



ERIKS MTC: Material Technology Centre

Edition 2010

know-how makes the difference

ERIKS



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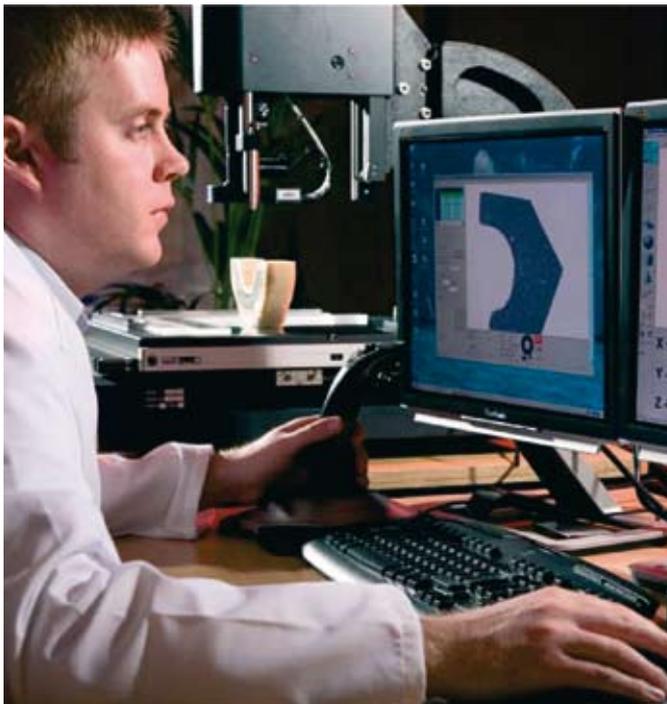
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The spirit that binds ERIKS

Every day at ERIKS we renew our commitment to a culture of continuous improvement in the engineering, design and manufacturing of seals, gaskets, hoses, elastomer parts and plastic parts.

The spirit that binds ERIKS is one of teamwork: common goals, shared enthusiasm for problem solving; and a passionate, company-wide belief that we can always make a positive difference.





ERIKS MTC: Material Technology Centre

ERIKS MTC advanced testing technology concept is a testimony to our commitment to the highest level of product quality and customer satisfaction possible.

ERIKS MTC

Through ERIKS MTC we can assure that customers requirements are met with:

- One of the most stringent quality assurance programmes in industry
- Material and dimensional certification
- Quality assurance can be documented to your specifications

Due to collaborations between our own lab-engineers and independent lab's we have the possibility to fine-tune all customer requests.

MTC has more testing facilities and highly qualified engineers for CAD design and FEA analysis programs.

We define different types of test-facilities for:

- O-rings and rubber parts
- Oilseals
- Mechanical seals



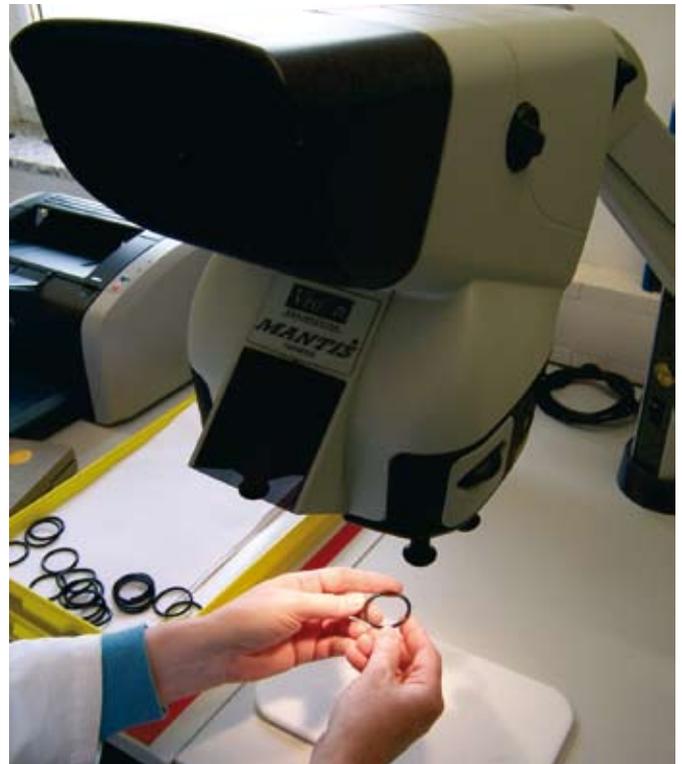


O-rings and rubber parts

ERIKS MTC has different capabilities to test and measure following international specifications.

We have capabilities to test and measure:

- Hardness
- Compression Set
- Tensile Strength
- Chemical and Heat ageing
- Ozone Resistance
- Material Composition
- Dimensional Measurements
- Surface Defects
- Material properties at temperatures from -70 °C to 300 °C
- Tests run to ASTM, DIN and ISO standard....
And to customer specific requirements





O-rings and rubber parts

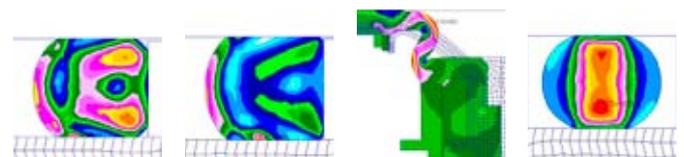
ERIKS MTC has the capabilities to measure hardness based on different international norms.

Testing of Hardness

The common method for hardness testing of rubber parts is Shore A. On O-rings or moulded parts the microhardness in IRHD is more specific. The drawing below shows the two methods.



The IRHD is measuring on a 2 mm sheet during 30 seconds. The Shore A is measured on a 6 mm sheet during 3 seconds. The first method is very sensitive for surface imperfections. The second method is difficult for measuring at small cross-sections.





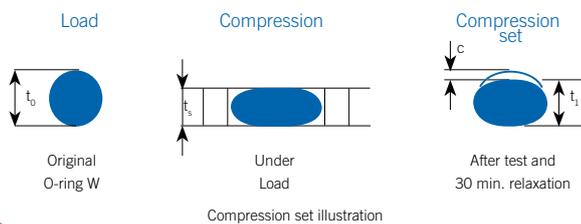
O-rings and rubber parts

Compression Set

This chapter discusses the next criteria that must be considered like compression set, hardness, tensile strength, chemical compatibility, thermal effects, pressure, and extrusion. Data and procedures enabling the designer to meet particular requirements or obtain specific performance from the seal will be found in this chapter.

Compression Set

In designing an O-ring seal, it is important to determine the compound early, as the compound selected may have an influence on the gland design. The application determines the rubber compound, the primary factor being the fluid to be sealed. But the elastomer must also resist extrusion when exposed to the maximum anticipated pressure and be capable of maintaining good physical properties through the full temperature range expected.



Compression Set and Compression

Compression set is the percentage of deflection that the elastomer fails to recover after a fixed period of time under a specific compression and temperature. Compression set is a very important sealing factor, because it is a measure of the expected loss of resiliency or “memory” of a compound. Compression set is generally determined in air and measured as a percentage of original deflection. Although it is desirable to have a low compression set value, this is not so critical as it might appear because of actual service variables. For instance, an O-ring may continue to seal after taking a 100% compression set, provided the temperature and system pressure remain constant and no motion or force causes a break in the line of seal contact. Also, swelling caused by contact with the service fluid, may compensate for compression set. The most severe condition is the combination of high compression set and shrinkage. This will lead to seal failure unless exceptionally high level of compression is employed. Compression set is calculated as follows:

$$C = \frac{t_0 - t_1}{t_0 - t_s} \times 100 \%$$



O-rings and rubber parts

- Tensile Strength and elongation
- Chemical and Heat Aging
- Ozone resistance

Tensile Strength and elongation

We have the highest specification test equipment available that allows us to accurately determine the following properties for any elastomeric material.

- Tensile Strength
- Stress-Strain relationship
- Elongation at Break
- Compressive Strength
- Hysteresis
- Creep

Our Tensometer is a two column design that eliminates any flexing of the test rig that could corrupt test results. We measure elongation using laser technology that allows us to measure true elongation of the test piece without contact issues.

Furthermore we have an environmental chamber that allows us to perform these tests at any temperature from -70 degree C up to 300 degree C and so replicate conditions of the real world application.

In conjunction with chemical and heat ageing we use tensile testing to enable us to better predict the performance of a material over time under real world conditions.

Chemical and Heat Aging

Chemical compatibility tests allow us to identify suitable materials for specific applications. We have the capability to test materials in different liquids at temperature from -40 degree C up to +300 degree C.

As with all our tests we can perform to all recognised international standards or to individual customer specific criteria.

Typical chemical resistance tests include - but are not limited to - changes in hardness, volume, compression set and tensile strength.

Ozon resistance

Often overlooked ozone can have a significant impact on the life of elastomers. Electrical devices (such as electrical motors) produce high concentrations of ozone, and high levels can also be created by climatic conditions.

To identify elastomers with the best Ozone resistance we run tests to recognised international standards such as ISO143-1.



O-rings and rubber parts

Material Composition

There are 5 techniques we commonly use for identifying material composition:

1. Fourier Transform Infra-red Spectroscopy (FTIR)
2. Thermogravimetric analysis (TGA)
3. Coupled TGA with FTIR
4. Scanning Electronic Microscope (SEM)
5. Differential Scanning Calorimetry (DSC)

1. Fourier Transform Infra-red Spectroscopy (FTIR):

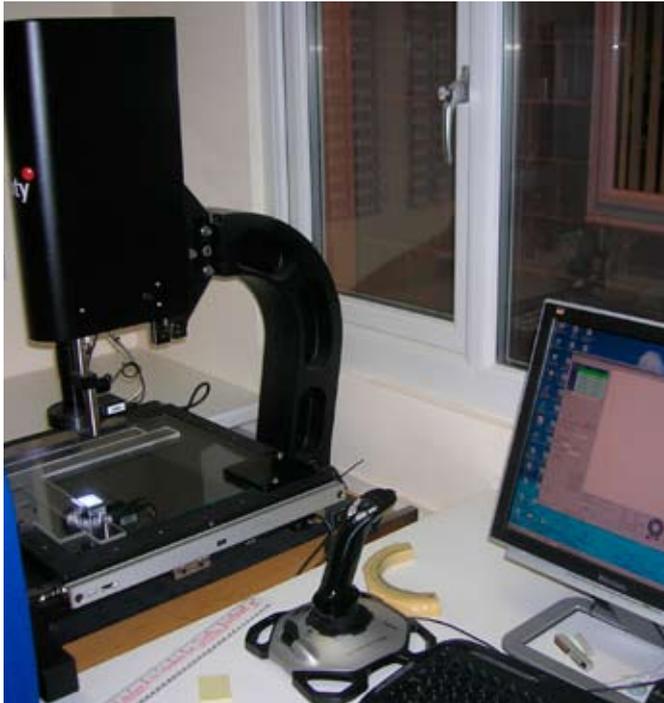
Infrared spectroscopy exploits the fact that molecules have specific frequencies at which they rotate or vibrate corresponding to discrete energy level. Therefore by exposing a material sample to a spectrum of infra red frequencies the equipment can detect which frequencies are absorbed by the material and thereby identify which molecules are present.

The benefit of this technique is that it is very quick and requires minimal sample presentation. The limitation of this method is that it is not as sensitive as other techniques. This technique is primarily to identify the base material properties and for batch to batch quality control checks.

2. Thermogravimetric Analysis (TGA):

This test is performed on samples to determine change in weight in relation to change in temperature. As each molecular chain will break down at a specific temperature this equipment is able to accurately determine how much weight loss occurs at a precise temperature and thereby identify the type and percentage of weight of each molecule present in the compound.

This test is used to identify type and percentage weight of molecules in the compound. However as different molecules break down at very similar temperatures it is not always easy to identify specific elements. Therefore it is most usual that we compare the weight loss vs. temperature profile of a sample against a known reference to identify the material composition.



O-rings and rubber parts

Material Composition

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5. Differential Scanning Calorimetry (DSC)

3. Coupled TGA with FTIR:

To more accurately establish the composition of a unknown material we couple the TGA with an FTIR. In this set up the gas burnt off the material in the TGA is passed through the FTIR.

As the elements in the gas are pure (pyrolised) the sensitivity of the FTIR is enhanced and allows us to make a more accurate identification of what type and quantity of elements make up the compound.

4. Scanning Electronic Microscope (SEM):

This technique involves a high voltage electron beam emitted by a cathode and focused by a group of electrostatic and electromagnetic lenses. As this beam is transmitted through a specimen it carries information about the inner structure of the specimen to the imaging system of the microscope

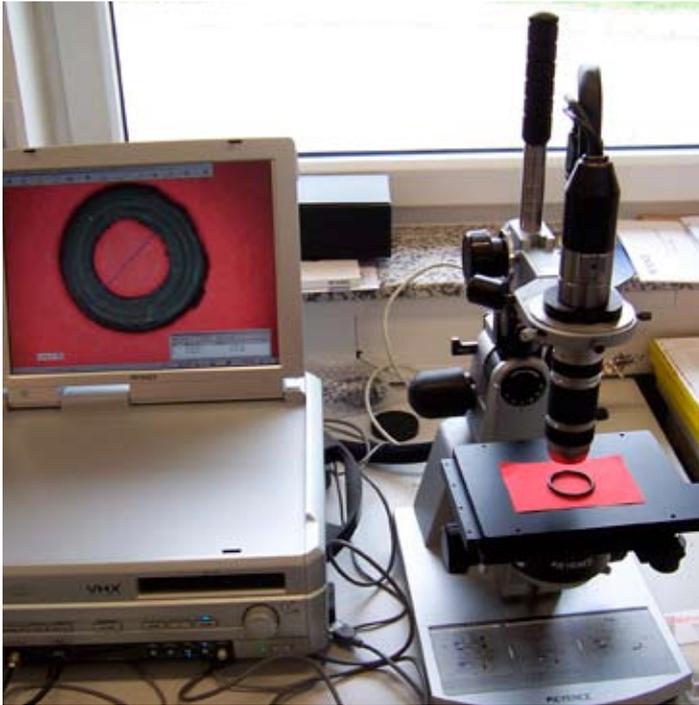
This technique not only allows us to identify specific elements in the material but also allows us to examine the structure and dispersion of elements within the material.

The main benefit of this analysis over the previous techniques is that it allows us to better analyse inorganic elements and to look at the homogeneity of the material. However it is relatively expensive and requires significant sample preparation.

5. Differential Scanning Calorimetry (DSC):

The basic principle underlying this technique is that, when a sample undergoes a physical transformation such as phase transitions, more (or less) heat will need to flow to it than for a reference to maintain both at the same temperature. For example, as a solid sample melts to a liquid it will require more heat flowing in to it to increase its temperature at the same rate as the reference

We mainly use DSC to analyse to establish the low temperature brittleness of elastomers.



O-rings and rubber parts

Dimensional Measurement

- Basler Inspection
- Cross-section measurement
- Visual and CMM dimensional measurement
- Surface Defects

Basler inspection machine on surface defects: 100% inspection of O-rings:

Via the Basler inspection machine the tolerances and the surface imperfections are controlled by a camera system.

Cross-section measurement:

Via a laser controlled system the cross-section is controlled automatically.

Combined Visual and CMM dimensional Measurement System:

We utilise state of the art computer controlled measurement systems to precisely measure components. Using a combination of visual edge detection and CMM probes we can accurately measure the shape of the most complex mouldings.

This equipment is used for quality control purposes, failure mode analysis and allows us to measure complex shapes and automatically generate engineering drawings for a component.

Surface Defects

Our Finite Element Analysis capability allows us to provide an accurate mathematical prediction of seal performance. This technology allows us to model seal performance on the computer and ensure right first time solutions to sealing applications.

The type of analysis we undertake can be as simple as that of calculating the maximum force required to insert a seal or as complex as predicted a seals performance after many years of service.

We undertake customer specific projects that can combine our material testing and dynamic testing capabilities, in conjunction with FEA prediction, to provide data that provides a high level of confidence the seal will retain its integrity over the designed life of the application.





Oilseals

Pioneer Weston's Technical support is key to our growth and differentiation from our competitors. As part of the technical support is our ability to test the seals. Our test capabilities are based upon being able to re-create the variables of the application that are critical to the seal.

Rotary Seal Test Capabilities

We possess some of the most advanced capabilities available for testing the performance of Rotary Seals.

We run test programs to SAE standard specification, our own demanding internal validation standard, customer specific requirements and special test programs for development projects or competitor benchmarking.

We currently have 3 standard test rigs, each housing 2 test spindles that can be individually configured for different seal types, sizes, speeds and test conditions.

For long term testing we also have a Durability Test Rig that is capable of driving 4 spindles, each spindle being capable of testing 6 seals, allowing us to test up to 24 seals simultaneously.

Summary of standard test capability

Maximum Seal OD	: 400mm
Speed	: Max 7,000 RPM
Rotation	: Clockwise/Anti-clockwise
Orientation	: Shaft or Housing Rotation
Pressure	: 0-10 bar (Water, Oil & Air)
Temperature	: 80 – 200 deg C
Shaft Eccentricity	: Adjustable up to 1mm
Housing Offset	: Adjustable up to 2mm
Torque Measurement	: Max 20 Nm
Data Logging	: Speed, Temperatures & Pressures
Environmental	: Slurry, Dust, Water





Oilseals

Key Facts regarding standard test rigs

Pioneer Weston's Technical support is key to our growth and differentiation from our competitors. As part of the technical support is our ability to test the seals. Our test capabilities are based upon being able to re-create the variables of the application that are critical to the seal.

Seal Capacity

The biggest seal size that we can accommodate on our test rigs is 400 mm.

Drive Configuration

Drive is provided by individual electric motors driving a spindle through a pulley and V belt drive. Speed is controlled by a local PLC, with up to 4 running speed conditions being programmable on any rig, and with 2 test spindles having no restrictions on number of speed conditions that can be programmed.

The maximum Speed/ Torque range for each spindle is determined by selection of pulley ratios.

The rigs can be configured to either rotate the spindle (the most common orientation) or to rotate the housing (primary required by axle seals).

All spindles can be rotated in a clockwise and anti-clockwise direction.

Shafts and Housing

Our test rigs allow us to adjust the housing offset by up to 2mm, and our shaft are designed to be adjustable so that we can also adjust the shaft eccentricity by up to 1 mm. The reason for building in this level of adjustment is to allow us to replicate real world conditions and find out at what extremes in which seal failure will occur. As most of our testing is for OEM applications with non standard seal dimensions it is usual that we will machine new test shafts and housings for each test.

Rotational Speed

The Test rig spindles are capable of running up to 20.000 RPM when fitted with ceramic bearings. The spindles can be run in both clockwise and anti-clockwise directions, and can be automatically reversed as part of the programmed test cycle.

Pressure

We have some test spindles fitted with housings that allow us to dynamically test seals at pressures of up to 10 bar. These spindles and associate housings and fittings are made from stainless steel and are specifically designed to be used with water (but are equally suitable for air & oil) and allow us to dynamically test pump seals in real world conditions.



Oilseals

Key Facts regarding standard test rigs

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Temperature

All test spindles can be connected to an oil heater and we can control bulk oil temperature between 80°C and 200°C.

Torque Measurement

Our test spindles are equipped with torque transducers capable of measuring start up and rotational torques of up to 20 Nm.

Data Acquisition

All our test rigs are set up for data logging and can record speed and multiple pressures and temperatures.



Environmental test set-up



Abrasive testing using sharp sand



Side view: Slurry Testing using
Abra dust slurry



Top view: Slurry Testing using
Abra dust slurry



Oilseals

Key Facts regarding standard test rigs

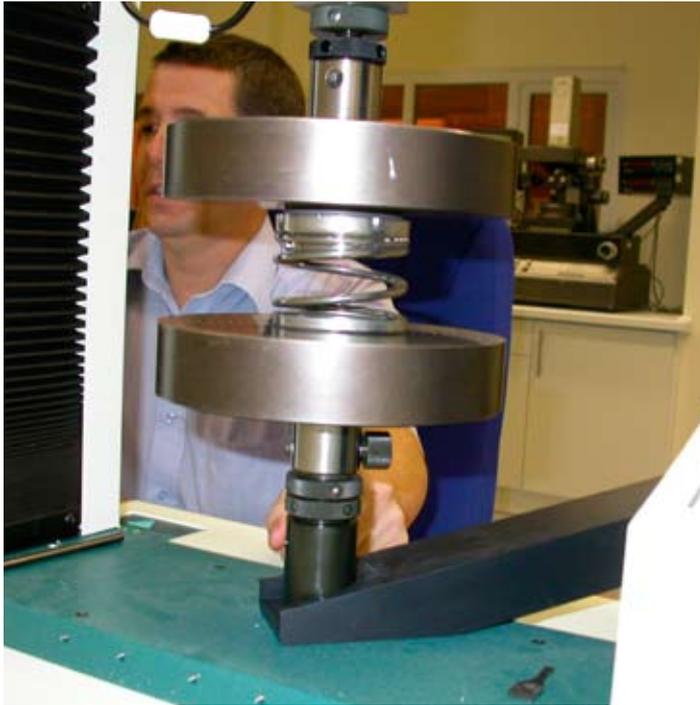
The Durability Test Rig is contained within its own room and is specifically designed for running long term tests.

Durability Test Rig

The Test Rig consists of two x 3kW motors each individually controllable through local PLC. Each motor can drive 2 x Spindles. Spindles and housing can be made to run up to 6 seals simultaneously and we can run different size seals on the same spindle.

This test rig is also used to test seals in customer components such as pumps and we have capability to simulate pressure and vacuum to simulate real world load cycles

The facility is equipped with data logging so that speeds, temperatures and pressures can be continually recorded.



Mechanical Seals

We offer extensive capabilities for testing all aspects of mechanical seal design.

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Extensive Capabilities

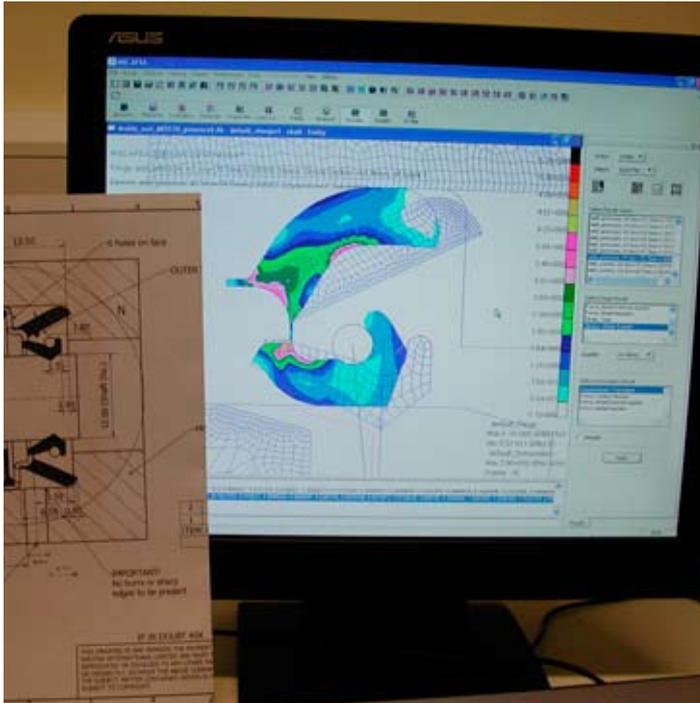
Dimensional Tolerances are measured using non contact visual inspection and cmm systems to an accuracy of 0.001 mm.

We have a range of material analysis techniques for identifying the composition and monitoring quality of face seal material and elastomers, these techniques include Thermo Gravimetric Analysis, Electron Microscopy and Infra Red Spectrometry.

Spring characteristics are measured using a tensometer and our dynamic test rigs are used to simulate accelerated real world operating conditions. Our test rigs are fully data logged and can be programmed to run different combination of variable pressure, temperature and speed, and to run repeat stop-start cycles to accelerate wear rate.



Passion for technology



FEA: Finite Element Analysis

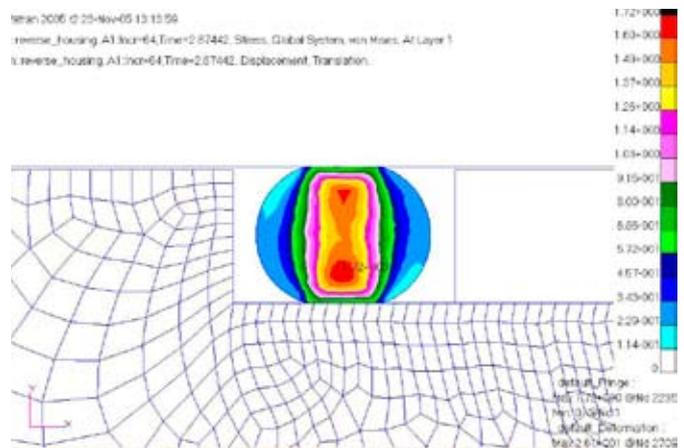
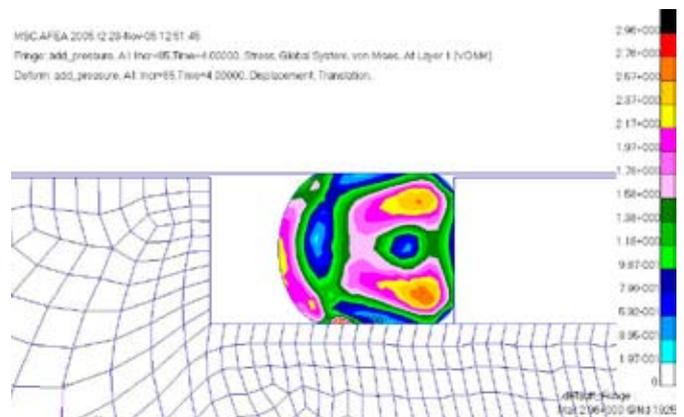
We undertake customer specific projects that can combine our material testing and dynamic testing capabilities

Finite Element Analysis (FEA):

Our Finite Element Analysis capability allows us to provide an accurate mathematical prediction of seal performance. This technology allows us to model seal performance on the computer and ensure right first time solutions to sealing applications.

The type of analysis we undertake can be as simple as calculating the maximum force required to insert a seal or as complex as predicting seals performance after many years of service.

We carry out customer specific projects that can combine our material testing and dynamic testing capabilities, in conjunction with FEA prediction, to provide data that provides a high level of confidence that the seal will retain its integrity over the designed life of the application.





Clean Room

- Flexible
- Reliable
- Fast
- Efficient
- Certified

A Clear Vision on Clean Products

Due to a growing awareness in the field of purity, industry focuses more and more on effectively controlling manufacturing processes. The goal is to prevent technical components from being the cause of pollution in processes and systems. Pollution can originate from airborne solid particles, which can be visible or invisible. These particles are called aerosols. To avoid this type of pollution is an important factor in the pharmaceutical, semiconductor and food industry.

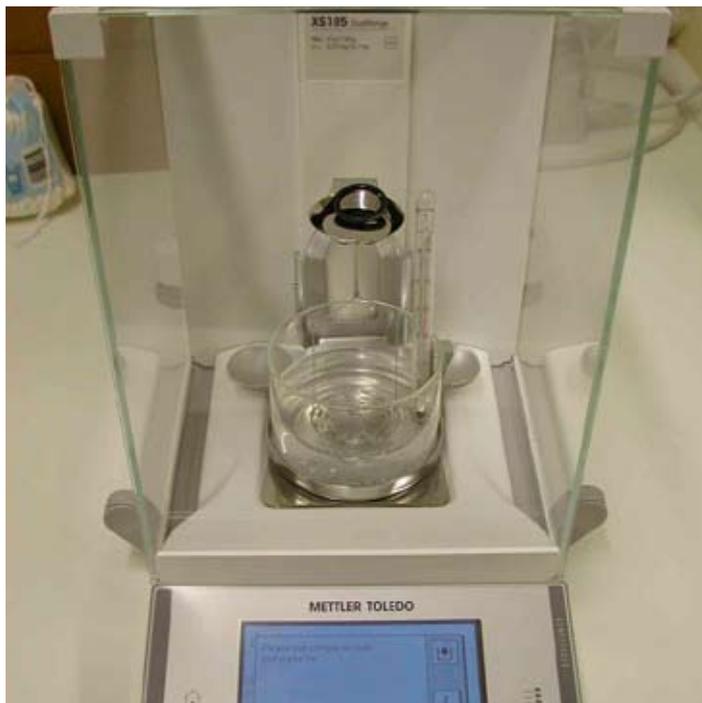
ISO class 7

The size of a human hair is 100 μm on average. Nowadays it is possible to filter up to 0.5 μm with very good results and relatively little effort. This filtering takes place in the cleanroom. This sealed space is filled with air in which only a limited number of particles with a size of about 0.5 μm are accepted to float inside clean room. The current standard for the industry is ISO 14644-1. Within this standard, ERIKS uses ISO class 7 (also known as class 10,000) for the clean room. The cleaning and packing takes place in an even tighter class 100 environment which is accepted by 90% of the industry.

Clean room cleaning and packing

ERIKS is fully equipped to take over your cleaning and packing activities in its own clean room.

Out-gassing of rubber products by means of vacuum ovens is also an added ERIKS-value to the market.



EC1935/2004 Extraction Test



Extraction Test Criteria

MTC can perform migration test with Soxhlet apparatus as shown in photo 1. According to European law EC1935 if rubber articles intended for repeated use in contact with food, the following extraction test criteria must be met.

1. For contacting with aqueous foods, the finished form of rubber articles when extracted with distilled water at reflux temperature shall yield extractives not to exceed 20 milligrams per square inch during the first 7 hours of extraction, nor to exceed 1 milligram per square inch during the succeeding 2 hours of extraction.

2. For contacting with fatty foods, the finished form of rubber articles when extracted with n-Hexane at reflux temperature shall yield extractives not to exceed 175 milligrams per square inch during the first 7 hours of extraction, nor to exceed 4 milligram per square inch during the succeeding 2 hours of extraction.





ERIKS Corporation Opens US Based Technical Center

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ERIKS Corporation opens US Application Technology Center

ERIKS USA Corporation opened the doors in mid 2009 to its Rocklin, California based Application Technology Center. The new facility, which is managed by Greg Pfister, ERIKS Director of Engineering, is part of an advanced growth strategy in the America's targeted at increasing our value to our customer base. As companies have been forced to consolidate and responsibilities have increased, ERIKS is in the position to become a valuable resource and an extension to your engineering department with our subject matter expertise on sealing solutions. We provide engineering and design services, compound development and failure analysis at the technical center.

For our customers and new prospects alike, ERIKS Technical Center focuses on three main competencies:

- **Materials:** For situations with difficult media, environmental and pressure requirements, the Technical Center has the capability and personnel to develop custom thermoplastic and elastomeric compounds.
- **Seal Design:** Utilizing state of the art software and technology, the Technical Center can work with your engineering department to analyze your requirements and come up with a unique design suited to your application.
- **Seal Analysis:** With our investment in advanced analysis equipment, The Technical Center has performed dozens of seal failure reports, material tests, immersions and seal aging scenarios for many of our key customers and prospects.



Passion for technology

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know-how makes the difference

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