CRYOMAGNETICS, INC.
INNOVATIVE TOOLS FOR SCIENTIFIC RESEARCH

Recondensing Superconducting Magnet Systems

Recondensing superconducting magnet systems use a 4.2K cryocooler to recondense liquid helium boiloff during static (persistent mode) operation. Depending upon the particular system design and the customer's planned use schedule, the 4.2K cryocooler can completely stop liquid helium boiloff and result in a zero loss system.

Recondensing systems are usually designed with a small amount of stored liquid helium. This results in a more compact design as compared to traditional superconducting magnet systems.

In all recondensing superconducting magnet systems, Cryomagnetics proprietary high temperature superconductor current leads are installed to minimize liquid helium usage. Cryomagnetics' high temperature current leads are proven performers and have been used in many superconducting magnet systems over the years.

Always designed with safety in mind, all recondensing systems are designed to ASME code and manufactured in Cryomagnetics' facility under strict quality procedures.

All recondensing systems are equipped with Cryomagnetics exclusive HRC-100 Helium Reliquefier Control System. The HRC-100 is designed to control liquefying rate by constantly monitoring pressure in the superconducting magnet system's helium chamber. Positive pressure will always be present within the helium chamber, thereby reducing the risk of ice formation. Features a digital display and easy integration in existing superconducting magnet systems.

As with traditional liquid helium based superconducting magnet systems, recondensing systems are available with a variety of thermal radiation shielding options. Intermediate thermal radiation shielding using liquid nitrogen is available, or designs with multiple thermal radiation shields without the use of liquid nitrogen are available. Custom applications requiring elevated bore temperatures can be accommodated.

Another very important factor to consider when deciding between a liquid cryogen free or a liquid helium based system is how the design addresses power outages and superconducting magnet quenches.

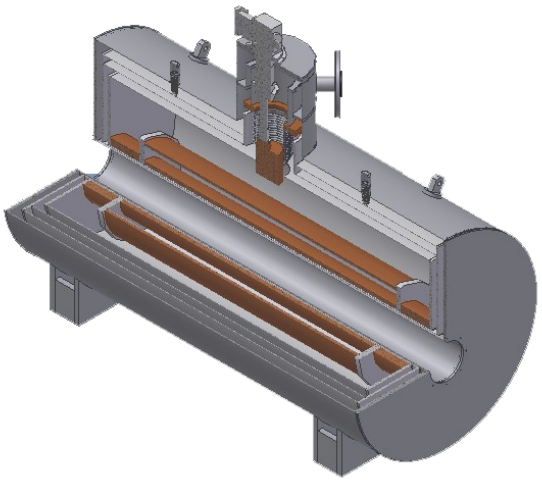
In the event of a power outage or cryocooler failure in a recondensing system, the liquid helium buffer will allow enough time for a safe discharge of the superconducting magnet without quench.

In a liquid cryogen free only system, the time between loss of cooling power and temperature rise above 4.2K is a matter of minutes, not allowing enough time for the safe discharge of the superconducting magnet.

The recondensing system can be viewed as having the best of both liquid cryogen free and liquid helium based systems—liquid helium costs are minimized, systems can be made smaller, and they have the ability to tolerant power faults without superconducting magnet quenches.

Recondensing Superconducting Magnet System

6 Tesla Split-Pair with 6 Tesla Extended Field Ion Trap Magnet System



Recondensing Superconducting Magnet System

Cutaway View of Typical Horizontal Bore Recondensing Magnet System

1006 Alvin Weinberg Drive • Oak Ridge, Tennessee 37830 • Telephone (865) 482-9551 • Fax (865) 483-1253
Web: www.cryomagnetics.com • Email: sales@cryomagnetics.com

Superconducting Magnets and Systems

C-Mag Cryogen-FREE Integrated VTI Systems

- Single Cryocooler for both the magnet and sample
- Low Vibration Options
- Large 49mm sample space
- Solenoids up to 14 Tesla
- Split Pairs up to 7 Tesla
- Multi-axis Configurations
- Upgradeable with dilution and He3 inserts

Superconducting Magnets

- Solenoids, split pairs, multi-axis
- Solenoids up to 21 Tesla
- Split Pairs up to 11 Tesla
- 2 and 3 axis Magnet Configurations
- Cryogen-FREE
- High homogeneity
- Ultra-low current
- Compensated
- Actively Shielded
- Custom Configurations

Turn-Key Systems

- Accelerator beamline magnets
- Gyrotron
- Nuclear Demagnetization
- Optical access magnets, microscopy
- OEM
- NMR/EPR
- Magnetic separation
- Magnetic Semiconductor crystal growth
- Ion-cyclotron resonance up to 12T

Magnet System Cooling Options

Cryogen FREE:

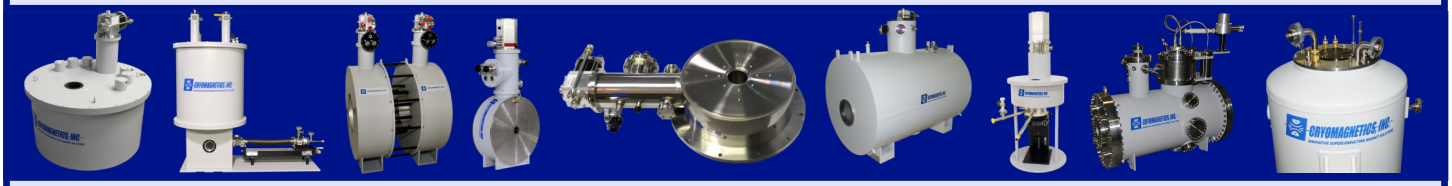
In response to liquid helium becoming increasingly difficult to obtain and afford, most research magnet configurations are now available Cryogen-FREE. Using two stage closed cycle cryocoolers, temperatures of <1.8K are obtainable. Vertical or horizontal bores in either room temperature or with integrated inserts are available. Efficient magnet and cryostat designs allow for the use of smaller cryocoolers. This saves both on initial investment and cost of long term operation. Mechanically decoupled sample stages are available as options for low vibration applications.

Recondensing systems:

Integration of a closed cycle cryocooler into a traditional liquid helium vessel allows for the recovery of helium traditionally lost through boiloff. The presence of a helium reservoir allows for operation with ultra low vibration as the cryocooler can be turned off during sensitive measurements (Helium will be lost while operating in this manner). Similarly, in the event of power failure the magnet can be discharged safely using the automatic rampdown feature of the Model 4G Power Supply.

Liquid Helium Cooled:

The lowest initial investment option continues to be liquid helium cooled systems. To help offset the high cost of helium, our efficient magnet designs allow for lower charging currents which result in the lowest boiloff in the industry. Superinsulated or liquid nitrogen shielded dewars are available. Liquid options are still traditionally used for high heat load applications such as rapid ramp rates, high field magnets and large mass designs.



Contact us today to order your configuration!

Additional cryogenic components available:

Model LM-510 Liquid Level Monitor and Sensors
Helium Reliquifier Control System
Model 612/614 Temperature Monitor and Sensors
Model GM-700 Gaussmeter and Sensors
Model 4G Bipolar Superconducting Magnet Power Supply
Current Leads (Vapor cooled, HTS and Duty Cycle Optimized)
Cryogenic Dewars, Vapor shielded, LN2 and Recondensing
Cryogenic Transfer Lines
HTS Magnets
Custom design and manufacture of magnets and cryostats

CRYOMAGNETICS, INC.
INNOVATIVE TOOLS FOR SCIENTIFIC RESEARCH

1006 Alvin Weinberg Drive • Oak Ridge, Tennessee 37830
Telephone (865) 482-9551 • Fax (865) 483-1253
Web: www.cryomagnetics.com • Email: sales@cryomagnetics.com

2014, Rev 0