

# Helium

The special element



The inert gas helium has a number of unique properties. Helium ...

- has the lowest molecular weight of all gases, except hydrogen
- is an absolutely inert gas. It does not form chemical compounds even at high temperatures
- is hardly soluble in metals and molten metals
- penetrates even the smallest gaps and pores due to its small atomic diameter
- has the lowest boiling point of all gases in a liquid state at 4.2 K (-296 °C), making the coldest liquid of all.

All these properties make helium indispensable for many applications.

There are only traces of approx. 5 ppmv helium in the atmosphere, making the extraction of helium from air very complex and generally uneconomical. On the other hand, due to special geological conditions, there are a few natural gas sources on earth which show increased content of helium thus enabling an economical extraction.



- Most important helium sources
- Messer helium filling plants Europe

## Worldwide logistics

Currently, helium is extracted from natural gas mainly in the USA, Qatar, Algeria, Russia, Poland and Australia. Large helium liquefiers are operated at each of the sources. In order to transport liquid helium economically, Messer uses an own fleet of special super vacuum insulated tank containers (TCs) with a maximum capacity of approx. 40,000 l each.

Once they are filled, the TCs are transported by road and, if necessary, by sea to the filling plants of Messer. Messer operates helium filling plants in Europe, the Americas and China. In Europe, these are located in Mitry-Mory (France), Lenzburg (Switzerland), Gumpoldskirchen (Austria) and Pancevo (Serbia).



Tank container for liquid helium

In Gumpoldskirchen, Messer operates a storage tank for liquid helium (capacity of 120,000 l). In this way short-term fluctuations of the primary helium supply in Europe can be bridged.

## Transfilling

In our filling plants we transfill the liquid helium from the tank containers to smaller super vacuum insulated liquid containers (dewars). The amount of helium is determined by weighing the container. The unavoidable flash gas during the transfer process is collected and, if necessary, purified by low temperature adsorption. With the use of compressors, it is then filled into compressed gas cylinders as gaseous helium.

## Perfected equipment

In order to largely avoid evaporation losses, liquid helium is delivered in special, super vacuum-insulated transport containers. Depending on the amount required, we use dewars from 50 to 450 l.

For withdrawing the liquid helium, the dewars have to be fitted with a suitable stinger. By connecting a helium gas cylinder the pressure in the dewar is increased until the liquid helium can be withdrawn through the outlet. Special types of dewars are equipped with an electrical pressure build-up system and a built-in stinger.

If required, specifically trained service technicians from Messer can provide support during the transfer process.



120,000 l horizontal tank container for liquid helium



Dewars of different sizes



Transfilling of liquid helium

## Indispensable for many applications

Due to its unique properties, helium is also used in a large number of very specialized applications.

Liquid helium is used as a cooling agent wherever extremely low temperatures (below  $-200\text{ °C}$ ) have to be generated but conventional refrigerators cannot be used for economic reasons. These applications are often connected with superconductivity. Magnetic resonance imaging (MRI) or nuclear magnetic resonance spectroscopy (NMR) and the operation of superconductive magnets in particle accelerators are of greatest technical importance.

Apart from what is probably its best-known use as a lifting gas for balloons and airships, gaseous helium is also used in a wide range of technical applications. Thus, helium is used in many processes in cutting and welding as well as in laser technology due to its high thermal conductivity or as coolant in manufacturing optical fibers.

For instance, its high diffusibility also makes it an ideal carrier gas in gas chromatography or the most widely used as tracer gas for leak detection.

Just as there are many different applications, there are also widely differing requirements regarding quality and delivery forms of gaseous helium. The purity of helium ranges from balloon helium to „6.0“, i.e. a purity of 99.9999%, and the form of delivery from 1 l pressure cans to 200 and 300 bar cylinders and bundles up to trailers which provide at 300 bar a capacity of up to  $4000\text{ m}^3$  of gaseous helium.



Liquid helium cools MRI scanners



Gaseous helium for gas chromatographs

## Service and support

Since helium is a scarce and valuable product, it must be used as efficiently as possible. Our technical customer service team supports in optimizing helium use and thus minimizing helium losses.



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