



TROUBLE SHOOTING – DISPLEX.

1.0 Cryostat is not getting cold.

All cryostat are tested at ARS for minimum temperature and cooldown time. During test the temperature is measured at the tip of cryostat using a calibrated test sensor not at the sample. The specifications of the cooler are with no experimental heat loads this means no wiring installed and no open windows for optical access and consequential radiant heat load.

Following reasons will result in higher temperatures and slow cooldown:

1. **Vacuum Level** in the shroud is poor. Vacuum level has to be a minimum 1×10^{-3} Torr. The better the vacuum the lower the temperature. Reasons:

- Small leaks in o-rings in shroud, .
- Poor quality vacuum pump. Vacuum hose.
- Check rate of rise to be sure.

2. **Radiation Shield** has to be closed off with aluminium foil during test.

3. **Vacuum Shroud** to have the blank ports installed during test.

3. **Temperature sensors** not properly installed:

The contact between the cryocooler and the sensor is loose. Install a gasket if necessary. Tighten the contact.

Thermally anchored leads. If the wiring is not properly anchored it can result in a high temperature reading at the sensor.

Shorting of the sensor leads will result in an incorrect temperature reading.

The Calibration curve of the sensor is not properly matched with the controller. See controller manual for this.

Thermocouples are being used. Thermocouples are inaccurate as compared with Silicon Diode sensors. They need to be periodically calibrated and the calibration information input into the controllers.

Crossalk between thermocouples.

4. **Orientation:**

Although the Displex Cryocooler is orientation independent it will have some degradation when the 4K cooler is installed with cold tip up. The gravity working against the high density helium will result in some reduced cooling power.

5. **Thermal Short:**

Thermal short between the temperature sensor or cold tip and the radiation shield.

Thermal short between the radiation shield and the vacuum Shroud.

6. **Compressor**

Cooling water has to be within specification. Temperature and flow rate.

Check the Helium Pressure in the compressor.



2.0 Sample Temperature is too high:

If the cryostat is cold and the sample temperature is not getting cold check the thermal path from the sample to the cooler.

1. For good thermal contact between sample holder and cryostat. Indium or silver gasket is important.
2. For good thermal contact between window of sample holder and sample holder. Make sure the indium wire is crushed in the groove of the sample holder.
3. Window must be sapphire for minimum temperature (This is user specified). Some IR windows will result in higher temperature at sample.
4. Contact between sample and window must be good. Use crycon grease or silver epoxy.
5. Too many instrumentation wires are installed on cryostat for user application. Each wire will cause some heat load.
6. High heat load radiation.
7. Thermal short, something (loose wire, tape) touching radiation shield

3.0 Compressor keeps shutting down:

The compressor oil may be too cold. Leave in heated room for a few hours. (Attach hoses and head and try again).

Cooling water not turned on.

Low Oil Level.

Modified set up:

It is probable that the additional volume of interconnecting gas lines between the compressors and the expanders has not been accounted for by the customer. After looking at the effects of the long lines, the longest being 53 ft of 1/2" superflex hose + 102 ft of 7/16" id copper tubing, that the system static pressure should be reduced to 185 psig instead of the standard system charge pressure of 200-205 psig. These long lines reduce the operating pressures at the expander ~ 6 psi, causing ~ 3% loss of refrigeration. They also add ~ 10 L of gas volume to the system which would cause the operating pressures and current draw to be high unless the system static pressure is reduced. Other things to consider would be:

1. We specify the minimum operating ambient to be 12 C. If the ambient air or cooling water is too cold, the oil will be too thick causing excessively high current draw.
2. We specify the ARS-4 power supply to be 208-230 V +/- 5%, 1 ph, 60 Hz or 200 V +/- 5%, 1 ph, 50 Hz. The order was apparently sent with a step-down transformer because the India voltage was specified to be 230 V, 50 Hz. We would normally have sent a 10% step-down transformer with each compressor to prevent high current draw at 50 Hz. If the transformer was in place in Canada @ 60 Hz, then the step-down voltage could have been too low which would have caused high current draw at 60 Hz. If the transformers were removed in Canada for testing there at the proper voltage, but then were not re-installed since sent to India, and if the India voltage is 230 V, then the current draw will be too high and the transformers must be installed as originally intended.
3. If 2. had occurred in Canada and the switch-circuit breakers were excessively tripped, it may be they had fatigued. Apparently they were replaced in Canada. True? Also, it is important that when the switch-circuit breaker is replaced that the quick disconnect terminals are squeezed before re-installing them so that they are bound tightly onto the new switch tabs. I believe Gerard had an installation procedure stating this but I don't have a copy of it. Do you? If so, let's check it out.
4. We do not recommend a 30 A circuit breaker on the compressor! Johnsen Ultravac will be on their own! However, I'm willing to give them some advice: If they choose to proceed, they should hardwire the compressor directly to the source supply with 10 AWG cable, with the 30 A breaker at the source supply, AND they must change the ARS-4 internal wiring to both the motor contactor and to the compressor motor with 10 AWG wires.



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Compressor Failure:

Circuit Breaker.

If the compressor has seen low voltage (170 V). The range of our specs and that we specify the need for voltage to be no less than 197 V @ 60 Hz. That extended operation at low voltage will cause a high current draw, sometimes within the range of the circuit breaker where it will not trip (<125% overcurrent may trip, 135% will trip). The circuit breaker will overheat during that time, transferring heat to the wire to deteriorate it. The combined effect of the overheating and high current draw will cause the wire to eventually break down and melt. The wire is normally rated for up to 32 A.

4.0 Helium Leak in System:

If the pressure in the system keeps dropping. Isolate the leak by disconnecting the cold head from the hoses. If it is still leaking. Disconnect the hoses from the compressor. In the process of elimination you can determine if the leak is in the compressor, the hoses or the cold head.

Once the leak is identified it can be fixed at ARS.