

RELY ON EXCELLENCE

## Espey WKA802 for sealing a CO<sub>2</sub> gear compressor

Sealing solution in the fertilizer industry for a high-pressure CO<sub>2</sub> application

Millions of tons of CO<sub>2</sub> are produced in the fertilizer industry. To prevent this from entering the atmosphere, one option is to store the CO<sub>2</sub> in underground geological formations (carbon capture and storage, CCS). Another option is to use the CO<sub>2</sub> for enhanced oil recovery (EOR). To transport the gas to where it will be used, it must first be pre-compressed and dehydrated. An American company in the nitrogen fertilizer industry decided to use MAN Diesel & Turbo SE geared compressors for this purpose.



### Nitrogen fertilizer production

In the production of nitrogen fertilizer, nitrogen from the atmosphere is converted into urea - a form of nitrogen fertilizer. This process uses enormous amounts of heat and pressure to convert atmospheric nitrogen into a form usable for plants. The heat and pressure required for this is usually generated using natural gas, which releases CO<sub>2</sub> when combusted.

### Making CO<sub>2</sub> ready for transport

After combustion the separated CO<sub>2</sub> initially contains 10.3 percent water vapor. It is dehydrated in a multistage gear compressor until it no longer contains any moisture. At the same time, the medium CO<sub>2</sub> content gradually increases from almost 90 percent to finally 100 percent. The now dry and pure CO<sub>2</sub> is then fed into a pipeline to a high-pressure compressor and transported on to an EOR or CCS field.

### Reliable sealing solution required

The gear compressor for serving this application includes 8 stages. Each stage requires an individual seal with the shortest possible installation length to avoid large overhangs and thus vibrations.

From stage 1 to stage 8, the shaft diameter decreases from 165 mm to 65 mm (6.50" to 2.56"), the revolutions increase from nearly 10,000 min<sup>-1</sup> to 26,000 min<sup>-1</sup>, and the maximum operating pressure increases from 3 bar up to 109 bar (43.51 PSI up to 1,580.91 PSI).

The design temperature varies from 130 °C to 150 °C (266 °F to 302 °F). The ambient temperature varies between 4 °C and 38 °C (39.2 °F and 100.4 °F). Because of the toxic and aggressive CO<sub>2</sub>, all seals must be designed with a barrier gas port for dry instrument air.

### CASE STUDY

- **Reference** : Original equipment of a CO<sub>2</sub>-gear compressor, Germany
- **Client**: Manufacturer of nitrogen fertilizer
- **Industry**: Chemical Industry
- **Challenge**: Development of a seal for a CO<sub>2</sub> high-pressure application
- **EagleBurgmann Services**: Consulting and design of a new carbon floating ring seal
- **Technical Solution**: Espey WKA802

## New Espey WKA802 by EagleBurgmann

The requirement was therefore for a seal that reliably prevents the emission of CO<sub>2</sub> and has the lowest possible barrier gas leakage to the atmosphere with regard to revolutions, design temperature and operating pressure.



The solution: Espey WKA802

EagleBurgmann's sealing experts took up this challenge and developed the new Espey carbon floating ring seal WKA802. It has one-piece seal rings made of a carbon/titanium combination and barrier gas and recirculation ports. The modular design allows all seal parts to be combined to suit the specific application. The seal lengths range from 145 mm (5.71") in stage 1 to 170 mm (6.69") in stage 8 to ensure the required short installation length. The seals guarantee a long operating time without maintenance.



## Operating conditions

- Application: multi-stage gear compressor
- Seal type: Espey WKA802
- Medium: water vapor, CO<sub>2</sub>
- Operation temperature: +130 °C ... + 150 °C (+266 °F ... +302 °F)
- Pressure abs.: 3 bar ... 109 bar (43.51 PSI ... 1,580.91 PSI)
- Revolutions: 10,000 min<sup>-1</sup> ... 26,000 min<sup>-1</sup>
- Shaft diameter: 65 mm ... 165 mm (2.56" ... 6.50")
- Radial play: max. 0.01 mm (0.0004")
- Barrier gas: dry instrument air



Installation of Espey WKA802 into a gear compressor



Further information on Espey WKA802

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