# 2s132K Cryocooler
## Specification Sheet

The 2s132K is a low vibration, no maintenance, highly reliable, acoustic Stirling (pulse tube) cryocooler for applications requiring cooling loads of 25 watts at 77k. Each unit is driven by two of RIX's 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 mass loading at the cooled point is of concern, RIX offers a remote head system (FAR), separating the PWG from the coldhead, further reducing vibration. To improve power consumption and increase versatility, each cooler is designed to be adjusted "on-the-fly" to match varying cooling demands. 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, and military and aerospace applications.

**Figure 1: 2s132K FAR SS Air Cooled**

## 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.

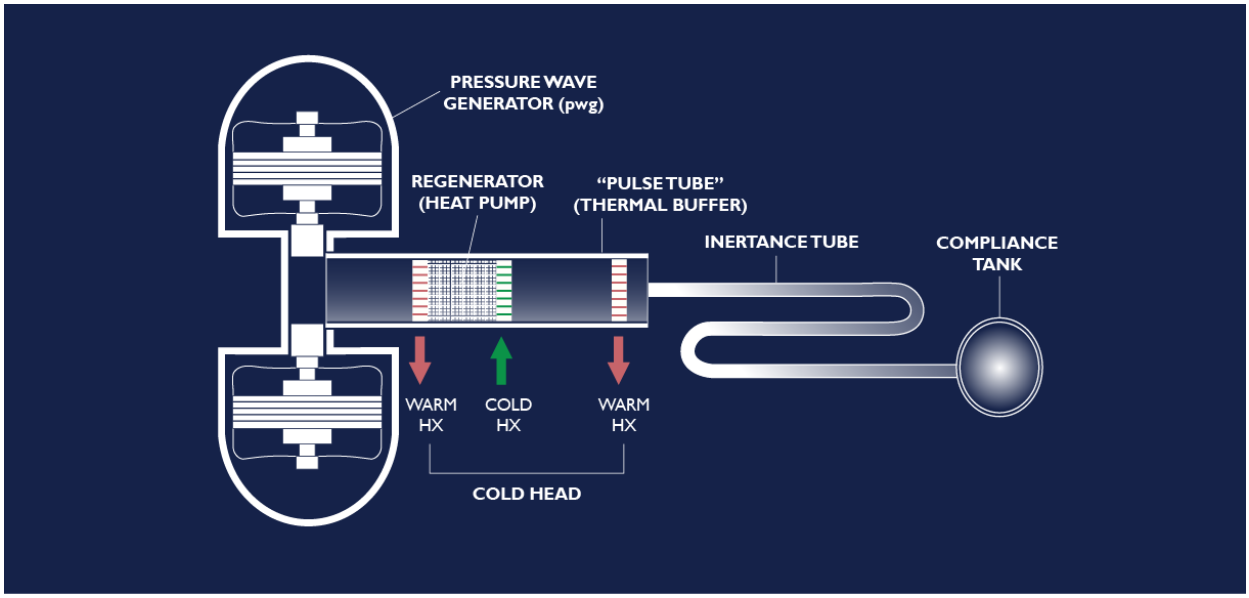


**Figure 2: Thermoacoustic (pulse tube)**

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 2S132K cryocooler generates 25+ watts of cooling power at 77K, and 65+ watts at 150K, from 600 watts electrical input, rejecting to 22 C ambient air, as approximated in Figure 3 (if water cooled the cooling power will be 2-5 watts higher at each point). Exterior surfaces are mainly constructed of anodized aluminum or stainless steel, depending on the configuration selected. All forms have a coldfinger with CF knife-edge sealed vacuum flange for mounting (optional DN flanges available). Piston stroke is rated at 12mm, with a maximum rating of 14mm, and controlled by the input power electronics. Instrumentation, automatic temperature control, water-cooling, and drive electronics are optionally available.

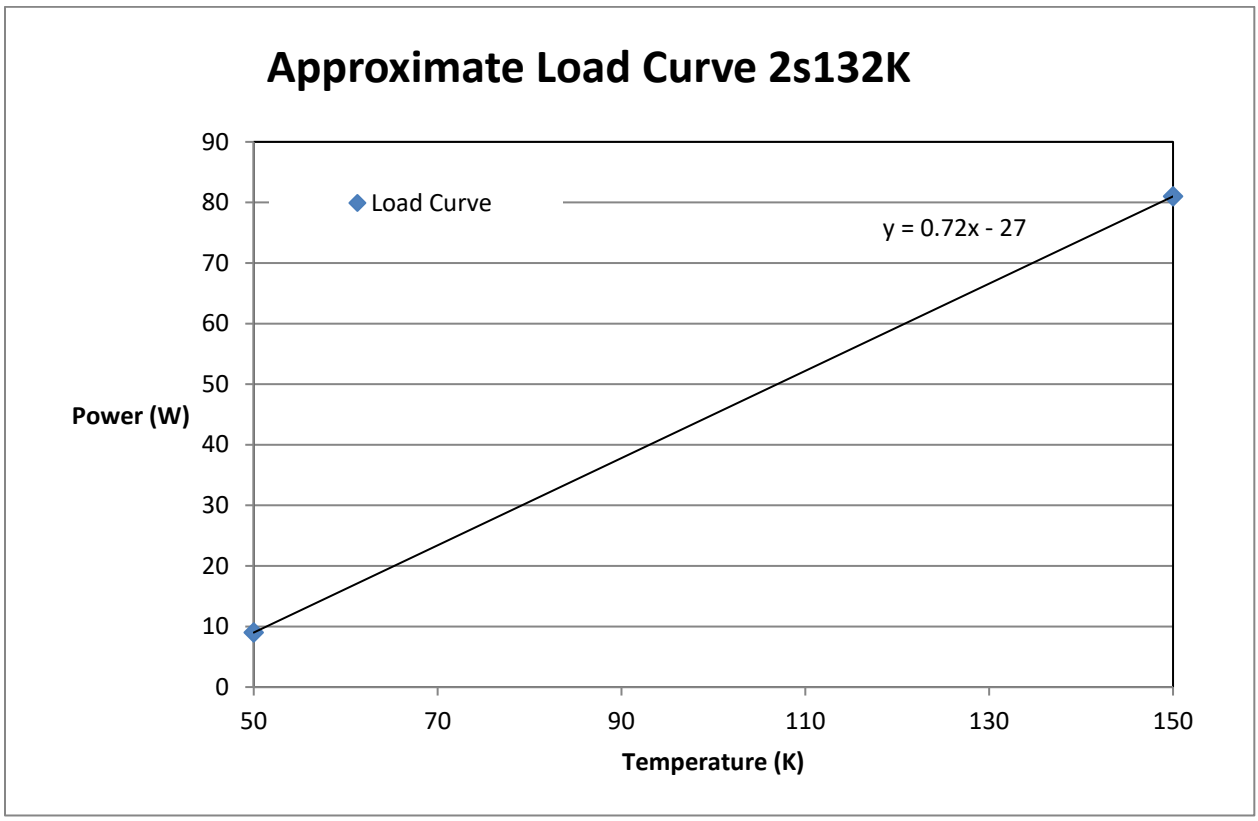


**Figure 3: 2s132K Typical Load Curve**

**FOR BEST PERFORMANCE THE COLD FINGER SHOULD BE MOUNTED VERTICALLY AND FACING DOWN. RIX'S SPECIFICATIONS ARE BASED ON THIS MOUNTING CONFIGURATION.**

**Materials of construction:**

Anodized aluminum or 300 series stainless steel in most non electromagnetic parts except heat exchangers (copper). All vessel components are constructed in accordance with applicable ASME Vessel Code requirements but are NOT stamped.

**Mounting:**

- Coldhead: CF75 vacuum knife-edge flange (Options available)
- Customer sample interface: Four #6-32 tapped holes, equally spaced on a 1.50" bolt circle

**Connections (Gas & Water):**

- "FAR" flexible transfer line with stainless steel braid and metallic bite seals optionally available
- Stainless Steel unit has rigid transfer line as standard
- Capped Schrader or Swagelok valve is provided for evacuation, filling, or connection
- Water-cooled (open-loop), standard water connections are barbed fittings for ¼" ID tubing

**Dimensions (approx.):**

- Pressure wave generator ~8.9" x 6" x 15.5"
- Remote coldhead ~6" diameter, 13" high (subject to change)
- See Figure 4 below

**Weight:**

- Pressure wave generator ~ 17.7kg net of options
- Coldhead with transfer line ~ 7.3kg net of options

**Motor (subject to change):**

- 250 x 2 We at 60 Hz, 12 mm stroke
- Core impedance @ 110VAC winding: 2-ohm DC, (18 @ 60 Hz)
- Stator inductance @ 110VAC winding: 46mH
- Rated operating voltage/current: 110 VAC 1ø rms @ 60 Hz/4.0 A rms (0.85 power factor)
- Stroke limit 14 mm
- 132 mm diameter, 80 mm long

**Piston & Gas Management:**

- Clearance seals, Rulon buffers
- Welded vessel for 3.0 MPa maximum allowable working pressure

## Thermal Management:

- Water-cooled - 1/4" barbed fittings for ¼" ID tubing
- 2 liter/minute minimum required flow at full load. Less than 50 kPa pressure drop (internal)
- Air cooled equipped with 2 CPU style heat exchangers with fans
- Type E thermocouple on cold tip for monitoring

All specifications are the most accurate representation of product at time of offering, subject to change without notice as RIX enhances product offering. Purchaser is responsible for verifying details of interface requirement.

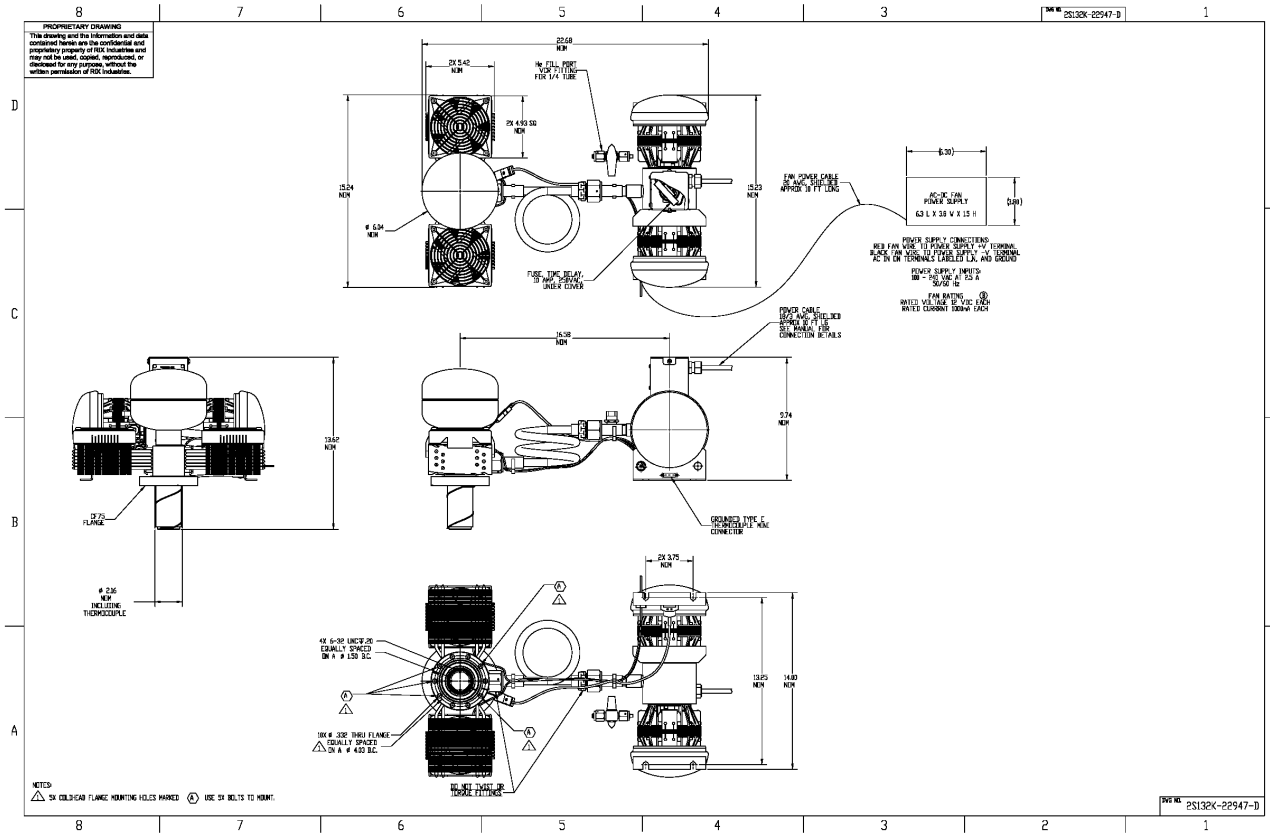


**Figure 4: Typical 2s132K FAR Cryocooler Dimensions with SS PWG and Rigid Transfer Line**