Elastocon®

Ageing Ovens

for precision ageing of rubber and plastic materials

Cell Ageing Ovens with four or six cells

Elastocon presents our latest generation of cell ovens for the precision ageing of polymer materials. We have produced and developed cell ovens and ageing cabinets since 1987. Benefitting from this long experience our ovens represent a major step forward in the design of such instruments.

Manufactured in 4 or 6 cell configurations, the ovens are available with either single temperature controller or multiple (individual) cell controllers.

- Improved insulation for lower energy consumption.
- Lower surface temperature.
- Settings are done on a colour touch screen.
- Micro PLC control.
- Resettable countdown timer for each cell.
- Individual cell identifier – "Test name".
- Alarm history.

The cell oven EB 20 equipped with 6 cells, each with individual temperatures.

All ageing ovens have a touch screen control utilising a micro PLC.

Different models:

EB 01-II	– cell oven, 4 cells one temperature for all cells, +40 to +200 °C
EB 19	– cell oven, 4 cells individual temperature for each cell, +40 to +200 °C
EB 19HT	– cell oven, 4 cells individual temperature for each cell, +40 to +300 °C
EB 20	– cell oven, 6 cells individual temperature for each cell, +40 to +200 °C
EB 20HT	– cell oven, 6 cells individual temperature for each cell, +40 to +300 °C

EB 01-II and EB 19

Sample Holder
– one holder per cell is included with the cell ovens.

Elastocon AB • Tvinnargatan 25 • SE-507 30 Brämhult • Sweden
Phone: +4633-22 56 30 • E-mail: info@elastocon.se • www.elastocon.se

db-ageing-ovens_23_1610

Cabinet Ageing Ovens

Cabinet Ovens with excellent temperature stability and distribution achieved by using an inner chamber with a controlled air flow.

The ovens can be supplied in two sizes, with 60 or 120 l useful volume (EB 04-II and EB 10-II).

These ovens are ideal for ageing finished products and large test pieces which are unsuitable for cell ovens. Both shelves and rods are supplied with these ovens for accommodating most types of samples. The settings are done on the colour touch PLC screen.

Cabinet Oven EB 04-II with air supply that requires external air and flow meter that can be set between 3 to 20 changes per hour.

EB 10-II with a factory set throttle to give a fixed air exchange rate of 7 or 14 changes per hour.

The temperature accuracy is very important for heat ageing tests, as a 1 °C error in temperature corresponds to around 10 % error in test time

Cabinet Oven EB 12-II, ageing oven for precision ageing of rubbers and plastics under controlled conditions and with high air speed.

The oven EB 12-II has the same specification and external size as EB 10-II-60, except high air speed with laminar flow from bottom to top, and a reduced internal volume of 50 l. The EB 12-II meets the requirements in ISO 188 method B1 and ISO 4577.

Ageing Oven Features

- Improved insulation
- Lower surface temperature
- Touch screen control utilising a micro PLC
- Countdown timers
- Alarm history
- Test names can be given in the PLC
- Improved door with hinges and two point locking
- Improved door sealing
- Easier shelf installation and removal
- Four glass window (option EB 04-IIW)
- Sensor that turns off the fan and heating when opening the door (option EB 04-IIDS)
- Access Port (option EB 04-AP)

Option EB 04-IIW – four glass window.

Cabinet Ageing Ovens

All Elastocon ageing ovens have two temperature instruments, one for controlling the temperature and one for indicating the temperature close to the samples.

EB 26 – an ageing oven with a carousel inside. Simple and fast mounting of the samples on the carousel which rotates inside the chamber during ageing.

This oven is based on our EB 12-II oven and has a factory fixed air exchange rate of either 7 or 14 changes/hour. This oven meets the requirements in ISO 188 method B2.

EB 27 – an ageing oven with high air exchange rate. It has 2 flow meters to cover the exchange rates between 3 to 200 changes/hour but still with low air speed inside the chamber.

This oven is based on our 120 litre EB 04-II oven. The oven meets the requirements in ISO 188 method A, ASTM D573, ASTM D5423 type 2, ASTM E145 type IIA, IEC 216-4-1 and IEC 811-1-2.

Test Tube Ovens

Test Tube Oven EB 11-II, with 24 test tubes.

Test Tube Oven EB 28, with 4 x 6 test tubes and four temperatures.

These ovens are designed for ageing tests according to ASTM D 865 Rubber-Deterioration by Heating in Air (Test Tube Enclosure). The ovens can also be used for testing in liquids according to ASTM D 471 and ISO 1817 Effect of liquids. Glass tubes for both standards are included.

Glass tubes for air cooling are included and water cooling can be supplied as an option.

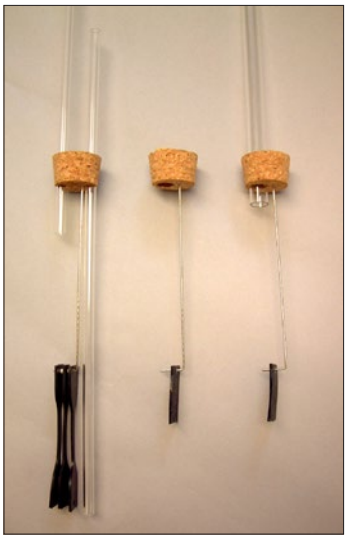
Insert for ASTM

The insert has three test tubes for testing according to ASTM D865 Heat Ageing and ASTM D471 Testing in liquids, and fits EB 19 and EB 20.

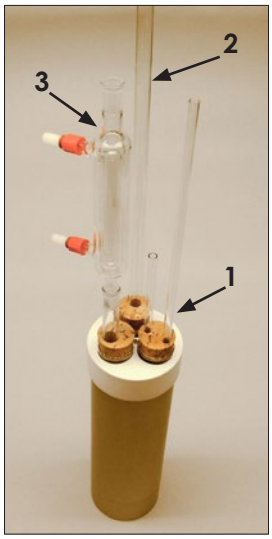
The glass tubes can be supplied with a grounded joint for a stopper or for a water cooler.

The glass tube system is also very suitable for testing in liquids according to ISO 1817.

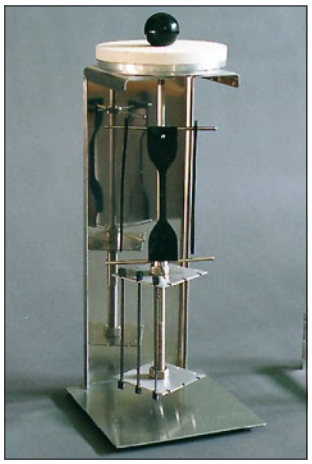
The images show the three configurations.
1. ASTM D865 Heat ageing
2. ASTM D471 Liquids with air cooler
3. ASTM D471 Liquids with water cooler



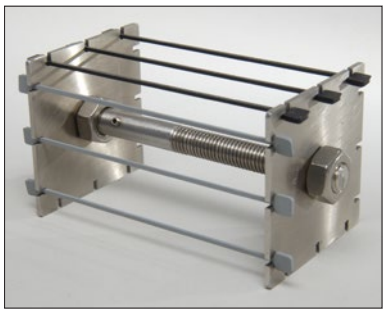
1 3 2



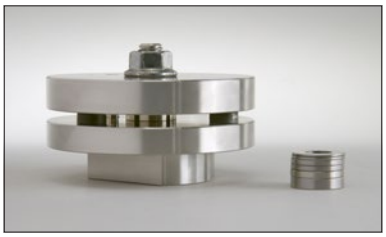
Accessories for the Elastocon Cell Ovens



Stand EB 01.01, stand to support the sample holder while mounting test pieces for ageing.



Tension Set Rig EV 04, according to ISO 2285.



Compression Set Rig EV 03, according to ISO 815-1.

Monitoring oven temperatures

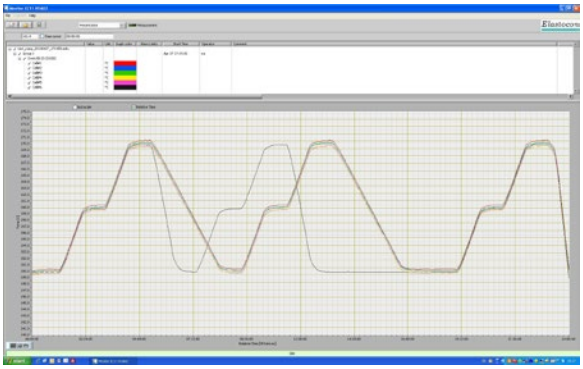
EC 11 is a data monitoring software, for monitoring instruments such as ovens and laboratories for temperature and humidity.

In the software it is possible to set alarm limits.

The software has three main windows, one to see actual temperature values and corresponding curves, one for comparing historical data and one for setting the communication with the amplifiers.

Sensors for temperature, humidity, pressure, displacement, V, mA etc are connected to a data box with amplifiers. Each data box can have 1 to 24 inputs for different sensors. One or more data boxes are connected via a network connection to a computer running the Monitor Plus software. Several data boxes can be situated in different rooms and be connected to the logging computer via the company network.

EC 11.01 is a viewer software making it possible to view the results from any computer in the network.



Technical specifications, Cell Ageing Ovens

	EB 01-II	EB 19	EB 20
Temperature range, °C:	+40 to +200	+40 to +200	+40 to +200
HT-version, °C:	–	+40 to +300	+40 to +300
Temp. control,+40 to +100 °C, °C:	±0,5	±0,5	±0,5
+101 to +200 °C, °C:	±1,0	±1,0	±1,0
+201 to +300 °C, °C:	±1,5	±1,5	±1,5
Temp.variation in time,°C:	±0,25	±0,25	±0,25
Temp.variation in space, %:	±0,5	±0,5	±0,5
Temperature sensors:	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN
No. of temperatures:	1	4	6
No. of cells:	4	4	6
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:	4 x 2,4	4 x 2,4	6 x 2,4
Dimensions, inner, dia x h, mm:	100 x 300	100 x 300	100 x 300
Dimensions, external, w x h x d, mm:	760 x 500 x 510	760 x 500 x 510	960 x 500 x 510
Weight, kg:	45	55	74
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)
Power, W:	900	900	1300
Standards:	ISO 188 method A, IEC 60811-1-2 IEC 60216-4-3	ISO 188 method A, IEC 60811-1-2 IEC 60216-4-3	ISO 188 method A, IEC 60811-1-2 IEC 60216-4-3

Common specifications:

- The ovens perform well inside the apparatus requirements in ISO 188, IEC 811 and other equivalent standards.
- The ovens are controlled from a PLC (with a colour touch screen).
- 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 set point (PLC).
- Temperature indicator with sensor in each cell (PLC).
- 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 and IEC 811.
- 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).
- Microfilter for the air which removes 99,99 % of all particles over 0,1 µm.
- Also available as high temperature versions up to 300 °C.

Options

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

EC 11 Monitor Software.

ED 04 Computer, PC.

ED 06 UPS 1000 VA double converter.

Network cable.

Elastocon manufactures a range of ageing ovens for precision ageing of rubbers and plastics under controlled conditions. All ovens conform to ISO 188, IEC 811 and other technical equivalent standards.

The ovens are designed to give very low temperature variations in time and space, low or high air speed and controlled air exchange rate. Good control of temperature, air speed and air exchange rate have been shown to be very important to achieve good repeatability and reproduceability when doing heat ageing tests of polymer materials.

Research done in Sweden shows that the air speed is a very important factor, influencing the ageing results by increased evaporation of softeners and antioxidants and by increased oxidation at higher air speeds. Elastocon ageing ovens have a low air speed, dependant of the air exchange rate only, or specified high air speed (1 m/s) to allow tests to be performed investigating the influence of air speed.

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

Technical specifications, Test Tube Ovens/Cabinet Ageing Ovens

	EB 11-II	EB 28	EB 26	EB 27
Temperature range, °C:	+40 to +200	+40 to +200	+40 to +200	+40 to +200
HT-version, °C:	+40 to +300	+40 to +300	+40 to +300	–
Temp. control,				
+40 to +100 °C, °C:	± 1,0	± 1,0	± 0,5	± 0,5
+101 to +200 °C, °C:	± 2,0	± 2,0	± 1,0	± 1,0
+201 to +300 °C, °C:	± 3,0	± 3,0	± 1,5	–
Temp.variation in time,°C:	± 0,5	± 0,5	± 0,25	± 0,25
Temp.variation in space, %:	± 0,5	± 0,5	± 0,5	± 0,5
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:	1	4	1	1
Test Tubes:	24	4 x 6	–	–
Lag time. s:	–	–	–	800
Air speed, m/s:	–	–	1 ±0,5	0,001 to 0,02
Air changes, changes/hour:		–		
+40 to +200 °C, changes/hour:	–	–	7 or 14*1	3 to 200
+201 to +300 °C, changes/hour:	–	–	7 or 14*1	–
Useful volume, l:	–	–	50	120
Dimensions, inner,				
dia x h, mm:	–	–	450 x 450 x 250	550 x 550 x 400
Test Tube-dimensions				
dia x h, mm:	38 x 300	38 x 300	–	–
Dimensions, external,				
w x h x d, mm:	760 x 820 x 510	760 x 820 x 510	875 x 845 x 620	910 x 820 x 720
Dimensions, window,				
4 glass, mm:	–	–	200 x 300	200 x 300 (option)
Illumination of inner chamber:	–	–	24 V, 10 W halogen	24 V, 10 W halogen*2
Sample rod positions:	–	–	6	24
Sample rods:	–	–	12	12
No. of specimen:	–	–	36	–
Shelf position:	–	–	–	3
Shelves:	–	–	–	2
Weight, kg:	88	70	104	115
Voltage, V/phase/freq:	220–240/1/50 (110–120/1/60)	220–240/1/50 (110–120/1/60)	220–240/1/50–60 –	220–240/1/50–60 –
Power, W:	900	900	2 200	3 100
Connections:	–	–	–	Compressed air
Standards:	ASTM D865, ASTM D471, ISO 1817	ASTM D865, ASTM D471, ISO 1817	ISO 188 method B2	ASTM D5423 type 1 and 2, ASTM E145 type II A, ASTM D573

**1 preset by manufacturer*
**2 only available with the window option*

***Note:** Observe that EB 27 needs connection to compressed air for the air exchanges*

Common specifications:

- The ovens perform well inside the apparatus requirements in referenced standards.
- The ovens perform well inside the apparatus requirements in ASTM D865, ASTM D471 and ISO 1817 (EB 11-II, EB 28).
- 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 chamber is made of stainless steel.
- Temperature controller with 0,1°C setpoint (PLC).
- Solid state relay for safe control.
- Temperature indicator with sensor in the inner chamber.
- Temperature indicator with sensor in one test tube (EB 11-II), four test tubes (EB 28).
- Fixed over temperature fuse.
- The air speed is low and is dependent on the air exchange rate only (EB 27).
- Cooling channels in the casing for low surface temperature.
- Controlled cooling fan for the electronics cabinet.
- Indication of power failure.
- Run-time meter (PLC).
- Count up and down time (PLC).

Options

EB-P Ramp function for temperature settings in the PLC.
EB 04-AP, Access Port.
ED 04 Computer, PC.
ED 06 UPS 1000 VA double converter.
EC 11 Monitor Software.
Network cable.

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

Technical specifications, Cabinet Ageing Ovens

	EB 04-II	EB 10-II	EB 12-II
Temperature range, °C:	+40 to +200	+40 to +200	+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
+101 to +200 °C, °C:	±1,0	±1,0	±1,0
+201 to +300 °C, °C:	±1,5	±1,5	±1,5
Temp.variation in time,°C:	±0,25	±0,25	±0,25
Temp.variation in space, %:	±0,5	±0,5	±0,5
Temperature sensors:	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN	Pt 100, 1/3 DIN
Air speed, m/s:	<0,001	<0,001	1± 0,5
Air changes, changes/hour:	3 to 20	7 or 14*1	7 or 14*1
Useful volume, l:	60 (120)	60 (120)	50
Dimensions, inner, w x h x d, mm:	450 x 450 x 300 (550 x 550 x 400, 120 l)	450 x 450 x 300 (550 x 550 x 400, 120 l)	450 x 450 x 250
Dimensions, external, w x h x d, mm:	810 x 720 x 620 (910 x 820 x 720, 120 l)	810 x 720 x 620 (910 x 820 x 720, 120 l)	810 x 720 x 620
Dimension, window, 4 glass, mm:	200 x 300 (option)	200 x 300 (option)	200 x 300 (option)
Illumination of the inner chamber:	24 V, 10 W halogen*2	24 V, 10 W halogen*2	24 V, 10 W halogen*2
Sample rod positions:	15 (24, 120 l)	15 (24, 120 l)	15
Sample rods:	10 (12, 120 l)	10 (12, 120 l)	15
Shelf positions:	3	3	–
Shelves:	2	2	–
Weight, kg:	87 (115, 120 l)	86 (114, 120 l)	91
Voltage, V/phase/freq:	220–240/1/50–60	220–240/1/50–60	220–240/1/50–60
Power, W:	2 100	2 100	2 200
Connections:	Compressed air	–	–
Standards:	ISO 188 method A, IEC 60811-1-2 IEC 60216-4-1	ISO 188 method A, IEC 60811-1-2 IEC 60216-4-1	ISO 188 method B, ISO 4577

**1 preset by manufacturer*
**2 only available with the window option*

***Note:** Observe that EB 04-II needs connection to compressed air for the air exchange.*

Common specifications:

- The ovens perform well inside the apparatus requirements in ISO 188, IEC 811 ASTM D 3012 , ISO 4577 and other equivalent standards.
- Special design with controlled air exchange rate and low or high air speed.
- 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 (PLC).
- Solid state relay for safe control.
- Temperature indicator with sensor in the inner chamber.
- Fixed over temperature fuse.
- Fixed set air exchange rate of 7 or 14 changes per hour (EB 10-II, EB 12-II) or adjustable via flow meter (EB 04-II).
- The air speed is low and is dependent on the air exchange rate only, as specified in ISO 188 method A and IEC 811 (EB 04-II, EB 10-II).
- High and laminar air speed as specified in ISO 188 method B (EB 12-II).
- Cooling channels in the casing for low surface temperature.
- Controlled cooling fan for the electronics cabinet.
- Indication of power failure (PLC).
- Run-time meter (PLC).
- Countdown timer (PLC).

Options

EB 04-IIW, four pane glass window and lamp illuminating the inner chamber (for EB 04-II, EB 10-II and EB 12-II).

EB 04-IIDS, door sensor that turns off fan and heating when the door is opened (for EB 04-II, EB 10-II and EB 12-II).

EB 04-AP, Access Port.

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

EC 11 Monitor Software.

ED 04 Computer, PC.

ED 06 UPS 1000 VA double converter.

Network cable.

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

Information about ageing of polymers

Durability testing

The durability of polymer materials is affected by a number of environmental factors in combination with the mechanical stresses that are caused by the use of the product itself.

Influencing factors

It was well known from an early stage in the development of polymer materials that factors like heat, sunlight, oxygen in air and humidity in general accelerate the degradation of rubber. Mechanical loads, erosion,impurities, micro-organisms and other special influences occur depending on the application of the material.

Accelerated ageing

Normally there is no time to wait for a test under real conditions. It could in actual fact take decades to get the natural results. Accelerated ageing is therefore used. This means the factors that cause natural ageing are reinforced. This could take place both outdoors – in a desert or tropical rain forest – and indoors in ovens, climate chambers or weather simulators.

Unfortunately this is often done with no proper critical analysis. The ageing process is accelerated far too much. The material is literally grilled. The accelerating ageing process then becomes completely different from the natural process. The result is incorrect predictions of the actual durability.

The philosophy of ageing processes

The functional environment must first of all be carefully analysed, so that the most important degradation factors in each application are identified. Using the available knowledge, it is then determined how far the acceleration can be taken.

The available knowledge and facts are seldom sufficient in order to determine the maximum permissible acceleration or to translate the results into an exact number of years under real conditions.

The acceleration has therefore to be carried out in moderation and using rules of thumb.

If durability testing is to be carried out seriously, long testing times – a year is not uncommon – must be expected. It is surely always better to wait a long time for a more correct result than to get an incorrect one quickly.

What to remember about the ageing process

In all ageing processes it is especially important to keep a constant temperature and in certain cases a constant relative humidity in air. This is because the speed of a chemical reaction is roughly doubled for a temperature increase of 10 °C – and ageing is in most cases a chemical reaction.

Normally, the highest deviation of ±1 °C is allowed. In all ageing, and especially for long testing times (up to a year and more can occur), it is extremely important to be sure that the temperature has been maintained within the permitted tolerance during the whole testing procedure.

Another important factor is the flow of air. During the ageing process, the oxygen in the air is used up and degradation products are formed. In order to make the testing reproducible, the oxygen concentration must be kept at a constant level, and the degradation products ventilated off. In order to meet these requirements, the air must be changed between 3 and 10 times per hour. The device must therefore be equipped with an air supply and flow meters. The air speed must also be low otherwise the oxidation rate can increase and Plasticisers and antioxidants be ventilated off.

Ageing polymer

When rubber materials ages with time, this normally show it in increased stiffness and reduced elongation. Easily oxidised materials, as for example natural rubber, become softer for longer ageing times.

When a rubber material ages, among other things, the following reactions take place:

a) **Oxidative degradation,** caused by oxygen, which creates breaks in the polymer chain.

b) **Thermal degradation,** caused by thermal movements in the polymer chains,which cause breaks in the polymer chain.

c) **Additional cross-linking** caused by the remains of curing agents. In curing systems with high sulphur content, polysulphide and disulphide links can break up and form new crosslinks of the di- and nonosulphide type.

The changes in a polymer material when ageing can be examined by testing for several properties. The most common way to test the effect of ageing on a rubber material is to do a tensile test and measure the change in hardness.

The total ageing effects are most apparent in the decrease in elongation at break. The additional cross-linking is most apparent in the increase in hardness and increase in tensile strength.

Elastocon®

Elastocon AB
Tvinnargatan 25 • SE-507 30 Brämhult • Sweden
Phone: +4633-22 56 30 • E-mail: info@elastocon.se
www.elastocon.se