

APS JOB SAFETY ANALYSIS

<b>JSA Number:</b>		JSA TITLE: Mar-USA Repair/Maintenance/Cryotiger		Date: 05/15/2007	NEW REVISED
<b>Name of contractor:</b> Mar-USA		Prepared BY: Christine Muchmore Troy Lutes		APS Coordinator: Troy Lutes	APS Approval (sign & date):  5/16/07
<b>Scope (Description) of Work</b> Mar-USA Engineers to service, troubleshoot, and maintain APS Detector Pool Mar165 CCD (three) and Mar345 Image plate (two) detectors. This includes software/computer work, mechanical modifications/component replacement, and cryotiger charging/repair.					
<b>Required and/or recommended Personal Protective Equipment (PPE): Safety Glasses</b>					
<b>Phase of Work/Basic Job Steps</b>		<b>Safety Concerns/Potential Hazards</b>		<b>Recommended Action or Safety Procedures</b>	
Argonne Requirements		Argonne ES&H Compliance and Emergency Situations.		All contractor personnel assigned to work on the Argonne site will attend/complete Mini Contractor Safety Orientation (CSO). The contractor must maintain proof of this training on his/her person by carrying the CSO Argonne card provided by the instructor. The contractor must provide proof of this training to the Tech Rep or SI when requested.	
Vendor Personnel Check-In		Worker Accountability		In addition, all contractor personnel are to attend building/area orientation in relation to their scope of work to ensure they are aware of shelters during severe weather or emergency evacuation meeting points as well as any other special conditions in relation to the specific building/area. The contractor must report daily, by contacting the Tech Rep, the number of employees he has on site. Contractor is also responsible for notifying Tech Rep of arrival/departure.	
General Conditions		PPE, Unauthorized Personnel In Work Area & Work Safe Practices		ANSI approved safety glasses and sturdy leather work shoes must be worn when servicing the system. All work zones, per scope of work, will be sectioned off or barricaded with OSHA approved signage posted.	

(Use additional sheets as necessary)

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**Job Safety Analysis  
Part - 2**

<b>Phase of Work/Basic Job Steps</b>	<b>Safety Concerns/Potential Hazards</b>	<b>Recommended Action or Safety Procedures</b>
Tool Inspection	Broken or Unauthorized Tools	All tools and equipment must be inspected by Argonne Tech Rep prior to use. Any tool or piece of equipment deemed unsatisfactory will be tagged and removed. Any tool or piece of equipment that leaves the Argonne site will have to be reinspected upon its return. GFCIs will be utilized on all drop cords and hand held tools.
Equipment Repair	Energized Equipment	No work allowed on energized components over 50V or on equipment with exposed voltages over 50V.
	Pinch Points/Moving Parts	Exercise caution while working with guards/cases removed where moving parts are present.
Cryotiger Repair	Flammable Gas	PT30 contains ~50% propane. PT30 creates an explosive mix when combined with air. Minimize gas release. Work in a well ventilated area.
	Frostbite	PT30 can cause frostbite when vented. Minimize gas release.

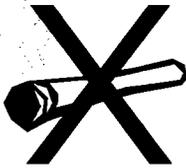
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## Instructions for charging a compressor

### INTRODUCTION

The cooling system for the MarCCD and MarMosaic detectors needs a special manifold to charge from a low-pressure tank of PT-30 gas. The charging manifold is used to fill the compressor in a slow, controlled manner, and a line gauge is used to monitor the pressure and prevent overfilling (which would cause PT-30 gas to leak from the overfill valve).



**NO SMOKING – NO SPARKS – NO FLAMES** in area. The gas is flammable and asphyxiating (by oxygen displacement). If much of it leaks, you should ventilate your area immediately. It is colorless and odorless. If you start to get dizzy while working with the gas, ventilate with fresh air, close valves, and reconnect or cap gas connections.

### INSTRUCTIONS

1. Air must not be introduced into the system. A disconnected manifold will always have a short section filled with air, so first this section of the manifold must be evacuated.
  - a. Close the Tank Valve, and close the two valves (V1 and V2) on the (still disconnected) manifold.
  - b. Connect the manifold to the recharge tank, but do NOT open the gas tank and do NOT make any connections to your system.
  - c. Connect your vacuum pump to manifold vacuum port. This should look like Figure 1.

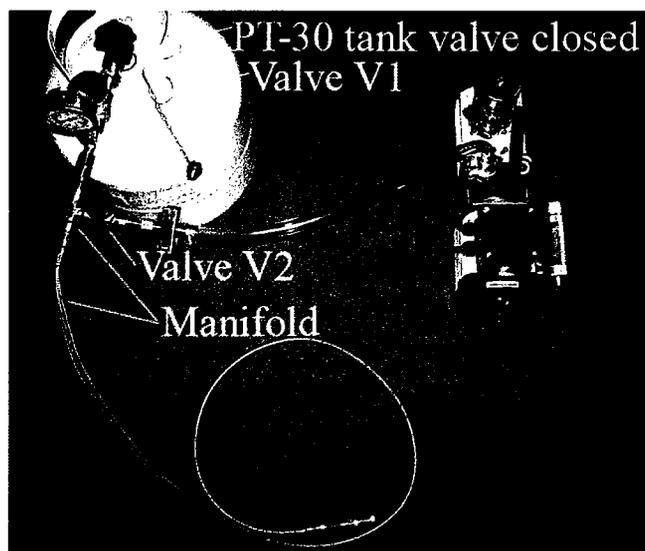
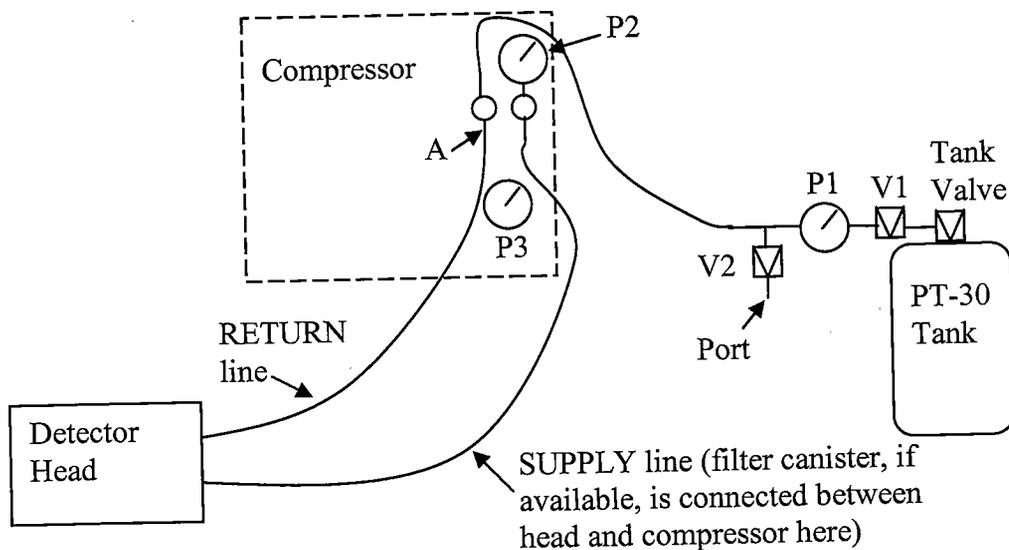


Figure 1 – Evacuate the charging manifold

- d. Usually a little flammable PT-30 gas is in the manifold, so make sure that the vacuum pump exhaust is not near any ignition source.
  - e. Turn on the pump and open valves V1 and V2 a full turn each. (Do NOT open the Tank Valve.) Pump down for about 20 minutes. The goal is to get all air and moisture out of the manifold.
  - f. Close valves V1 and V2 completely, and stop the vacuum pump.
2. You **must** make sure of the following:
    - a. The detector is at room temperature.
    - b. The vacuum pump valve V2 (shown in Figure 1) is completely closed.
    - c. If you are charging the system due to a big leak, check that the system contains at least some PT-30 gas greater than atmospheric pressure (gauge P3 in Figure 2 reads greater than about 5 PSI). If  $P3 \leq 5$  PSI, you must stop and go to Section 6 to evacuate air and moisture from the system.
  3. Now make the connections according to Figures 2, 3, and 4 below.



**Figure 2 – Schematic of connections**

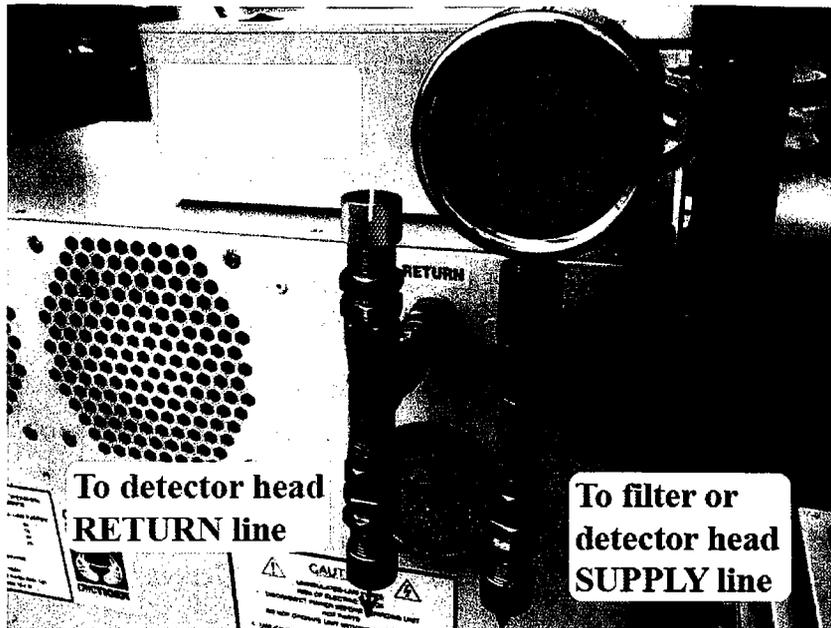


Figure 3 – The “T” and “T Gauge” connections

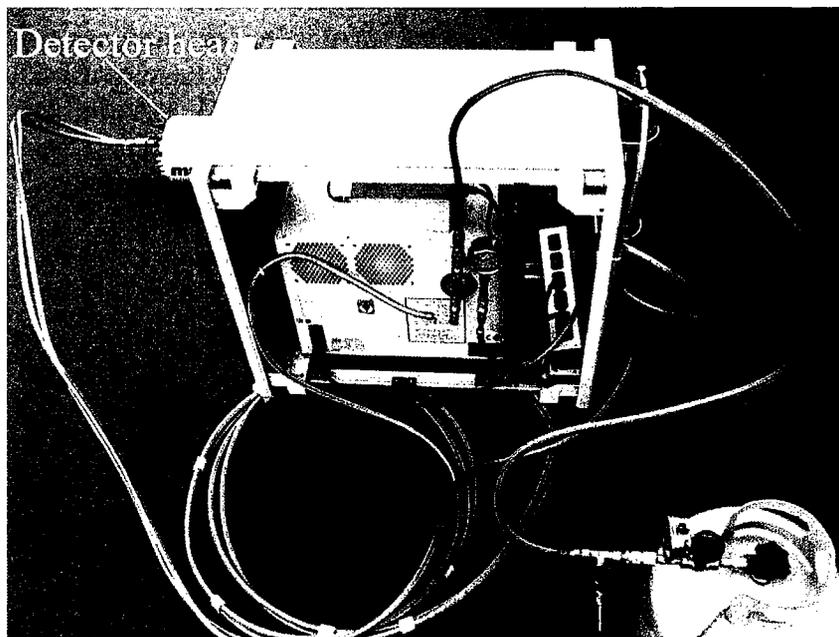


Figure 4 – The system connected, ready to be charged

After all connections are made, continue as follows:

- a. Open the Tank Valve a full turn.
- b. Turn the compressor on in the *marccd* software (Configure->Detector menu "Cooler Power" box). Make sure P3 < 30 PSI, indicating compressor is running.
- c. Open valve V1 a quarter turn. (Do NOT open V2.) Pressure reading on gauge P2 will begin to increase slowly.
- d. Watch P2 increase to about 300 PSI, then close V1. **Be careful not to overfill the system.**
- e. Stop the compressor using the same menu in *marccd* software. Wait until P2 and P3 gauges equilibrate. The final pressure should be about 260-300 PSI. **(If overfilled, go to Section 5.)**
- f. If P3 reads less than 260 PSI after equilibration, repeat steps **b.** through **f.**
- g. Close valve V1, Tank Valve, and disconnect manifold. (If you do not own the "T" and "T Gauge," they must be disconnected and shipped back to Mar USA.) Compressor is ready to operate.

*Note - If pressure P2 doesn't increase at step d., PT-30 tank may be running low. To suck the last gas from the tank into the system, stop the compressor, close Tank Valve, V1, and V2. Disconnect RETURN hose at the "T" side—point A in Figure 2, and cap the "T" and hose end. Do steps a. through f. Reconnect RETURN hose after equilibration.*

4. Pack manifold for shipping back to Mar USA as shown in Figure 5.

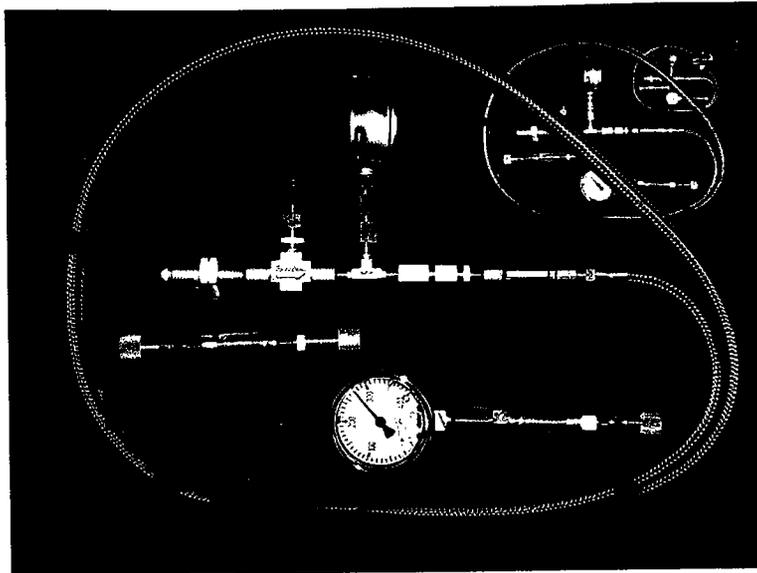


Figure 5 – Packing the charging manifold

5. **Special instructions** only for the case that a compressor is accidentally overfilled:

If the equilibrium pressure of the system on P2 is over 300 PSI, it is overfilled and should not be operated in this state. Leaks may occur from both the detector head overfill valve, and the overfill valve inside the compressor.

- a. Make sure the compressor is stopped, and valves V1, V2, and Tank Valve are closed.
- b. Keep the system configured as in Figure 2, but attach long tubing between Port next to V2 and vent tube to safe area (e.g. outside window). Be careful to avoid any flames or sparks.
- c. Target pressure on gauge P2 is just under 300 PSI (ideal is 260-300 PSI). While carefully monitoring pressure P2, slowly open valve V2 not more than a quarter turn. Close the valve as soon as P2 is less than 300 PSI.
- d. Go back to step 3.g. above.

6. **Special instructions** only for the case that a compressor has leaked out all (or almost all) gas and may possibly be contaminated with room air:

Before charging the system as described in Section 3, if pressure gauge P3  $\leq$  5 PSI, you must evacuate air and moisture out of the system. If you do not, severe ice blockages may prevent detector cooling. (If the system contains higher remaining gas pressure, there is little chance it is contaminated with room air.)

- a. Read gauge P3 before making any new connections. If P3  $\leq$  5 PSI (very low end of gauge), continue to step b. (*Otherwise, if P3 > 5 PSI, go back to Section 3 and charge the system normally.*)
- b. Close all valves (V1, V2, Tank Valve).
- c. Connect the system as shown in Figure 2.
- d. The remaining small amount of gas from the system will escape into the air (in the next step), so make sure room is well-ventilated with no ignition sources or sparks present. (*If the room is too small or other concerns exist, connect tubing to Port next to V2, and vent to a safe area.*)
- e. Open V2 a half turn to let remaining gas pressure escape into the air. (Do NOT open the Tank Valve or V1.)
- f. Connect vacuum pump to Port next to V2.
- g. Turn on the pump and open valve V2 a full turn. (Do NOT open the Tank Valve or V1.) Pump down for about 20 minutes (30 minutes if the system has been equilibrated with room air for a long time, due to a broken connector). The goal is to get all air and moisture out of the system.
- h. Close valve V2 completely, and stop the vacuum pump. Now go back to begin Section 3 and charge the system normally.