Refrigerant-Ready Elastomers

NEXT-GEN MATERIALS TO FUTURE-PROOF HEATING AND COOLING APPLICATIONS

The future of refrigerants

The heating, ventilation, air conditioning and refrigeration (HVACR) industry is undergoing a major transformation as it balances environmental responsibility, safety and system efficiency. Trelleborg's innovative solutions play a key role in supporting this shift by delivering advanced sealing technologies that ensure performance in the changing landscape.

Changing global regulations, evolving refrigerant chemistries, and an increased focus on energy efficiency are reshaping compressor design and material requirements. Refrigerants have progressed from early natural options to synthetic solutions and now toward next-generation refrigerants such as hydrofluoroolefins (HFOs), lower-global warming potential hydrofluorocarbons (low-GWP HFCs) and blended alternatives, alongside renewed interest in natural refrigerants like hydrocarbons, ammonia and CO_2.

These shifts introduce new challenges for HVACR and automotive original equipment manufacturers (OEMs). Materials must withstand aggressive refrigerant and lubricant combinations, extreme operating temperatures, and offer a long service life, especially in hermetically sealed compressor systems. At the same time, manufacturers must prepare for future regulatory pressure, including potential per- and polyfluoroalkyl substances (PFAS) restrictions, while ensuring performance, durability and system efficiency are not compromised.

PARTNERING TO NAVIGATE A NEW LANDSCAPE

Trelleborg Sealing Solutions partners closely with OEMs to navigate this rapidly evolving refrigerant landscape. With deep material expertise, global resources and a strong understanding of refrigerant chemistry, we help our customers identify elastomer solutions that meet today's requirements while preparing for tomorrow's regulations.

Collaboration is at the core of our approach. From early material selection and application design to validation testing and system optimization, our engineers work side-by-side with you to develop reliable sealing solutions. This partnership gives OEMs confidence when designing new systems or retrofitting existing compressors for next-generation refrigerants, electrified platforms and higher-efficiency designs.

Collaborative engineering & testing support

Future-ready materials

Proven refrigerant compatibility

System reliability & efficiency

REFRIGERANT-READY ELASTOMERS

Engineered for demanding heating and cooling environments, our portfolio of refrigerant-ready elastomers delivers reliable performance under extreme conditions. They resist swelling, hardness changes and weight variation when exposed to refrigerants and lubricants, all while maintaining mechanical integrity over long service lives. This is especially critical in fully hermetic systems, where seals cannot be serviced once installed.

We have conducted extensive refrigerant compatibility testing, aligned with ASHRAE specifications, to evaluate elastomers in current and future refrigerants, lubricants and challenging combinations. The results highlight that no single elastomer fits all applications. A robust portfolio is essential to meet the diverse demands of modern HVACR systems. With validated ethylene propylene diene monomer (EPDM), hydrogenated acrylonitrile butadiene rubber (HNBR), chloroprene rubber (CR) and fluorocarbon (FKM) materials, we support OEMs across a wide range of refrigerant technologies, including natural and fluorinated options.

Features and benefits

- Low swell and low extractability in refrigerants and lubricants
- Stable mechanical properties over long service life
- Proven performance across wide temperature ranges from -30 °C to +150 °C/-22 °F to +302 °F and beyond
- Compatibility with HFOs, HFCs, blends and natural refrigerants
- Options for applications requiring electrical resistivity
- Validated by in-house immersion and extractability testing
- Available in O-Rings, custom-molded elastomers and vibration-damping components
- Backed by global engineering, testing and application support

CONTACT YOUR CUSTOMER SOLUTION CENTER

Do your heating and cooling systems require next-generation refrigerants? Facing environmental responsibility, safety and system efficiency or regulatory challenges?

Connect with your local Trelleborg Sealing Solutions Customer Solution Center for expert support in material selection, testing and application design tailored to your needs and requirements.

www.trelleborg.com/seals/contact-form

Material portfolio

As refrigerant chemistries, lubricants and system designs continue to change, no single material can meet every requirement. Our diverse, validated portfolio enables OEMs to balance refrigerant compatibility, durability, efficiency and regulatory compliance across a wide range of applications. Trelleborg engineers partner with you to select the optimal material for your application to ensure the best possible solution for your specific needs.

HNBR materials

Heat-resistant with long-term stability

Our HNBR materials are engineered for demanding HVACR and automotive applications, delivering strong fluid compatibility with hydrocarbon-based, CO_2 and selected fluorinated refrigerants, as well as polyolester (POE), polyalkylene glycol (PAG) and mineral oil (MO) lubricants. These compounds support a wide operating temperature range from -40 °C to +150 °C/-40 °F to +302 °F and beyond.

- **H7T85:** 70 Shore A material with superior low-temperature flexibility
- **574CX:** 70 Shore A grade standard material for custom-molded shapes

FKM materials

Engineered for extreme environments

Known for their stability in challenging environments, our FKM materials offer broad compatibility with lubricants, hydrocarbon-based, CO_2 and selected fluorinated refrigerants. These properties make FKM a strong option in high-temperature or automotive thermal management scenarios.

- **V8T38:** Ideal for applications requiring high-temperature performance and chemical compatibility
- **V9T82:** Engineered for demanding pressure environments, and uniquely suited to withstand rapid gas decompression (RGD)

EPDM materials

Cost-effective with proven compatibility

Our EPDM materials offer a well-balanced combination of chemical stability, durability and versatility. With broad compatibility across HFCs, HFOs, refrigerant blends and CO_2, EPDMs demonstrate low extractability and controlled swell to provide reliable sealing performance.

- **E7526:** 70 Shore A material offering exceptional low-temperature flexibility
- **E9H06:** 90 Shore A material engineered specifically for RGD resistance and applications requiring electrical resistivity
- **560NG:** 70 Shore A material delivering high heat resistance
- **ECT8V:** 75 Shore A material offering excellent low-temperature performance, ideal for automotive applications

CR materials

Reliable with broad chemical compatibility

Offering stable sealing behavior our CR materials are engineered for temperatures from -40 °C to +120 °C/ -40 °F to +248 °F and provide excellent compatibility with fluorinated gases, hydrocarbons and CO_2 refrigerants, as well as POE, PAG and MO lubricants.

- **482HX:** Low-extractable CR

PRODUCTS & APPLICATIONS

Next-generation refrigerants, electrification and higher efficiency targets are driving new demands in heating and cooling technology. We support a wide range of applications with elastomer solutions engineered for refrigerant compatibility, durability and long service life.

- **Compressors:** Elastomer materials deliver proven performance across all major compressor types, including scroll, rotary, centrifugal, screw and reciprocating designs. They provide long service life in compact, hermetic designs and excellent chemical compatibility and stability under diverse pressure and temperature conditions.
- **Valves:** Elastomer solutions ensure dimensional stability for precise refrigerant flow control and system efficiency.
- **Sensing equipment:** Engineered sealing materials support modern HVACR sensors, maintaining accuracy and functional reliability in critical measurement environments.
- **Automotive thermal management systems:** Offering compatibility with coolants and lubricants, specialized seals designed for engine cooling and thermal management applications combine high-pressure, high-speed and low-friction performance.

Product portfolio

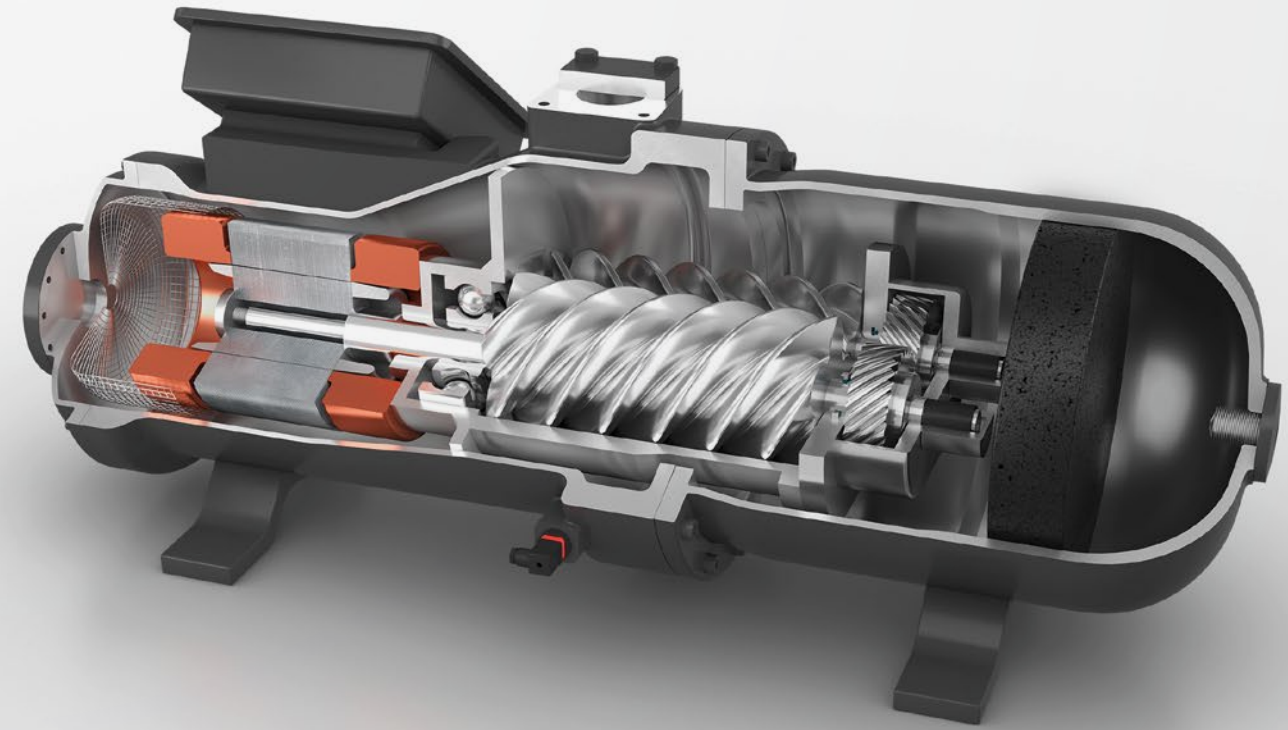
We offer a broad range of proven sealing products for heating and cooling applications. Typical products include:

- O-Rings
- Custom-molded components
- Square rings
- Multicomponent elastomer-to-metal bonded parts
- Noise-vibration dampers

GLOBAL MATERIAL COMPOUNDING & MANUFACTURING

Local solutions to support near-sourcing strategies worldwide

We provide local and regional compounding and manufacturing across all polymer families, supporting your near-sourcing efforts. This global capability reduces lead times and improves supply security, with no compromise on material performance or quality. Elastomer components are manufactured close to your operations, ensuring local availability of final sealing solutions.



Proven performance

At Trelleborg, our in-house R&D capabilities drive the development of cutting-edge polymer solutions tailored to tackle complex industrial challenges. By combining advanced material science with a commitment to innovation, we deliver proven results that enhance performance and reliability across diverse heating and cooling applications.

ELASTOMER TESTING PROGRAM

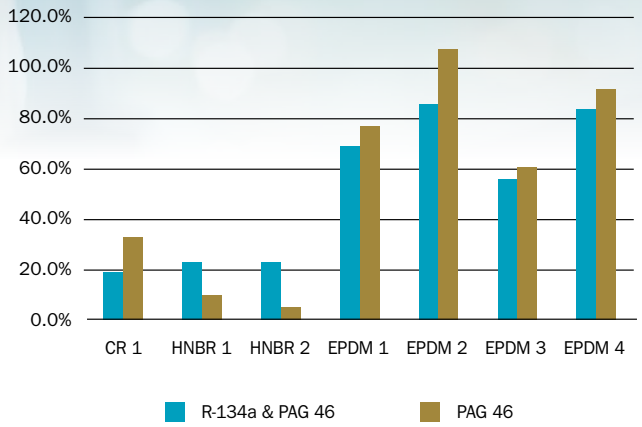
Validating refrigerant-ready elastomers

To ensure optimal performance in current and future refrigerants, lubricants, and challenging fluid combinations, we conduct rigorous in-house testing. Our advanced screening methods, aligned with modified ASHRAE standards, evaluate material behavior under intense thermal and chemical stress conditions. This data-driven approach replicates real-world operational demands, ensuring material selection is based on proven performance and long-term reliability for your most demanding sealing applications.

We conduct testing utilizing a single refrigerant or lubricant or a combined lubricant and refrigerant mixture. The process exposes elastomer materials to HFCs, HFOs, blends, hydrocarbons and lubricants at extreme temperatures ranging from +70 °C to +100 °C/+158 °F to +212 °F over a 14-day period. Following exposure, our material scientists analyze critical properties to assess compatibility and long-term sealing performance, including:

- **Volume change**
- **Hardness shift**
- **Mechanical properties**
- **Compression set**

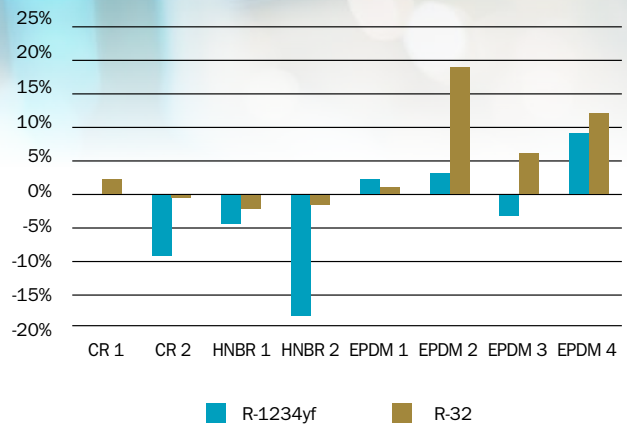
Volume change following lubricant and refrigerant exposure



To assess elastomer compatibility, materials were exposed to PAG lubricant and R-134a refrigerant at elevated temperatures for 14 days. Conducted in our in-house laboratory, this rigorous test fully submerges the elastomer in lubricant and subjects it to both vapor and liquid refrigerant.

The results indicated that EPDM and CR experienced less volume swell when R-134a was mixed with the lubricant. Conversely, HNBR performed best when exposed to 100% PAG lubricant. This data demonstrates that fluid composition is a critical factor for elastomer compatibility in refrigeration applications.

Tensile strength shifts after refrigerant exposure



To evaluate mechanical stability, we measured the tensile strength of our materials before and after refrigerant exposure. The data reveals robust overall performance, with only minor mechanical shifts across our elastomer portfolio. EPDM grades show a slight increase in tensile strength, while HNBR and CR experience a controlled reduction. These results highlight the importance of optimal polymer selection to ensure long-term safety and mechanical reliability in demanding refrigerant environments.

Our specialized test vessels evaluate elastomer compatibility with modern refrigerants and lubricants under strictly controlled conditions to ensure precise, data-driven material selection for the most demanding heating and cooling applications.

COLLABORATIVE CUSTOM TESTING

At Trelleborg, our specialized in-house material laboratory and skilled R&D team provide customer-specific testing upon request for refrigerant systems, heating and cooling applications and compressor components.

Our advanced testing capabilities allow us to tailor precise test conditions to your unique requirements, including customized temperatures, refrigerant and lubricant fluid combinations and exposure durations. We also customize output parameters to support your strict product qualification and development goals, delivering targeted evaluations of compression set, volume change, hardness and mechanical properties.

Trelleborg is a world leader in engineered polymer solutions that protect essential applications in demanding environments. Its innovative solutions accelerate performance for customers in a sustainable way.

Trelleborg Sealing Solutions combines deep materials and applications expertise with close customer collaboration to fulfil our mission as a leading provider of precision seals, bearings and custom polymer components. We focus on meeting the most demanding needs of aerospace, food and beverage, semiconductor and general industrial customers.

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