

# Sealing compounds for CO<sub>2</sub> air conditioning technology

**CO<sub>2</sub> is considered the refrigerant of the future in automobiles because as of 2011 – with a transition period up to 2017 - EU Directives will require all new passenger cars and light commercial vehicles to operate with an eco-friendly refrigerant. The use of CO<sub>2</sub> helps to reduce the greenhouse effect in the atmosphere but makes new demands on sealing compounds.**

Although the currently used refrigerant, R134a, does not influence the ozone layer it is a highly effective propellant gas and thus contributes to global warming in a major way. The comparison of the adverse effect of various propellant gases on our climate is expressed in their global warming potential (GWP). It characterises the effectiveness of other (for instance fluorinated) propellant gases compared to CO<sub>2</sub> (R744) as a reference substance. CO<sub>2</sub> has a GWP value of merely 1 whereas R134a has a GWP value of 1300. Put in a different way, 1 kilogram of R134a equates to a global warming potential of 1300 kg R744/CO<sub>2</sub>.

A new EU directive will require all new vehicle models to be equipped with more eco-friendly air conditioning

systems as of 2011, and all new vehicles as of 2017. From today's perspective, the old systems will be replaced by R744 systems. In addition to their eco-friendliness, the new R744 air conditioning systems offer the advantage of higher efficiency or cooling dynamics, meaning that a car's interior that has become extremely hot in summer can be cooled down to comfortable temperatures relatively fast with R744. In winter, as well, the reverse process (heat pump principle), namely quick heating, can prevent the windows from fogging inside and de-ice them on the outside.

Renowned air conditioning component and systems manufacturers have already developed innovative solutions enabling the installation of CO<sub>2</sub> technology into new vehicle models as soon as possible.

Air conditioning systems operating with R744 have major differences compared with R134a cooling systems, making exacting demands on the components to be adapted to the new systems. At up to 150 – 160 bar, operating pressures for R744 exceed those of R134a by a multiple. At up to 180 °C, temperatures are in a critical range as well. With soft



seals, for example, this requires the use of specially developed elastomer compounds, with permeation behaviour, i.e. the resistance to explosive decompression, being of crucial importance for perfect sealing performance.

A major role in complying with the specified, maximum permissible leakage values is played by the seals used in the various air conditioning components.

The main requirements in this context are high- and low-temperature resistance, good media resistance, high extrusion resistance, minimal gas permeability, resistance to explosive decompression and excellent long-term performance.

In addition to metal and rubber-metal seals, the O-Ring Division of Parker Hannifin's Seal Group has developed elastomer compounds which are used according to the requirements of the particular application and operating conditions. The materials already being used in CO<sub>2</sub> components are FKM, EPDM and HNBR and EPDM/BIIR compounds from which O-rings and moulded parts – mainly for use as static seals – are manufactured.

## Characteristics / Applications

Available compounds:

EPDM:	E3804	(90 Shore A)
FKM:	V8771	(90 Shore A)
HNBR:	N8805	(90 Shore A)
EPDM/BIIR:	BB8878	(85 Shore A)

- High extrusion resistance
- Temperature range: -55 to + 200 °C
- Suitable for PAG / PAO / POE oils
- Low permeation
- Excellent resistance to explosive decompression
- High wear resistance
- ParCoat® surface coating possible
- O-rings and moulded shapes for applications / components like
  - connectors, fittings
  - control and expansion valves, thermostats
  - condensers, heat exchangers, evaporators
  - mechanical seals, compressors
  - ...

## Physical Values

Compound	Elastomer	Hardness [Shore A]	Tensile strength [N/mm <sup>2</sup> ]	Ultimate elongation [%]
E3804	EPDM	90	16	135
V8771	FKM	90	18	127
N8805	HNBR	90	27	260
BB8878	EPDM/BIIR	85	15	120