EIGHT-STAGE, 200-BAR CO₂ COMPRESSOR

Atlas Copco Gas and Process Solutions
EFFICIENT, RELIABLE HIGH-PRESSURE CO₂ DELIVERY

The Atlas Copco High-Pressure CO₂ Compressor is specifically developed for modern applications requiring high compression where efficient design translates into major energy savings. This integrated solution delivers over 200 bar while promising a long lifetime of reliable operation.

Integral Gear Technology

When multiple stages are required to compress a gas such as CO₂ from inlet to outlet, the benefits of integral gear design quickly become apparent. By mounting impellers at the ends of multiple pinions that are connected to bull gears, the speed of the individual impellers and the respective stage can be optimized. This results in excellent efficiency and reduces the overall footprint of the compressor.

Integral gearing also makes it easy to segregate the individual stages and implement interstage cooling, something that is difficult in standard inline radial compressors. Interstage cooling further increases overall efficiency by ensuring even isothermal compression.

Dynamic Dry Gas Seals

Another of the compressor’s technical features are its dynamic, contactless dry-gas seals. These seals not only eliminate mechanical wear and increase rotational efficiency, they ensure that CO₂ remains inside the compressor.

In-field tests show the dynamic dry gas seals releasing, on average, 35 times less CO₂ into the atmosphere than standard carbon ring seals.

The thin width of the dry gas seals is also an advantage for rotor dynamics. It dramatically reduces cross coupling – the interplay between gas flow and the vibration of the rotors. Cross coupling is further minimized by high-damping bearings for the pinions and bull gearings.

Performance Through Innovation

Compressing CO₂ to high pressures creates unique technical challenges. Pushing the gas into its supercritical state results in a sudden higher density of the compound and increased force levels on rotating equipment. The Atlas Copco High-Pressure CO₂ Compressor is specifically designed with these considerations in mind.

Based on decades of experience in the field of CO₂ compression, Atlas Copco Gas and Process developed an integrated solution with exceptional robustness and the reliability required for the job. And, thanks to extremely low leakage values, the compressor uses around 30% less energy than a standard single-shaft compressor.
important applications

CO₂ has long been used in modern industrial process ranging from oil and gas refinement to chemical and food industry processes. These days, a number of applications require more than gaseous CO₂. They require that the compound is delivered under high, sometimes supercritical, pressure and in larger quantities.

1. Supercritical Power Cycle

The emerging Supercritical Power Cycle through oxyfuel combustion is a game changer. Proven to be among the most efficient fossil fuel power cycles, it uses supercritical CO₂ (sCO₂) as a working fluid and operates above supercritical point/region of CO₂. Instead of conventional phase changes to recover energy, sCO₂ undergoes drastic density changes over small temperature and pressure gradients, enabling significant energy recovery within comparatively small equipment. The entire cycle relies on efficiency, where the design of the CO₂ compressor is crucial.

2. Urea / Fertilizer Production

Pressures of 140-200 bar greatly increase conversion of ammonia and CO₂ to produce urea. Efficiency and reliability are important for an urea installation and integrally-geared centrifugal compressors are well established in the industry due to lower power requirements, robustness and ease of maintenance.

3. Enhanced Oil Recovery

An answer for underperforming oil fields is CO₂ Enhanced Oil Recovery (EOR). High-pressure CO₂ is injected into an oil reservoir to boost production. A principle called partial miscibility allows the CO₂ at a supercritical pressure and temperature to completely mix with oil, enabling it to flow freely for collection. Under lower pressure, the CO₂ and oil easily separate.

4. Carbon Capture and Storage (CCS)

Capturing and storing CO₂ released from burning fossil fuels has emerged as a promising technology. The most mature form of CCS is post-combustion capture, where CO₂ is removed after fossil-fuel combustion by using a chemical solvent. But even with more efficient oxyfuel and precombustion technologies, if there is no immediate use for the CO₂ (such as EOR or fertilizer production) it needs to be stored. Here, high-pressure compression of CO₂ is required to inject it into suitable underground reservoirs.
Putting CO$_2$ Under Pressure

The eight-stage GT-Series CO$_2$ compressor incorporates Atlas Copco’s proven impeller, aerodynamics and integral gear design, along with specially designed robust casing and dynamic gas seals, to create a complete all-in-one solution for high-pressure carbon dioxide delivery.

1. Impeller and Rotor Assembly
   Atlas Copco’s CO$_2$ Compressor features a proven impeller and rotor assembly design referenced in thousands of its GT-series compressors around the world. The compressor’s impellers are milled from a solid forging for extra strength. All geometries have been thoroughly tested.

2. Horizontally-split Bearings
   The high-speed rotor is supported by radial tilting pad bearings that are designed to eliminate virtually all vibration and provide superior operating stability.

3. Dry Gas Seals
   Specially designed dynamic, contactless dry gas seals ensure that CO$_2$ does not escape into the atmosphere, eliminate mechanical wear and tear, and play an important part in the overall rotor design to manage expected cross coupling effects.
Technical Specifications

- Flow: 18 000 Nm³/h/10 594 ncfm
- Inlet Pressure: Atmospheric
- Outlet Pressure: 205 bar(a)/2 973 psia
- Stages: Eight, with interstage cooling
- Seals: Dynamic dry gas
- Bearings: Horizontally-split high-dampening bearings
- Power: 4.2 MW/5 632 HP
- Applications: High-pressure CO₂ delivery for applications such as urea production, carbon capture storage and enhanced oil recovery

Customer Benefits

- Top reliability with well-referenced compressor core
- Noticeable energy savings of up to 30% vs. single-shaft compressors
- Minimal gas leakage
- Compact footprint
- Backed by decades of experience in CO₂ compression

Compact Footprint

The compressor’s core unit, lube oil system, driver and intercooler are all integrated into a compact baseframe. The result is a small compact footprint and reduced erection time.
We stand by our responsibilities towards our customers, towards the environment and the people around us. We make performance stand the test of time. This is what we call – Sustainable Productivity.