

# Polymer Products for Compressor Applications



**CDI**  
PRODUCTS®

A Michelin Group Company



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## Why Compressor Manufacturers Should Consider CDI.

### Custom Engineered Polymer Components for Compressors

Our expansive portfolio of high-performance polymeric materials and on-site engineering and design expertise offer our customers an invaluable resource for transforming advanced engineering materials into high-performance solutions. Our range of materials enables compressor manufacturers to improve reliability, enhancing efficiency and savings in life cycle costs.

### Compressor Improvements Increase Component Demands

The reciprocating compressor industry dates back nearly 200 years, but advancing capabilities and improvements in both performance and reliability, mean that quality components for compressors are increasingly more critical.

The efficiency and reliability of reciprocating compressors have been enhanced by the application of engineered polymeric & thermoplastic materials for critical sealing components. As we continue to push the limits of compression, more advanced materials and innovative seal designs are required to achieve these increasing demands.

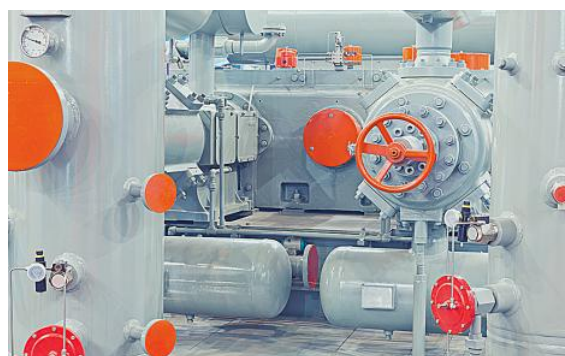
### Extensive Materials Catalog

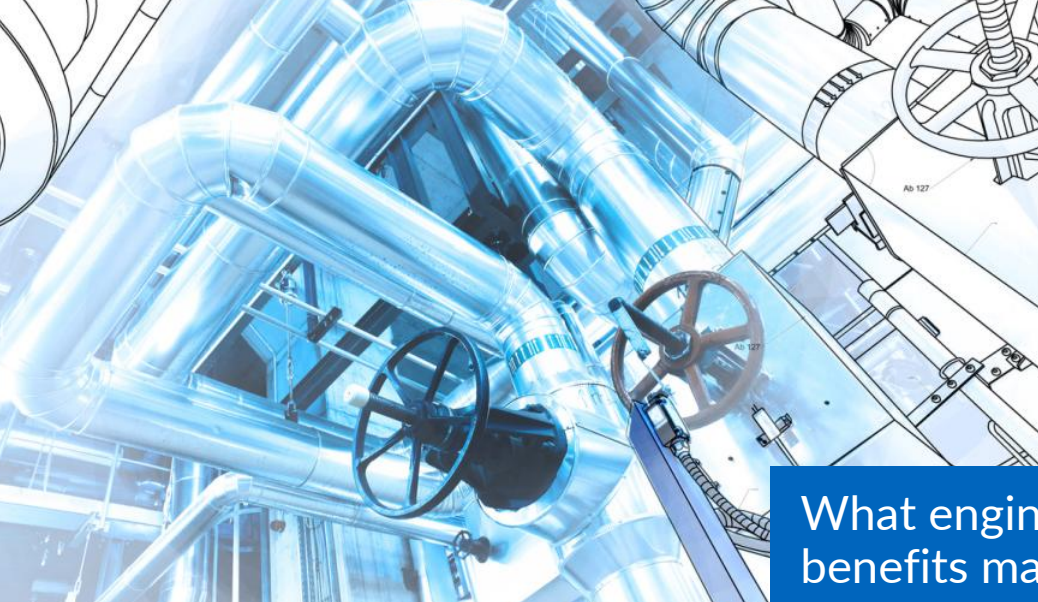
By upgrading to carefully selected engineered polymer materials, compressor performance can be increased without sacrificing reliability. CDI's portfolio of materials offers some of the most advanced engineered polymer materials available today for use in piston rings, wear bands, packing rings, wiper rings, and spring-energized seals.

**Greater reliability and life cycle cost savings**

Material development is enhanced by our ability to perform thorough in-house mechanical and tribological testing of raw, blended material and finished components.

- Differential Scanning Calorimetry (DSC)
- Thermogravimetric Analysis (TGA)
- Fourier Transform Infrared Spectroscopy (FT-IR)
- Thermomechanical Analysis (TMA)
- Wear Testing (ASTM 3702)
- Physical and Mechanical Properties Testing





## What engineered polymer design benefits make CDI material the ideal choice?

CDI's engineered polymers are designed and blended to achieve specific properties and functionalities to meet the demands of various compression applications. CDI use various monomers to form our long chain polymers, allowing us to enhance desired characteristics within our materials, such as, wear resistance, strength, flexibility, heat resistance, and chemical resistance. Each batch of CDI blended material is tested in our state of the art lab to ensure the material properties meet or exceed our customer's needs for their specific application.

### CDI material advantages

- Increased compressor efficiencies
- Greater component reliability
- A broad selection for a multitude of applications
- Longer product life and less leakage
- Optimized for high-demand operating conditions
- Lower MTBF and reduced maintenance
- Significant life cycle cost savings

## What makes us unique?

### Engineered Polymers

Since we design and specify our compounds, we have superior control over the properties and performance of our materials. The broadest range of polymer manufacturing and processing methods enables us to use the most appropriate method per application.

### Custom Compounds

Our custom compounds are created from different polymers and filler packages, each designed to specifically address the application.

### Solutions Provider

CDI specializes in providing solutions to help our partners solve challenges that no single material can accomplish. Not only do we manufacture composite products, but CDI also develops our own unique engineered polymer materials in combination with our extensive manufacturing capabilities.





## What sets CDI apart?

Materials expertise, collaborative partnerships, vertical integration, and superior value set us apart.

Our experts stay abreast of the latest advancements and develop solutions using our proprietary formulations. We can design custom blends tailored and validated to your specific application.

Our collaborative partnerships with OEMs provide tangible results to compressor operators for new projects and existing applications.

Our in-house engineering, material development, and manufacturing offer full vertical integration. From raw materials to finished products, we have the expertise and industry knowledge to solve your toughest challenges.

Our products are engineered to meet and exceed the highest standards while still delivering superior value.



## How do we support the global compressor industry?

We offer custom high-performance polymer products for compressors used in several industry applications:

- Hydrogen Compression
- Enhanced Oil Recovery (EOR)
- Natural Gas Gathering
- Air and Nitrogen Injection
- Pipeline Transmission
- Gas Storage Injection Withdrawal
- Compressed Natural Gas (CNG)
- Liquefied Natural Gas (LNG)
- Refining, Petrochemical, & Industrial Gases
- Boil Off Methane Compressors
- Bone Dry Gas Applications





# DESIGN AND MANUFACTURING

## Vertical Intergration

### MANUFACTURING PROCESSES

CDI offers a wide array of traditional and modern machining capabilities to manufacture compressor parts, from short runs to full-scale production. We offer some of the most extensive molding and manufacturing capabilities in the industry, including:

- PTFE-based compounds up to 100" diameter
- Hot Compression Molding up to 42" diameter
- Assembly and kitting
- Injection Molding of finished and semi-finished parts
- Multi-Access CNC machining
- Collaborative Robotic Manufacturing

## Smart Manufacturing

### INNOVATIVE TECHNOLOGY

CDI's exceptional engineering staff combines material, application, and development expertise to create unique solutions for the most demanding industry problems. Our technical staff optimizes the design and manufacturing process by using state-of-the-art programs such as:

- 3D Solid Modeling (CAD/CAM)
- Finite Elemental Analysis (FEA)
- Mold Flow Analysis (MFA)
- 3D Printing



# Material Selection Guide

## PTFE

Operating Conditions				Sealing Components Types			Common Applications
CDI Compound	Lube	Non-Lube	Bone Dry	Piston Rings	Rider Rings	Pressure Packing Rings	
A47	N/A	✓	✓	✓	✓	✓	Dry and Bone-Dry Process Gases, Helium, Nitrogen
A50	✓	✓	✓	✓	✓	✓	Benzene, Ethylene, Hydrogen, Isobutane, Nitrogen, Propane
A90	✓	✓	N/A	✓	✓	✓	Air, Carbon Dioxide, Ethylene, Hydrocarbons, Natural Gas
A91M	✓	✓	N/A	✓	✓	✓	Hydrocarbons, Natural Gas, Sour Gas
A172	✓	✓	✓	✓	✓	✓	Air, Carbon Dioxide, Natural Gas
A187	N/A	✓	✓	✓	✓	✓	Ammonia, Carbon Dioxide, Dry and Bone-dry Process Gases
A190	✓	✓	N/A	✓	✓	✓	Air, Carbon Dioxide, Natural Gas
A498	N/A	✓	✓	✓	✓	✓	Hydrocarbons, Natural Gas
A520	N/A	✓	✓	✓	✓	✓	High Temperature Dry Air
A681	✓	✓	✓	✓	✓	✓	Extreme Service Gas Compression

## PEEK

A455	✓	✓	✓	✓	✓	✓	Gas Injection, Methane, Propylene, High-Pressure Steam
A456	✓	✓	✓	✓	✓	✓	Process Gases
A497	✓	✓	✓	✓	✓	✓	High-Pressure Process Gases, Hydrocarbons, Natural Gas
A521	✓	N/A	✓	✓	✓	✓	High-Pressure Process Gases
A522	✓	✓	✓	✓	✓	✓	High-Pressure Process Gases

## PPS

A523	N/A	✓	✓	✓	✓	✓	High-Pressure Process Gases
A655	✓	✓	N/A	✓	✓	✓	High-Pressure Process Gases

**For a comprehensive list of materials and applications, please contact CDI for additional information and material recommendations.**



## PTFE Compounds

Material	CDI Compound Benefits
A47	<ul style="list-style-type: none"> <li>• Compression-molded proprietary PTFE compound with glass fiber and selected proprietary fillers</li> <li>• Proven material for process gas and dry gas applications such as hydrogen</li> <li>• Excellent wear properties and is non-abrasive against soft mating surfaces</li> <li>• Recommended for non-lubricated applications for piston rings, rider rings, and rod packing</li> </ul>
A50	<ul style="list-style-type: none"> <li>• Compression-molded PTFE compound with polyimide and selected proprietary fillers</li> <li>• Proven material for process gas and dry gas applications; Excellent wear properties and is non-abrasive against soft mating surfaces</li> <li>• Excellent wear properties and is non-abrasive against soft mating surfaces</li> <li>• Recommended for both lubricated and non-lubricated applications for piston rings, rider rings, and rod packing</li> </ul>
A90	<ul style="list-style-type: none"> <li>• Compression-molded carbon-graphite-filled PTFE compound</li> <li>• Resistant to most chemicals</li> <li>• Recommended for both lubricated and non-lubricated applications for piston rings, rider rings, and rod packing</li> <li>• Exhibits good mechanical and wear properties</li> </ul>
A91M	<ul style="list-style-type: none"> <li>• Compression-molded, bronze and molybdenum disulfide filled, PTFE compound</li> <li>• Better thermal conductivity, toughness, and resistance to elevated temperatures than carbon and glass-filled PTFE compounds</li> <li>• Recommended for lube or non-lubricated dry air compression applications</li> <li>• Recommended for piston rings, rider rings, and rod packings</li> </ul>
A172	<ul style="list-style-type: none"> <li>• Compression-molded PTFE compound with glass fiber, molybdenum disulfide, and selected other fillers</li> <li>• Offers better lubricity than A90 material</li> <li>• Preferred material for natural gas, bone dry air, and crude Argon applications</li> <li>• Recommended for both lubricated and non-lubricated applications for piston rings, rider rings, and rod packing</li> </ul>
A187	<ul style="list-style-type: none"> <li>• Compression-molded, proprietary PTFE compound with glass fiber and selected propriety fillers</li> <li>• Proven material for process gas and dry gas applications such as hydrogen</li> <li>• Excellent wear properties, not recommended for soft mating surfaces</li> <li>• Recommended for non-lubricated applications for piston rings, rider rings, and rod packing</li> </ul>
A190	<ul style="list-style-type: none"> <li>• Compression-molded, carbon-graphite reinforced, PTFE compound</li> <li>• Preferred material for standard applications, not bone dry gases</li> <li>• Recommended for both lubricated and non-lubricated applications for piston rings, rider rings, and rod packing</li> <li>• Increased properties over A90</li> </ul>
A498	<ul style="list-style-type: none"> <li>• Proprietary hot compression molded polymer blend developed exclusively by CDI</li> <li>• Excellent wear properties for high-duty cycle applications where superior physical properties are required</li> <li>• Preferred material for non-lubricated compression applications, particularly in bone dry natural gas, hydrocarbon mixtures, ammonia, and CO2</li> <li>• Not suitable for use in dry air compressors or lubrication compressor applications</li> </ul>
A520	<ul style="list-style-type: none"> <li>• Specially developed PTFE-based polymer for use in oil-free dry nitrogen compression</li> <li>• Exceptional wear resistance in demanding applications where other self-lubricating materials experience short life</li> <li>• Suitable for use in other inert gas applications such as helium, boil-off methane, or argon</li> <li>• Recommended for low- to medium-pressure inert gas applications</li> </ul>
A681	<ul style="list-style-type: none"> <li>• Proprietary compression-molded filled PTFE for extreme service gas compressor applications</li> <li>• Can handle higher service temperatures than most compounds</li> <li>• Exhibits excellent wear properties at elevated temperatures</li> <li>• Resistant to most chemicals</li> <li>• Recommended for piston rings, rider rings, and rod packing in both lubricated and mini-lube applications</li> </ul>



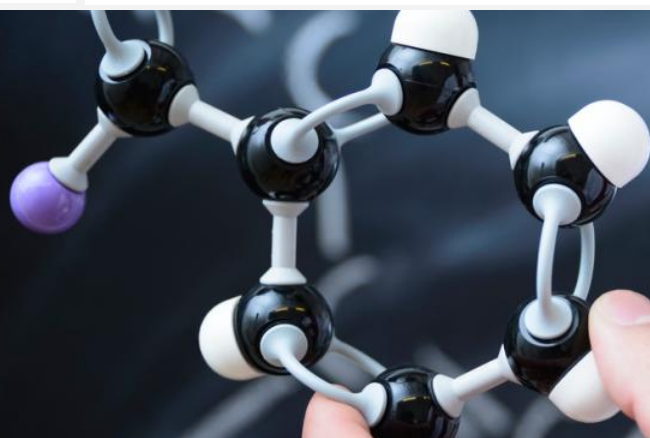


## PEEK Compounds

Material	CDI Compound Benefits
A455	<ul style="list-style-type: none"> <li>• Hot compression-molded, proprietary, filled PEEK compound</li> <li>• High strength and toughness, coupled with excellent wear properties in dry gases, allow it to be used for very high-pressure gas applications such as natural gas injection</li> <li>• Successfully used in steam, propylene, hydrogen, gas injection, and methane applications</li> <li>• Excellent chemical resistance to most chemicals except chlorine</li> <li>• Recommended for piston rings, cut rider rings, and rod packing in both lubricated and some non-lubricated applications</li> </ul>
A456	<ul style="list-style-type: none"> <li>• Hot compression-molded, proprietary, filled PEEK compound</li> <li>• Exhibits excellent wear and deformation properties at elevated temperatures and pressures where filled PTFE compounds will fail</li> <li>• Excellent chemical resistance to most chemicals except chlorine</li> <li>• Recommended for piston rings, cut rider rings, and rod packing in both lubricated and non-lubricated applications</li> </ul>
A497	<ul style="list-style-type: none"> <li>• Hot compression-molded, proprietary, filled PEEK compound</li> <li>• Exhibits better deformation properties than A450 and A456 at elevated temperatures and pressures</li> <li>• Successfully used in hydrogen service</li> <li>• Successfully used in bone-dry gas applications</li> <li>• Recommended for piston rings, cut rider rings, and rod packing in both lubricated and non-lubricated applications</li> </ul>
A521	<ul style="list-style-type: none"> <li>• Hot compression-molded, proprietary, filled PEEK compound</li> <li>• Exhibits better deformation properties than A450 and A456 at elevated temperatures and pressures</li> <li>• High strength and resistant to most chemicals except chlorine</li> <li>• Successfully used in bone-dry gas applications</li> <li>• Recommended for piston rings, cut rider rings, and rod packing in lubricated applications</li> </ul>
A522	<ul style="list-style-type: none"> <li>• Hot compression-molded, proprietary, filled PEEK compound</li> <li>• Exhibits better deformation properties, elevated temperatures, and pressures</li> <li>• Recommended for hydrogen service</li> <li>• Successfully used in other bone-dry gas applications such as dry helium or dry argon</li> <li>• Recommended for piston rings, cut rider rings, and rod packing in both lubricated and non-lubricated applications</li> </ul>

## PPS Compounds

Material	CDI Compound Benefits
A523	<ul style="list-style-type: none"> <li>• A523 proprietary PPS-based polymer developed to meet the requirements of non-lubricated dry nitrogen compressors</li> <li>• Exhibits excellent wear and deformation properties at elevated temperatures and pressures where filled PTFE compounds will fail</li> <li>• Able to extend beyond the operating limits of both pressure and temperature compared to A520</li> <li>• Preferred selection for dry nitrogen, helium, and argon compression applications, not suitable for oxygen or gases containing oxygen</li> <li>• Recommended for non-lubricated applications for piston rings, rider rings, and rod packing</li> </ul>
A655	<ul style="list-style-type: none"> <li>• Hot compression-molded, proprietary, filled PPS compound</li> <li>• Exhibits excellent wear and deformation properties at elevated temperatures and pressures where filled PTFE compounds will fail</li> <li>• Excellent chemical resistance to most chemicals except chlorine</li> <li>• Successfully used in process gas and natural gas compression applications</li> <li>• Recommended for piston rings, cut-rider rings, and rod packing in both lubricated and mini-lube applications</li> </ul>



# Critical Compressor Components

## Custom Engineered Polymer Components for Compressors

For proper sealing and support of the piston and rod assembly, piston and rider rings must be designed from high-performance materials that prevent premature wear. CDI experts carefully evaluate ring geometry requirements, dimensions, and the application environment before recommending technical configurations.

Our engineering staff creates custom designs for both lubricated and non-lubricated reciprocating air and gas compressors. Regardless of the size and complexity, CDI has the design expertise and molding tools needed to manufacture material stock shapes for any sealing component.

### Piston Ring Designs

The function of the piston ring is to seal the gas pressure within the cylinder. CDI offers a variety of piston ring styles and materials to provide optimum sealing and ring life. Piston rings are installed in the grooves machined on the OD of a metallic piston.

### Rider Ring Designs

The function of the rider band ring is to support the weight of the piston and rod assembly and prevent metal-to-metal contact. CDI offers various rider ring styles and materials for multiple applications to provide optimum ring life.

### Rod Packing Designs

Pressure packing rings are dynamic, pressure-actuated seals. The basic sealing ring is an assembly of two or more rings cut into segments and overlapped at the joints to form a seal. Garter springs hold the segments together and keep them in contact with the piston rod during the assembly and while the compressor is shut down. CDI offers different pressure packing styles and materials to provide an optimum seal and ring life.

### Valve Components

Valve plates are a critical component of ported plate compressor valves. Valve plates are subjected to impact loads by repeated contact with the guard and seat. They are also subjected to fatigue loads caused by varying differential pressure. Additionally, dirty, corrosive gas and liquids in the gas can minimize a valve plate's lifespan. CDI manufactures high-performance ported valve plates from several nonmetallic materials. Parts are machined to close tolerances and lapped to provide a good surface finish and flatness. CDI also manufactures buttons and poppets for gas compressor valves as replacement parts.



## Packing Case Design

Reciprocating compressor packing case design and manufacturing are critical components for ensuring reliable and efficient operation. The packing case contains the packing elements and provides a seal between the high-pressure gas and the surrounding environment. The design of the packing case must consider factors such as the type of gas being compressed, operating pressure and temperature, and size and stroke of the compressor. By combining CDI's extensive materials selection, trusted ring design, and industry-leading engineering, CDI is proud to offer pressure, intermediate, and wiper assemblies designed specifically for all reciprocating compressor applications.

## Packing Case Manufacturing

Manufacturing techniques, such as precision machining and collaborative robotic-assisted manufacturing, are at the core of CDI case manufacturing to ensure the packing case can withstand the high stresses and pressures they will experience during operation. Additionally, proper installation of ring sets and pressure testing of the packing case is essential for the long-term performance and reliability of the compressor. At CDI, we specialize in designing and manufacturing high-quality reciprocating compressor packing cases to meet the demanding needs of our customers.



Understanding and manufacturing to our OEM partner specifications are critical to successfully servicing our customers. All case design and manufacturing can be catered to achieve these specifications. Our manufacturing options include.

- Physical & Mechanical Properties Testing
- Material Certifications
- Finish Ground Surfaces
- Lapped Mating Surfaces
- Laser Engraving
- Kitted, Partial, or Complete Assembly
- OEM Packaging





# CDI PRODUCTS®

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Contact us today for quality products for your most critical compressor applications.

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Better Science. Better Service. Better Solutions.

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