2s226K Cryocooler
Specification Sheet

The 2s226K is a low vibration, no maintenance, highly reliable, acoustic Stirling (pulse tube) cryocooler for applications requiring cooling loads up to 140 watts at 77k. Each unit is driven by two of RIX's linear reciprocating motors with clearance seal pistons, providing wear free operation with no lubrication required. These compact systems are ideal not only for laboratory use but also for military and aerospace applications.

RIX's design is completely absent of cold moving parts or seals, eliminating maintenance that is required of most other technologies. The dual opposed motor/piston design within the pressure wave generator (PWG) is naturally balanced, reducing vibration and noise. When vibration at the cooled point is of concern RIX's remote head system (FAR), which separates the PWG from the coldhead, can include a flexible transfer line in place of the standard rigid pipe, however, some degradation in performance may occur. To improve power consumption and increase versatility, each cooler is designed to be adjusted "on-the-fly" to match varying cooling load requirements. These advantages are accompanied by competitive pricing in both small and large quantities, making them ideal not only for laboratory use but also for HTS, medical, liquefaction, military and aerospace applications.

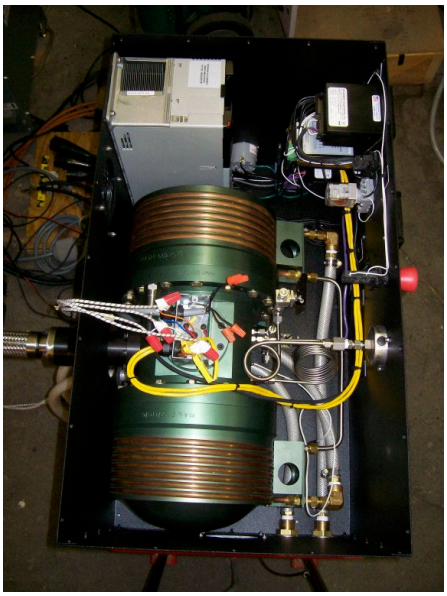

Figure 1: 2s226K PWG Mounted in Enclosure

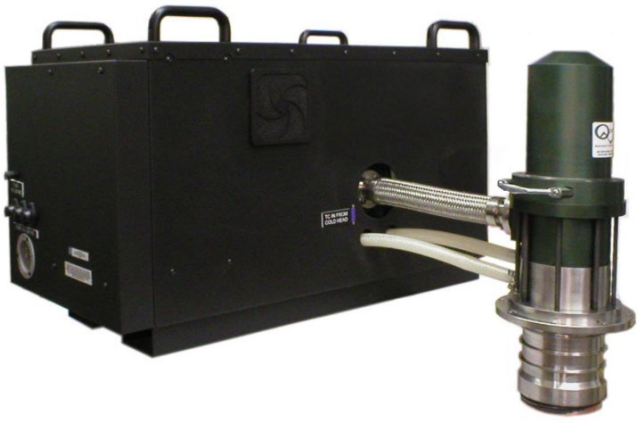

Figure 2: PWG with Enclosure and Drive Electronics

Operating Principle

The base cryocooler unit consists of a pressure wave generator driven by robust linear reciprocating motors and an acoustic Stirling (pulse-tube) coldhead. The acoustic Stirling coldhead consists of a warm heat exchanger, a regenerator, a cold heat exchanger, a thermal buffer tube, a hot heat exchanger, an inertance tube, and compliance tank. Figure 3 below is shown as an inline configuration for clarity, but the actual coldhead is "folded over" at the cold heat exchanger to create a salient cold zone.

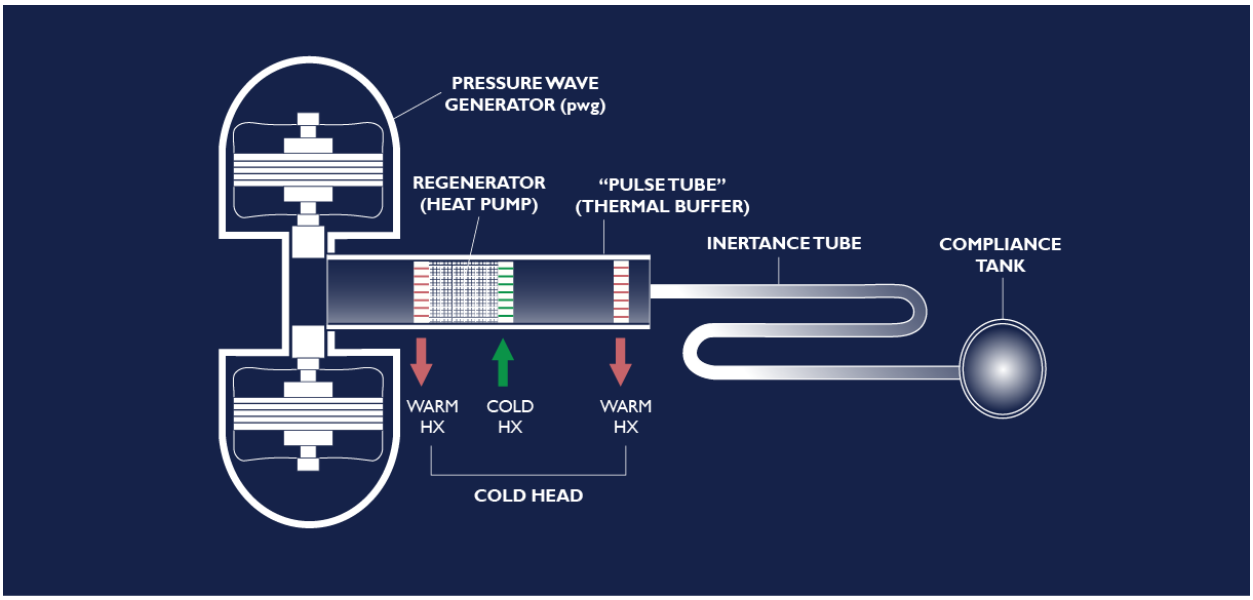

Figure 3: Thermoacoustic (pulse tube) Diagram

1) Pressurized helium gas is cyclically compressed and expanded relative to the mean pressure (charge pressure) by the pistons of the PWG.
2) With each forward stroke of the pistons, the gas moves through the aftercooler, or warm heat exchanger, where heat is removed. The gas parcel continues through the regenerator, which precools it before reaching the cold heat exchanger.
3) As the gas moves toward the cold heat exchanger, gas in the acoustic network (thermal buffer tube, hot heat exchanger, reservoir) also moves in the same direction. Even as the driven gas stops advancing, when the pistons reach their upper limits, the network's gas continues moving, driven by its own inertia in the high-speed inertance tube. This acts like a virtual piston, moving away from the cold exchanger, which expands the gas in that area. As it expands, it gathers heat from the surroundings (the area or substance to be cooled).
4) The pistons begin withdrawing and helium then moves back through the regenerator and aftercooler. Still delayed by its inertia, the gas in the network follows and the cycle begins again.
5) The cryocooler motors and heat exchangers are cooled by local air, water, or an optional closed water loop that consists of a reservoir, a pump, and a liquid-to-air heat exchanger.

Specifications

General:

Model 2s226K cryocooler generates approximately 140 watts rated cooling output @ 77K from approximately 2500 watts electrical input, rejecting to 20 C water, as shown in Figure 4. Exterior surfaces are mainly constructed of anodized aluminum or stainless steel. The coldhead is mounted via a vacuum flange with dimensions as defined in Figure 5. Piston stroke is rated at 20mm, with a maximum rating of 22mm, and controlled by the input power electronics. Instrumentation, automatic temperature control, enclosures, and drive electronics are optionally available.

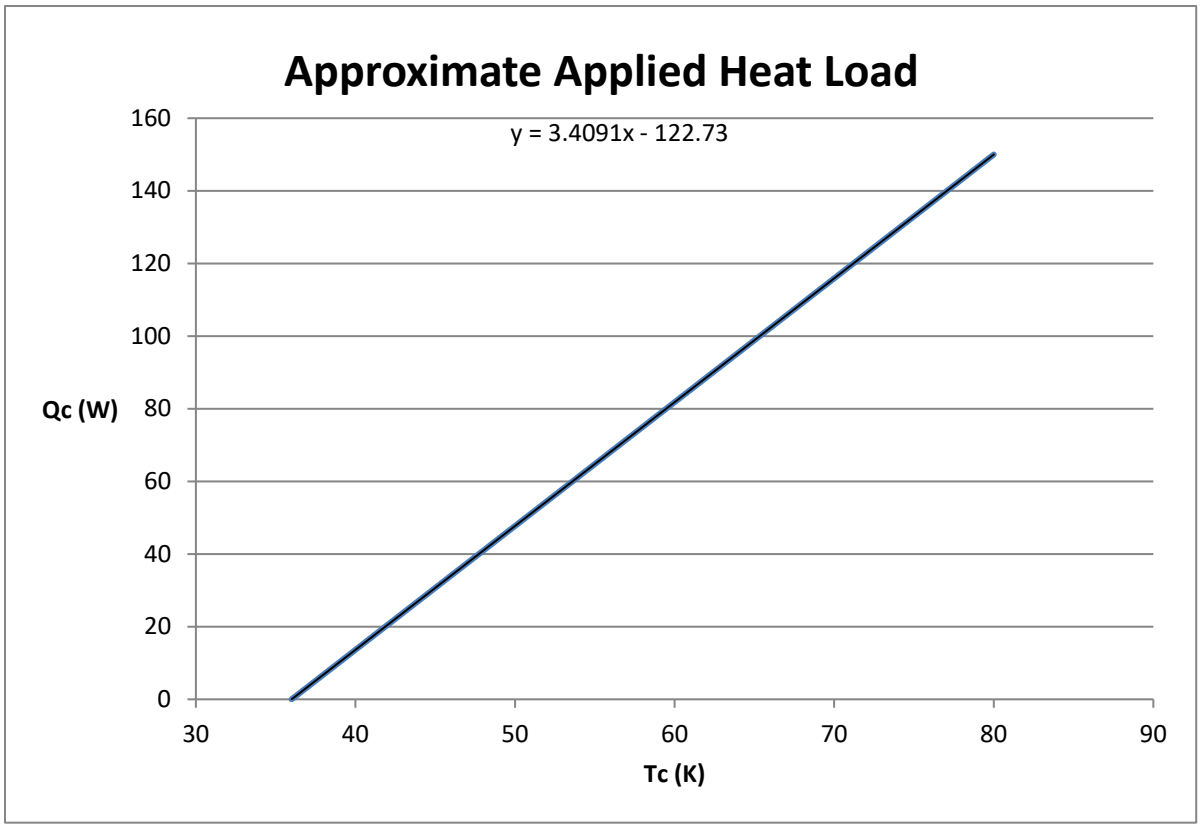

Figure 4: Approximate Cooling Load Curve

Materials of construction:

- 300 series stainless and anodized aluminum in most non-electromagnetic parts. All vessel components are constructed in accordance with applicable ASME Vessel Code requirements but are NOT stamped.

Connections (Internal Charge Gas):

- Connection dimensional details to be determined and subject to compatibility with adaptor. 1/4-inch swagelok tube fitting is provided for evacuation, filling, or connection of working fluid (99.999 helium).

NOTE: METRIC FITTINGS CAN BE SUPPLIED AT NO EXTRA COST IF SPECIFIED.

Dimensions: - see Interface Drawing, Figure 5

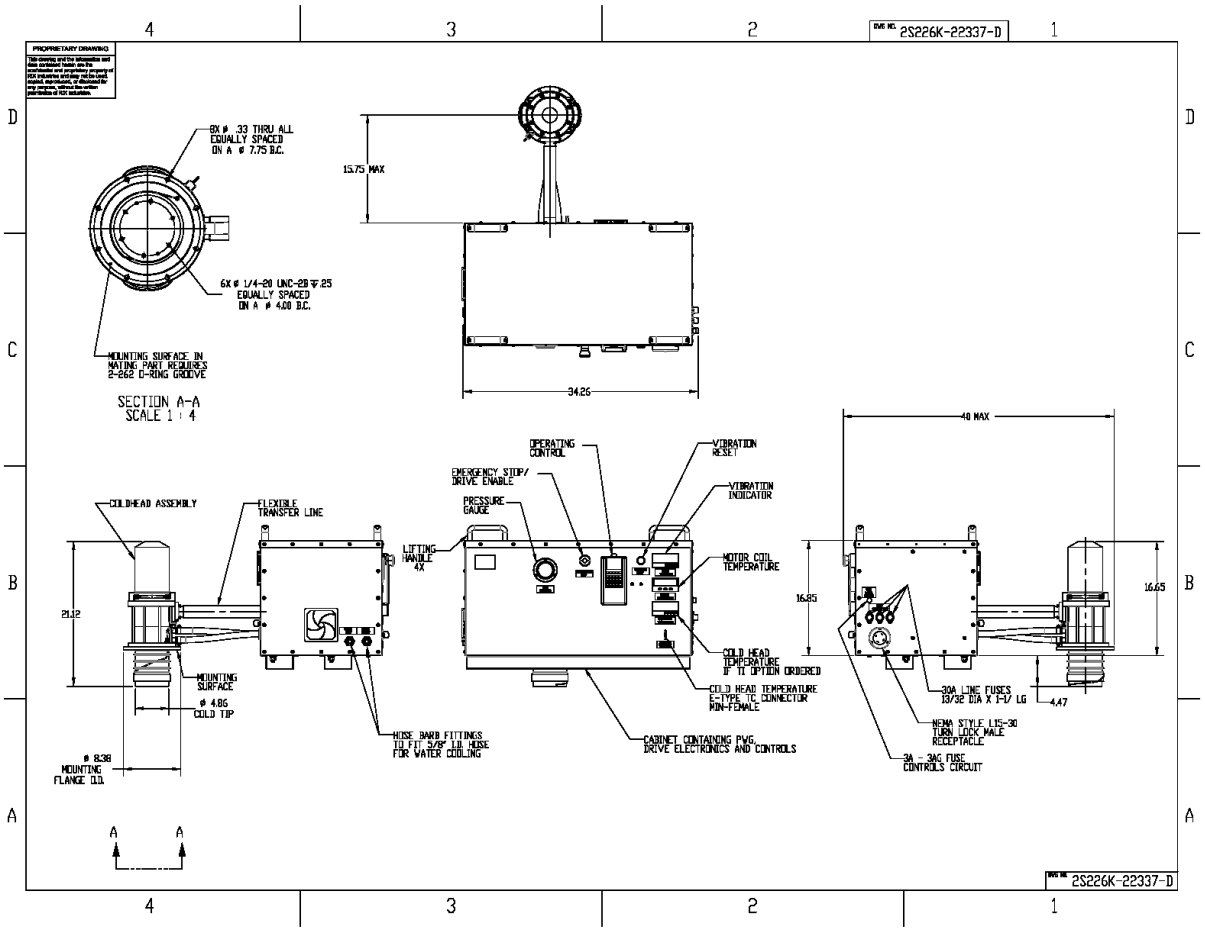

Figure 5: Interface Drawing

Weight:

- Pressure Wave Generator (PWG) ~ 60kg
- Coldhead ~ 21kg
- Complete system including enclosure and drive electronics ~ 105kg (system ship weight TBD)

Motor Rating (subject to change as required):

- 1200 x 2 kWe nominal max at 60 Hz, 20 mm
- Core impedance @ 208VAC winding: 1.0 ohm DC (10 @ 60 Hz)
- Stator inductance @ 208VAC winding: 33mH
- Nominal BL product @ max voltage winding: 54 N/Ampere
- Rated operating voltage: 208 VAC 1ø rms @ 60 Hz
- Rated operating current: 15 Amperes rms (0.8 power factor)
- Intrinsic stiffness: 102 kN/m (approximate)
- Damping: Rm 26 N-s/m (approximate)

Motor Mechanical:

- SS720 multi-strap suspension
- M-19 laminated stator construction
- FeNdB magnets
- Stroke limit 22 mm (20 mm operation must be centered within 1 mm)
- Moving mass 3.64 kg (approximately with 3.661" piston)

Piston & Gas Management:

- Clearance seals, Rulon buffers
- Inertance balance tube for drift management
- Bolted vessel for 3.0 MPa maximum allowable working (mean) pressure

Thermal Management:

- Direct conductive motor cooling to external liquid cooling loop in parallel with coldhead aftercooler
- 10 liter/minute recommended flow for full load. Less than 300 kPa pressure drop (internal)