Operating Instructions for 5408M1 Dry Ice Machine

OPERATING INSTRUCTIONS

The Dry Ice Machine modelis the state-of-the-art bench-top dry ice machine. Using this model is easier, faster, safer, and will provide better value from liquid CO_2 cylinders than ever before.

Before you use the machine, please read these operating instructions completely.

INSTRUCTIONS

To make solid blocks of dry ice, you will need the following:

- Dry Ice Machine-Ultra A cylinder of liquid CO_2 with
- siphon
- Wrench (not included) to connect supply line and CO_2
- cylinder Insulating gloves and protective goggles

Expected results:

- Weight: 1-pound dry ice block
- Dimensions: 6” x 4” x 1-1/2”
- Density: a function of the temperature and pressures inherent in the process should be 50% of commercial grade (approximately)

Cautionary Notes: *WE ADVISE USERS TO WEAR INSULATED GLOVES AND PROTECTIVE GOGGLES*

1) This machine should be used only in an open and well-ventilated room. CO_2 vapor – whether from the cylinder, from the machine during operation, or from blocks of sublimating dry ice – is heavier than air; and may displace air in a closed space leading to **possible asphyxiation**.

2) Cylinders of liquid CO_2 at room temperature (20-24 ℃) operate at pressures near 850 pounds per square inch (psi). Users should be familiar with using such equipment.

3) While using the model 800, incidental contact with dry ice (-78.5 ℃ / 109.3 ℉) is likely.

Operation: *PLEASE WEAR INSULATED GLOVES AND PROTECTIVE GOGGLES*

1) To make dry ice, attach supply line to valve of liquid CO_2 cylinder, making sure to insert washer (included) between the CGA 320 coupling and cylinder. Tighten nut with wrench.

2) Slide dry ice tray into machine so it makes contact with the back of machine.

3) Pull the lever to the closed position. The dry ice tray is now “locked” in place. ***Never make dry ice unless the tray is locked.***

4) Open valve of liquid CO_2 cylinder, allowing liquid to flow through the supply line, and enter model 600 tray.

5) While tray is filling with dry ice, CO_2 vapor will vent into heat exchange chamber (cooling in-coming liquid), and then will exit through the back and top of the machine.

6) After about 60 seconds, the check valve – toward rear of machine and top – will open, making a very noticeable sputtering sound, releasing vapor and small bits of dry ice. As soon you see the steady flow of dry ice chips close valve slowly on CO_2 cylinder to stop flow of liquid.

7) Move lever open position to unlock dry ice tray. Pull tray from machine. Turn tray upside down; and a 6 x 4 x 1-1/2 - inch block of dry ice, weighing about one pound, will slip out of the tray. **Don't forget to use insulating gloves**.

NOTE: Under some conditions, you may have to shake or tap bottom of tray to release dry ice block.

8) Repeat steps 2 through 7 to make additional blocks of dry ice. Subsequent blocks may take slightly less time to make, since dry ice tray and assembly already are cold.

Blocks of dry ice may be stored in rigid Insulated Shipper-PUR polyurethane (PUR) and Insulated Shipper, expanded polystyrene (EPS) foam insulated containers, including the EPS container supplied with the Dry Ice Machine-Ultra.

Never store dry ice in air-tight containers, since CO_2 vapor sublimating off surface of the dry ice will build pressure, eventually bursting the container.

9) When you have completed making dry ice, allow machine to reach to room temperature before returning machine to storage.

Making Dry Ice from Liquid Carbon Dioxide (CO_2)
Making dry ice takes advantage of the principle of adiabatic expansion, also known as the Joule-Thompson effect. Liquid CO_2 in a cylinder at room temperature and at approximately 850 psi is ejected through a small orifice into the dry ice tray of the Model 800, which is at normal atmospheric pressure (about 14 psi). However, at normal atmospheric pressure, the liquid CO_2 expands, cooling rapidly. Within the confines of the Model 800 dry ice machine, the cooling is so severe that the temperature drops to -78.5 ℃ / -10 9.3 ℉, at which point some of the CO_2 converts to dry ice snow (solid), packing inside the dry ice tray.

The efficiency of the process (ratio of solid-to-liquid) varies based on temperature and pressure, so that lowering the temperature of the liquid improves the yield of solid (dry ice.) For example, at room temperature and approximately 800 psi, the yield is near 26%; but at 0 ℉ and 290 psi, the yield improves to 39%. With this in mind, cold vapor generated by the process is directed within the Model 800 to pre-cool incoming liquid through a heat exchanger, which improves the yield of the Model 800 over previous models. Under typical conditions of use, dry ice yield can be 25% to 30% better than in previous dry ice machines. Storing cylinders of liquid CO_2 in refrigerators or even freezers can increase yields still further.

Cold storage of liquid CO_2 has another benefit: it increases the proportion of CO_2 liquid to vapor in the cylinder. For example, at 70 ℉ a cylinder w ith 50 lbs. of CO_2 actually contains about 70% liquid and 30% vapor. Lowering the temperature to 60 ℉ increases the proportion to 77% liquid and 23% vapor, while raising the temperature to 80 ℉ decreases the proportion to 58% to 42% vapor. Above 87.8 ℉ (the critical temperature), al l liquid CO_2 converts to vapor and dry ice can not be produced. Below 87.8 ℉, the colder the CO_2 cylinder, the more liquid CO_2 is available for production of dry ice.