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CABINET FREEZER USER'S MANUAL

Nitrogen (LN2)

MANUFACTURED FOR:

_____

MODEL: _____

SIZE: _____

SERIAL NO.:_____

DATE: _____

INTRODUCTION

This manual provides information on Cryogenic Cabinet Freezers using Liquid Nitrogen.

Where necessary for clarification, special comments will be included for a specific variation.

A short synopsis of important operating pointers follows this introduction.

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Properties of Nitrogen

CAUTION: Nitrogen is a colorless, non-toxic gas. The atmosphere we breathe is 78% nitrogen by volume. The spent vapor must be exhausted to the outside of the building. This is to prevent the nitrogen concentration in the room air from building up to an excessive concentration and reduce the amount of life supporting oxygen in the air to an unacceptable level.
Good ventilation is very important to avoid harm to personnel.

Cabinet Freezer Cryogenic Freezer

IMPORTANT OPERATION AND MAINTENANCE POINTERS

The following synopsis is intended to be a handy reference of specific, important, OPERATION, CLEANUP, and MAINTENANCE FACTORS, requiring most frequent attention. However, familiarity and understanding of the detailed explanations and descriptions in the manual is essential.

OPERATIONS:

1. Temperature setting must not be lower than -125°F.
2. Develop a procedure for temporary shutdown of freezer.

CLEAN-UP:

1. Cover motors and control cabinet to protect them from splash water. UNCOVER MOTORS TO RUN FANS.
2. Do not abuse door gaskets.
3. Dry out freezer as well as possible after clean-up. LEAVE FREEZER DOOR OPEN BETWEEN SHIFTS.

MAINTENANCE;

1. Check if fan motors are running, daily.
2. Check injection solenoid valve operation at least weekly.

SECTION I

DESCRIPTION OF THE CABINET FREEZER

1.1 CABINET FREEZER PROCESS

The 2 Basic principles of the Cabinet Freezer Process are:

a. The use of fans to circulate the cold gases at high velocity.
b. Accurate control of temperature.

The Cabinet Freezer Process utilizes the “wind chill” effect to increase the speed that products can be frozen. The high velocity gas flow created by the circulation fans, continually removes the thin layer of warm air that normally surrounds the product to be frozen. This keeps the super cold cryogen gases in constant contact with the surface of the product. The rapid freeze achieved by the high velocity gas flow reduces product shrinkage and moisture loss as well as to improve the final quality of the product.

The Cabinet Freezer process does not deposit liquid Nitrogen directly on the product. The small particles of liquid formed at the injection nozzles are rapidly sublimed (converted to cold gas) by absorbing heat from the temperature controlled freezer zone. The secret to the efficient operation of the Cabinet Freezer is accurate temperature control of the unit to eliminate the build-up of liquid cryogen.

The Cabinet Freezer temperature controlled injection system keeps the cryogen consumption to the minimum required to match the product heat load. If the product flow stops, the freezer automatically reduces back the cryogen injection rate to the minimum required to maintain the desired operating temperature.

A key error made by many operators of cryogenic cabinets is not properly managing the freezing process. Standards need to be set for various products as well as maintaining proper rack loading, freeze times and prompt maintenance.

1.2 THE CABINET FREEZER

The fiberglass parts are high strength spray/hand lay-up molded fiberglass parts, coated with a USDA accepted food grade gel coat. All double walled parts are insulated with foam-in-place closed cell polyurethane foam for high insulating value and high structural strength. The door gaskets are preformed spun polyester strips. If they are damaged, the individual gasket sections can be replaced easily.

All exposed internal metal parts are stainless steel or aluminum. All exposed plastic parts are of materials approved by inspection agencies for use as food contact surfaces.

1.3 CIRCULATING FANS

Variable speed fan freezers do not have brakes. The 1 HP 1750 rpm motors stop almost instantly by using DC injection braking. Whenever the door is opened, a safety limit switch will shut the fan motors off.

WARNING! If electrical power is shut-off to control panel, while fans are rotating, there is no effective electronic braking, and therefore fans will coast to a stop (long period) even with the door open.

1.4 CONTROL PANEL

The freezer controls are conveniently located on the front of the control cabinet. The controls are the following:

1. Main power disconnect switch handle (240 VAC, 3 Phase, 60 Hertz)
2. Fan motor power push button
2.b Fan motor speed potentiometer
3. LN2 Injection power push button
4. Exhaust blower power push button
4.b Exhaust blower speed potentiometer
5. Temperature controller
6. Product dwell timer
7. Emergency Stop push button
8. Optional: O2 Monitor
9. Optional: Floor Heater

1.5 INJECTION HEADER

The injection assembly feeds the cryogen through the side of the box into the freezer, through the use of extension headers, which supplies liquid to the header nozzles.
The headers have a number of openings to install spray nozzles or plugs to tune the system to the product being run.
These nozzles can have an orifice opening ranging from .040" up to .052". All nitrogen Cabinet Freezers are supplied with nozzles that have an orifice opening of .043" (6503). Plugs are provided to eliminate some nozzles if need be when tuning the Cabinet Freezer. Other size nozzles can also be purchased for tuning the injection depending on the type of product being chilled or frozen. The headers can be turned in many directions to help in getting the best performance out of the system.

SAFETY NOTE: Do not disassemble the cryogen piping before first closing all appropriate supply valves and fully depressurizing all appropriate lines. Liquid LN2 is under pressure which could later be explosively released.

1.6 TEMPERATURE CONTROL SYSTEM

The Cabinet Freezer utilizes one RTD type (Resistance Temperature Device) temperature probe to send a signal to the temperature controller to operate the injection solenoid valve assembly. A stainless steel sheathed platinum type sensor extends into the cabinet freezer itself. The temperature controller is mounted on the front door/cover of the electrical control cabinet.

SECTION II

INSTALLATION

2.1 POSITIONING THE FREEZER

The freezer should be moved by a fork lift. Lifting should be done only on the side opposite the motor and electrical or from the back. Move the freezer into proper relative position on the floor for installation.

2.2 LEVELING THE FREEZER

Use shims under the bottom to level the freezer. Check for proper door alignment and that it closes properly.

2.3 ELECTRIC WIRING CONECTIONS

Consult the wiring diagrams for proper sizing and location. Unless special voltage requirements are requested, the incoming power is 240 Volts – 3 Phase – 60 Hertz. Standard freezer disconnect switch fusing is 25amps. Freezers with the optional floor heater, the disconnect switch fusing is 30amps.

2.4 FINAL ADJUSTMENTS

The door latch is adjustable to allow proper closing/locking of the door. All nuts and bolts should be checked to be sure they are tightened properly. They should be rechecked after the first few days. Expansion and contraction caused by temperature changes can cause threaded fasteners to work loose.

2.5 EXHAUST AND BLOWER

Based upon preliminary feedback information, the customer was advised how to install the exhaust blower, depending on proximity of location and climatic conditions. It is the customer's responsibility to supply and install the blower. If the exhaust is through the roof, the blower can be mounted under the roof, or outside on the rooftop. In certain cases, the blower may be mounted outside a nearby wall. The horizontal run of the exhaust should pitch downwards towards the blower to allow water to drain outward.

Prior to the freezer being shipped, the appropriate installation drawing for mounting the blower is forwarded to the customer to pass on to his installation contractor who is normally responsible for mounting and connecting the piping to the freezer exhaust outlet and the blower inlet

2.6 EXHAUST FAN FAILURE

Currently, the Cabinet Freezer and most cryogenic freezers will not allow the LN2 to operate if the exhaust blower is not energized. However, in the event that an exhaust duct becomes blocked, or an exhaust motor goes out and does not blow a fuse, it is possible for the LN2 to be injected without adequate exhaust. RS Cryo has available an O2 monitor that can be added to provide additional protection and insure compliance with OSHA and USDA safety standards for LN2 and oxygen levels in enclosed processing areas. There is a separate sheet for information and pricing on the suggested monitor and installation procedure.

2.7 RELIEF VALVE

Currently, the Cabinet Freezer and most cryogenic freezers have a safety relief valve(s) at various locations in the liquid supply system entering the freezer. Should these relief valve(s) be activated, nitrogen can be introduced directly into your processing room. An adapter has been added to the relief valve near the injection solenoid valve of the freezer, so that piping can be attached to redirect any LN_2 to an outside location.

SECTION III

3.1 INITIAL SART-UP

1. Check to insure the proper voltage and amperage is supplied to the control panel. 240V + 10 - 5% 3 Phase 60 Hertz. Standard freezer disconnect switch fusing is 25amps. Freezers with the optional floor heater, the disconnect switch fusing is 30amps.

2. Purge all LN_2 supply lines to remove loose debris, clean strainers.

3. Close and latch the door.

4. Turn on main disconnect switch.

5. Start exhaust blower. Check for proper fan motor rotation – Radial blade blowers have a small suction even when rotating backwards.

6. Start Fans. Check for proper rotation (ccw direction), viewed from inside the freezer. Or, see motor rotation decal.

7. Turn on the LN2 injection after opening all LN2 valves. Check for proper operation of the injection header/nozzles (checking that nozzles are all spraying and not blocked).

8. Check temperature controller for proper operation and tune the injection system.

3.2 Daily

The freezer should be visually inspected before start-up. A check should be made of loose bolts, damaged gaskets, etc. which should be repaired.

The freezer Start-Up Procedure:

1. Turn of LN_2 circulating pump (if applicable) and open all supply valves.
2. Close and latch door.
3. Turn on master disconnect.
4. Start exhaust blower – check for proper operation.
5. Start fan motors – check to see that all are operational.
6. Turn on instrument power, set temperature controller.
7. Set product dwell timer to appropriate setting

3.3 LN2 INJECTION – DESCRIPTION TUNING & ADJUSTMENT

The LN_2 injection system has one, two, three or more header tubes in the system. Tuning of the LN2 injection system is generally required only during the initial installation and any time major changes in production techniques/product occur.

At temperatures warmer than the controller set point, the solenoid valve opens giving maximum LN_2 flow (ALM1 on the temperature controller). When the zone cools down to the set point, the ALM1 system will stay on. If the temperature continues to decrease below set point, the ALM1 system will turn off stopping all liquid LN_2 flow.

Proper system operation calls for the ALM1 system to be on 100% of the time. It needs to be tuned to primarily handle the fixed heat load of an idling freezer with no product being frozen. It may be necessary to add or subtract spray nozzles in order to keep the injection on to handle the product heat load.

3.4 INJECTION SYSTEM TUNNING PROCEDURE

Final Settings

1. Cool down the freezer. It should reach operating temperature in 15-20 minutes.

2. Set the temperature controller in the control cabinet to -80°F or the required freezer temperature.

3. Load the freezer at the expected production capacity. Monitor the ALM1 light on the temperature controller. If the ALM1 light rarely or never goes on, some nozzles will need to be taken out and plugs added. If ALM1 never shuts off or the zone cannot maintain temperature, additional nozzles are needed.

It may be necessary to do some fine-tuning, after following the above procedure, to meet specific production conditions. Problems with exhaust vapor control and entrainment of room air are reduced when a freezer is properly tuned because the LN2 flow is better matched to the actual demand.

The quality assistance or line supervisor should have a chart or table showing the proper settings for the ”tuned” freezer as well as operating temperatures, loading etc., for each product. This acts as a quick-list if product results deviate from standard.

3.5 OPERATING TEMPERATURE

The normal operating temperature of the Cabinet Freezer can be adjusted from 140° to -125°F. RS Cryo recommends a freezing temperature of -80°F for most products for optimum product quality, maximum freezing capacity and best operating efficiency. We prefer to control the temperature to no colder than -125°F for the prevention of damage to equipment, efficient economics and safety to personnel.

Nitrogen is used as an expendable refrigerant unlike ammonia or Freon, which is recycled in a closed loop system. The liquid is stored in an insulated pressure vessel at typical conditions of 40psig °F. The low temperature, high capacity freezing available with LN2, is obtained by expanding the liquid through the injection nozzles to atmospheric pressure.

3.6 PRODUCT DWELL TIMER OPERATION

OPERATION:

When the power is on, the timer/counter/tachometer is in the operation mode. Press ﹀ or ﹀ to change SV, or ﹤ to make change on a desired digit. The indicator of the selected digit will flash. After the change is made, press “mode” to save the setting. If SV or parameters are not changed, press “mode” once to switch between SET1 and SET2.

CONFIGURATION:

Press “mode” in operation mode for more than 3 seconds to enter configuration mode. Press “mode” once to switch among parameters. To return to operation mode, press “mode” for more than 3 seconds.

When being used, the timer begins counting down to 0 once the LN2 injection button is pressed in and will continue to count down until it is reset by pulling the LN2 injection button back out. (timer will also continue to count down if the fans stop or the door is opened).

Side Note: The timer does not save the time or stop timing if the solenoid valve, fan motors or exhaust blowers stop functioning.

3.7 SHUTDOWN AT END OF SHIFT

At the end of a production shift, the freezer should be shut down in the following sequence:

1. LN2 Injection.
2. Fans.
3. After about 5 minutes – exhaust blower.
4. Main Power switch.

For shutdowns, it is not necessary to close the liquid valves at the tank or at the freezer.

3.8 CLEAN-UP

Do not spray the control cabinet or fan motors. These should only be wiped clean.

The fan motors should be covered with plastic bags. The control cabinet should be protected by a plastic sheet or other suitable means. The plastic bags must be removed before running the freezer.

Hose down the interior of the freezer. Give particular attention to the door gaskets strips.

It is best to start a production shift with the freezer as dry as possible. It is recommended that with all power off, the door be left open until the next production shift.

The fiberglass walls of the freezer can be polished periodically with Dupont Auto Body Cleaner and Polish (a white paste).

CAUTION:

The doors gasket is designed to provide an effective seal and will not require frequent replacement if normal care is taken not to damage them.

If it is evident that a freezer door is frozen shut, do not force it open because this may tear the door gasket. If possible, allow the freezer to sit and warm up for a short amount of time, say 30 minutes, and try again to open the door.

The clean-up crew must take care not to drag the hose over the gaskets or otherwise abuse them.

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