



# LNG Dewar Instructions

## **FAR-005** **Revision --**

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**REVISION STATUS**

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**Figure 1, FAR LNG Dewar**

## **PURPOSE**

The purpose of this document is to give instructions as to how to fill the FAR Liquid Natural Gas (LNG) Dewar and transfer LNG from the Dewar.

## HAZARDS

**DANGER:** Fire/Explosion Hazard. LNG is a flammable gas and may burn or explode when leaked or vented into the air. Always work with LNG in an open-air area such that LNG cannot accumulate. Make sure the area near the Dewar and your rocket are free from sparks, heat, or fire sources. Point vents away from personnel.

**DANGER:** Asphyxiant Hazard. LNG is an asphyxiant and will displace oxygen in a confined-space when leaked or vented into the air. Always work with LNG in an open-air area such that LNG cannot accumulate. Point vents away from personnel.

**DANGER:** Eye Injury Hazard. The LNG Dewar holds the LNG under pressure. Spraying/venting LNG is extremely cold and under pressure which can damage your eyes. Wear safety glasses while working with LNG. Point vents away from personnel.

**DANGER:** Freeze Burn Hazard. LNG is a cryogen and is extremely cold. Wear cold gloves (leather gloves) while working with LNG lines, fittings, and valves. Point vents away from personnel.

## REQUIRED SAFETY EQUIPMENT

Safety Glasses

Cold Gloves (Leather Gloves)

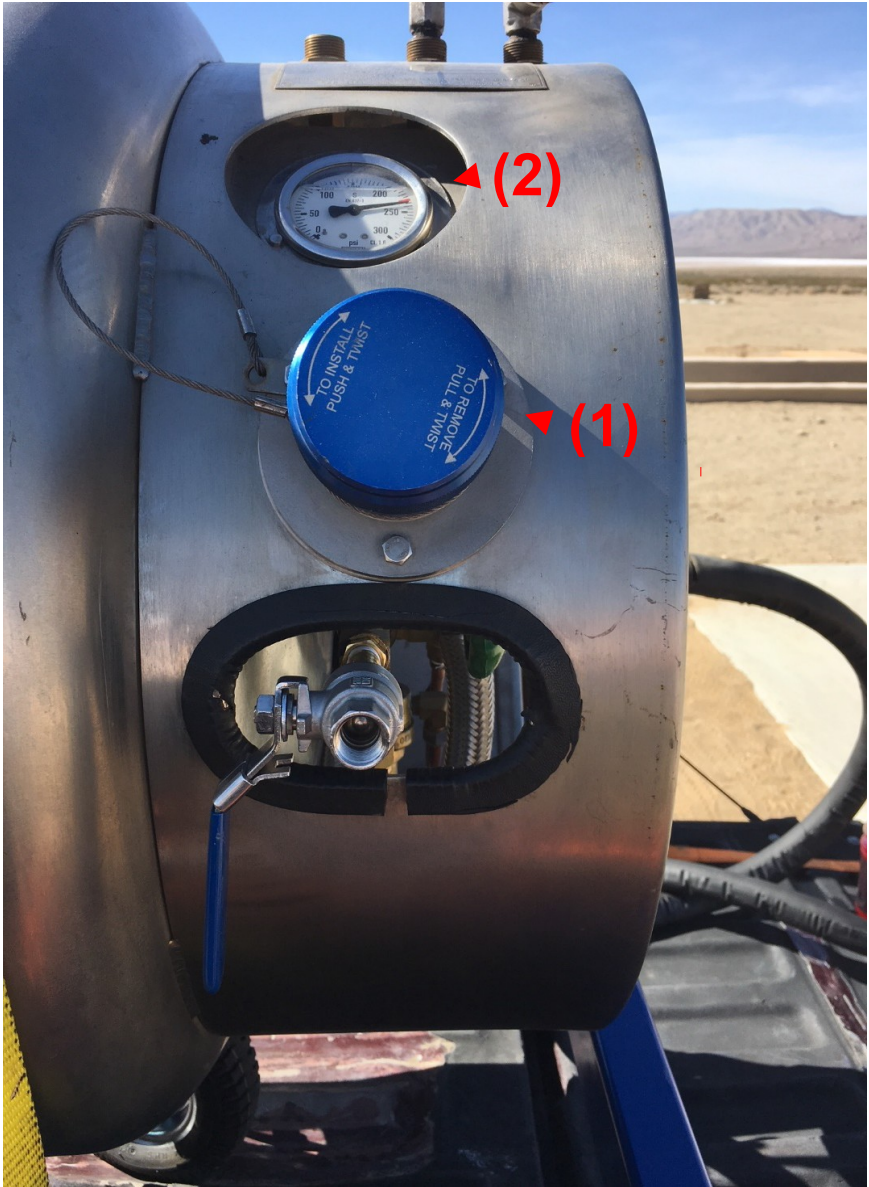
## FILL PROCEDURE

The Dewar should be filled at the Boron Clean Energy fueling station. Be sure to wear protective equipment (safety glasses and leather gloves).

- (1) Attach the ground cable from LNG pump to the Dewar.
- (2) Use the air gun at the fueling station to blow off any dust/debris/ice crystals from the Dewar fill fitting, the LNG station fueling nozzle and Dewar primary venting port.
- (3) Insert the LNG station fueling nozzle into the Dewar fill fitting. Make sure the nozzle handles are all the way forward before fueling.
- (4) Press the green "START" button on the pump to start the fueling process.
- (5) If the fueling stops before the Dewar is full, check the Dewar pressure gauge. If the Dewar pressure is more than 150-psi, insert the station vent hose onto the primary vent fitting on the Dewar. The station vent hose requires a ¼-turn to lock in place.
- (6) Open the green vent valve on the Dewar to start the venting process to lower the Dewar pressure.
- (7) When the Dewar pressure reaches 150-psi or below, close the green vent valve and replace the vent hose to the station pump.
- (8) The pump will automatically stop fueling when the tank is full. When the pump has stopped, press the red "STOP" button.
- (9) Remove the pump nozzle from the Dewar and replace it on the pump station.
- (10) Remove the ground clamp and replace it on the pump station.

A video of the fueling process is shown here:

<https://www.youtube.com/watch?v=7qAP3WJ4Aa8>



**Figure 2, Dewar Fill Port. Remove the Blue Cover to Access the Fill Port. (1) Fill Fitting, (2) Dewar Pressure Gauge**



**Figure 3, The Vent Port for Venting the Dewar at the LNG Fueling Station (Venting the Dewar at FAR will use an Alternate Port).**



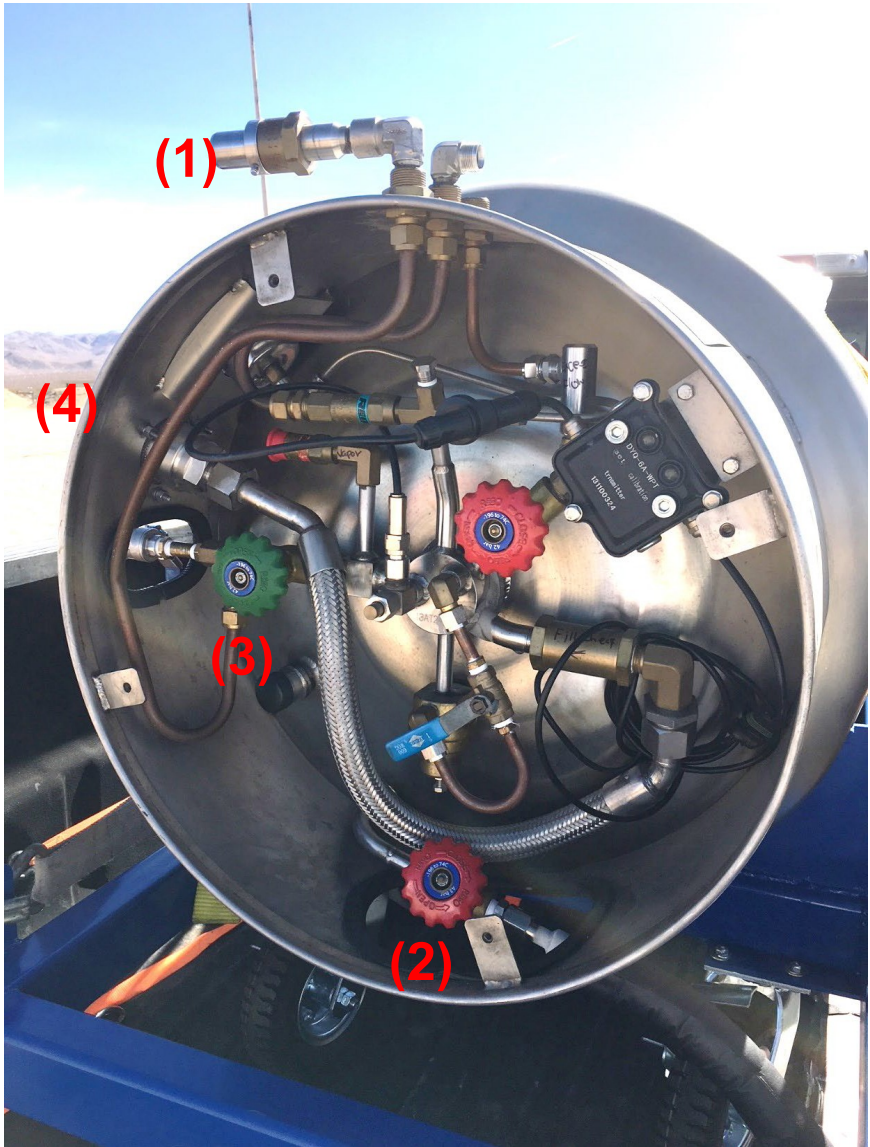


Figure 4, Dewar Controls

## TRANSFER LNG PROCEDURE

- (1) Connect the cryogenic transfer hose to the fitting attached to the red dispense valve at the bottom of the Dewar. The fitting is a #8 male JIC fitting (37° flare tube fitting). Connect the other end of the cryogenic transfer hose to your rocket tank.
- (2) Make sure the pressure in the Dewar is low (the lower the pressure, the colder and denser the LNG will be). Figure 7 gives you data on density vs. Dewar pressure. It is recommended that the Dewar pressure be below 50-psi. Lower pressure will result in colder, denser LNG. If the pressure is high, you will need to vent the Dewar to bring down the pressure. To vent the Dewar, you need to open the green vent valve. Then open the secondary vent ball valve. Allow the Dewar to vent the LNG gas. **DANGER: Fire/Explosion Hazard. Make sure the area near the vent is free from spark, heat, or fire sources.**
- (3) When the Dewar pressure has equalized at ~50-psi, close the green vent valve first, then close the secondary vent valve.
- (4) To begin loading LNG, open the red dispense valve and open any valve you may have on your system (fill and vent).
- (5) When done filling, you should allow your tank to chill down for a few minutes, so the transferred LNG reaches thermal equilibrium. Then you may top-off your tank with more LNG.
- (6) Once your tank is full, close the valve on your tank and close the red valve on the Dewar. Vent the transfer hose line by cracking the flare nut fitting on the end of the transfer hose. **WARNING: Hose Damage. If you allow cryogenic LNG to remain trapped in the hose, it will warm into gas and could rupture the hose.**
- (7) Once the cryogenic transfer hose is vented, remove the end from your tank and cap the free end(s) of the transfer hose, so the hose cannot be contaminated.



**Figure 5, Red Handled Valve is the Dispense Valve. The Cryogenic Transfer Hose will Attach via a #8 Male JIC Fitting.**

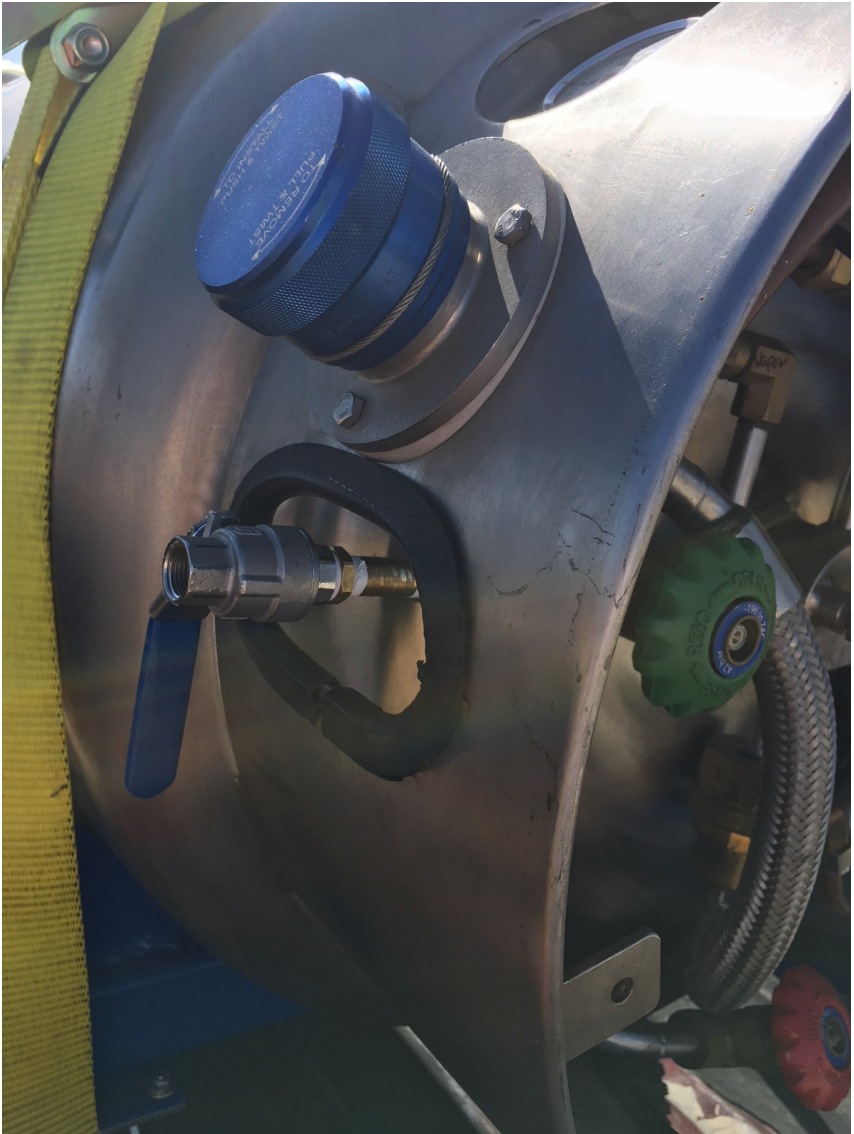


Figure 6, The Secondary Vent Valve/Port

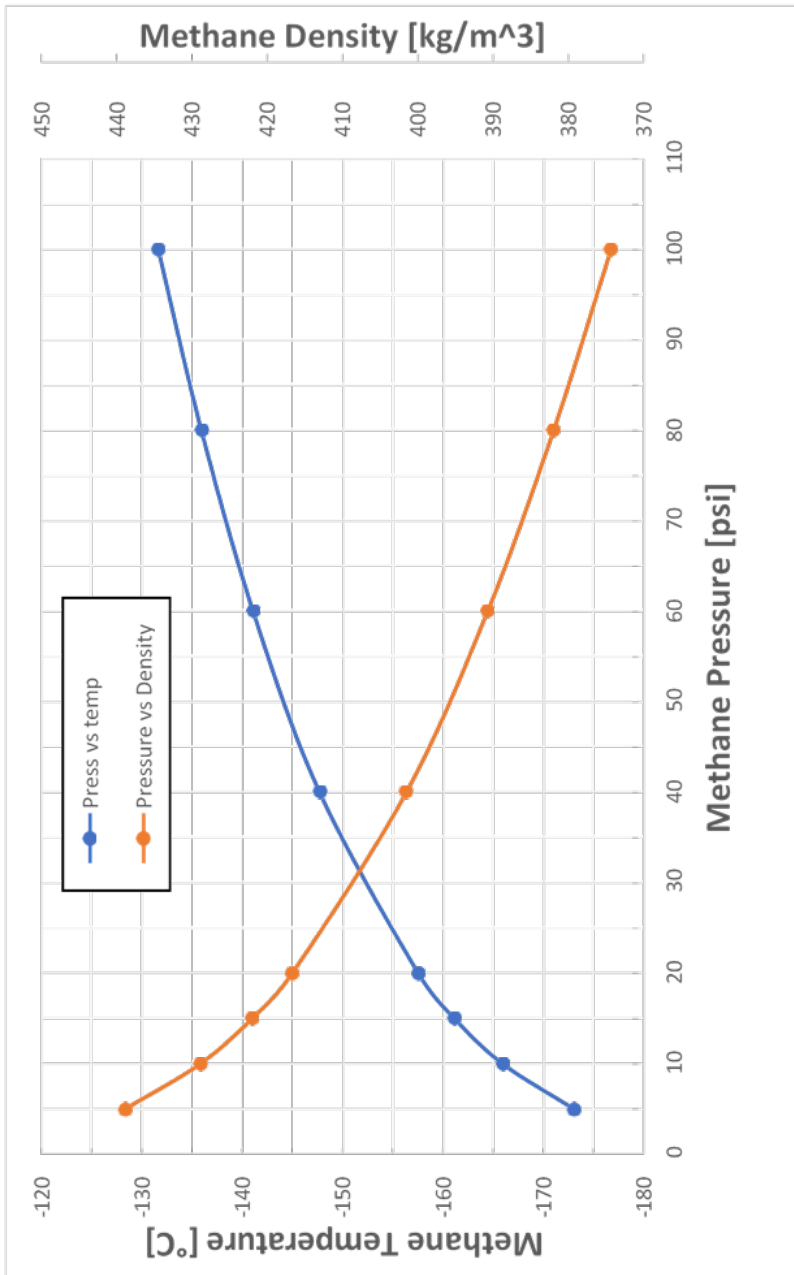


Figure 7, Methane Dewar Pressure vs. Methane Temperature and Density