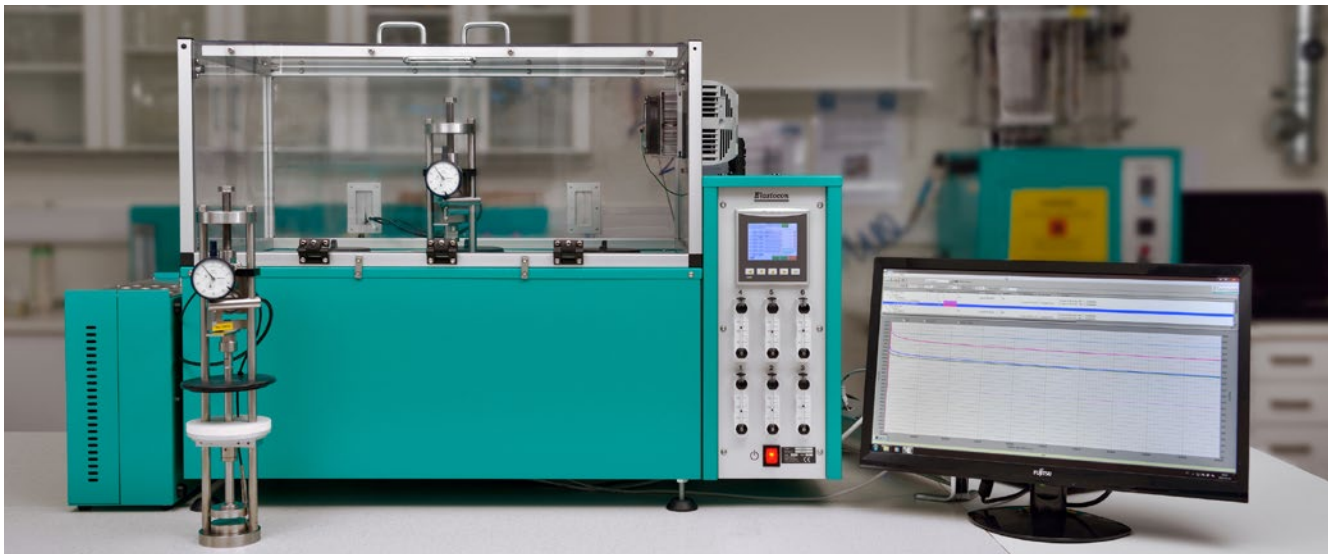
Elastocon®

Stress relaxation and creep systems



Stress relaxation tests on rubber materials have become highly popular for determining the properties of rubber. From the beginning stress relaxation tests were predominantly used in scientific projects at universities, but a growing use in industrial applications has been shown in recent years, mainly due to the introduction of stress relaxation tests in different product standards, such as sealing rings for pipes and in specifications in the automotive industry.

Stress relaxation is a reduction in the counterforce for maintaining the applied strain, the force is not constant but decreases with time when the material ages. This is expressed as a percentage of the initial force.

The process that is mainly responsible for stress relaxation may be chemical or physical in nature, and under normal conditions both types of process will occur simultaneously.

However at low or normal temperatures, and/or over a short time, stress relaxation is dominated by physical processes whilest over long time periods or high temperatures chemical processes are dominant.

A key factor in achieving good reproducibility and repeatability while conducting the stress relaxation test is to keep the temperature and compression constant during all measurements.

There are mainly two different ways of testing stress relaxation, continuous and discontinuous. One advantage with continuous testing is that it requires much less labour time of the operator.

Simplified you can describe the continuous test as a test that you start and then don't have to think about until the test time is ended. The same simplified description of the discontinuous test would be that you make a manual measuring of the force, put the test rig away for ageing, at specified time intervals the rig is removed from the ageing environment, a new manual measurement is taken and the rig returned to the ageing process, this continues until the test is terminated.

Standardised test methods

The present standard **ISO 3384-1 includes two methods**, **A** and **B**, which can be used in both air or liquids. In **method A**, the compression is applied and all counterforce measurements are made at the test temperature. In **method B**, the compression is applied and all counterforce measurements are made at standard laboratory temperature. The test pieces are stored at the test temperature.

ISO 3384-2 is a newer second part describing tests with temperature cycling, and also **includes two methods**, **A** and **B**.

ISO 6914 method A describes the testing of stress relaxation in tension.

Our equipment will naturally work with other technically equivalent standards as well.

Elastocon AB • Tvinnargatan 25 • SE-507 30 Brämhult • Sweden
Phone: +46 33 323 39 00 • E-mail: info@elastocon.se • www.elastocon.com

db-relaxation_45_2406

Complete stress relaxation test systems

Continuous test system

- Stress relaxation rigs – the ISO standards recommend 3 samples/material/temperature, but 2 are ok
- Amplifier box
- Cell ageing oven – specially designed for stress relaxation tests, for testing in elevated temperatures, cycling temperatures or temperatures below laboratory temperature
- Computer
- Software
- UPS

Optional accessories

- Extension cords
- Liquid containers
- Room temperature box, for testing in room temperatures or for conditioning of the samples
- Low temperature box, for testing in temperatures between +4 and +40 °C

Comparison of continuous and discontinuous stress relaxation testing

Continuous stress relaxation testing	Discontinuous stress relaxation testing
Less manual work, measurement will continue throughout the test after it is started.	More manual work, needed to manually perform the measurements at certain points during the test period.
Logging automatically and continuously which means that if wanted, it is possible to obtain measured values from any given point from the test after the test is terminated.	No extra data is saved, only the manual taken measurements. Not possible to add extra evaluation points after the test is finalized.
No physical movement of the rigs after the test is started.	It has been shown that each time a rig is moved the result may be affected due to the vibration that occurs in this operation.
Most of Elastocon's customers around the world ask for this type of testing, several big companies have it in their company standard.	Less customers ask for this type of test, it is included in the internal standards of some large companies.
Possible to run tests automatically according to ISO 3384-1 method A and method B, ISO 3384-2 as well as ISO 6914 and other technically equivalent standards.	No automatic testing is possible, requires a lot of manual work. But testing according to ISO 3384-1 and 3384-2 is possible of course.
Possible to run tests automatically with either stable or cyclic temperatures.	The temperature will not be stable throughout the whole test, the measurements will, as default, take place in ambient room temperature (can also be done within a special temperature chamber).
Test either in compression or tension, in air/gases or liquid.	Test in compression, air or liquid (liquid might be rather messy during the measurements).
Automatic testing according to ISO 3384-1 method B with a programmable oven.	
Cycling testing according to ISO 3384-2 in temperature interval -40 to +250 °C	

Instruments for continuous testing of stress relaxation

Stress relaxation rig, EB 02

This is a rig for continuous stress relaxation measurements in both compression and tension.

The rig works together with the cell ovens EB 21, EB 22, EB 38, EB 39 and the programmable temperature cycling cell ovens EB 21LTHTP and EB 17.

EB 02 relaxation rigs arranged for different test methods


Rig 1

Rig 1 *is arranged for testing in compression according to ISO 3384 and ASTM D6147.*


Rig 2

Rig 2 *is arranged for testing in tension according to ISO 6914 method A.*


Rig 3

Rig 3 *is arranged for testing in liquid according to ISO 3384.*


Rig 4

Rig 4 *is arranged for testing according to ALE-test.*


Rig 5

Rig 5 *is a triple rig for tension according to ISO 6914 method A.*

Rig	Type of testing
EB 02	Compression at temperatures from +5 °C up to +200 °C (ISO 3384 and ASTM D6147).
EB 02HT	Compression at temperatures from -70°C up to +300 °C (ISO 3384 and ASTM D6147).
EB 02VHT	Compression at temperatures from +5 °C to +350 °C (ISO 3384).
EB 02TE	Tension at temperatures from +5 °C up to +200 °C (ISO 6914 method A).
EB 02TE, HT	Tension at temperatures from -70°C up to +300 °C (ISO 6914 method A).
EB 02TR, TE	Tension at temperatures from +5 °C up to +200 °C (ISO 6914 method A). This is a **triple rig**, where you can perform a triple test in air in the same rig.
EB 02AP	Acid proof material, compression in liquids at temperatures from +5 °C up to +150 °C (ISO 3384 and ASTM D6147). Includes air tight liquid container and compression plate.
EB 02SA	Super acid proof material, compression in liquids at temperatures from +5 °C up to +200 °C (ISO 3384 and ASTM D6147). Includes liquid container and compression plate.
EB 02ALE	Compression with possibility to exchange liquid and air at temperatures from +5 °C up to +200 °C.
EB 02HF	High force compression, up to 45 kN at temperatures from +5 °C up to +200 °C (ISO 3384).

Note! Make sure to choose a correct load cell for the testing. Recommendation is to use the load cell between 10 % to 100 % of specified max load. Below 10 % the accuracy may be lower than the specified ± 1 % in ISO 3384 and ISO 6914 method A.

Accessories to the rigs

EB 02.01 Container and pressure plate for testing in liquids in temperatures up to +200 °C *(only for EB 02 and EB 02HT rigs)*.

EB 02.01P Air tight container and pressure plate for measurements in liquid for pressure up to 3 bar and temperatures up to +150 °C *(only for EB 02, EB 02HT and EB 02AP rigs)*. A pressure gauge (EB 02.01P6) for this container is also available as an option.

EB 02.03 Load cell 100 N – *default for tension*.

EB 02.05.1 Extension cord for load cells, 2.5 m (for other placement of amplifier box than close to the cell oven).

EB 02.05.2 Extension cord for temperature sensor, 2.5 m (for other placement of amplifier box than close to the cell oven).

EB 02.12 Container for testing in liquids in tension up to 200 °C *(only for EB 02TE and EB 02TE, HT rigs)*.

EB 02.17 Load cell 600 N (samples ø13 mm) for Shore A up to 80° – *default for compression*.

EB 02.18 Load cell 1200 N (samples ø13 mm) for Shore A up to 90° – for compression.

EB 02.19 Load cell 2000 N, for bigger samples, or harder samples from products – for compression.

EB 02.21 Compression plates in acid proof material (EN 1.4436).

EB 02.23 Stand for relaxation rigs for secure placement on the laboratory bench.

EB 02.26 Test piece holder for the relaxation rig for ageing other samples simultaneously as the relaxation test.

EB 02.29 Fixture for bending test with 3-point loading, the test fixture is developed from ISO 899-2 and enables a type of stress relaxation test for plastic materials.

EB 02.01 Container

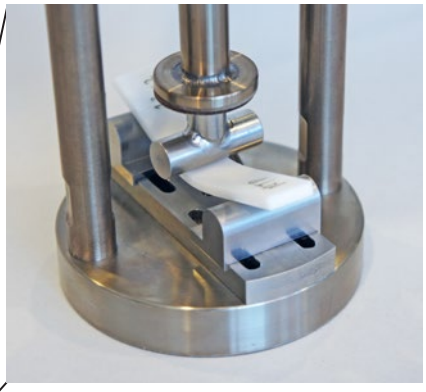
EB 02.01P Container

Compression plates and tension grips.

EB 02.23 Stand for relaxation rigs

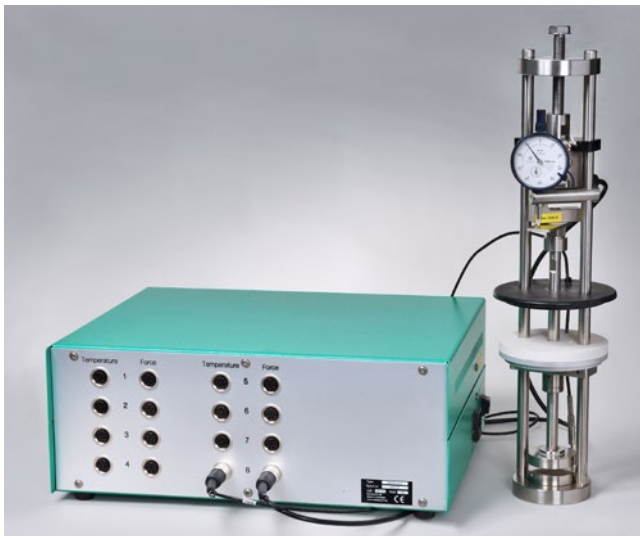
EB 02.26 Test piece holder

We can supply an optional test piece holder (EB 02.26) for the relaxation rig, to attach test pieces for tensile test for ageing during the relaxation test.



EB 02.29 *Fixture for bending test with 3-point loading.*

Amplifier box for relaxation rigs



EB 02.14-x. The amplifier box communicates via a network connection. This means that the amplifier can be directly connected to the network connector on a PC, or anywhere in a local ethernet network.

The box can also have up to 24 channels or connect 12 relaxation rigs.

x = number of rigs that can be connected to the amplifier box, available in sizes: 4, 6, 8 or 12 rigs/box.

High force compression rig/oven

EB 02HF is a rig for very high forces, which enables stress relaxation test in compression with forces up to 45 kN (45 000 N). The compression is made in an external compression tester (not included).

The EB 02HF.01 oven for the high force rig is specially designed to keep the temperature on the high force rig and the sample during the compression in the external tension-compression tester.

ALE-test

Aeration and Liquid Exchange test

When testing stress relaxation in fuels and oils the liquid may be ageing faster than the rubber, so the liquid has to be replaced at intervals.

The testing is traditionally done in a closed container without oxygen present and this does not correlate with the actual situation in a fuel tank or a motor.

To make it possible to perform more realistic ageing tests we have developed a system where we replace the liquid by pumping and we add air and have an agitation of the liquid to get the air and newly inserted liquid evenly distributed. The rate of liquid exchange and air can be programmed.

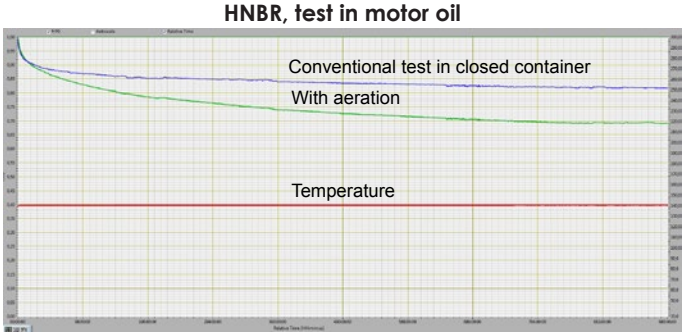
The ALE-test instrument was developed in a joint project with Scania, AB Volvo, Volvo Cars, SP Technical Research Institute of Sweden, Lanxess and Elastocon about ageing of elastomers in biofuels. The project was financed by the Swedish Energy Agency and participating companies.

EB 02ALE rig with EB 02.24-x ALE control box

The electronic control box handles both the liquid circulation, air pump and the stirrer function of the ALE-rig. All of these parameters are controlled from the PLC colour touch screen on the control box.

x = number of rigs that can be connected to the control box, available in sizes; 2, 4 or 6 rigs per box.

HNBR, test in motor oil



The graph shows a test run in motor oil with and without the ALE-test. The blue curve is the rigs in conventional relaxation and the green curve is with aeration.

Cell ovens for stress relaxation

Elastocon offers cell ovens designated for stress relaxation tests. This means that the inner height of the cells are adapted to fit our relaxation rigs so that they will achieve as good thermal contact as possible with the bottom of the cell.

The ovens have an integrated draught hood that eliminates the changes in the force during the test, due to temperature changes in the environment around the top part of the rigs. The hood is made of polycarbonate, and has a temperature control system (Peltier cooling system) capable of keeping the temperature within ± 0,25 °C.

The ovens are available in the following versions:

EB 21 4 cells with individual temperature control.

EB 22 6 cells with individual temperature control.

EB 38 4 cells with individual temperature control, temperature up to +350 °C.

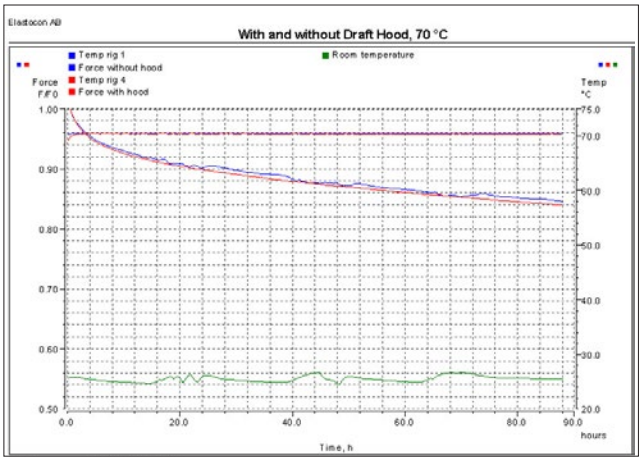
EB 39 6 cells with individual temperature control, according to ASTM D6147.

EB 17 6 cells with the same temperature and cycling between subzero to elevated temperature.

EB 21 LTHTP 4 cells with individual temperature control and cycling between RT to elevated temperature.

Common specifications for the cell ovens

- The ovens perform well inside the apparatus requirements in ISO 188, IEC 811 and other equivalent standards.
- The oven is controlled from a PLC (with a colour touch screen).
- Integrated draught hood.
- Special design with controlled air exchange rate and low air speed.
- The casing consists of steel, painted with powder paint in bluegreen colour.
- The inner cells are made of aluminium.
- Temperature controller with 0,1°C setpoint (PLC) or liquid circulator EB 17.
- Fixed over temperature fuse.
- Flowmeters with needle valves, for setting the air exchange rate.
- The air speed is low and is dependent on the air exchange rate only, as specified in ISO 188 method A*.
- Alarm for low air pressure (PLC).
- Built in air pump.
- Cooling channels in the casing for low surface temperature.
- Temperature controlled cooling fan for the electronics cabinet.
- Indication of power failure (PLC).
- Run-time meter (PLC).
- Countdown timer (PLC).
- Individual cell identifier “Test name”.
- Microfilter for the air which removes 99,99 % of all particles over 0,1 µm.



The graph shows a test run with and without the temperature hood. The blue curves are the rigs without a hood and for the red curves a hood is used. The green curve is the room temperature.

Cell oven, EB 21. *For relaxation tests with 4 cells with individual temperatures.*

Cell oven, EB 22. *For relaxation tests with 6 cells with individual temperatures.*

***** *According to ASTM D6147 for cell oven EB 39.*

Temperature cycling relaxation tests

Temperature cycling is important within the automotive industry, where the shrinkage of the seals is an important factor, since this can lead to leakage. We have different solutions for temperature cycling ovens, depending on your requirements.

Temperature cycling oven EB 17

EB 17 with 6 cells with the same temperature for all cells, requires a liquid circulator for temperature control.

The liquid circulators are available in two versions:

- **EB 17.01**, for temperatures between -40 to +200 °C.
- **EB 17.03**, for temperatures between -70 to +200 °C.

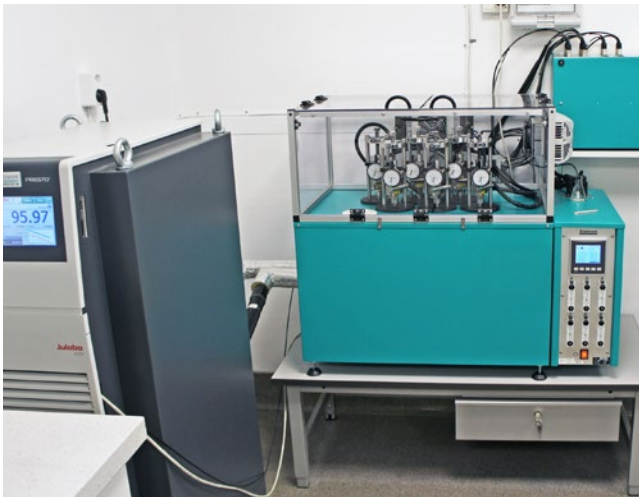
A high temperature option is also available:

- **EB 17HT** and **EB 17.01**, for temperatures between -40 to +245 °C.

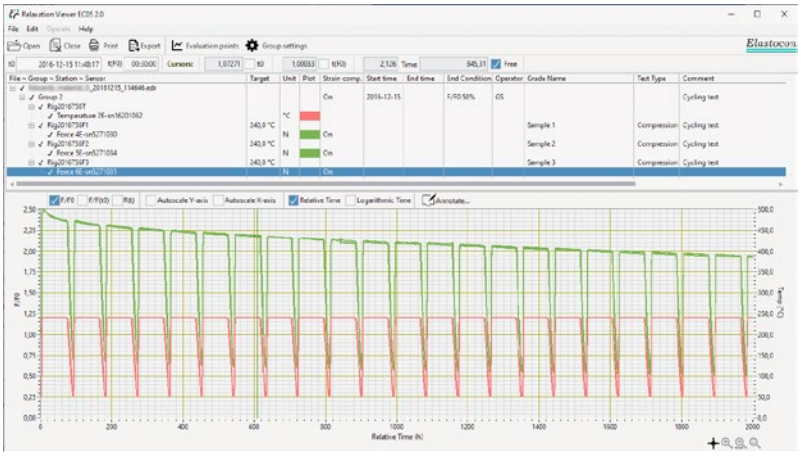
All EB 17 options can run tests according to ISO 3384-1 method A and B, ISO 3384-2 method A and B, as well as ISO 6914 method A.

EB 17 and **EB 17HT** can only be combined with **EB 02HT** or **EB 02TEHT** rigs.

An optional table (**EB 17.04**) is also available for EB 17, to meet the height of the liquid circulator.



Temperature cycling oven EB 17 *for relaxation tests with 6 cells with the same temperature and cycling between subzero to elevated temperature. The oven is placed on the EB 17.04 table, with the liquid circulator to the left.*



This graph shows a relaxation test with cycling temperature.

Liquid circulator, **EB 17.01**

Liquid circulator, **EB 17.03**

EB 21LTHTP temperature cycling oven

Our second type of cell oven for cycling temperature is **EB 21LTHTP**, it has 4 cells with individual temperature control, with temperature range between approximately +20 to +300 °C.

This oven is cooled with tap water, which should not exceed +18 °C to have a satisfying cooling function throughout the whole temperature interval. The lowest temperature is dependent of the tap water temperature.

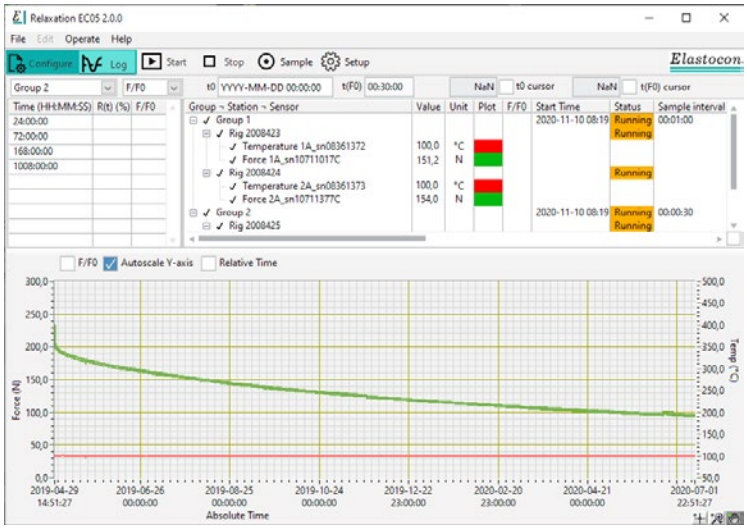
This oven can run tests according to ISO 3384-1 method A and B, ISO 3384-2 method A (from +23 °C up to +300 °C), as well as ISO 6914 method A.

Temperature cycling oven EB 21LTHTP *for relaxation tests with 4 cells with individual temperature control and cycling between RT to elevated temperature.*

Software for relaxation testing, EC 05

The application performs and evaluates stress relaxation tests and supports both ISO and ASTM standards.

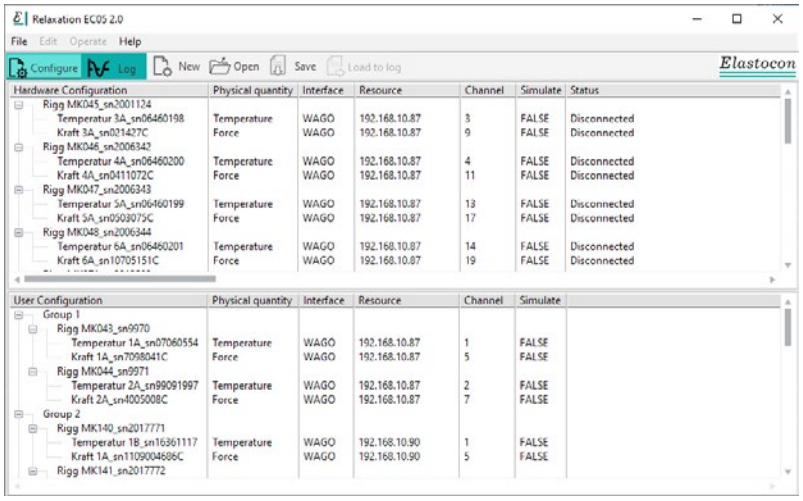
The software is easy to use and is packed with features.



Functions

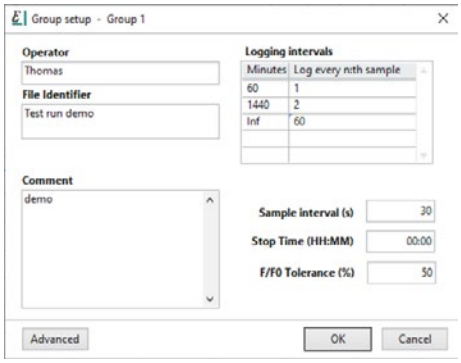
- Edit the test setup and supervise test status.
- Evaluate stress relaxation.
- Automatically increase logging time interval.
- View result as absolute force in N, F/F0, R(t) or F/F(t0).
- Calculate of the median value when testing double or triple test pieces.
- Create test reports.
- Compensate for the load cell deformation.
- Switch between absolute or relative time.
- View result graph as linear or logarithmic time.
- Easily zero the force.
- Easily set F0.
- Set end condition as F/F0 or time.

Configuration view



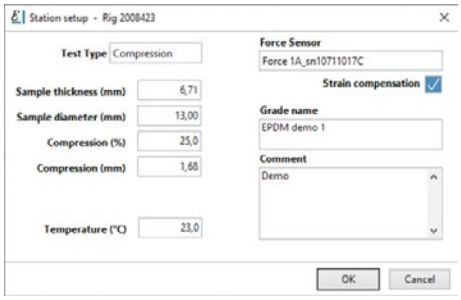
In the **Configuration view** the user can combine one, two or three rigs to a group. Data for the group is saved in one file. The software calculates the median results from the rigs in the group.

Group Setup



In the **Group Setup** window, the file name for the result file is specified, the logging intervals can be modified, and the end conditions are set as time, F/F0 or a combination of both.

Station Setup



In the **Station Setup** window, the user sets the type of test (compression or tension) and the test piece dimensions.

Support Agreement

We offer an annual support agreement.

Included in the support agreement:

- Free e-mail and telephone support for both technical and testing issues.
- Free remote control support for problem solving and/or updates.
- Free software update during the validity time of the support agreement.

The support agreement should be renewed annually for continuous validity.

Software for relaxation testing, EC 05

Evaluation points

Group 1		F/F0
Time (HH:MM)	R(t) (%)	F/F0
168:00	19	0,81
336:00	25	0,75
1008:00	35	0,65
2016:00	41	0,59

In the **Evaluation points** table, evaluation points can be specified, at which the application will calculate the relaxation percentage and F/F0.

EC 05 Viewer

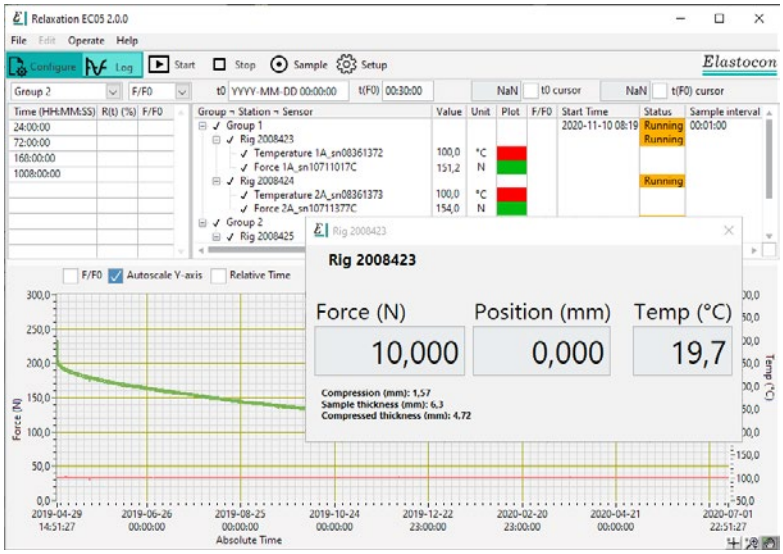
The Relaxation Viewer is a part of EC 05 Relaxation, and this is where you analyze the test results and create test reports.

Additional Viewer licenses can be purchased so the Viewer can be installed on a separate computer. This allows a user to check and evaluate the tests from an office computer.

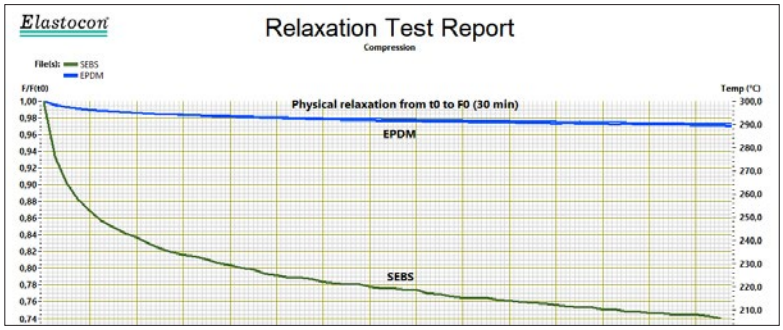
Features of the EC 05 Viewer

- Open multiple files for comparison and analysis.
- Create reports for printing or export.
- Edit evaluation points.
- Analyze according to different standards.
- Export measurement data.

Log view

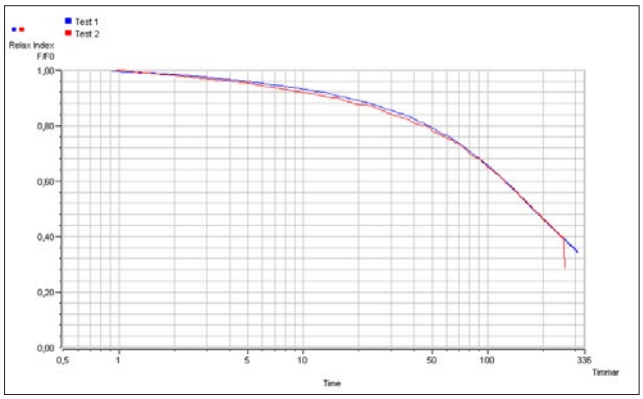


In the **Log view**, the user sets the logging details, the evaluation points – time for t0 and F0, and starts the test.

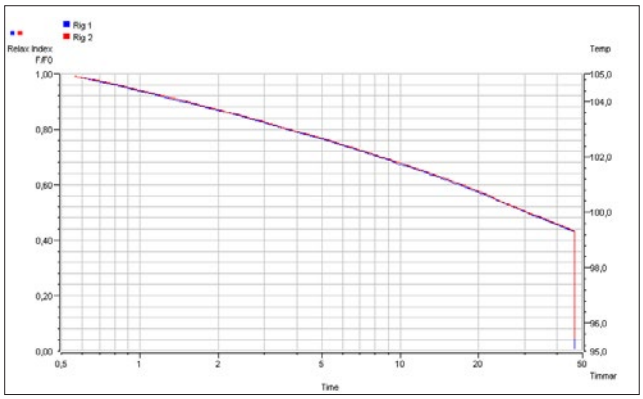


This graph detail shows relaxation from t0 till F0.

Examples of test results



The graph shows the repeatability of the relaxation rigs. This graph is from two tests of the same compound run at different times.



This is a graph from two samples of the same compound run at the same time in different rigs.

All-in-one computer, ED 04, to run the relaxation testing software

The ED 04 computer has Windows, minimum i5 processor, 8 GB RAM, 20-inch monitor, keyboard and mouse.

Uninterruptible power supply (UPS), ED 06

To eliminate disturbances from shorter power failures. The ED 04 computer and the EB 02.14-x amplifier box is recommended to be connected to a power back up. Only available for 230V, 50-60Hz, 1000 VA double conversion.

Estimation of lifetime from relaxation tests

Stress relaxation tests are ideal for making lifetime estimations using an Arrhenius plot.

How to do an estimation of lifetime of rubber materials using an Arrhenius plot is described in the ISO standard ISO 11346.

When doing an Arrhenius plot, tests are made of a critical property at different times and at least at three test temperatures.

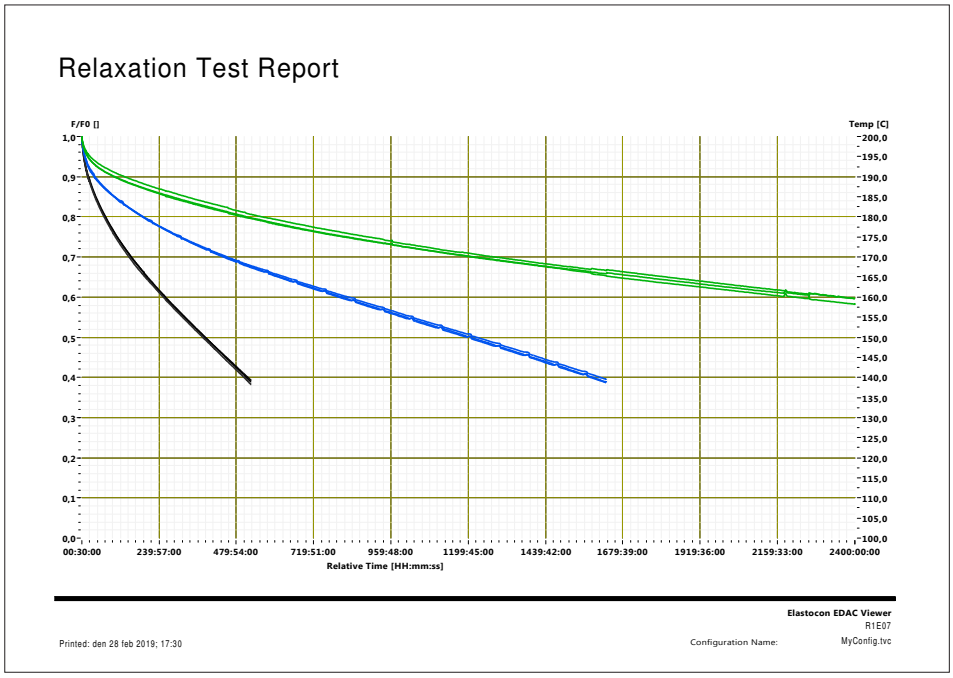
The tests are normally run until the properties are reduced to 50 % of the original value, see figure.

The time to reach this level is determined for each temperature.

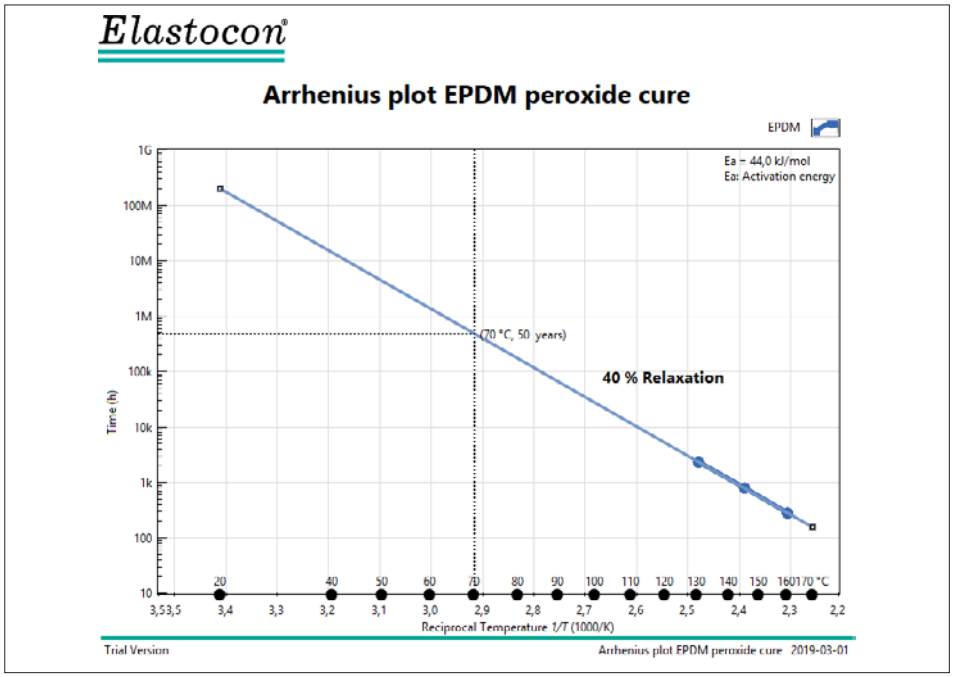
The test temperatures are chosen so the test time for the highest temperature is at least one week and the time for the lowest temperature is about 3–9 months.

The times to reach the "end of life" time for each temperature are plotted in an Arrhenius plot, which is a graph with logarithmic time on the Y-axis and 1/T on the X-axis, where T is the temperature in Kelvin.

A straight line is drawn through the points and extrapolated to the temperature of use, to obtain an estimation of the life-time of the tested material.



EPDM relaxation curves at three temperatures.



Arrhenius plot at 40 % relaxation.

Software for Arrhenius plot, EC 15

EC 15 is a software that will help you create an Arrhenius plot e.g. after your stress relaxation test.

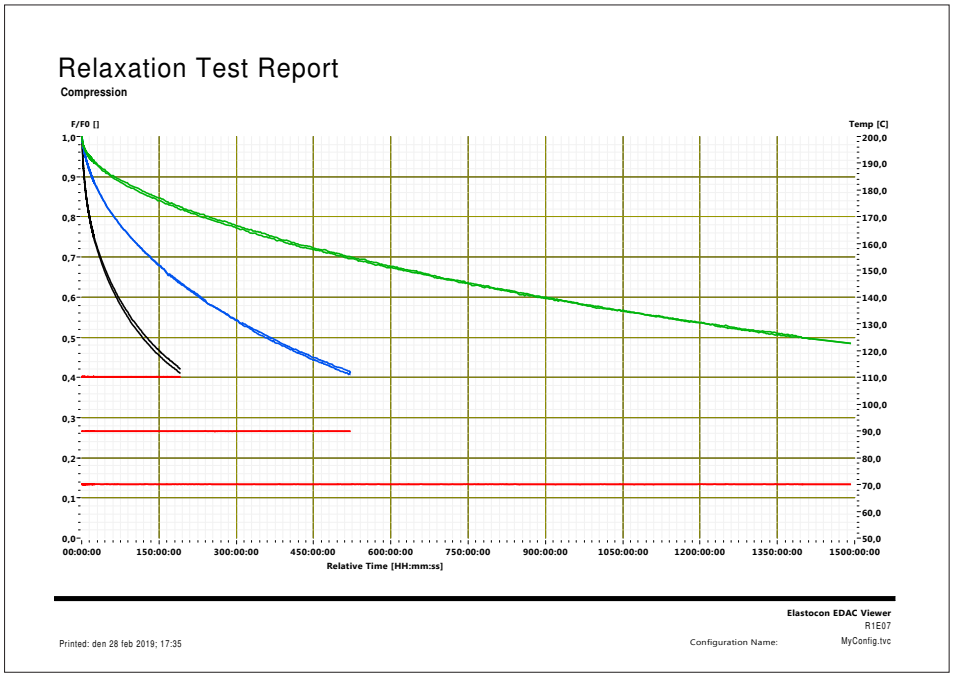
The software is very user friendly and simple to use. It has some customizations according to your wishes.

You can choose temperature points, values of the axis of the graph, change colours, compare different materials/ batches, type your own annotations in the graph, show or hide the activation energy etc.

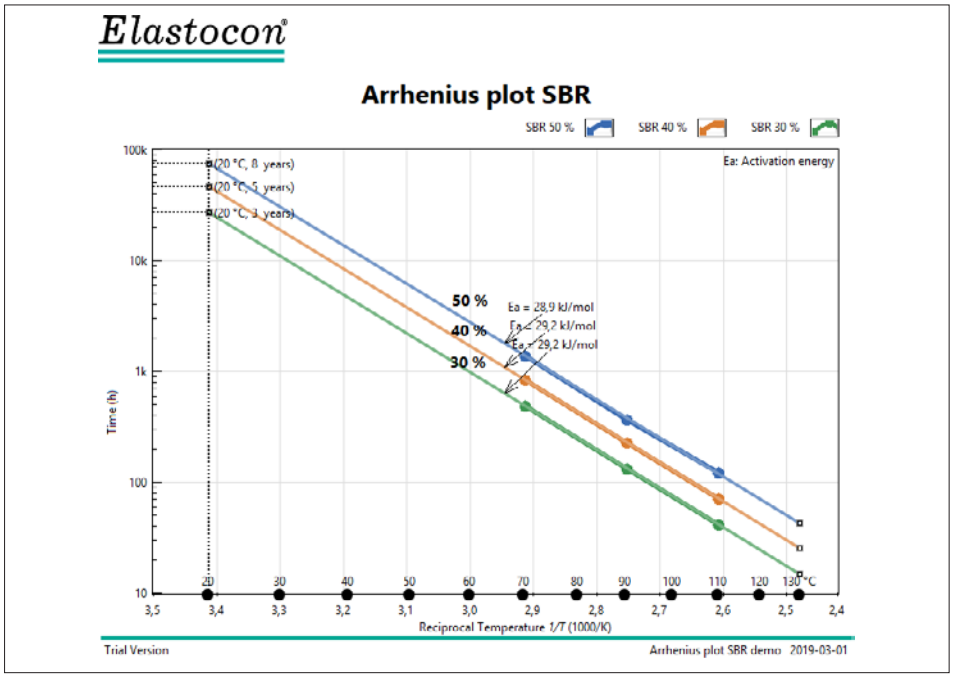
Included in the software are also some short and easy understandable demo videos (no sound) to get you started with the software.

When you're finished you can save your plot or use different options for printing it (send to clipboard, save as image or print/create pdf-file).

It has never been easier to make an Arrhenius plot after a stress relaxation test than with EC 15.



SBR relaxation curves at three temperatures.



Arrhenius plot at 30 %, 40 % and 50 % relaxation.

Temperature boxes

EB 02.08

The room temperature box, EB 02.08, is used when testing at room temperature to avoid variation in the load curve caused by temperature variation in the laboratory.

The capacity of the box is 8 rigs. It can also be used for conditioning test pieces at 23 °C.

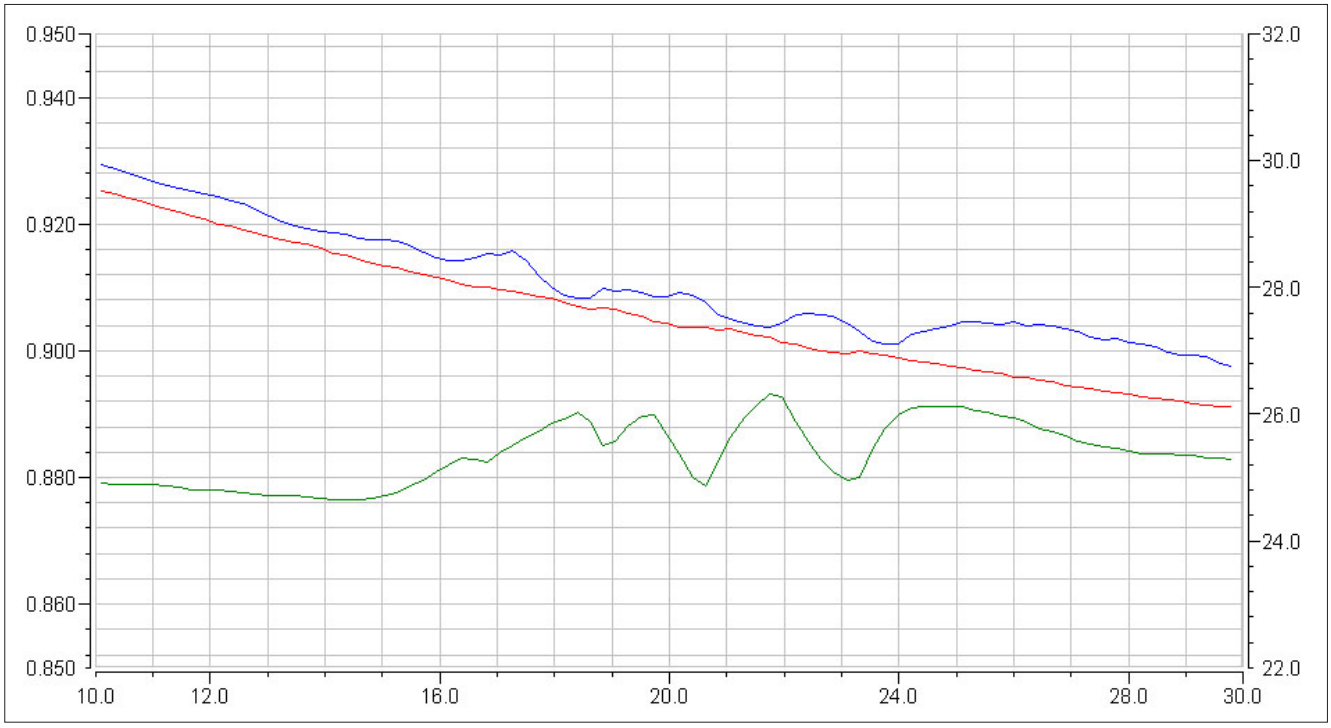
EB 02.25

The low temperature box, EB 02.25, is almost the same as EB 02.08, but this box is equipped with water cooling by tap water. This cooling enables temperature range between +4 to +40 °C. Tap water temperature cannot exceed +15 °C.

Common specifications for EB 02.08 /EB 02.25

- The casing consists of steel, powder coated in blue-green colour.
- Temperature is set from a computer.

The room temperature box, EB 02.08 and the low temperature box, EB 02.25 look similar, but the latter has cooling by tap water.



This graph shows a test run with and without the Room temperature box when testing at 23 °C.

The blue curves are the rigs without the box and for the red curves the box is used. The green curve is the room temperature.

Automatic relaxation and creep testers

EB 18-II-3 and EB 32 – for stress relaxation tests and creep tests

Test stations for testing in tension and for testing in compression.

Elastocon offers two models for high precision automatic relaxation and creep tests, **EB 18-II-3** and **EB 32**. Both models perfom tests according to ISO 188 method A, ISO 3384-1 method A, ISO 6914 method A and ISO 899 with modified test specimen (no strain gauge required).

In **EB 18-II-3** each test station can run with an individual temperature, between +40 °C to +200 °C.

The **EB 32** is equipped with a liquid circulator (EB 32.01) for cooling, and can cycle between -40 °C and +200 °C, with the same temperature in all test stations, thus also performing tests according to ISO 3384-1 method B, and ISO 3384-2 method A and B.

The test rigs are based on our relaxation rig EB 02, but here the lowering and raising of the rigs as well as the compression or stretching of the samples are motor driven by a servo motor.

The test rigs are built into a cabinet made of poly-carbonate with aluminium profiles, which provides the same temperature stability around the upper part of the rigs as our other continuous relaxation test systems.

The instruments are, by default, delivered with compression plates, 1000 N load cells.

If testing at room temperature is wanted, the test can be performed with the rigs in their raised position in the hood instead of down in the cells of the oven.

Other accessories such as different loadcells, testing in compression in liquid, testing in air in tension and special clamps for testing in creep according to ISO 899-1 can be ordered separately. A high temperature version is available (EB 18-II-3HT), with temperature up to +300 °C. Versions with high force up to 2 000 N/5 000 N (HF/XHF) can also be supplied.

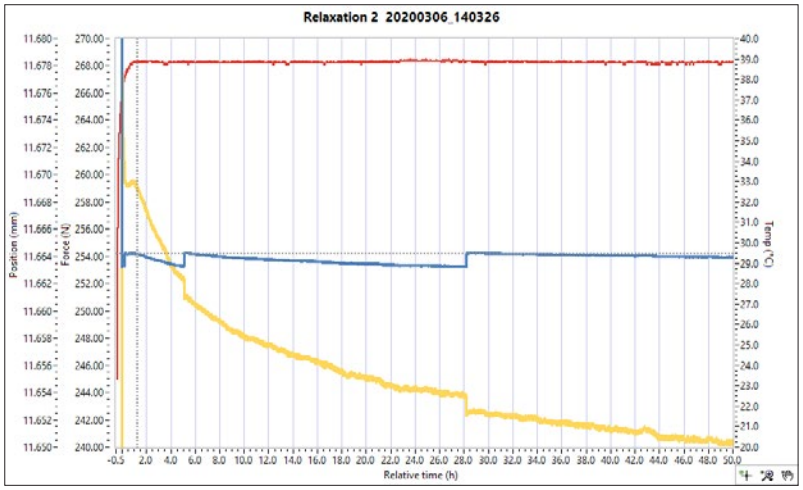
Easy to change between test methods

Both testing methods, stress relaxation and creep uses the same accessories. The shifting between the two test methods is done when the required **EC 13** software is started. Changing between compression and tension consist of a simple rebuilding of the rigs, thoroughly described in the manual.

The EB 32.01 liquid circulator for cooling to the left of the automatic relaxation and creep tester EB 32, which can cycle between -40 °C and +200 °C, with the same temperature in all test stations.

Stress relaxation tests with automatic relaxation and creep testers EB 18-II-3/EB 32

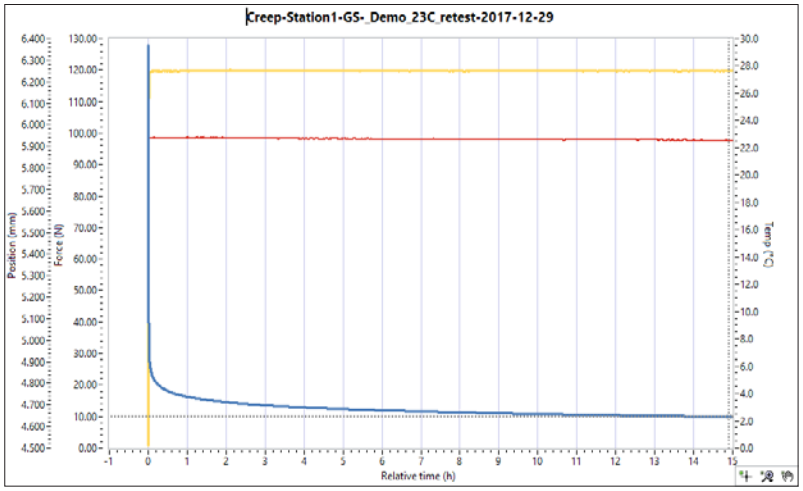
- Relaxation tests can be done in both compression and tension.
- Utilising load cells and servo motors to apply and hold the compression in the EB 18-II-3/EB 32, automatically compensates for the spring effect in the load cells.
- The compression or tension in mm or % is set in the software and the computer instructs the closed loop circuit of the servo motor and load cell amplifier to keep the set value.
- High accuracy in the displacement measurement.
- Results are presented in graphical or table formats as absolute relaxation in N or as F/Fo in absolute or relative time as well as linear or log time.
- Possibility of running new features such as load and temperature ramps controlled by the computer.
- Test can be made in liquids using a liquid container (option).



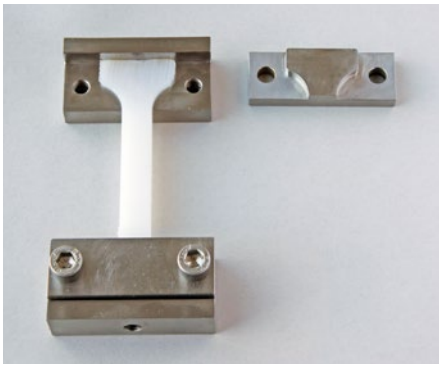
Relaxation test with EC 13 software. *The red curve is the temperature, the yellow curve is the force and the blue curve shows the position and each step is an adjustment of 0,001 mm.*

Creep tests with automatic relaxation and creep testers EB 18-II-3/EB 32

- Creep tests can be done in both compression and tension.
- Utilising load cells and servo motors to apply and hold the load, the EB 18-II-3/EB 32 tester eliminates the handling problems associated with dead load weights.
- The load in MPa or N is set in the software and the computer instructs the closed loop circuit of the servo motor and load cell amplifier to keep the set load. This means that the load is kept even if the computer fails.
- High accuracy in the displacement measurement.
- Results are presented in graphical or table formats as absolute creep or creep index. In order to study the actual sample failure the data logging rate is increased just before break occurs.
- Possibility of running new features such as load and temperature ramps controlled by the computer.
- Test can be made in liquids using a liquid container (option).



Creep test with EC 13 software. *The red curve is the temperature, the yellow curve is the load and the blue curve is the creep.*



EB 18-II.01 *Clamp for creep tests in tension, according to ISO 899-1, with 50 mm gauge length.*

Instruments for creep testing

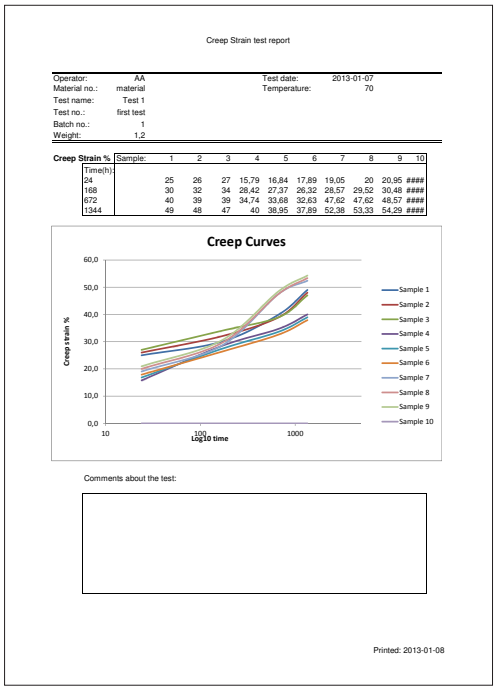
Besides the automatic relaxation and creep testers, EB 18-II-3 and EB 32, Elastocon can also offer creep instruments like **EB 15** for full notch creep test (FNCT) according to ISO 16770 and **EB 25** according to ISO 899, for example, which can be customized in some extent.

Another creep instrument is the **EB 24** film creep tester below.

Please contact us for more information about our creep instruments.

Film creep tester, EB 24

The film creep tester EB 24 has a digital ruler system including a line laser pointer for manually measuring the creep. The ruler has a wireless connection to the included computer. The values are fed into an spreadsheet template, which calculates the result and presents the graphs.



Creep Strain test report

Operator:	AA	Test date:	2013-01-07
Material no.:	material	Temperature:	70
Test name:	Test 1		
Test no.:	first test		
Batch no.:	1		
Weight:	1,2		

Creep Strain %	Sample:	1	2	3	4	5	6	7	8	9	10
Time(h):											
24		25	26	27	15,79	16,84	17,89	19,05	20	20,95	####
168		30	32	34	28,42	27,37	26,32	28,57	29,52	30,48	####
672		40	39	39	34,74	33,68	32,63	47,62	47,62	48,57	####
1344		49	48	47	40	38,95	37,89	52,38	53,33	54,29	####

Comments about the test:

Printed: 2013-01-08

Spreadsheet template report.

The film creep tester has a fixed set air exchange rate, 7 or 14 changes per hour. It includes hooks to hang 10 test pieces 25 × 100 mm and 10 sets of grips to attach to the test pieces, together with weights, 1,3 kg and 2,3 kg.

Common specifications

- The oven performs well inside the apparatus requirements in ISO 188, IEC 811 and other equivalent standards.
- Special design with controlled air exchange rate and low air speed.
- Flow meter that can be set between 3 to 20 changes per hour.
- The casing consists of steel, painted with epoxy powder paint in bluegreen colour.
- The inner chamber is made of stainless steel.
- Temperature controller with 0,1°C setpoint.
- Solid state relay for safe control.
- Temperature indicator with sensor in the inner chamber.
- Fixed over temperature fuse.
- Cooling channels in the casing for low surface temperature.
- Controlled cooling fan for the electronics cabinet.
- Run-time meter.
- Countdown timer.
- Door sensor to turn off laser and illumination when the door is opened.

Technical specifications

Stress relaxation rig	EB 02	EB 02HT	EB 02VHT
Temperature range, °C:	+5 to +200	-70 to +300	+5 to +350
Default range in compression, N:	600	600	600
Resolution, compression, N:	0,05	0,05	0,05
Optional range in compression, N *(must be specified in order):*	1 200 / 2 000	1 200 / 2 000	1 200 / 2 000
Resolution, compression, N:	0,1 / 0,2	0,1 / 0,2	0,1 / 0,2
Accuracy, %:	± 0,1 of full range	± 0,1 of full range	± 0,1 of full range
Dimensions, dia × h, mm:	120 × 450	120 × 450	120 × 450
Weight, kg:	4,5	4,5	4,5
Material:	Stainless steel	Stainless steel	Stainless steel
Temperature sensor:	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN
Standards:	ISO 3384, ASTM D6147	ISO 3384, ASTM D6147	ISO 3384
Suitable accessories			
Liquid container:	EB 02.01	EB 02.01	EB 02.01
Air tight container:	EB 02.01P	EB 02.01P	–
Pressure gauge for air tight container:	EB 02.01P6	EB 02.01P6	–
Extension cords for load cell:	EB 02.05.1	EB 02.05.1	EB 02.05.1
Extension cords for temperature:	EB 02.05.2	EB 02.05.2	EB 02.05.2
Load cell 1 200 N:	EB 02.18	EB 02.18	EB 02.18
Load cell 2 000 N:	EB 02.19	EB 02.19	EB 02.19
Test piece holder:	EB 02.26	EB 02.26	EB 02.26
Bending fixture with 3-point loading:	EB 02.29	EB 02.29	EB 02.29

Stress relaxation rig	EB 02TE	EB 02TE, HT	EB 02TR, TE
Number of test pieces:	1	1	3
Temperature range, °C:	+5 to +200	-70 to +300	+5 to +200
Default range in tension, N:	100	100	100
Resolution, tension N:	0,01	0,01	0,01
Accuracy, %:	± 0,1 of full range	± 0,1 of full range	± 0,1 of full range
Dimensions, dia × h, mm:	120 × 450	120 × 450	120 × 450
Weight, kg:	4,5	4,5	5,7
Material:	Stainless steel	Stainless steel	Stainless steel
Temperature sensor:	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN
Standards:	ISO 6914 method A	ISO 6914 method A	ISO 6914 method A
Suitable accessories			
Liquid container:	EB 02.12	EB 02.12	–
Air tight container:	–	–	–
Pressure gauge for air tight container:	–	–	–
Extension cords for load cell:	EB 02.05.1	EB 02.05.1	EB 02.05.1 (3 per rig)
Extension cords for temperature:	EB 02.05.2	EB 02.05.2	EB 02.05.2
Load cell 1 200 N:	–	–	–
Load cell 2 000 N:	–	–	–
Test piece holder:	EB 02.26	EB 02.26	–
Bending fixture with 3-point loading:	–	–	–

ELASTOCON reserve the right to modify these specifications in part or in whole.

Technical specifications

Stress relaxation rig	EB 02AP	EB 02SA	EB 02ALE	EB 02HF
Temperature range, °C:	+5 to +150	+5 to +200	+5 to +200	+5 to +200
Default range in compression/tension, N:	600	600	600	45 000
Resolution, compression/tension, N:	0,05	0,05	0,05	–
Optional range in compression, N *(must be specified in order):*	1 200 / 2 000	1 200 / 2 000	1 200 / 2 000	–
Resolution, compression/tension, N:	0,1 / 0,2	0,1 / 0,2	0,1 / 0,2	–
Accuracy, %:	± 0,1 of full range	± 0,1 of full range	± 0,1 of full range	± 0,1 of full range
Dimensions, dia × h, mm:	120 × 450	120 × 450	120 × 450	120 × 450
Weight, kg:	4,5	4,5	4,5	4,5
Material:	EN 1.4436 (acid proof)	EN 1.4547 (super acid proof)	Stainless steel	Stainless steel
Temperature sensor:	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN
Standards:	ISO 3384 ASTM D6147	ISO 3384 ASTM D6147	–	ISO 3384
Suitable accessories				
Liquid container:	–	included	included	–
Air tight container:	included	–	–	–
Pressure gauge for air tight container:	EB 02.01P6	–	–	–
Test piece holder:	–	–	included	–
Extension cords for load cell:	EB 02.05.1	EB 02.05.1	EB 02.05.1	EB 02.05.1
Extension cords for temperature:	EB 02.05.2	EB 02.05.2	EB 02.05.2	EB 02.05.2
Load cell 1 200 N:	EB 02.18	EB 02.18	EB 02.18	–
Load cell 2 000 N:	EB 02.19	EB 02.19	EB 02.19	–
			NOTE! *Must be connected to special control box, EB 02.24-x*	

Included in the purchase of relaxation rigs

- **Manual** in English
- **Necessary tools**
- **Accredited calibration** with certificate

Types of stress relaxation rigs

EB 02	Compression
EB 02HT	Compression, high temperatures
EB 02VHT	Compression, very high temperatures
EB 02TE	Tension
EB 02TE, HT	Tension, high temperatures
EB 02TR, TE	Tension with 3 test pieces
EB 02AP	Acid proof material for testing in liquids and compression
EB 02SA	Super acid proof material for testing in liquids and compression
EB 02ALE	Compression with liquid exchange and aeration
EB 02HF	High force compression

Technical specifications

Container and compression plate for testing of stress relaxation in liquids, EB 02.01

Maximum temperature, °C:	+200
Diameter, mm:	90
Height, mm:	95
Weight, kg:	1
Material:	Stainless steel

Container for testing of stress relaxation in liquids (tension), EB 02.12

Maximum temperature, °C:	+200
D ht, kg:	1.4
Material:	Stainless steel

Airtight container for testing of stress relaxation in liquids (compression), EB 02.01P

Temperature range, °C:	+5 to +150
Diameter, mm:	90
Height, mm:	95 + 25
Weight, kg:	1.1
Material:	Stainless steel
Seals:	FPM default or EPDM

Consumables

EB 02.01P1	set of 6 O-rings, FPM for EB 02.01P
EB 02.01P2	set of 6 O-rings, EPDM Peroxide cured for EB 02.01P

Test piece holder for relaxation rig, EB 02.26

On the holder there is room for either 5 small O-rings or standard specimens e.g. ISO 37-3 alternatively 3 bigger O-rings (e.g. 40 mm in diameter).

Amplifier box EB 02.14

Pt 100 input

Connection type:	3 wire
Temperature range; °C:	-200 to +850
Resolution, °C:	0,1
Conversion time, ms:	320
Measuring error (25 °C), %:	± 0,2 of full range
Bit width, bits:	2 × 16

Load cell input

Signal voltage, Ud, mV:	-16 to +16
Signal voltage Uref, V:	-10 to +10
Resolution, bits:	16
Conversion time, ms:	250
Measuring error, %:	0,1 of full range
Bit width, bits:	16

Communication

Transmission medium:	Twisted pair S-UTP 100 ¤ cat5
Buscoupler connection:	RJ45
Max length of fieldbus segment:	100 m between hubstation EB 02.14
Baud rate:	10 mbits/s
Protocols:	ModBus/TCP, HTTP, bootp ModBus, UDP

Common specifications

Dimensions, external, w × h × d, mm:	400 × 150 × 310
Weight, kg:	6
Power, W :	100
Voltage, V/phase/freq:	90–240 VAC/1/50–60

NOTE: *If the amplifier box will not be placed directly behind the oven, please include the extension cords to the relaxation rigs (***EB 02.05.1** *and* **EB 02.05.2***, one of each per rig) to facilitate the manual work in the laboratory.*

Amplifier box EB 02.14TR

Amplifier box EB 02.14TR is an option for the stress relaxation rig EB 02TR, TE. The technical specifications are the same as for the EB 02.14 amplifier box.

ELASTOCON reserve the right to modify these specifications in part or in whole.

Technical specifications

Uninterruptible power supply (UPS), ED 06

On-line double conversion with PFC (Power Factor Correction) system

Rating, VA/W:	1000/900
Dimensions, external, w × h × d, mm:	160 × 252 × 387
Input Voltage Range, V:	190–276
Frequncy:	50/60, autoselection

ALE control box, EB 02.24-x

Air flow, ml/min:	0 to 100
Liquid flow, ml/min:	0,001 to 2,5
No. of channels:	2, 4 or 6
Stirrer speed, rpm:	0 to 2 500
Maximum temperature of liquid in the pump, °C:	50
Dimensions, external, w × h × d, mm:	410 × 500 × 580
Weight, kg:	30
Power, W:	500
Voltage, V/phase/freq:	200–240/1/50–60 or 100–120/1/50–60

Included accessories

- **Manual** in English
- **Stylus pen** for the instrument touch screen
- **Calibration** including certificate

	Room temperature box, EB 02.08	Low temperature box EB 02.25
Temperature range, °C:	+10 to +40 [1]	+4 to +40 [1, 2]
Nominal temperature, °C:	+23	+23
Temp. variation in time, °C:	± 0,5	± 0,5
Temp. variation in space, %:	± 1,0	± 1,0
Temperature reduction, below ambient, °C:	min 12	min 21
Temperature sensor:	NTC	NTC
Dimensions, external, w × d × h, mm:	620 × 610 × 630	620 × 610 × 630
No. of relaxation rigs:	8	8
Weight, kg:	33	36
Voltage, V/phase/freq:	200–240/1/50–60 or 100–120/1/50–60	200–240/1/50–60 –
Cooling power, W:	62	234
Total power, W:	200	500

[1] *Lowest temperature depending of ambient temperature.*
[2] *Equipped with water cooling by tap water. Tap water temperature cannot exceed +15 °C.*

Included accessories

- **Manual** in English
- **Accredited calibration** including certificate

ELASTOCON reserve the right to modify these specifications in part or in whole.

Technical specifications

Film creep tester, EB 24

Temperature range, °C:	+40 to +200
Temp. control, +40 to +100 °C, °C:	± 0,5
+101 to +200 °C, °C:	± 1,0
Temp. variation in time, °C:	± 0,25
Temp. variation in space, %:	± 0,5
Temperature sensors:	Pt 100, 1/3 DIN
Air speed, m/s:	<0,001
Air changes, changes/hour:	3 to 20
Useful volume, l:	120
Dimensions, inner, w × h × d, mm:	550 × 550 × 400
Dimensions, external, w × h × d, mm:	920 × 820 × 780
Dimension, window, 4 glass, mm:	370 × 300
Base dimension w × d, mm	910 × 670
Illumination of the inner chamber:	2 × 10 W, 24 V halogen
Measuring system, resolution, mm:	0,01
Measuring system, accuracy, mm:	0,05
Tolerance of weights (+ one clamp), g:	± 5
Weight, kg:	135
Voltage / Frequency, V / Hz:	220 to 240 / 50
Power, W:	2 100
Standards:	ISO 188, IEC 811 and equivalent standards

Included accessories

- **Computer** (Windows) with necessary software
- **Hooks** to hang 10 test pieces 25 × 100 mm (thickness of test specimens max 3,5 mm)
- **10 sets of grips** to attach to the test pieces together with the **weights** (1,3 kg and 2,3 kg)
- **Manual** in English
- **Stylus pen** for the instrument touch screen
- **Accredited calibration** including certificate

Optional accessories

EC 11 Monitor software.

ED 06 UPS 1000 VA double converter, recommended for the computer in case of power failure.

ED 07.01-x Network cable (different lengths: 3, 5, and 10 m).

EB-P Ramp function for temperature settings in the PLC.

EA 01 Silent, oil-free air compressor, 105 l/min. Suitable if compressed air is missing.

Note: *EB 24 needs connection to dry and clean compressed air for the air exchange. The air speed is low and is dependent on the air exchange rate only, as specified in ISO 188, method A and IEC 811.*

Cell ageing ovens

	EB 21	EB 22	EB 38	EB 39
Temperature range, °C:	+40 to +200	+40 to +200	+40 to +350	+40 to +200
HT-version, °C:	+40 to +300	+40 to +300	–	+40 to +300
Temp. control,+40 to +100 °C, °C:	± 0,5	± 0,5	± 0,5	± 0,5
+101 to +200 °C, °C:	± 1,0	± 1,0	± 1,0	± 1,0
+201 to +300 °C, °C:	± 1,5	± 1,5	± 1,5	± 1,5
+301 to +350 °C, °C:	–	–	± 2,0	–
Temp.variation in time,°C:	± 0,25	± 0,25	± 0,25	± 0,25
Temperature sensors:	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN
No. of temperatures:	4	6	4	6
No. of cells:	4	6	4	6
Air speed, m/s:	<0,001	<0,001	<0,001	<0,001
Air changes, changes/hour:	3 to 20	3 to 20	3 to 20	20 to 160
Useful volume, l:	4 × 1,3	6 × 1,3	4 × 1,3	6 × 1,3
Dimensions, inner, dia × h, mm:	100 × 160	100 × 160	100 × 160	100 × 160
Dimensions, external, w × h × d, mm:	760 × 715 × 520	960 × 715 × 520	760 × 715 × 610	960 × 715 × 520
Base dimension w × d, mm	750 × 510	960 × 510	750 × 510	960 × 510
Weight, kg:	50	57	50~57	57
Voltage, V/phase/freq:	220–240/1/50 (110–120/1/60)	220–240/1/50 (110–120/1/60)	220–240/1/50 (110–120/1/60)	220–240/1/50 (110–120/1/60)
Power, W:	900	1300	1200	1300
Standards:	ISO 188 method A	ISO 188 method A	ISO 188 method A	ASTM D6147

Included accessories

- **Manual** in English
- **Stylus pen** for the instrument touch screen
- **Accredited calibration** including certificate

Optional accessories

ED 07.01-x Network cable (different lengths: 3, 5, 10 m)

EB-P Ramp function for temperature settings in the PLC

Note: *EB 39 needs connection to dry and clean compressed air for the air exchange.*

Examples of temperature combinations between cells with individual temperature, °C:

Cell no 3	Cell no 4
40	70
Cell no 1	**Cell no 2**
100	200

Cell no 3	Cell no 4
60	200
Cell no 1	**Cell no 2**
200	200

Cell no 3	Cell no 4
50	70
Cell no 1	**Cell no 2**
200	200

ELASTOCON reserve the right to modify these specifications in part or in whole.

Technical specifications

Cell ageing ovens

	EB 17	EB 17HT	EB 21LTHTP
Temperature range, °C:	–	–	+20 to +300
with EB 17.01	-40 to +200	-40 to +245	–
with EB 17.03	-70 to +200	–	–
Temp. control, -70 to +20 °C, °C:	± 2,0	± 2,0	–
+21 to +100 °C, °C:	± 1,0	± 1,0	–
+40 to +100 °C, °C:	–	–	± 0,5
+101 to +200 °C, °C:	± 2,0	–	± 1,0
+101 to +245 °C, °C:	–	± 2,0	–
+201 to +300 °C, °C:	–	–	± 1,5
Temp.variation in time,°C:	± 0,25	± 0,25	± 0,25
Temperature sensors:	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN
No. of temperatures:	1	1	4
No. of cells:	6	6	4
Air speed, m/s:	<0,001	<0,001	<0,001
Air changes, changes/hour:	3 to 20	3 to 20	3 to 20
Useful volume, l:	6 × 1,3	6 × 1,3	4 × 1,3
Dimensions, inner, dia × h, mm:	100 × 160	100 × 160	100 × 160
Dimensions, external, w × h × d, mm:	960 × 850 × 520	960 × 850 × 520	760 × 850 × 520
Base dimension w × d, mm	960 × 510	960 × 510	750 × 510
Weight, kg:	approx. 74	approx. 74	approx. 62
Voltage, V/phase/freq:	220–240/1/50 or 60	220–240/1/50 or 60	220–240/1/50 (110–120/1/60)
Power, W:	1500	1500	900
Water flow l/min:	–	–	0,1 to 1
Standards:	ISO 188 method A,	ISO 188 method A,	ISO 188 method A,
Programmable temperature from PLC	ISO 3384-1 method A and B, ISO 3384-2 method A and B, ISO 6914 method A	ISO 3384-1 method A and B, ISO 3384-2 method A and B, ISO 6914 method A	ISO 3384-1 method A and B, ISO 3384-2 method A*, ISO 6914 method A
Type of cooling:	Liquid circulator	Liquid circulator	Tap water (should not exceed +18 °C to have a satisfying cooling function)

Note: *EB 17 and EB 17HT can only be combined with EB 02HT or EB 02TEHT rigs.*

** From +23 to +300 °C.*

Included accessories

- **Manual** in English
- **Stylus pen** for the instrument touch screen
- **Accredited calibration** including certificate

Liquid circulators for cell ageing ovens EB 17, EB 17HT and EB 32

	EB 17.01/EB 32.01	EB 17.03*
Heating power, W:	1800	6000
Cooling power at +20 °C, W:	1200	2500
Cooling power at -40 °C, W:	1100	2400
Temperature stability °C:	± 0,05	± 0,05
Dimensions, external, w × h × d, mm:	430 × 1260 × 650	610 × 1250 × 1080
Weight, kg:	164	365
Volume, l:	3,9	9,5
Pump flow rate, l/min:	16–40	35–80
Pressure, bar:	0,3–1,7	0,48–3,2
Cooling of compressor:	air	air
Voltage, V/phase/freq:	230/1/50 *(default)* (208/1/60, *EB 17.01-60 or EB 32.01-60*)	400/3/50 *(default)* (208–230/3/60, *EB 17.03-60*)
Power, A:	16 (15)	18 (30@208 V, 33@230 V)

***** *EB 17.03 liquid circulator will not work with EB 17HT.*

Included accessories

- **Hoses and valves** for connection and communication with EB 17, EB 17HT or EB 32
- **Manual** in English

ELASTOCON reserve the right to modify these specifications in part or in whole.

Technical specifications

Automatic relaxation and creep testers

	EB 18-II-3	EB 32
Temperature range, °C:	+40 to +200 (+300 for HT-version)	-40 to +200
Temp. control, -40 to +20 °C, °C:	–	± 2,0
+21 to +100 °C, °C:	–	± 1,0
+40 to +100 °C, °C:	± 0,5	–
+101 to +200 °C, °C:	± 1,0	± 2,0
+201 to +300 °C, °C:	± 1,5	–
Temp. variation in time, °C:	± 0,25	± 1,0
Temperature sensors:	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN
No. of temperatures:	3	1
No. of cells:	3	3
Air speed, m/s:	<0,001	<0,001
Air changes, changes/hour:	3 to 20	3 to 20
Force range compression, N (both):	0 to 1 000 (alternatively 100, 500 or 1 500), (2 000 for HF-version, 5 000 for XHF)	
Force range tension, N:	100 (tension is optional)	100 (tension is optional)
Force resolution, N:	0,1 in compression and 0,01 in tension	0,1 in compression and 0,01 in tension
Force accuracy, N:	0,2 (0,02, 0,1, 0,4)	0,2 (0,02, 0,1, 0,4)
Displacement resolution, mm:	0,0001	0,0001
Displacement accuracy, mm:	0,003	0,003
Speed range, mm/min:	0,1 to 200	0,1 to 200
Compression plate, mm dia:	50	50
Power, W:	1200	1200
Voltage, V/Hz:	220–240/50, or 110–120/60	220–240/50, or 110–120/60
Type of cooling:	–	Liquid circulator (*see previous page, EB 32.01*)
Materials, sample fixtures:	Stainless steel	Stainless steel
Materials, rigs:	Stainless steel and aluminium	Stainless steel and aluminium
Casing:	Powder painted steel	Powder painted steel
Size, w × d × h, mm:	1260 × 570 × 1220	1 260 × 570 × 1 220
Base dimension w × d, mm	1230 × 570	1230 × 570
Weight, kg:	151	165
Standards:	**Both models:** ISO 188 method A, ISO 3384-1 method A, ISO 6914 method A, ISO 899 with modified test specimen (no strain gauge required) **EB 32 only**: ISO 3384-1 method B, ISO 3384-2 method A and B	

Included accessories

- **All-in-one computer** (Windows) with monitor, keyboard and mouse
- **Support** agreement first year
- **Manual** in English
- **Stylus pen** for the instrument touch screen
- **Accredited calibration** including certificate

Optional accessories

For rebuilding the rigs to tension

EB 02.02 Grips for testing relaxation in tension, according to ISO 6914.

EB 02.03 Load Cell 100 N for tests in tension, including adapters.

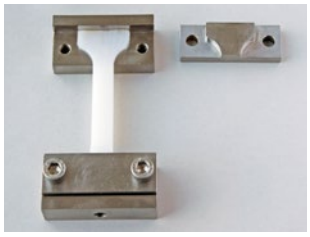
EB 18-II.01 Clamp for creep test in tension, according to ISO 899-1.

For testing in liquids

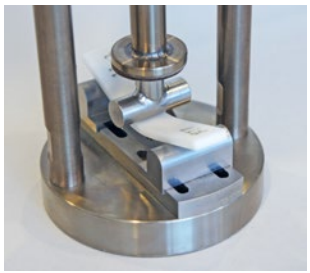
EB 02.01 Container and pressure plate (with a hole in the centre) for testing in liquids, according to ISO 3384.

For testing in bending

EB 02.29 Fixture for flexural creep by 3-point loading, according to ISO 899-2.



EB 18-II.01 *Clamp for creep tests in tension with 50 mm gauge length.*



EB 02.29 *Fixture for flexural creep by 3-point loading, according to ISO 899-2.*

ELASTOCON reserve the right to modify these specifications in part or in whole.

Important recommendations for all instruments!

For the best performance of the instrument, we recommend the following working environment:

- Standard laboratory temperature of either 23 °C ± 2° or 27 °C ± 2°.
- Humidity not more than 90 % RH – non condensing.
- For long term logging instruments secure the power to the computer with a double converting UPS, for reducing electrical disturbances and power failure (ask Elastocon for recommendations or quotation).
- Other environmental aspects: Pollution degree 2 – Laboratory environment

Testing of stress relaxation with cycling temperature

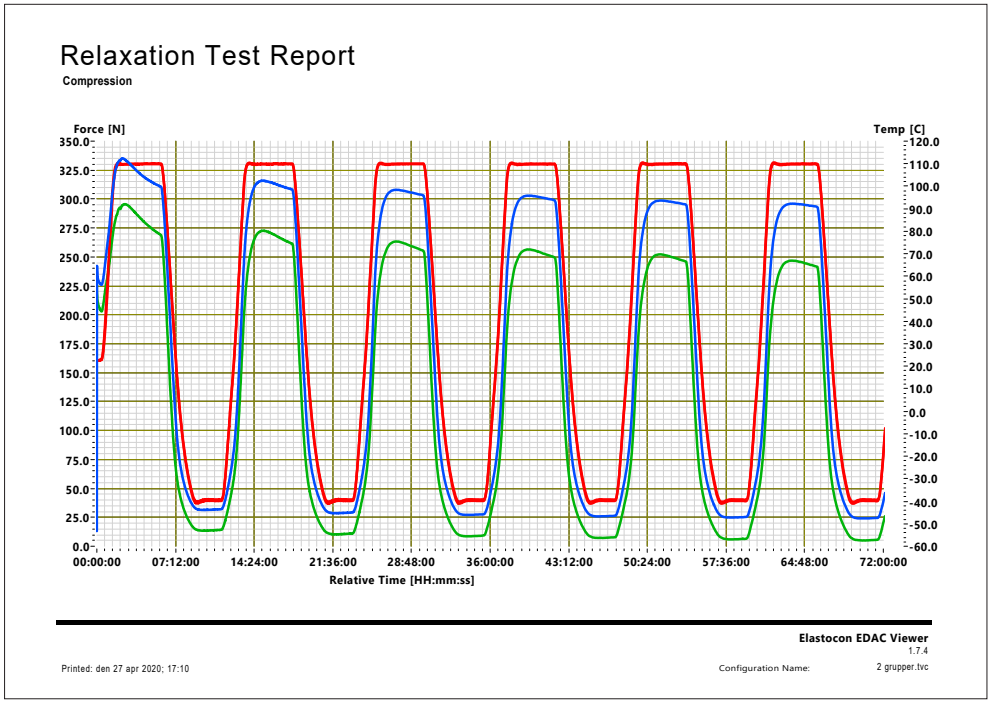
Relaxation tests with temperature cycling have been popular with some automotive manufacturers for observing the temperature performance of seals in a car or truck engine.

When an engine is running the seals are exposed to high temperatures and when the vehicle is not used and parked outside it can be exposed to very low temperatures.

As rubber expands about 10 times more than steel when going to higher temperatures, the seals give a high sealing force. But when going to low temperatures and even sub-zero temperatures the rubber is shrinking, so the sealing force may be lost totally and cause a leak. In addition to the shrinking the ageing further reduces the sealing force.

This condition is simulated in our Relaxation system EB 17.

Relaxation system EB 17 with temperature cycling.



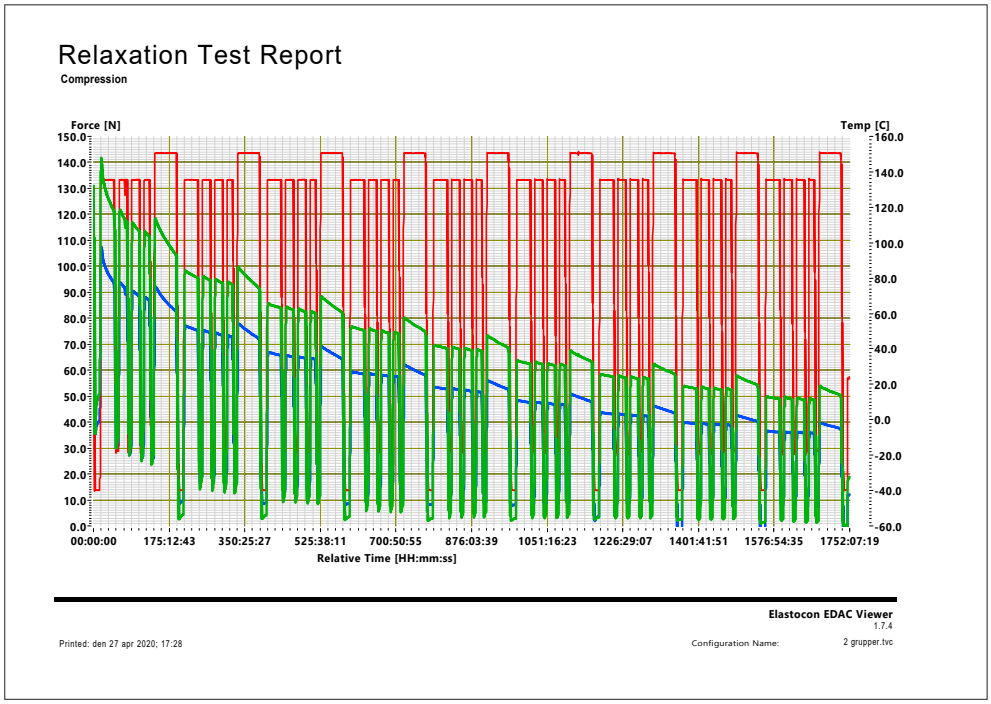
Volvo cycle, 2 materials

More example graphs follows on the next page

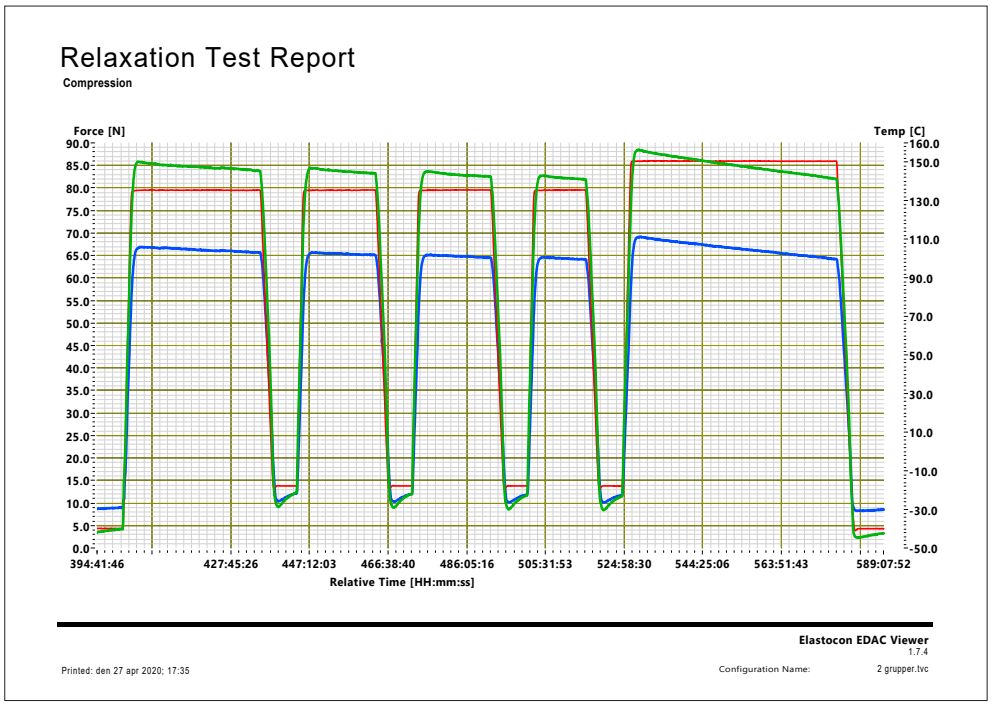
ELASTOCON reserve the right to modify these specifications in part or in whole.

Testing of stress relaxation with cycling temperature – example graphs

(Continuation from the previous page)



GM cycle, 2 materials



One GM cycle

Elastocon AB
Tvinnargatan 25 • SE-507 30 Brämhult • Sweden
Phone: +46 33 323 39 00 • E-mail: info@elastocon.se
www.elastocon.com