

10 K Closed Cycle Refrigerator Systems



Sample in Vacuum



Sample in Top-Loading Exchange Gas

Cryo Industries manufactures closed cycle cryogenic workstations for a large variety of experimental requirements. Described below are three different standard styles. Systems can be provided with special sample 'T' style mounts, temperature controllers and sensors. **Custom systems are no problem!**

Style 1: Sample in Vacuum Mounting



Designed for 'cold finger' sample mounting. Easy sample access through quick connect vacuum shroud and single thread radiation shield. A large variety of standard shrouds and 'T' style mounts are available. The models REF-396-C22 (Standard) and REF-516-DC2 (compact) are typical optical configurations. Temperature range is from <math><9</math> to 325 K. An optional high temperature stage extends operation to 600 K.

Style 2: Sample in Exchange Gas

Samples are 'Top Loading' and can be changed in seconds without shutting off or warming the refrigerator. Interchange samples in seconds without thermal or vacuum cycling of the system. Exchange gas cooling of low thermal conductive samples. Independent sample mount heater results in fast thermal response. Ultra-stable variable temperature operation. Independent temperature control of sample mount and refrigerator cold finger. The Model REF-452-D22 is ideal for materials characterization. The Model REF-399-D22 (Mossbauer) features low vibration through bellows, spacer and exchange gas isolation



Style 3: Sample in Exchange Gas

- *Accepts variety of bolt in/out experimental inserts*
- *Removable Refrigerator*
- *Interchangeable open cycle liquid helium flow refrigerator available.*

Style 3 has all the features of Style 2 plus more!

Accepts a large variety of easy to 'bolt-on' inserts. No indium or solder seals. One system can accept many different removable inserts, such as compact 'mail' for magnet gap experiments.



In addition, the refrigerator can be removed for 'cold finger' or other applications. Even extend the operating range to less than 4 K with our interchangeable model RC102/110 REF liquid helium flow refrigerator. Avoid unreliable, clogging and expensive J-T (Joule-Thomson) third stages usually needed to get near 4 K. For those special cases or new future requirements you won't need to try to borrow a liquid helium cryostat

or miss those critical data points. ONE cryostat can do it all. The Model REF-469-D offers optical transmission (two windows at 180 degrees apart). Other optical configurations and different window materials are available. A slim body superconductor characterization system is REF-468-DSC. Systems are available for upgrading to a 'Top Loading' cryostat using your existing closed cycle refrigerator.

CRYO INDUSTRIES

Cryo Industries has 25 years experience in designing and manufacturing Closed Cycle Refrigerator Systems. This has resulted in a high level of expertise and over 375 field tested and proven designs of Closed Cycle Refrigerator Systems.

Cryo Industries pairs innovative design with leading edge technology, by integrating cryocoolers that offer the most reliable and longest track records on the market into the Closed Cycle Refrigerator Systems. Cryo is able to incorporate any of the following Cryocoolers into our designs. You simply select the cooling power you need!



10 K Sumitomo (SHI) Cryocooler Cooling Power Specification Chart

Model	1st Stage @ 50 Hz	2nd Stage @ 50 Hz	1st Stage at 60 Hz	2nd Stage at 60 Hz
DE-202	7.3W @ 77 K	1.8W @ 20 K	8.8W @ 77 K	2.2W @ 20 K
DE-204SL	13.5W @ 80 K	6.7W @ 20 K	16.2W @ 80 K	8.1W @ 20 K
CH-204S	13.5W @ 80 K	6.7W @ 20 K	16.2W @ 80 K	8.1W @ 20 K
CH-208R	65W @ 77 K	6W @ 20 K	80W @ 77 K	7.5W @ 20 K
CH-208L	28W @ 77 K	8W @ 20 K	35W @ 77 K	10W @ 20 K
CH-210	110W @ 77 K	6W @ 20 K	110W @ 77 K	6W @ 20 K

Note: DE-202 and DE-204SL use a single phase HC4E-1 water cooled compressor

Note: CH-204S uses either a single or 3 Phase water cooled compressor (customer must specify)

Note: CH-208 and CH-210 requires a 3 Phase (Low or High Voltage) F70 water cooled compressor



10 K CTI Cryocooler Cooling Power Specification Chart

Model	1st Stage @ 50 Hz	2nd Stage @ 50 Hz	1st Stage at 60 Hz	2nd Stage at 60 Hz
M-22			8W @ 77 K	1W @ 20 K
M-350			20W @ 77 K	4W @ 20 K
M-1020			34W @ 77 K	12W @ 20 K

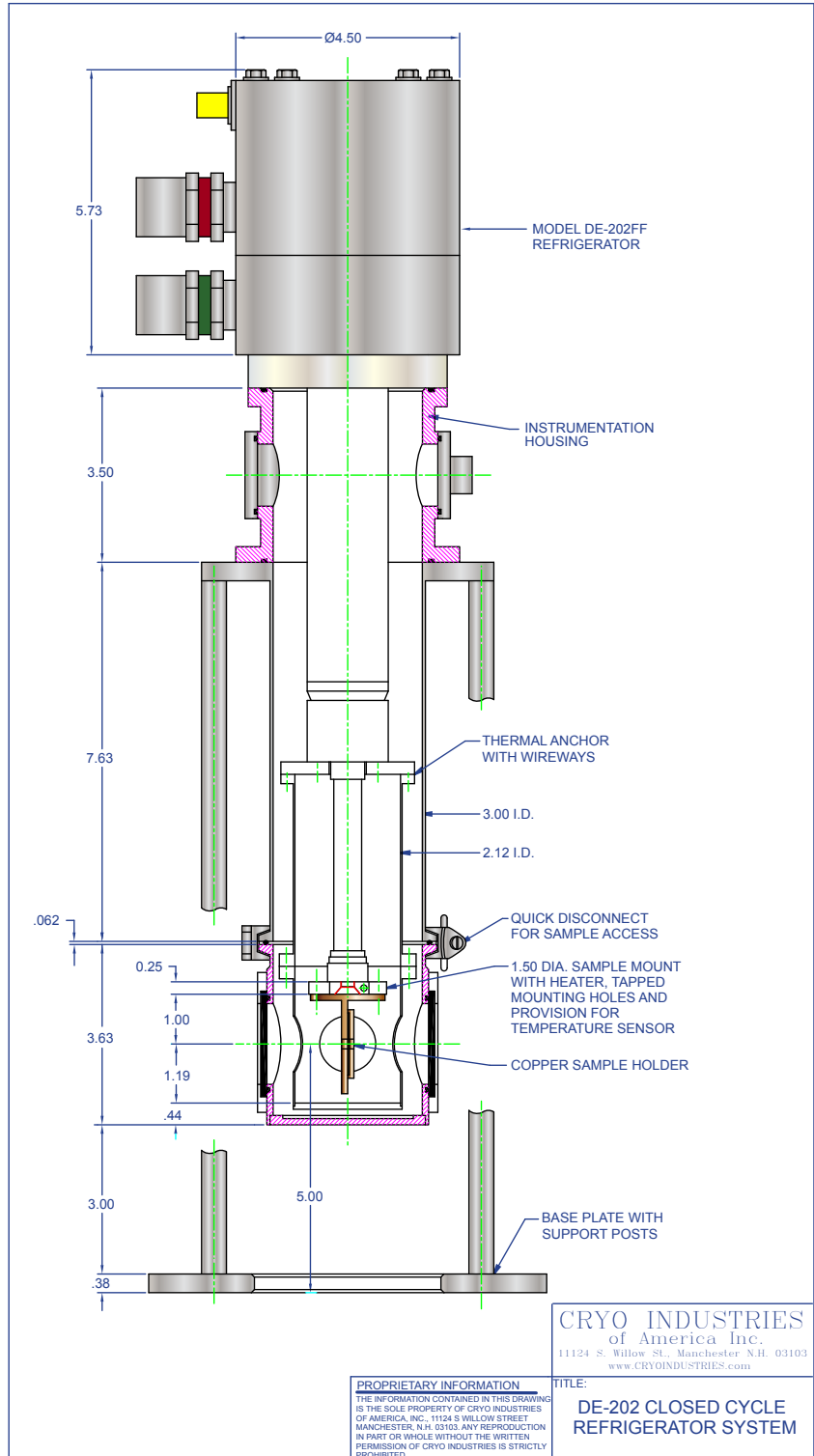
Note: Both M-22 and M-350 use Model 8200 Single Phase Water-Cooled Compressor

Note: M-1020 requires Model 9600 Three Phase Water-Cooled Compressor

Closed Cycle Refrigerator System: Sample in Vacuum Optical



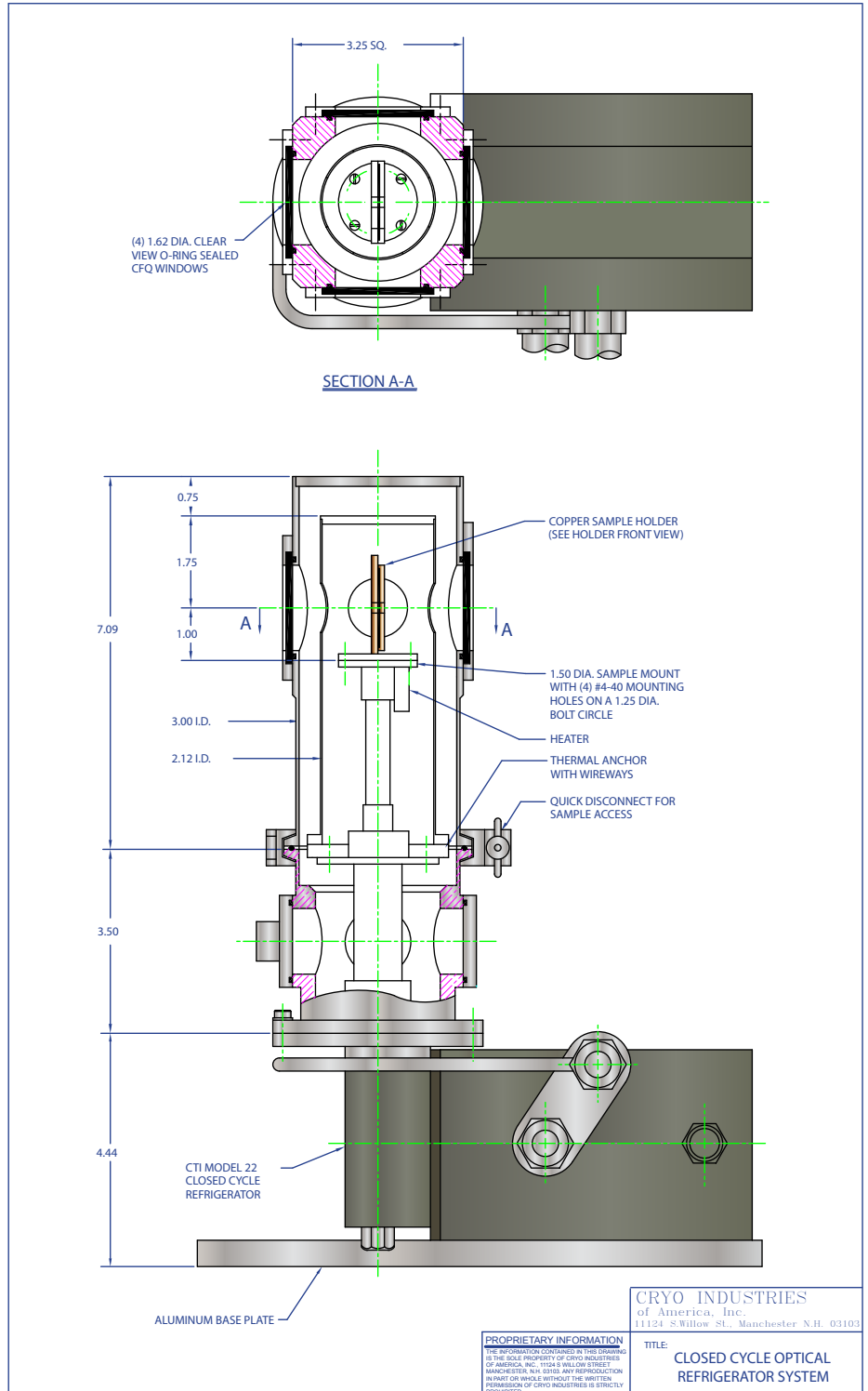
This design features Sumitomo (SHI) Model DE-202. If higher cooling power is needed any of the cryocooler listed on the Cooling Power Chart can be integrated into this design.



Closed Cycle Refrigerator System: Sample in Vacuum Optical



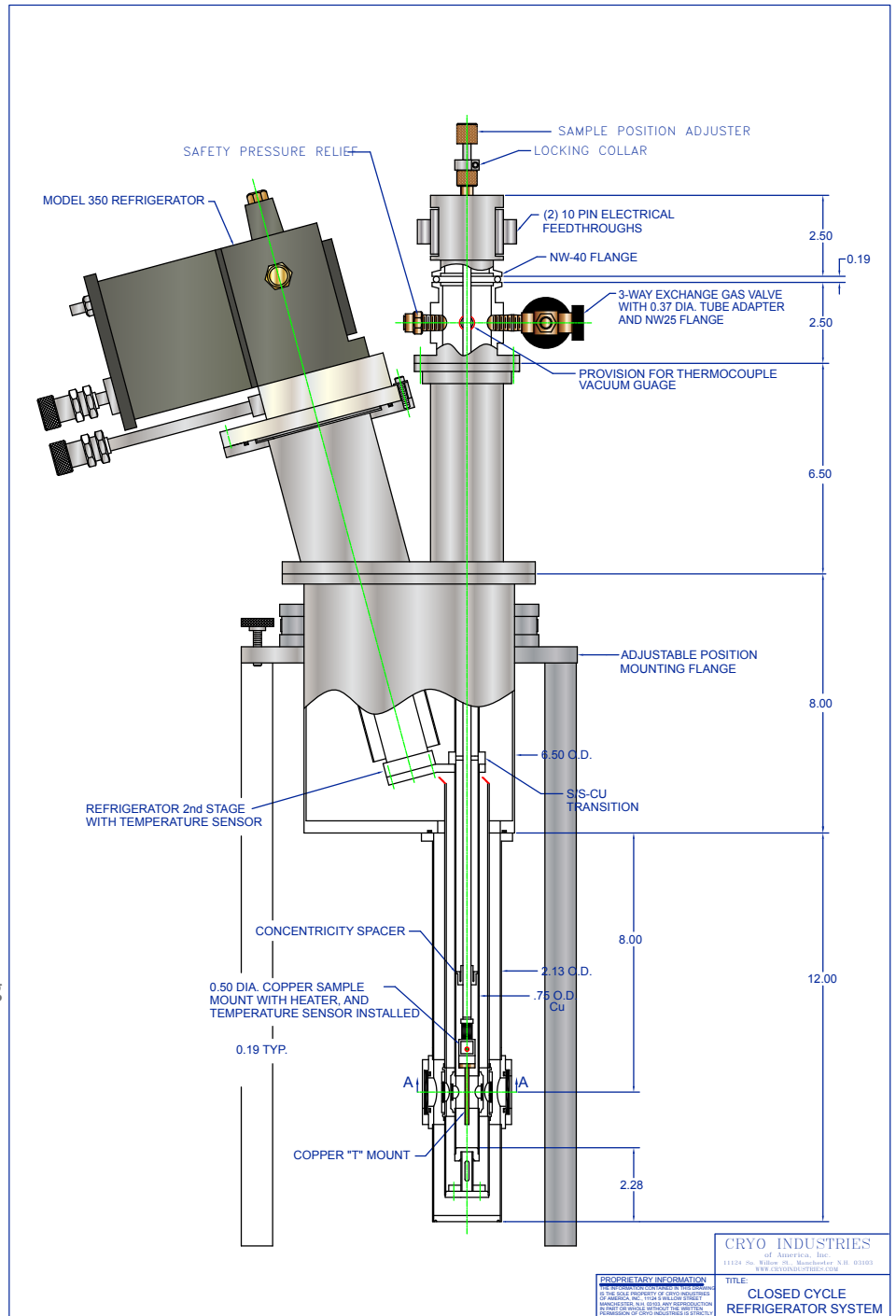
This design features CTI Model 22. If higher cooling power is needed any of the cryocooler listed on the Cooling Power Chart can be integrated into this design.



Closed Cycle Refrigerator System: Top Loading Sample in Exchange Gas Refrigerator on Top



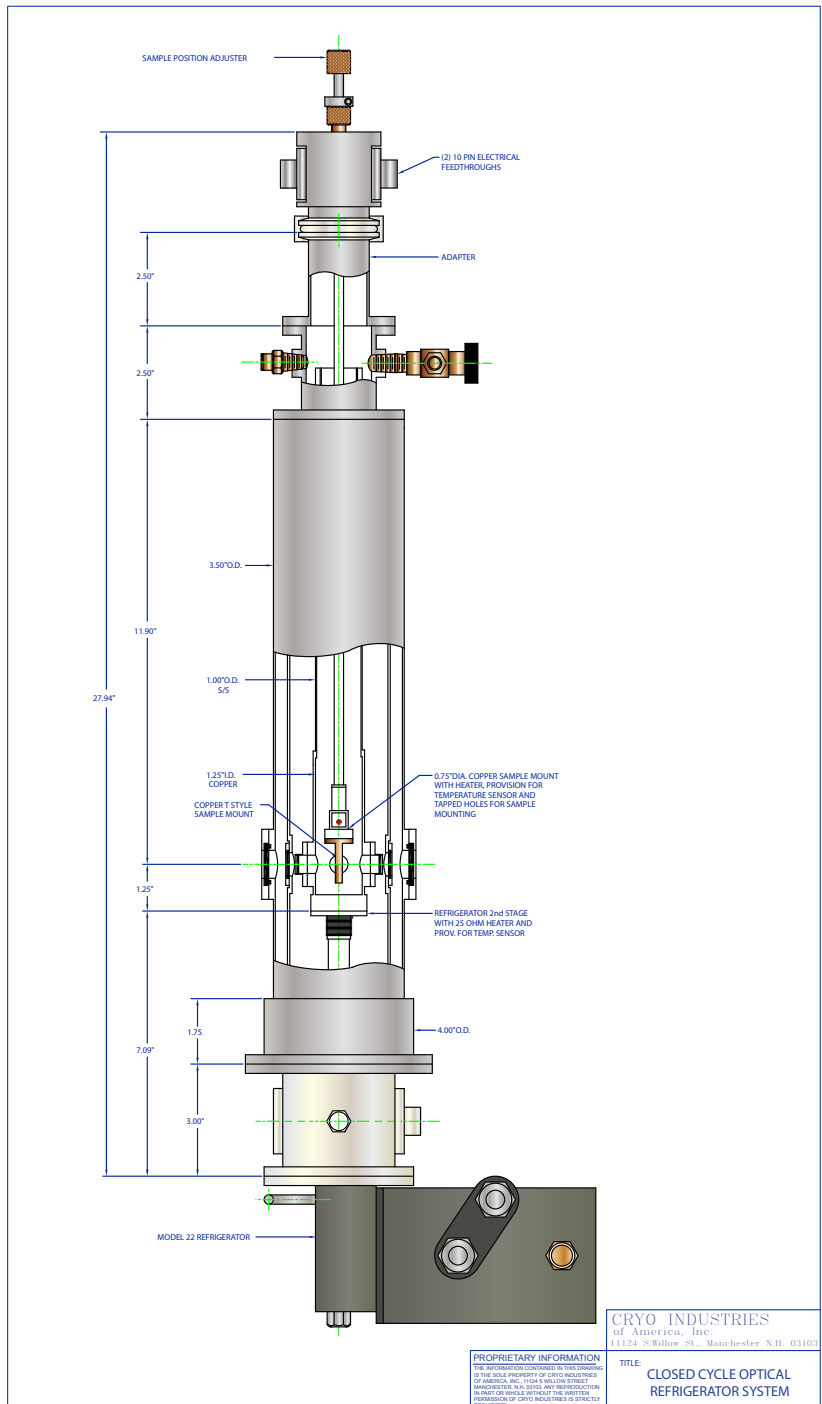
This design features CTI Model 350. If higher cooling power is needed any of the cryocooler listed on the Cooling Power Chart can be integrated into this design.



Closed Cycle Refrigerator System: Top Loading Sample in Exchange Gas Refrigerator on Bottom



This design features CTI Model 22. If higher cooling power is needed any of the cryocooler listed on the Cooling Power Chart can be integrated into this design.



CRYO INDUSTRIES

Cryo Industries is able to **custom design** a system that will meet all of your experimental needs. Following are examples of custom Closed Cycle Refrigerator Systems that we have designed and manufactured over the years. You supply us with your experimental specifications and we will provide you with a system that is guaranteed to meet those needs!

Custom Closed Cycle System for
Narrow Gap Experiments



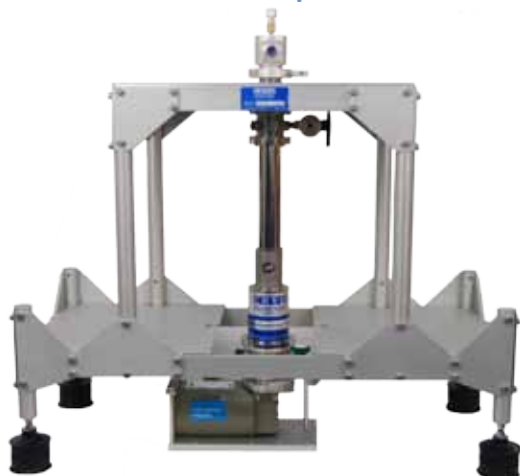
Custom Closed Cycle System
Non-Optical for High
Vacuum



Custom Closed Cycle System
for X-Ray Beamline



Custom Closed Cycle System for
Mossbauer Experiments



Custom Closed Cycle System for
Large Sample Size Experiments

