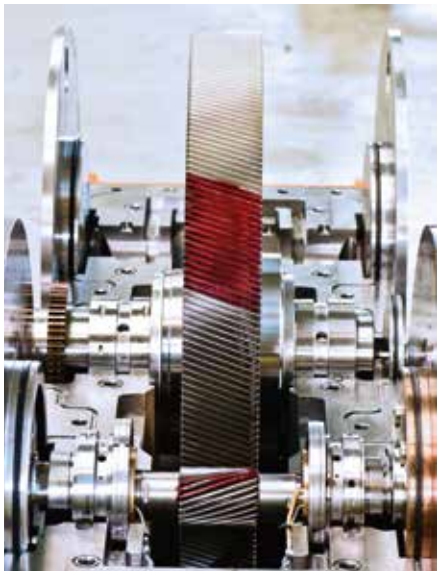
EIGHT-STAGE, 200-BAR CO_2 COMPRESSOR

Atlas Copco Gas and Process Solutions

Atlas Copco

EFFICIENT, RELIABLE HIGH-PRESSURE CO_2 DELIVERY

The Atlas Copco High-Pressure CO_2 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.



Atlas Copco are specialists in the integral gear technology employed in the high-pressure CO_2 compressor.

Performance Through Innovation

Compressing CO_2 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 CO_2 Compressor is specifically designed with these considerations in mind.

Based on decades of experience in the field of CO_2 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.

Integral Gear Technology

When multiple stages are required to compress a gas such as CO_2 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 CO_2 remains inside the compressor.

In-field tests show the dynamic dry gas seals releasing, on average, 35 times less CO_2 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 pinons and bull gearings.

IMPORTANT APPLICATIONS

CO_2 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 CO_2. 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 CO_2 (sCO_2) as a working fluid and operates above supercritical point/region of CO_2. Instead of conventional phase changes to recover energy, sCO_2 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 CO_2 compressor is crucial.

2. Urea / Fertilizer Production

Pressures of 140-200 bar greatly increase conversion of ammonia and CO_2 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 CO_2 Enhanced Oil Recovery (EOR). High-pressure CO_2 is injected into an oil reservoir to boost production. A principle called partial miscibility allows the CO_2 at a supercritical pressure and temperature to completely mix with oil, enabling it to flow freely for collection. Under lower pressure, the CO_2 and oil easily separate.

4. Carbon Capture and Storage (CCS)

Capturing and storing CO_2 released from burning fossil fuels has emerged as a promising technology. The most mature form of CCS is post-combustion capture, where CO_2 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 CO_2 (such as EOR or fertilizer production) it needs to be stored. Here, high-pressure compression of CO_2 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

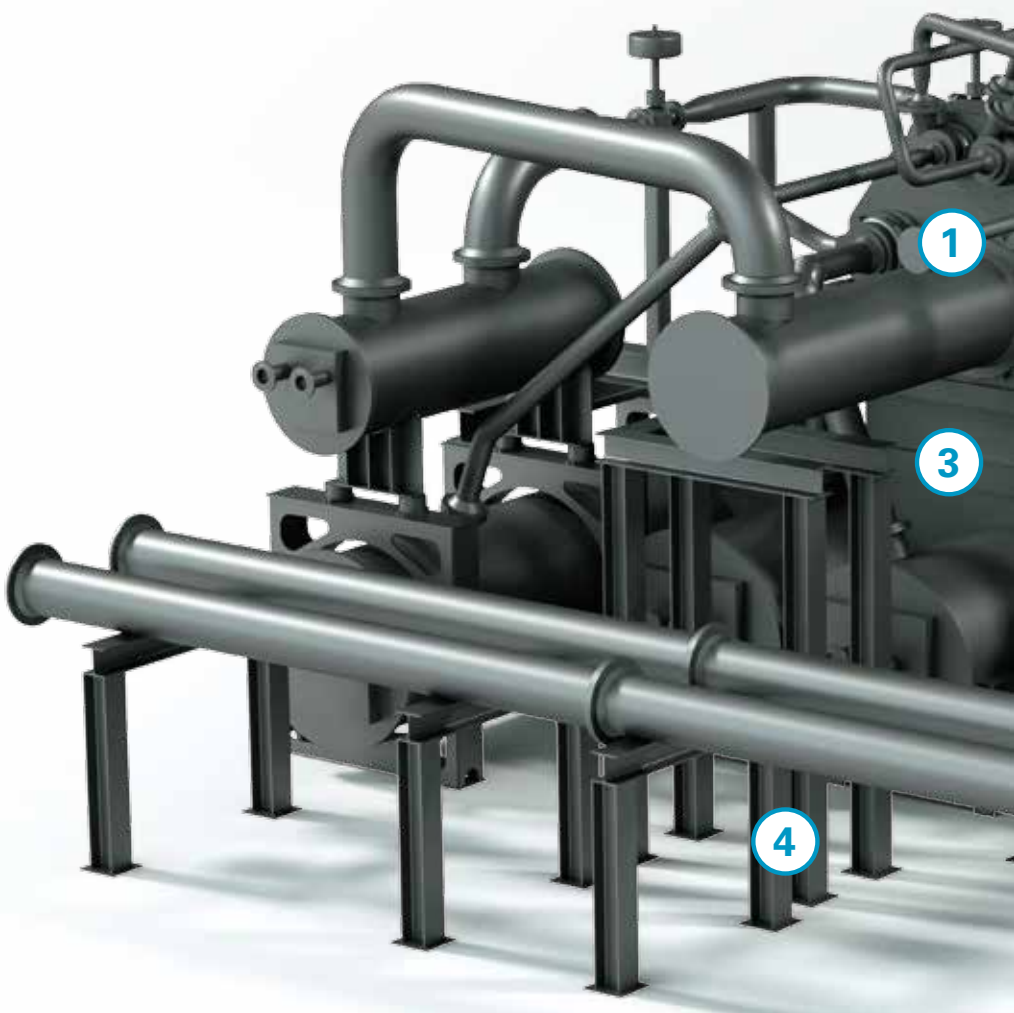
Atlas Copco's CO_2 Compressor features a proven impeller and rotor assembly design referenced in thousands of its GT-series compressors around the world. The compressor's impellers are milled from a solid forging for extra strength. All geometries have been thoroughly tested.

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.



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 CO_2 compression

④ 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.

Technical Specifications

- **Flow:** 18 000 Nm^3/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 CO_2 delivery for applications such as urea production, carbon capture storage and enhanced oil recovery

COMMITTED TO SUSTAINABLE PRODUCTIVITY

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.

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