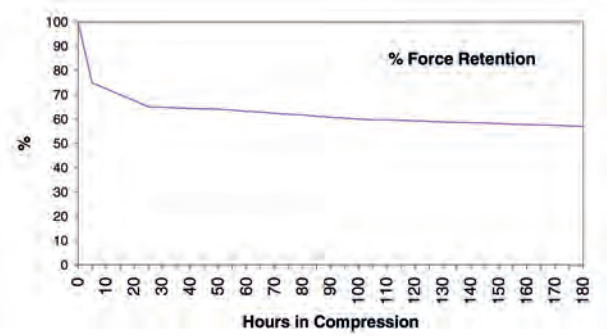
4 The upper and lower platens of the test jig have a high quality surface finish and are parallel to one another.

Summary

CSR is becoming an increasingly popular test in the development of new sealant materials, fuels and oils and is proving valuable to engineers when diagnosing field problems.

Its major advantage is that it replicates the conditions sealant materials are subjected to when functioning in their intended applications such as in engines, transmissions and pipelines. Provided certain critical factors are controlled, CSR test results are both repeatable and reproducible.

Figure 1



C11 Compression Stress Relaxometer

- **Discontinuous method only one instrument for any number of jigs**
- **Simple measurement of force / relaxation**
- **Forces to 2.2kN measured**
- **Over range protection for load cells & jigs**

The test sample is compressed by a known amount in a Wallace jig for the duration of the test *(for info on Wallace jigs, see pages 20 & 21)*.

The resulting force at the interface between the sample and the jig is measured using Wallace's force measuring instrument, the C11 Compression Stress Relaxometer.

Only one Relaxometer is needed for any number of jigs.

The C11 is easy to use with a simple operator interface, allowing a test to be initiated quickly and simply. The force, measured at intervals defined by the relevant standard, is displayed on the instrument and can be stored in the optional computer software.

Specification

Dimensions	380 x 365 x 665mm (w x d x h)
Weight	55 kg
Air supply	300kPa, 4.5l free air per min or 1.51 per cycle
Standard load range	0-2.2kN (0-225 kgf), 0-500lbf)
Alternative load range	0 - 220N (0 - 22 kgf, 0 - 50lbf), 0 - 440N (0 - 44 kgf, 0 - 100lbf), 0 - 1.1kN (0 - 112 kgf, 0 - 250 lbf),
Operating speeds	Fast approach = 2mm/sec max. Min rate of load increase = 0.25N/sec
Standards	BS 903 Pt.A42 ISO 3384, ASTM D6147

Instrument Operation

The principle of the C11 is based on an electrical contact being made between the load cell and the head of the jig. The contact is only broken when the force applied by the Relaxometer marginally exceeds the counterforce exerted by the test sample. The Relaxometer features an air cylinder to apply the force and a load cell to measure it. At the start of the test cycle the measuring head moves quickly to the jig. At a pre-set force value, the measuring head reduces speed to allow the load cell to more accurately read the force. When the applied force just exceeds the counterforce the test is halted and the result is displayed digitally or transferred to the PC software.

Software (optional)

The software allows data from a number of individual jigs to be collected and stored. Results from individual samples may be reported as Force, Force Retention or Stress Relaxation and can be viewed in tabular or graphical form. Results from several tests can be overlaid allowing comparisons to be easily made.

To avoid testing bottlenecks, the software also includes a scheduler which notifies the operator of the timing of each of the jig's test.

Data may be printed out or exported to commercial spreadsheets for further analysis. Commonly used test parameters can be stored allowing the operator to change the test conditions and be reminded when tests are due.

Compression Stress Relaxation - Standard Jigs

- **Tests in oil, gas & high temperatures**
- **Applies different compression ratios**
- **Accepts different sample sizes**
- **Suitable for testing 'O' rings**
- **Samples easily loaded**

Jig Description

Wallace jig assemblies are made from stainless steel with the test sample compressed between two flat, parallel platen faces. The lower platen face is adjustable to give the correct compression while the upper face is mounted in a frictionless manner to allow accurate measurement of the counterforce exerted by the sample.

The fixed height jig (C11/1) is supplied with one fixed spacer, it's height being determined by the sample size and the required percentage compression – see illustration. There are a number of standard fixed height spacers available to suit different sample heights and percentage compressions. Special spacers can be made to order.

The adjustable height jig (C11/6) is supplied with one adjustable spacer. This allows the required compression ratio to be achieved on samples of varying heights. The distance between the upper and lower platen faces can be adjusted in the range 0.0mm to 12.0mm.

O-Ring Adaptor

An O-ring adaptor (C11/7), suitable for both the C11/1 & C11/6 jigs, can accommodate O-rings of up to 41mm diameter. It simply locates over the bottom plate of the jig and a small hole drilled through the adaptor allows air to vent to atmosphere, preventing a pressure differential across the seal.

Counterforce Measurement

For optimum accuracy, it is very important to identify the point at which the force applied by the measuring instrument equals the counterforce exerted by the sample in the jig. The Wallace measurement method is innovative but simple and is based on a continuous electrical contact between the measuring instrument (Relaxometer) and the head of the jig.

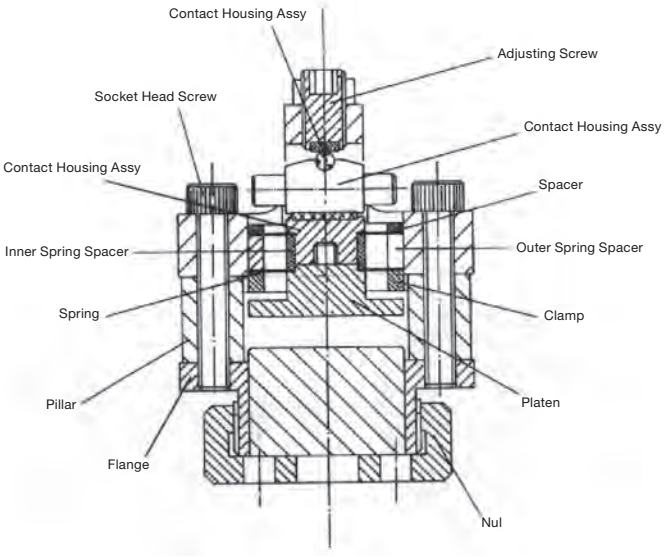
The force is only recorded when the electrical contact is broken i.e. when the force applied by the Relaxometer marginally exceeds the counterforce exerted by the test sample. At this point the sample is over-compressed by only a few microns which is allowable in the standards.

Insulating Chamber

The chamber allows a heated jig to maintain its temperature during testing. A laboratory oven can be used to heat the jigs, which are then transferred to an insulating chamber for testing on the compression stress relaxometer. The chamber design allows a jig to be quickly exchanged with another.

Test Samples

Wallace offer a number of standard rotary cutters for preparing test samples *(see page 20)*.



Specification

Fixed Height Jig	C11/1
Height	120mm
Weight	1.8 kg
Test temperatures	°C -40 / +250
Adjustable Height Jig	C11/6
Height	120mm
Weight	1.8 kg
Test temperatures	°C -40 / +250

C3 / C4 Compression Set Apparatus

Specification

1 version, single daylight	
Diameter	150mm
Height	60mm
Weight	3.2 kg
2 version, double daylight	
Diameter	150mm
Height	80mm
Weight	4.5 kg
3 version, triple daylight	
Diameter	150mm
Height	100mm
Weight	6.3 kg
Standards	BS 903 Pt. A6 ASTM D395 ISO 815

- **Measures set at constant strain**
- **Machined to high quality**
- **One, two or three samples per fixture**
- **Rotary cutters to prepare samples**

Machined to a very high quality standard, these fixtures measure the residual strain in a rubber sample after it has been compressed for a specified period and then allowed to recover. Samples of either 13mm or 29 mm diameter are placed between the plates and the bolts tightened. Spacer rings around the bolts control the compressive strain applied.

Wallace offer single daylight (i.e. 2 plates), double daylight (3 plates) and triple daylight (4 plates) versions. When ordering please specify whether C3 (BS) or C4 (ASTM) models are required and specify the number of daylights (plates).

Preparation of Test Pieces

For use with a bench drill to produce parallel sided test samples, two rotary cutters are available 13mm diameter (ref S6/4/1) & 29mm diameter (S6/4/2).

Definition

Set is the residual strain in a rubber test piece after it been subjected to stress for a given time and then allowed to recover for a given time, the temperature being constant during the test.

Compression set at constant strain is the difference between the original thickness of the test piece and that after recovery expressed as a percentage of the initially applied compression:

$$= \frac{t_o - t_r}{t_o - t_s} \times 100$$

Compression set at constant strain
Where t_o = original thickness of test piece
t_r = thickness of test piece after recovery
t_s = thickness of the spacer

Specimen Preparation **S4 Bench Thickness Gauge**

- **Constant anvil pressure**
- **Digital - resolution to 0.01mm**
- **Ranges of different anvils & weights**
- **Optional RS232C Interface**

This digital gauge accurately measures the thickness of rubber and similar soft materials using a constant pressure anvil. The gauge conforms to international test standards and is widely used when testing rubber for tensile strength and compression set.

The 150mm-diameter base provides a smooth flat ground surface upon which the test piece is placed. Location for a lower anvil, required by some standards, is also provided. The digital indicator is attached to an arm, which can slide on a vertical column.

Throughout the dial gauge travel (25mm), a constant force on the spindle ensures the anvil pressure on the test piece is constant.

A lifting lever attached to the indicator raises the spindle and upper anvil, allowing easy location of the test piece.

Accessories

Various diameter anvils can be screwed into the dial gauge spindle.

A range of additive weights can be placed in the carrier at the upper end of the spindle, which creates the correct anvil pressure on the test piece.

A software package is available which exports data from the indicator to a PC for further analysis.

For information on Wallace cutters that prepare tensile & compression test samples, refer to page 20 and on Wallace compression set apparatus see page 18.

Specification

Dimensions	150 x 150 x 200mm (w x d x h)
Weight	3 kg
Indicator travel	25mm
Resolution	0.01mm
Upper anvils	Diameter, 3.7 & 5.5mm
Additive weights	g 30
Standards	
Tensile:	BS 903 Pt. A38, ISO 4648
Compression:	BS 903 Pt. A6, ISO 815

S6 Specimen Preparation Equipment

1. Specimen Cutting Dies

A large range of cutting dies, conforming to international standards, is available for use with the S1 Specimen Cutting Press *(see page 21)*. Each die is fitted with a safety back plate. A shank can be fitted to each cutting die, acting as the interface for locking the die into the ram of the press.

Dumb-bell, circular and parallel blade cutters are available as well as angle, crescent and trouser tear cutters.

We also supply cutters to our customer's own design and offer a cutter reconditioning and sharpening service.

All cutters are fully inspected before despatch and, upon request, are supplied with a certificate of conformity.

2. Specimen Moulds

Specimen moulds are available for producing rubber test pieces for use with the following Wallace equipment: C3/C4 Compression Set Apparatus *(see page 18)*, F15/F16 De Mattia Flexing Machines *(see page 24)* and R1 Lüpke Pendulum.

All moulds are three-plate, each consisting of a top plate, an inner frame containing one or more cavities of the required shape and size, with a bottom plate. Dowels are used to locate the plates.

3. S6/3/6 Specimen Nicking Cutter

This apparatus cuts accurately and quickly the nick required in a sample to carry out a tear test.

The sample is held in guides to ensure correct location. When the spring loaded latch is released, the sample is clamped lightly between plates under a known spring pressure.

The action of the apparatus is to raise the cutting blade to the level needed to achieve the correct depth of cut (0.5 or 1.0 mm). The operating knob is pushed forwards so that the blade makes a clean cut; then the sample can be removed.

A suitable lubricant is used on the sample during the cutting operation, to aid a clean cut.

The apparatus is mounted on a baseplate, which can be screwed to a bench for improved stability and ease of use.

Specification

Specimen Nicking Cutter	
Dimensions	290 x 180 x 90mm (w x d x h)
Weight	3.5 kg
Nick depth	0.5 or 1.0mm
Standards	BS 903 Pt A3 ISO 34 - 1 ASTM D 624

S1 Specimen Cutting Press

- **Simple, safe operation**
- **Robust design with built-in safety catch**
- **Large cutting table area**
- **Automatic ejection of samples**
- **Adjustable strokes to prevent cutter damage**

This robust, manually operated press cuts test samples from sheets of rubber and other soft materials with an exceptionally high force (41kN). Once prepared the samples are typically subjected to physical tests such as tensile, tear, dynamic, cure etc.

The press is operated with two hands. While one hand is used to lift the safety catch, the other pulls the handle which, through a lever system drives the ram down. If the safety catch is not lifted, the ram cannot be moved ensuring operator safety.

The ram stroke is easily adjustable, ensuring that the die cuts through the sample but is not itself compressed, preventing damage to the cutting edge. But as a further precaution the operator is advised to place a suitable backing material on the cutting table to protect the very sharp edges of the cutter.

Articulated stainless steel fingers, mounted off the press frame, are adjusted to pass through the holes in the cutter back-plate so that the sample is automatically ejected on the return stroke of the ram.

The cutting table is 150mm wide by 200mm deep and cutters must not exceed these dimensions.

Accessories

A large range of cutting dies, conforming to international standards, is available for use with the S1 Specimen Cutting Press *(see page 20)*.

Specification

Dimensions	150 x 360 x 840mm (w x d x h)
Weight	31 kg
Nick depth	0.5 or 1.0mm
Cutting Table	
Width	150mm
Depth	200mm
Maximun ram force	kN 41

X17/25 Thin Film Grips

- **Eliminates slippage & breakage at the grip**
- **Reduces number of invalid tests**
- **Self aligning**
- **Quick & easy loading into conventional grips**

The innovative design of Wallace's Thin Film Grips (X17) prevents slippage or breakage of thin rubber samples when tested for tensile strength.

Difficulties are often encountered when testing samples cut from thin sheets made of latex rubber and other highly extensible materials.

Products made by dipping NR latex can extend by up to ten times their original length and are often coated with a lubricant. Therefore slippage or breakage at the grips frequently invalidates tests.

A unique combination of the clamping and capstan effects in the Thin Film Grips overcomes these problems. Indeed the X17 grips achieve a 360° wrap-around of the sample, which due to the exponential relationship of the capstan effect, squares the gripping friction on the sample.

Originally designed by the MRPRA for testing latex samples up to 25mm wide, the grips are also suitable for compliant elastomeric material, paper, fabric and threads less than 0.2mm in thickness.

The X17 grips are opened and closed by a simple thumb and forefinger action and are provided with a tab end which can be secured quickly by conventional tensile tester grips.

Wallace Instruments also supply a hand operated cutting press (S1) and cutting dies to help laboratories prepare rubber samples for tensile testing *(see pages 20 & 21)*.

Specification

Max. width of sample	25mm
Max. thickness of sample	0.2mm
Max. tensile load	N 100
Dimensions	40 x 27 x 75mm (w x d x h)
Weight	100 kg

Density **X22B & X21C High Precision Densimeters**

- **Density resolutions to 3 or 4 decimal points**
- **Lightweight, portable design**
- **Displays results in seconds**
- **Measures densities of less than 1.00**

The X22B high precision densimeter from Wallace is a low cost, accurate instrument for measuring density of a variety of materials, including rubber, plastics, sintered metals, ceramics, foods and liquids.

The densimeter computes the density and volume of a sample by weighing it in air and then in water. It has a scale capacity of 300g and can handle complete objects, samples or loose materials.

The high precision densimeter uses simple touch button operation, can measure samples with a density of less than 1, and has a facility to compensate for water temperature.

The operator is warned if the instrument is subject to excess vibration.

The X22B model displays the density to three decimal places and the operator is warned if the sample weight is not sufficient for third decimal place accuracy.

An RS 232C interface is supplied as standard The X21C is similar to the X22B, but offers resolution to four decimal places.

The Wallace Densimeter comes complete with wind and dust shields, calibration weight, thermometer and AC adaptor.

Accessories

Optional accessories include a kit to measure the density of liquids (X22B/LD), a high speed printer and Density Data Collection Software (DDCS) for PC use.

The DDCS provides the opportunity to collect and analyse the data and allows the data to be exported to most commercial spreadsheets, word processor and databases.

Specification

X 22B	
Dimensions	190 x 218 x 170mm (w x d x h)
Weight	1.5 kg
Scale capacity	300 g
Resolution	0.001
X 21C	
Dimensions	213 x 319 x 301mm (w x d x h)
Weight	5.8 kg
Scale capacity	200 g
Resolution	0.0001

Flexing **F15 / F16 De Mattia Flexing Machine**

- **Models to test 12, 24 & 36 samples**
- **Temperature controlled oven, 60 - 150°C**
- **Balanced main shaft for smooth operation**
- **Easy loading of test samples**
- **Pre-settable run period**
- **Long life**

Wallace Flexing Machines are used to test specially moulded rubber samples for resistance to cracking or cut growth by repeated flexing.

Flex testing is recommended when flexing encountered in service can be simulated by the action of this test, as for example in the sidewall of tyres or soles of shoes.

The operator gains safe and easy access through front and rear doors and the samples are installed so that they are flexed but not elongated during test.

Two sets of opposing grips are reciprocated at constant frequency for a preset period, controlled by a cycle counter.

Cracking and cut growth spreads with increasing cycles. The machine is stopped at specified intervals and the cracks evaluated by the operator.

Wallace offer a range of machines capable of testing simultaneously 12, 24 or 36 samples in an unheated cabinet or an oven (temperature range 60-150°C).

Four recessed lamps provide interior illumination.

The main shaft is fitted with a balance weight, ensuring smooth running and long machine life.

Specification

Model	**F15/12**	**F15/24**	**F15/36**	**F16/12**	**F16/24**	**F16/36**
Oven	No	No	No	Yes	Yes	Yes
No. Samples	12	24	36	12	24	36
Dimension width, mm	710	710	710	710	710	710
Depth, mm	570	570	570	570	570	570
Height, mm	1210	1210	1210	1210	1210	1210
Weight, kg	210	210	210	275	275	275
Max. power, VA	900	900	900	2900	2900	2900
Oven temp. °C				60 -150	60 -150	60 -150
Temp. stability, °C				± 1	± 1	± 1
Standards	BS 903 Pt A10 – ISO 132, BS 903 Pt A11 – ISO 813, ASTM D 813					

Accessories

In accordance with the testing standards, Wallace offers the following special moulds and piercing tool for producing a groove in the edge of the test specimen. This groove helps to induce the onset of cracking during flexing:

F1/1 Three cavity specimen mould
F1/1/1 Six cavity specimen mould
F1/3 Piercing Tool with needle

Product Index

Notes

Notes

Notes

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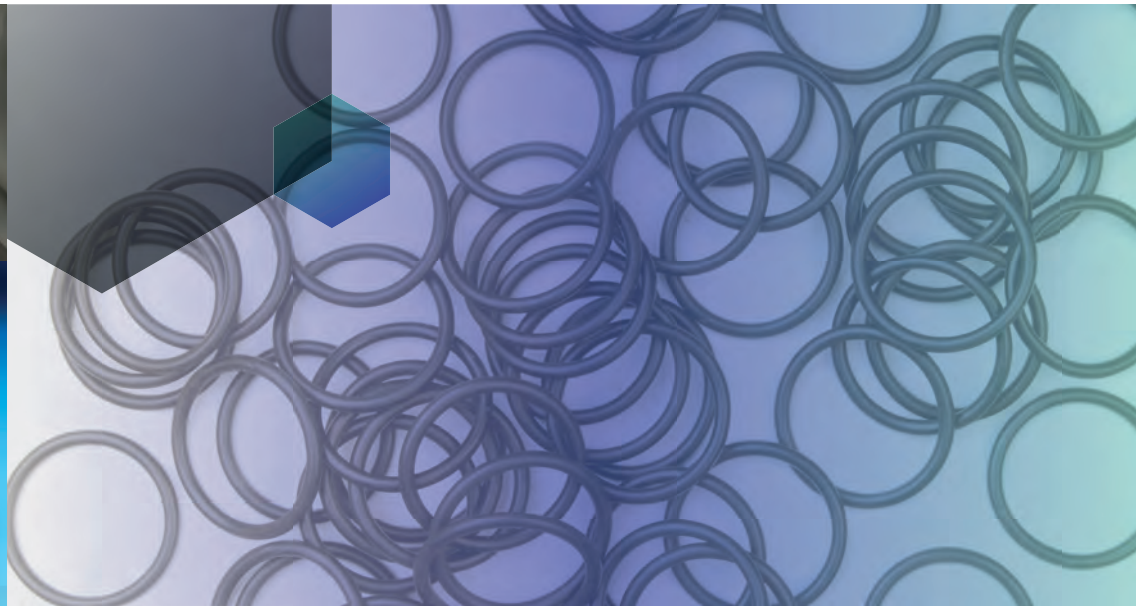

wallace
a brand of Elektron Technology

Wallace is a brand of Elektron Technology

- Elektron Technology is a global group of companies that, together, make fast-moving engineered products
- We invent, manufacture and market critical equipment for the networked economy
- We concentrate on the three most important technology building blocks: monitoring and control, connectivity and switching, precision instrumentation
- Wallace is an example of one of our many precision instrumentation brands