



HelioSmart Recovery

- Technical Specifications

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The Bruker HelioSmart Recovery system is a very compact, easy-to-site helium collection unit that has been carefully optimized for the use with NMR spectrometers.

Helium is a scarce, non-renewable resource. To protect this resource in a socially responsible way and to make lab operations more sustainable, the Bruker HelioSmart Recovery system collects helium boil-off from NMR magnets and stores the gas in high pressure cylinders. From there, the gaseous helium can be re-used for other purposes or returned to a gas supplier. NMR users who have access to a helium liquefaction facility can purify and reliquefy the helium and re-use it in an NMR magnet to become more independent, especially during periods of global helium shortage. To keep costs low and to make siting as easy as possible, the Bruker HelioSmart

has been dimensioned to collect the steady state boil-off of several NMR magnets in parallel, excluding helium transfers, resulting in a typical recovery rate of 80 - 85 percent. The Bruker HelioSmart Recovery system has been carefully engineered to ensure safe operation with NMR magnets and has been optimized to eliminate spectral artifacts.

The Bruker HelioSmart Recovery is a fully integrated helium recovery system with an internal gas bag and a three-stage high pressure compressor. The compressor starts and stops automatically as a function of the fill level of the gas bag, and typically requires ten to twelve minutes to empty the gas bag. The recovery system is equipped with an electronic control unit with a color display. The system also includes pressure relief valves, a filter unit, and a condensate drain.

Helium Recovery Set incl. Connecting Hardware for one NMR Magnet AH0721	European Version	US Version
Electrical Power	230 V / 50 Hz / 2.2 kW (*)	220 V / 60 Hz / 2.2 kW (*)
Dimensions (L x W x H)	1400 mm x 850 mm x 1550 mm	
Mass	approx. 450 kg	
Gas Bag Volume	approx. 400 liters (equivalent to approximately 0.5 liters of liquid helium)	
Compressor Speed	approx. 40 l/min	
Fluid Interfaces	KF25 (low pressure side); cutting ring fitting for 8 mm pipe (high pressure side)	
Connecting Hardware	The set includes the hardware which is required to connect the recovery unit to one NMR magnet (D3XX dewar or magnet with a KF25 interface). The connecting hardware includes 50 meters of flexible tubing.	

Table 1: Technical Specification for the Helium Recovery Set

* Power draw when the compressor is on

Gas Storage AH0722	European Version	US Version
Operating Pressure	200 bar	200 bar
Volume	12 x 50 liters (equivalent to approximately 140 liters of liquid helium)	12 x 45 liters (equivalent to approximately 125 liters of liquid helium)
Connection Hose to Recovery Unit	Included (approx. 10 m)	Included (approx. 10 m)

Table 2: Technical Specification for the Gas Storage

Additional Connecting Hardware		
Extension Set	Hardware required to connect one additional magnet (D3XX dewar or KF25) to the recovery unit	AH0723
Recovery Tubing	50 meters of flexible tubing	AH0724

Table 3: Technical Specification for the Connecting Hardware

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Installation Example: Bruker HelioSmart with Three NMR Magnets

In steady state operation, the three magnets in our installation example boil off a total of 42 milliliters of liquid helium per hour. At room temperature and atmospheric pressure, this corresponds to a volume of approximately 34 liters of helium gas per hour. It thus takes approximately 11 hours for the gas bag inside the HelioSmart Recovery system to fill up.

Once the gas bag is full, the compressor starts automatically, and the helium is compressed from the gas bag into high pressure cylinders. This process takes approximately 10 minutes. While the compressor is running, the power draw of the recovery system amounts to approximately 2.2 kW. After the compression cycle has finished, the recovery system returns to a mostly passive mode in which helium is collected in the gas bag. This passive phase again lasts 11 hours, and then the next compression cycle starts.

The maximum operating pressure of the high pressure cylinders is 200 bar. In our installation example, a high pressure storage consisting of 12 x 50 liter cylinders is used. At 200 bar, this volume corresponds to 140 liters of liquid helium, i.e. the cylinder pack can hold the helium that corresponds to approximately 280 complete fillings of the internal gas bag. In the example presented here, the cylinder pack would thus be full after four to five months of continuous helium recovery.

Magnet	Steady-State Boil-Off
Magnet 1 (400 MHz)	13 ml/h
Magnet 2 (500 MHz)	13 ml/h
Magnet 3 (600 MHz)	16 ml/h

Table 4: Steady-state helium consumption of the magnets in the installation example.



Figure 1: Artist's view of the setup described in the installation example with one recovery unit and three NMR magnets. The high pressure storage is not shown.

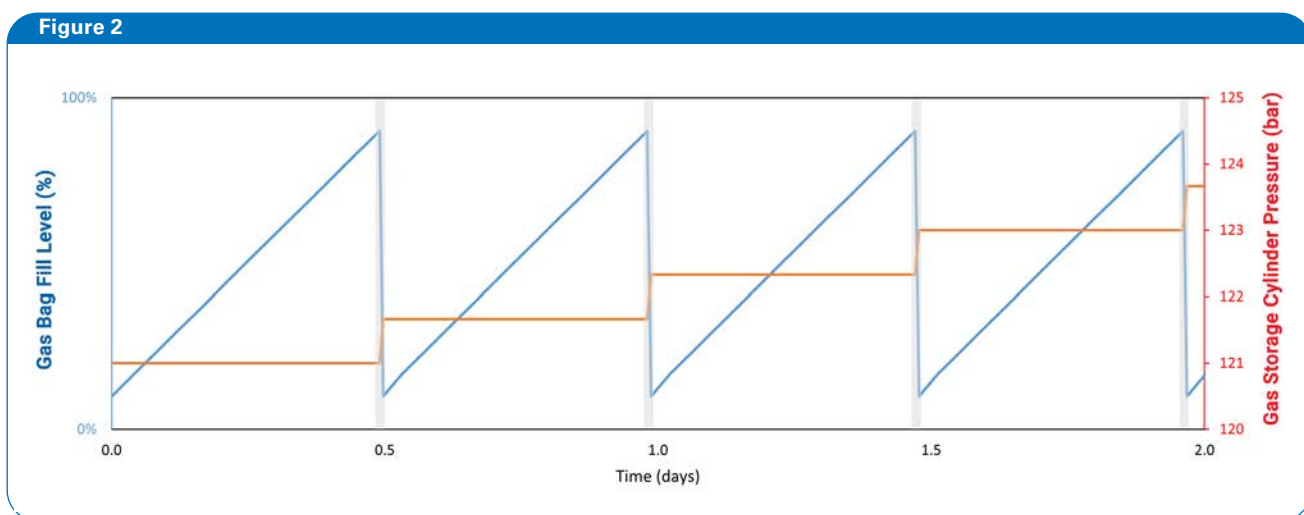


Figure 2: Gas bag fill level and gas storage pressure as a function of time for the installation example described in the text. The gray vertical bars indicate when the three-stage compressor is operational.

● Main Dimensions

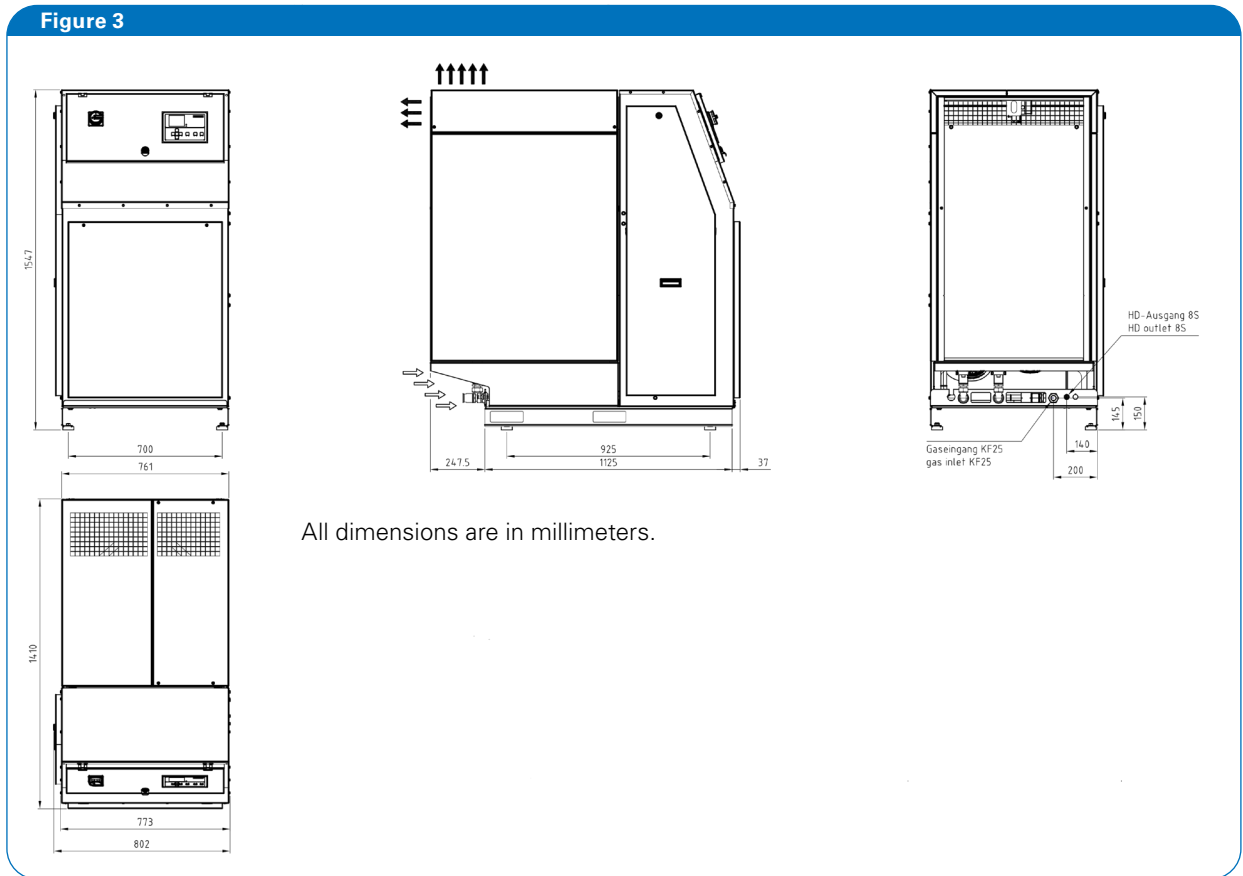


Figure 3: External dimensions of the HelioSmart Recovery Unit



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